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Innovation in literacy and numeracy using e-learning technologies in Australian primary schools 2002

Colin Webb

Jenni Way

Angus Brook
University of Notre Dame Australia, abrook1@nd.edu.au

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INNOVATION AND E-LEARNING IN AUSTRALIAN PRIMARY SCHOOLS

Innovation in Literacy and Numeracy using e-Learning Technologies in Australian Primary Schools 2002

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Colin Webb

Dr Jenni Way

Angus Brooke

University of Western Sydney

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1. INFORMATION AND COMMUNICATION TECHNOLOGIES IN AUSTRALIAN SCHOOLS

Policies and directions

"Australia, like all other nations, is in the midst of a profound transition from the old mechanised economy to the new information economy. The general trends are clear, the stakes are high and the task is urgent."

Learning for the Knowledge Society: An Education and Training Action Plan for the Information Economy (DETYA, 2000, p 62)

The National Agenda

In recent years the policies, strategies and major research reports originating from Australian government departments have begun to build the national agenda for the physical and educational infrastructure required to position Australia in the global information economy. *Backing Australia's Ability*: *An Innovation Action Plan For The Future* (2001) outlined the Australian Government's strategy to encourage and support innovation and enhance Australia's international competitiveness, economic prosperity and social wellbeing" (p7). The Australian Government's view of an information economy is one where information, knowledge and education are major factors that contribute to business and social activity (*Australia's Strategic Framework for the Information Economy 2004–2006: Opportunities and Challenges for the Information Age,* DCITA 2004, p2). Fundamental to achieving this goal is the establishment of an infrastructure to support information and communications technologies (ICT) and innovative e-learning environments in schools.

The integration of ICT into school educational practice is crucial to prepare "young people to participate in and contribute to an information society that requires high levels of literacy, numeracy, technological competence and a spirit of creativity and enterprise" (DETYA 2000, p17).

Australia's Teachers: Australia's Future – Advancing Innovation, Science, Technology and Mathematics (DEST 2003) targeted the building of a culture of innovation in all Australian schools and a "capacity and predisposition for innovation" in all students, as being fundamental to the establishment of such a culture in Australia.

Innovation in the context of education

Both internal and external forces (Yee, 1998) drive the need for schools to change and to innovate in order to change. In educational settings, external forces may be the need to update practices in keeping with the findings of international research, and to continually conform to national trends and even community expectations. Internal forces may be the pressures created by curricular reform, the desire to improve student outcomes (either as a whole or particular groups of students) or in response to the collective or individual values of teachers. The utility, or success of an innovation in educational settings is determined by how well it responds to these internal and external forces in the context of individual schools and classrooms.

The various models of innovation describe the external and internal pressures that influence the decisions of schools and education systems. In brief, there are four major models of innovation described in the literature.

The Economic and Industrial Model of Innovation

This model generally frames innovation as 'enterprise', or, the transformation of ideas and knowledge into economic outcomes and growth (DCITA 2004). In this economic and industrial model educational institutions are viewed as providing the means to create an entrepreneurial culture through the teaching of ICT skills in the context of their future application in the economy. The use of ICT's in teaching and learning is driven by the

need to develop an innovative culture to serve the needs of the economy and industry (Cumming & Owen, 2001).

The Scientific and Technological Model of Innovation

The scientific and technological model of innovation is exemplified by the practices of research, invention and technology. In the most general sense, this model frames innovation as techniques or technologies that transform human abilities and life (Martinich, 2002, p1). In general, the scientific/technological model of innovation influences the education sector in two main ways. Firstly, it has a significant influence on the construction of student outcomes. Secondly, in this model the potential for technologies to transform education as a practice means that the technologies will not just be integrated into curriculum and teaching practices, they will, through their use, have a transformative effect on education.

The Situational (Responsive) Model of Innovation

Innovation in this model is described as "bottom up and small scale, it is what the imaginative and responsive school does when it encounters problems and challenges or when it thinks out a different and potentially better way of doing something that has become stalled by custom or tradition" (Hargreaves, 1999, p.46). In this respect, the situational (responsive) model of innovation differs from the previous two insofar as it frames innovation as small-scale transformation, eg, school innovation, within the micro-environs of the particular educational setting. As such, this model of innovation is able to facilitate transformation of an educational institution, classroom or student group on the basis of the needs of that environment, such as, socio-economic disadvantage, cultural difference, and gender.

The Educational Model of Innovation

The educational model of innovation frames innovation, in the broadest sense, as "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers, 1995, p.1). Accordingly, the educational model of innovation focuses on the idea of the 'new': new learning objects, new ways of teaching, and new learning environments.

Framework for Innovation and ICT in Education

The economic/industrial, the scientific/technological, and, the educational models of innovation describe the forces or pressures to innovate that are largely 'external' to individual schools. The situational/responsive model of innovation describes some of the 'internal' forces that impact on the decision-making processes in schools.

The economic and scientific models influence the framework of innovation which focuses upon the curriculum, (what is learned) and, consequently, the 'content' of the educational model, (skills, competencies, research and the acquisition of knowledge/information). Innovation in the educational model is concerned with the delivery of the 'content' and primarily focuses on the most effective methods of delivering the curriculum, i.e.,

pedagogy. ICT in these models become essential within the curriculum as tools to be incorporated in the pedagogically driven framework of innovation; as transformative agents of teaching and learning.

ICT in the context of the curriculum driven framework of innovation are described as:

1) innovative objects; and
2) innovative tools to increase the efficiency of achieving curriculum outcomes.

In a pedagogically driven framework of innovation ICT become:

1) tools for innovative ways of teaching and learning; and
2) transformative agents, a synthesis of pedagogy/technology transforming teaching and learning in meaningful ways.

State Government Policies

While there was considerable variation in emphasis and approach, between 2001 and 2004, all states and territories articulated and implemented strategies covering ICT infrastructure, curriculum and pedagogy. Implicit in all these policies is the belief that integration of ICT's into Australian schools will have a 'transforming' effect on education. The Australian Capital Territory's *Learning Technologies Plan for Government Schools* states that ICT:

> "…supports the creative and innovative practices already in place … The challenge now is to capitalise on the very large investment in hardware, software, networks and experience by making learning technologies an integral tool for teaching and learning in all our classrooms."
> *Transforming the Way we Teach and Learn* (DET, ACT, 2004, p1).

The approximate combined expenditure of the states for school ICT projects, particularly physical infrastructure, during 2003-2004 was $750 million, with significantly more budgeted for 2005-2006. That a huge proportion of this funding was allocated to hardware, software, systems infrastructure and bandwidth clearly indicates the desire of state and territory education systems to create the physical digital architecture and management systems on which innovative learning environments might be developed. Such investments indicate a strong belief in the capacity of the technology to transform education.

Computers in Primary Schools

Computers are now regarded by policy makers and teachers to be a part of the basic infrastructure of primary schools. The density of computers in schools in Australia has increased significantly over the past fifteen years. By 2002 the average ratio of computers to students in state and territory government schools was 1 to 5.3 (calculated using figures from MCEETYA (2002), *The National Report on Schooling in Australia 2001*). Achieving such ratios has been a direct result of the policies of state and territory governments, and, given that this significant increase in computer density in primary schools has been achieved in a relatively short period of time, it is understandable why such achievements are described as innovative.

Anecdotal evidence suggests that in 2002 the majority of Catholic primary schools had not achieved the density of computers that had been achieved in government schools

but that, as a whole, the Catholic education sector had devoted significant resources to redressing this imbalance in ICT infrastructure.

It is difficult to gain information on the density of computers and network infrastructure in Independent schools. The 1999 DEETYA study found that the difference in the levels of ICT resources in schools across the Independent school sector was significant.

Local Area Network (LAN) Infrastructure and Internet Access

Policy impetus and world attention created by the 'information super highway' has set an agenda for education systems and schools to get 'connected'. The motivation to construct school local area networks (LAN), initially, was to gain access to the Internet because this would provide teachers and students with access to 'information'. The cost of creating LANs in schools inhibited their construction prior to 2002, primarily because the cost associated with building LANs were met from school budgets.

As the desire to reticulate Internet access to the computers in schools has increased, the issue of bandwidth has become critical. Given that the average number of computers in each government school across Australia is approximately 50, and that it is not uncommon for primary schools to have more than 100 computers, it is easy to comprehend why the investment in school LANs and the provision of broadband Internet access is a critical issue at the school and system level.

ICT Infrastructure in Australian primary schools

The picture that emerges in 2002 of government schools in particular, from the various policy documents is that the basic ICT infrastructure of a primary school, across all sectors and all states has:

- a ratio of computers to students between 1:4 and 1:8. (with some Catholic and small Independent schools having ratios of $1:10^{+}$);
- an increasing number of computers that are less than three years old;
- computers that use a standard suite of software (Standard Operating Environment or SOE);
- a local area network connecting computers in the school (ranging from some to all);
- access to the Internet (phone, cable, ISDN, satellite, optic fibre); and
- connectivity to a wide area network maintained and managed by an education system.

This picture of the infrastructure of a typical primary school can now be considered as 'basic'. To achieve this in 1995 would have been considered highly innovative. To have achieved this by 2005 is clearly a direct result of government funding and business community support and systems wide expectations that computer dense, broadband-networked environments are now part of the basic infrastructure of primary schools in Australia. Creating these environments has, in itself, been innovative. Given that there is a tendency for relatively significant changes in the technologies to occur over short time frames the basic infrastructure that has emerged over recent years has achieved an element of stability and predictability, primarily through the level of support from government.

However the DETYA funded study*, Real Time: Computers, Change and Schooling* (Meredith, Russell, Blackwood, Thomas, Wise, 1999) concluded that inequitable access to the physical hardware and Internet access was a very real issue in Australia, especially for Indigenous Australians, for rural and isolated young people and for some smaller Independent schools.

Curriculum and ICT

During the 1980's, with limited computer resources, schools aimed to integrate computers into the existing curriculum framework (Collins, 1991). At the time, Collins argued that only those uses of computers that fitted the prevailing school structure and the curriculum would be adopted by the school. By the late 1990's Fullan (1997) and Spender (1998) argued that the technologies themselves were challenging the structure and the curriculum of schools; that they were transformative.

The National Goal for the use of ICT 1.6 states that students should "be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies on society" (MCEETY, 1999. p.2) and indicates the significance ICT's have attained in the curriculum. During the 1990's the curriculum documents of state and territory departments of education have gradually shifted from statements about adding computer use and information skills as a 'cross curriculum perspective' to existing curriculum documents, towards embedding ICT outcomes within new curriculum documents. This can be summarised as:

- Early 1990's – learning about computer technologies: computers as new technological tools;
- Late 1990's – learning with computer technologies in an integrated curriculum; computers as learning tools;
- Post 2000 – changing the nature of teaching and learning through the integrated use of ICT; ICT as transforming schools as learning environments.

In the Australian Capital Territory for example**,** the *Information Access Curriculum Support Paper* (1997) described ICT use as one of the 'cross curriculum' perspectives making it the teacher's responsibility to integrate ICT into the curriculum in all learning. By 2004 the *Learning Technologies Plan for ACT Government Schools and Preschools 2004-2006: Transforming the way we teach and learn* referred ICT as transformative technologies (DET ACT, 2004, p11). The Tasmanian *ICT in Education (K-12) Strategic Policy 2002-2005* contains the following goals of ICT in education:

- Transform teaching and learning;
- Improve efficiency and effectiveness;
- Develop community of learners; and
- Enable students to leave school with ICT skills to participate in knowledge society.

In all such policy documents there is a clear expectation that, now the technologies are in place, they should have a transformative effect on teaching and learning in primary schools. While education systems have focused on providing the technologies, innovation that is expected to result from the provision of ICT is largely the responsibility of individual schools and teachers.

At a time when there were significant changes in the ecology of schools it is understandable that principals and teachers would be uncertain about the integration of computer technologies into the curriculum. While the impact of ICT on curriculum is at an early stage it is none the less evident and, as Professor Ron Toomey concludes:

> "Recent research on the leading practice use of ICT in schools suggests that it is playing an increasingly important role in enhancing teaching and learning across many of the curriculum Key Learning Areas. It demonstrates that the introduction of ICT to classrooms may result in improved learning outcomes, and indicates that generic skills are cultivated in such an environment. Finally, it shows that the introduction of ICT can contribute to whole school improvement". (Toomey. 2001, p5).

Pedagogy and ICT

Pedagogy is a term that describes the 'act' of teaching. It is a malleable term that portrays both the art and the science of teaching and is often used as a synonym for the act of teaching students. As school curriculum responds to the changing needs of society, so does pedagogy. To achieve new learning outcomes often requires new pedagogy.

A growing body of research (for example, Barker, 1999; Goodyer, 1999; Hannifin, 1999; Hayes, Schuck, Segal, Dwyer & McEwen, 2001) identifies the potential of computer-based technologies to transform pedagogy in the following ways:

- A shift from instructivist to constructivist education philosophies;
- A move from teacher-centred to student-centred learning activities;
- A shift from a focus on local resources to global resources; and
- An increased complexity of tasks and use of multi-modal information.

These findings are reflected in state education documents such as the ACT's *Learning Technologies Plan for ACT Government Schools & Preschools 2004-2006:*
ICT encourages:

- Student-centred learning;
- Active, exploratory, inquiry-based learning;
- Collaborative work;
- Creativity, critical thinking and informed decision-making;
- Involvement in authentic and real-life tasks;
- The transfer of skills and knowledge (DET ACT, 2004 p 3).

2. COMMONWEALTH BANK E-LEARNING GRANTS PROGRAM

Teacher descriptions of innovative projects using ICT's to enhance literacy and numeracy; a national perspective.

"As a direct result of the e-learning grant, literacy and numeracy programs would be supported with enhanced use of technology…..This initiative is innovative for our school, as we have never used technology as a tool to improve specific learning outcomes".
NSW Government school e-Learning Grant application, 2002

Commonwealth Bank e-Learning Grants program

In 2002, in conjunction with the Australian Government's National Literacy and Numeracy Week, the Commonwealth Bank launched the *e-Learning Grants* program, run in collaboration with State and Territory education authorities. Through this program, all Australian primary schools are invited to apply for one of 70 annual grants of $5,000 each to implement creative programs to develop students' literacy and numeracy skills through e-learning initiatives. By 2005, the e-Learning Grants program contributed $1.4 million in grants to 280 primary schools across Australia.

The applications for the grants, prepared by Government, Catholic and Independent primary schools from all states and territories, provide a rich source of teacher descriptions of how ICT are currently being used in the curriculum and also teacher descriptions of how technologies would be used to create innovative projects to enhance student literacy and numeracy. The study reported here analyses the applications in order to create a global picture of teacher perceptions of innovation.

One of the questions that this research investigates is 'How do grants such as the Commonwealth Bank e-Learning Grants Program encourage and promote 'innovation in schools'?

Scope of the Study

The 2002 Commonwealth Bank e-Learning Grants program was significant in that it increased funding for e-learning projects in Australian primary schools by $350,000. All primary schools (Government, Catholic and Independent) throughout Australia were eligible to apply regardless of whether they were just starting out with e-learning or already had well established programs. The e-Learning Grants program was well publicised and its association with National Literacy and Numeracy Week 2002 drew a large number of applications from primary schools throughout Australia.

In the first year of this initiative the e-Learning Grants program drew applications from thirteen hundred primary schools from Government, Catholic and Independent schools. The 1300 schools that submitted applications represented almost 20% (19.4%) of all primary schools in Australia (MCEETYA 2002). It is reasonable to assume that these schools believed that their project descriptions might be considered innovative otherwise they would not have completed the six pages involved in the grant application.

The thirteen hundred schools that submitted applications were individually contacted to obtain their consent to use the information contained in their applications for this study. Four hundred and sixty four (464) schools provided written consent and this study focuses on the data from these schools only. Those schools that consented represent 36% of the total number of schools who applied. The 464 schools in the study represent almost 6% (0.058%) of the 7980 primary schools (approximate number of primary schools that includes primary, primary special education and combined primary and secondary schools) in Australia in 2002 (MCEETYA 2002).

This study aims to describe how teachers associate these technologies with literacy and numeracy to provide an insight into the collective mind and the manner in which primary

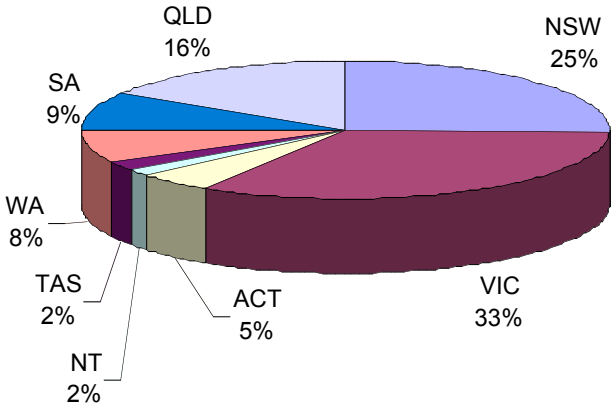
teachers across Australia make sense of these new technologies and, how they not only integrate ICT into their classroom practice but how teachers describe the innovative use of ICT in primary school environments.

Representation of schools across States/Territories

Table 1 Study Schools by State		
State/Territory	**Number**	**% of Sample**
NSW	118	25.3%
VIC	155	33.5%
ACT	22	4.8%
NT	7	1.5%
TAS	10	2.2%
WA	36	7.6%
SA	41	8.9%
QLD	75	16.2%

Graph 1

Study Schools by State



Victorian schools are over-represented in the study while New South Wales schools are under-represented. This may be an artefact of the consent process and the time taken to gain consent from the schools that had originally applied for funding. In general, the distribution of schools in the study is arguably consistent with the distribution of schools across the states and territories (see Table 2).

Table 2 % of Schools in Study Compared With Actual % of Australian Schools			
State/Territory	**% of Sample**	**Actual %of Schools***	**% Difference**
NSW	25.30%	33%	-7.70%
VIC	33.50%	25%	+8.50%
ACT	4.80%	1%	+3.80%
NT	1.50%	2%	-0.50%
TAS	2.20%	3%	-0.80%
WA	7.60%	10%	-2.40%
SA	8.90%	8%	+0.90%
QLD	16.20%	18%	-1.80%

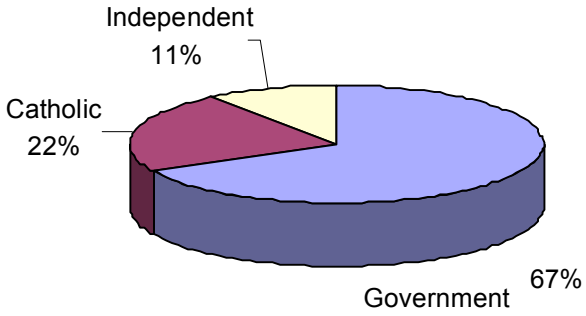
* The National Report on Schooling in Australia 2001

Representation of schools across Sectors

Table 3 Schools by Sector		
Sector	**Number**	**%**
Government	312	67.1%
Catholic	103	22.3%
Independent	49	10.6%

Graph 2

Study Schools by Sector



Government schools appear to be underrepresented by approximately 9% in the sample while Catholic and Independent schools appear to be over-represented by between 4-5%. These differences, as with the differences in the distribution of schools across the states are relatively minor (see Table 4).

Table 4 % of Schools by Sector in Study Compared With Actual % of Australian Schools			
Sector	**% of Sample**	**Actual %of Schools ***	**% Difference**
Government	67.1%	76%	-8.9%
Catholic	22.3%	19%	+3.3%
Independent	10.6%	5%	+5.6%

*The National Report on Schooling in Australia 2001.

Methodology

Each of the 464 applications was individually reviewed and categories and coding schemes were developed. After the data had been entered into the database some of the 'fields' of data were further examined to determine, where appropriate, what trends, or categories of data were expressed within the text. The descriptions of innovation contained in the applications reveal what teachers believe constitutes innovative practice. These teacher 'understandings' (Billig, 1997) embedded in the text were subjected to a 'content analysis' processes to determine the incidence of phenomena (categories of description), particularly those that might reveal the relationship between teacher perceptions of ICT infrastructure, pedagogy and classroom practice, motivation and innovation. Significantly, for policy and curriculum development, such teacher perceptions provide a basis to test the evolving theories of adoption suggested by Fullan (1997) and Spender (1998). The textual artefacts (Marton, Hounsell & Entwistle 1984) contained in the applications provide valuable insights into the ways in which teachers perceive the technologies and their impact on schools, teaching and learning.

A Three Dimensional Analysis Framework

Three consistent dimensions emerged in the applications. These were the dimensions of 'ICT Infrastructure', 'Motivation and ICT Use' and 'Innovation and Pedagogy'. Essentially, these dimensions describe the 'what', 'why' and 'how' of ICT use by schools in the context of their proposed innovative projects. Within each dimension three or four types or levels were identified, as listed in Table 5. Explanation of the characteristics of these types/levels is provided later in the report, together with examples from the schools' grant applications.

Table 5 Three –dimensional analysis framework

Dimension	Type 1	Type 2	Type 3	Type 4
ICT Infrastructure	Disconnected environment	Initially connected environment	Established connected environment	Multifaceted connected environment
Motivation and ICT Use	Situational – Reactive	Skills Oriented	Proactive – Higher Order	
Pedagogy and Innovation	ICT as an Innovative Object	ICT as a Curriculum Tool	New Learning Environment	

The three dimensions provide a framework for analysing, and, importantly, understanding the teacher descriptions of their 'innovative' ICT projects for enhancing literacy and/or numeracy learning in their schools. Therefore, the three-dimensional framework that emerged from the grant applications themselves became the critical tool for analysing the content of the applications and describing the national situation.

The framework potentially provides a means of 'locating' schools within each of the dimensions that enables teachers and policy makers to understand the potential for innovation within the context of an individual school. The separate dimensions and the interactions between the dimensions provide a means for revealing the complex factors within a school environment that determine the nature of ICT use.

3. ICT PROJECT FOCUS

WHAT Australian schools propose as innovative ICT projects

Innovative schools …. ”focus on students as innovators, problem solvers, communicators, creative team players, to be adaptive, technologically skilled and lifelong learners.”

Australia’s Teachers: Australia’s Future – Advancing Innovation, Science, Technology and Mathematics (DEST 2003, p5).

Project Focus

Literacy or Numeracy Focus

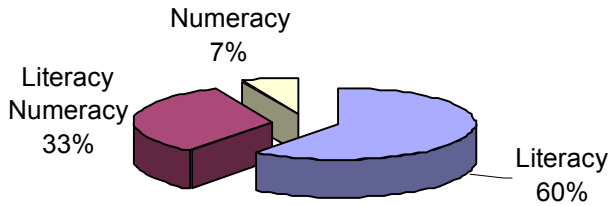
The e-Learning Grants application form asked schools (teachers) to describe how the grant would be innovatively used to enhance literacy and/or numeracy skills. Literacy was clearly the focus of 60% of schools. Numeracy was the focus for only 7% of schools. Projects that involved both literacy and numeracy accounted for one-third of the projects (33%). In total 432 schools (93%) involved projects that focused on either literacy or involved a project that integrated both literacy and numeracy.

Table 6 Project Focus: Literacy/Numeracy

Project Focus	N° Schools	%
Literacy	278	59.9
Literacy & Numeracy	154	33.2
Numeracy	31	6.7

Graph 3

Total Schools Project Focus: Literacy/Numeracy



Literacy Projects

The nature of the 278 Literacy projects proposed by schools varied widely from focusing on specific skills such as spelling or reading through to multimedia literacies and broader communication projects. The following quotes from the schools' project descriptions provide a sense of the diversity of the literacy initiatives proposed by schools.

> "In early stage 1 and stage 1, teachers will concentrate on the use of the word processor to identify spelling and grammatical errors in writing…. This will

necessitate more teaching of word processing skills and typing using a keyboard." (NSW Government School)

"Our initiative is to target the children's speaking and listening skills through the use of multimedia." (Victorian Catholic School)

"All important events will be displayed on the intranet along with student's written reports, oral and written descriptions, recounts, personal views, images and videos." (Northern Territory Government School)

"As part of the strategy to enhance the development of language, the e – Learning approach would become one of the devices that would be used by the Teachers, Teachers Assistants and Speech Pathologist to stimulate the development of language." (Western Australian Government School)

Numeracy Projects

The 31 (7% of schools) numeracy projects were also varied in nature. Project descriptions often referred to using ICT as a motivational device to combat negative attitudes towards mathematics. The following quotes from school project descriptions indicate the diversity and scope of numeracy proposals.

"We propose to develop a variety of learning experiences based around the measurement, number, data and space strands…. To undertake investigations in the community and within the school grounds… Using technology will be an integral element in the investigation, calculation and presentation stages of each activity." (Queensland Government School)

"Our initiative is to develop a staff maintained Intranet Website, which focuses on Numeracy… main homepage would provide key focus areas, which teachers and students could use daily… Links to internal Numeracy software programs, other teacher resources within the school, games, research links (quick URL's which quickly link to relevant Internet sites." (NSW Catholic School)

"As a distance Education school it is very difficult to provide sufficient numeracy and open-ended challenge material for all our children... Access to the Internet and e learning has to be one of the best possible ways we can achieve this." (Northern Territory Government School)

Combined Literacy and Numeracy Projects

The 154 (33% of schools) projects that contained a combination of Literacy and numeracy aims covered a variety of project types, including those that integrated several curriculum areas. In many projects a tendency for the Literacy aspects to dominate the numeracy aspects was apparent.

"…approach to learning ensures that both literacy and numeracy are embedded within each of our students' Learning Journeys (extended, in-depth

> research projects)….. Without realising it, these students had covered all the Literacy Outcomes of Speaking, Listening, Reading, Viewing & Writing; and were Thinking and Working Mathematically as well as exploring Space, Number, Chance & Data." (ACT Independent School)

Literacy, as a priority area in schools, is also a teaching area where teachers are likely to have greater confidence and experience. Experience and confidence may be the reason why schools were more likely to develop projects that focused on literacy. This may also explain why they are more likely to develop projects that use new technologies in the area of literacy. In contrast, numerous studies have found that many teachers do not feel confident in using ICT in their classrooms. The connection between the 'confident' curriculum focus and the lack of confidence in ICT use may explain the comments contained within the school applications focusing on literacy.

> "Although the teachers display an interest in and recognise that e-learning is an education requirement in today's learning environment, in general their use of it as such is limited by a lack of confidence and competence. They see technology as yet another area to be added to an already overcrowded curriculum…. It has been decided to explore e-learning as a means to further develop the skills and strategies for literacy." (NSW Catholic School)

> "...to develop the confidence of staff when using computers and related technology so that these skills could be taught to students in the school." (South Australian Government School)

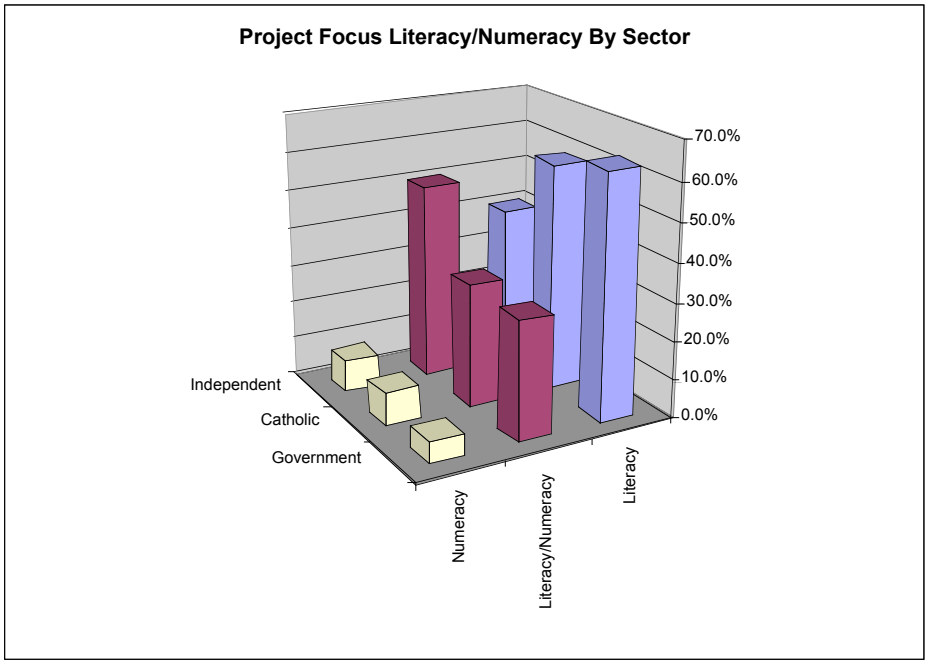
Project Focus by Sector and State/Territory

The focus on numeracy was consistently low across all sectors. The major difference in the project focus across sectors is a larger percentage of Independent schools with projects integrating both literacy and numeracy compared with the Government and Catholic Schools.

Table 7 Project Focus by Sector

Sector	Literacy	Literacy/Numeracy	Numeracy
Government	63.3%	30.9%	5.8%
Catholic	59.2%	32.0%	8.7%
Independent	40.8%	51.0%	8.2%

Graph 4



When the project focus information is separated into the states and territories, Tasmania is the only state or territory that appears to deviate from the overall pattern but this may be an artefact of the relatively small number of school applications (10) in the sample. Overall, however, the pattern is that that most schools, across state/territories and sectors developed projects with a focus on literacy.

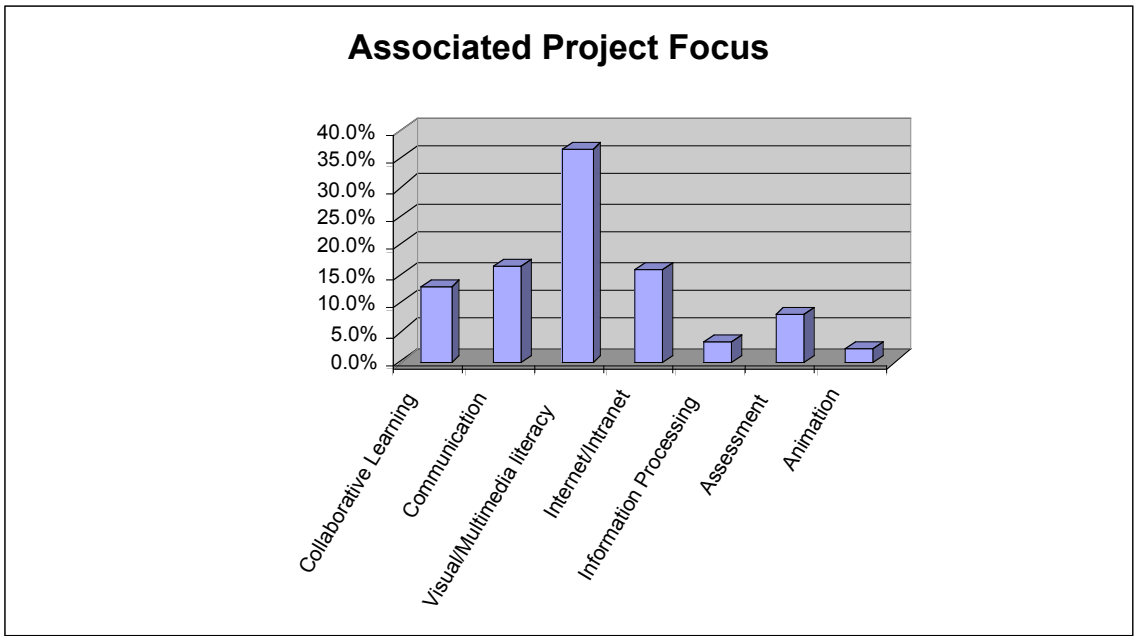
The 2002 Commonwealth Bank's e-Learning Grants program was run in association with the Australian Government's National Literacy and Numeracy Week 2002 and the applications were specifically to enhance literacy and numeracy. What this study has revealed is a significant preference for teachers to associate innovation with ICT's with literacy. Where the projects included combined literacy and numeracy outcomes the projects had a predominant focus on literacy.

Associated Focus Areas

In the project descriptions a number of 'associated' or 'integrated' components to the main project focus emerged. Most of the applications involved projects that included one or more of these categories. These associated categories provide some indication of the pedagogical approaches adopted by teachers and 'cross-curricular' themes such as visual/media literacies and assessment.

Table 8 Associated Project Focus	
Collaborative Learning	13.1%
Communication	16.4%
Visual/ Multimedia literacy	36.6%
Internet/Intranet	16.2%
Information Processing	3.7%
Assessment	8.2%
Animation	2.2%

Graph 5



The following quotes from applications provide an indication of the nature of each associated project focus:

> "Web quests incorporate cooperative and collaborative learning, since students work on projects in groups and caters for individual differences by providing multiple intelligence work. They are tools, not educational theories, and can help students meet standards focused on critical-thinking and analysis skills, therefore developing and enhancing numeracy and literacy outcomes." (NSW Catholic School)

> "…to communicate with their learning cohort, their teachers, their parents and the wider community through email and the use of digital camera/video are the vital new aspects of learning – e-learning – which will give these kids the passport to the sort of life skills previously unattainable in their small isolated, rural communities." (NSW Government School)

"Technological Literacy encompasses the concepts of information literacy as well as the skills to operate various technologies in order to access global information and perform as a literate member of society. This entails the processing, interpretation and critical analysis of online and on-screen sources of information that blend print information with visual, audio and other forms of expression." (Queensland Catholic School)

"Through this initiative the children will be able to see that information originates and exists in various forms and that it can easily be manipulated, managed and presented in various ways." (Queensland Independent School)

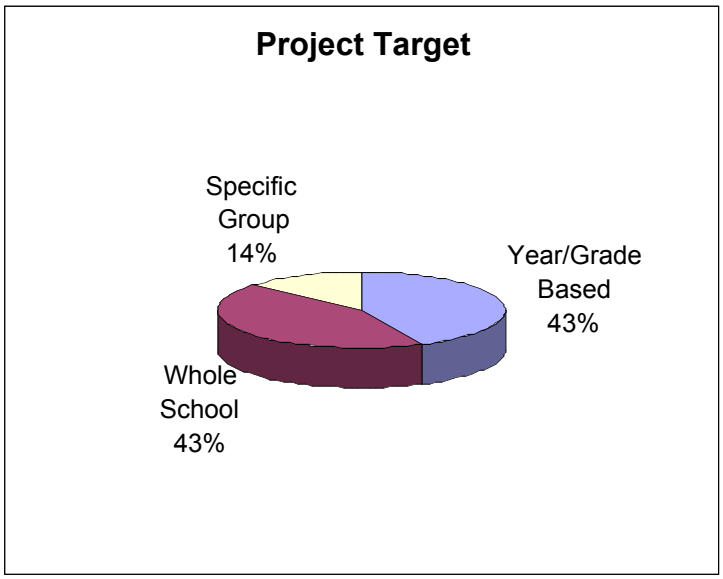
Target Groups

Teachers were asked to identify the particular group of students the project would target. Three categories emerged:

1) Schools that had a project to target a specific year levels or grades;
2) Schools where the project applied to the whole school; and
3) Schools that identified specific groups of students (non year/grade) as the target of their project.

In the third category considerable 'overlap' occurred between the whole school category and the category of 'specific groups'. The specific group category can be considered to be a subset of the 'whole school category'.

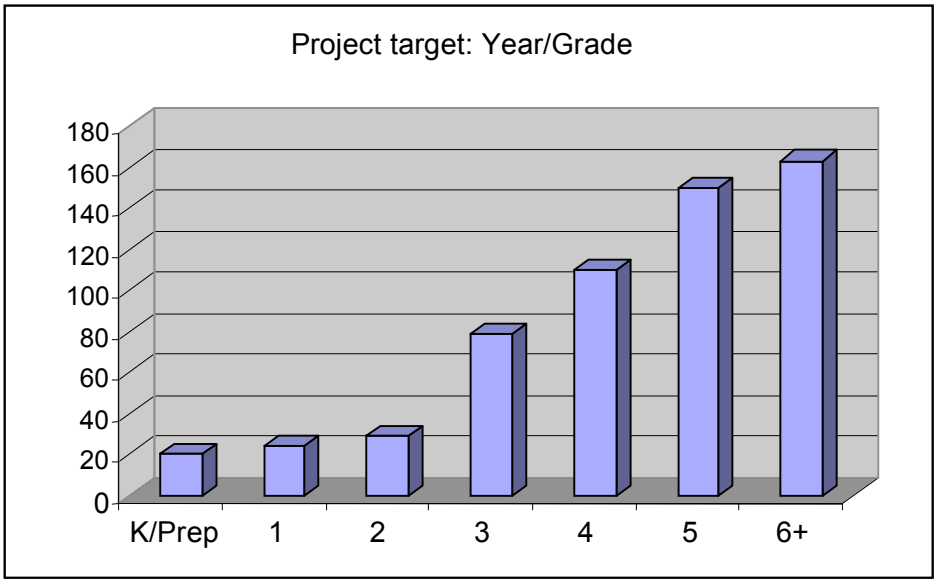
Graph 6



Target a specific grade or grades

Almost half of the schools in the sample (220 schools, 43.1%) indicated that their project would target a specific year/grade or years/grades.

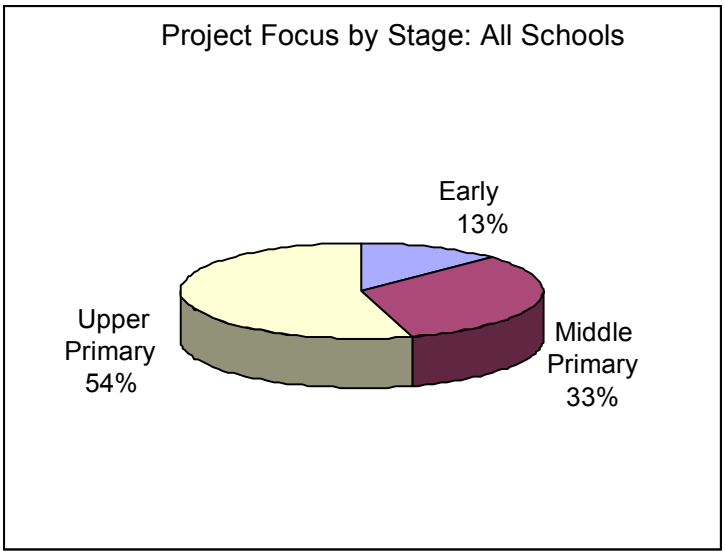
Graph 7



In many instances schools indicated that their project would target more than one year/grade but, as the graph above indicates, there was an overwhelming trend for school projects to target upper primary students.

The tendency to associate 'innovative projects' with upper primary was consistent across all the states and territories with the exception of Tasmania and the Northern Territory, but this was probably an effect caused by the small number of schools in their sample. The tendency to target upper primary groups for innovative project development was also consistent across education sectors.

Graph 8



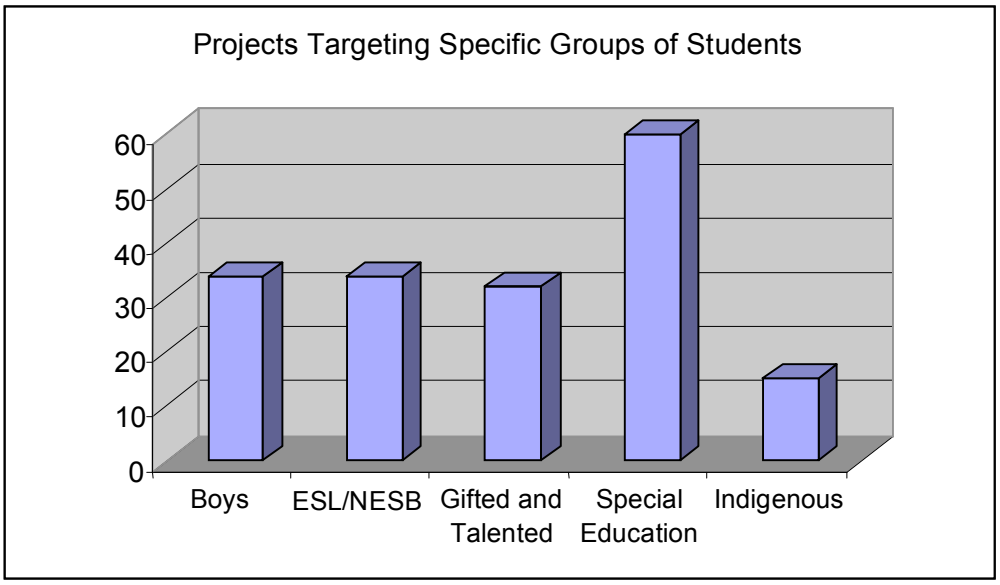
Target a specific group of students (non year/grade)

A number of groups emerged in the project descriptions that were not grade/year based or whole school. These projects identified groups of students within the school such as boys, gifted and talented and 'English as a second language' or 'non-English speaking background' students. Many of these projects had a whole school focus but they also specifically targeted students a sub-group of students. The projects were developed to address perceived 'needs' or 'deficits' in the target group.

Table 9 Projects Targeting Specific Groups of Students

Group	N°	%
Boys	34	7.3%
ESL/NESB	34	7.3%
Gifted and Talented	32	6.9%
Special Education	60	12.9%
Indigenous	15	3.2%

Graph 9



The following quotes, one for each of the listed target groups, provide an illustration of the nature of these projects:

> "E-learning provides opportunities for boys to improve and practise literacy skills….. Technology and e-learning are giving boys opportunities that are compatible with their masculinity and the ways that boys learn." (Western Australian Catholic School)

> "In particular, with students from a non-English speaking background it allows them to engage in learning tasks that involve opportunities to develop English language skills…" (NSW Independent School)

> "At the top end of the range, results indicate students with a high proficiency in literacy. These students have also demonstrated advanced levels of computer skills in word processing and DTP software as well as multimedia software, especially in the use of PowerPoint and FrontPage…..Our desire is to broaden the experience of these accomplished students in multimedia production, specifically in the design and production of digital movies." (NSW Government School)

> "Given the nature of the student population, school community and strong commitment to life long learning, technology was identified as the significant tool in the development of literacy skills for our students. No matter what the disability all students can access technology, some with the use of adaptive equipment, and therefore participate in the learning process." (Queensland Government School)

> "We are a small school of 123 students, 86% of which are of Aboriginal descent... Most of the children that attend this school would not have access to

a computer in their home. We find computers and other IT equipment extremely useful and adaptable tools when trying to motivate and enthuse many of our students as compared to 'traditional' teaching strategies." (NSW Government School)

Project Budgets

Schools were asked to provide a budget outlining how they intended to spend the $5,000 Commonwealth Bank e-Learning Grant. The 464 schools applied for a total of $2,175,130 (almost $2.2 million), an average of $4,688 per school. When the budget items were reviewed a number of broad categories emerged. The major categories to emerge in the budgets were:

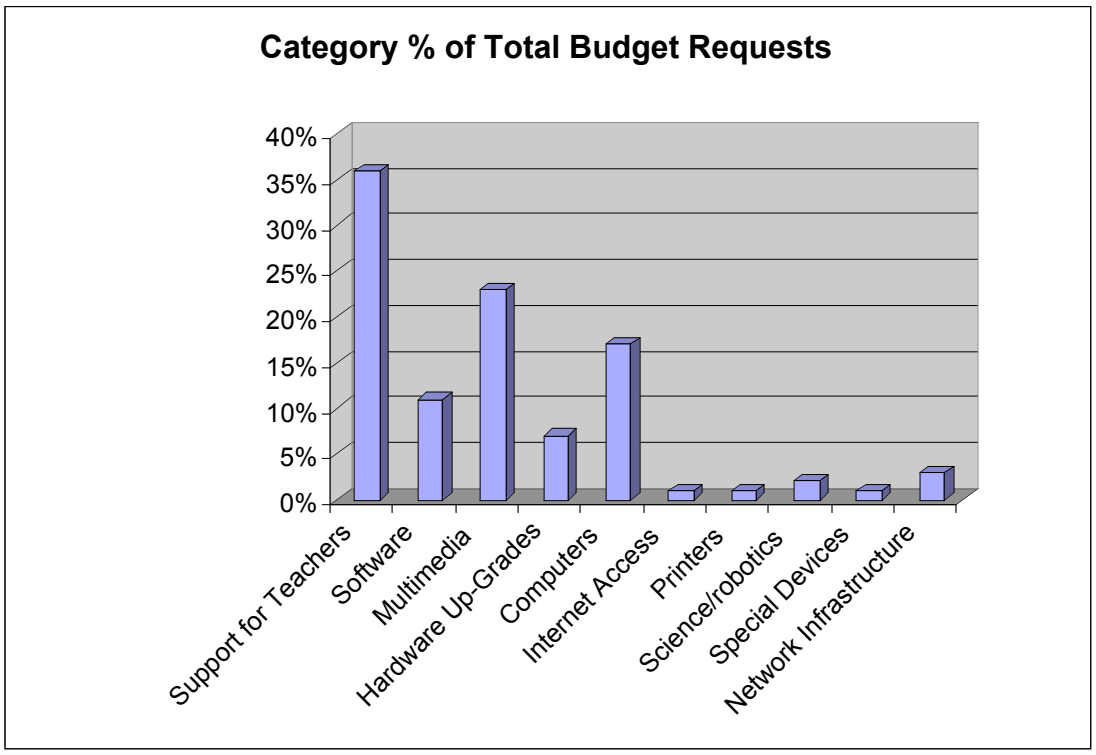
- Support for Teachers;
- Software;
- Multimedia;
- Hardware Up-Grades;
- Computers;
- Internet Access;
- Printers;
- Science/robotics;
- Special Devices; and
- Network Infrastructure.

Almost 150 schools included items in their budgets that could not be placed in one of the above categories or that could not be aggregated to create other categories. This 'Other' category accounted for approximately 4% of the total funds.

Table 10 Budget Request Categories Percentages

Support for Teachers	36.3%
Multimedia	23.0%
Hardware Up-Grades	1.6%
Computers	16.7%
Software	11.4%
Internet Access	0.6%
Printers	1.1%
Network Infrastructure	2.8%
Science/robotics	1.5%
Special Devices	0.56%
Other	4%

Graph 10



The three largest categories of Teacher support, Multimedia and Computers have been further analysed below.

Support for Teachers

This category includes professional development, expert assistance and release time for teachers. Funding to support teachers amounted to 36% (release time; 21%, professional development; 7%, expert assistance; 8%) of the total funds applied for in the e-Learning Grant applications. These requests indicate that teachers feel a significant need for support through professional development programs, advice and support from experts in the areas of curriculum development and ICT, and, time to plan to utilise the technologies in classroom and school projects.

For example:

> "Professional development in positive, interactive pedagogy (real teaching practice)." (NSW Government School)
>
> "In-school Professional Development from IT support person covering areas such as skills for particular software, the use of electronic communication and use of peripherals (scanner, digital video camera, digital camera)." (NSW Catholic School)

Almost all the descriptions of proposed professional development were 'in-school'. Teacher release time involves the employment of teachers to release classroom teachers from their normal teaching load. In requesting teacher release time, teachers

were asking for time, either for individuals or for groups of teachers, to plan and develop teaching and learning activities using the technologies and for time to work with other teachers.

> "…staff will be released from class and given professional development training in the operation of the equipment over a two-day period. Trainers for this purpose will come from both in-house specialists (peer-training) and the department's e-learning coaches." (ACT Government School)

The applications for funding for teacher support were consistent across all states/territories and sectors.

Multimedia Technologies

Almost a quarter of the funding requests from schools were for 'multimedia technologies'. The multimedia technologies described in the budgets included, Digital Video Cameras, Digital Cameras, Web Cameras, Scanners and Data Projectors. Some of these items are particularly expensive for schools and are not usually supplied to schools from state or territory governments. Digital video cameras ranged in price from $1,500 to $3,000. The data projectors requested ranged in price from $1,200 to $5,000.

The following quotes illustrate some of the uses for these digital devices:

> "If a Data Projector is available the teaching process would be more efficient and effective: all students in the class would have visible access to the computer output needed to produce the Power Point presentation, instead of the teacher and librarian needing to teach each group at each computer individually." (NSW Catholic School)

> "The initiative will allow our students to further enhance their work through the addition of digital video and digital stills. It will allow students to experiment, explore, and further enhance their understanding of digital imaging and the use of technology in all aspects of their lives….
>
> - To train students in the use of digital video hardware.
> - To train students in the use of digital video software.
> - To enlighten students to the possible uses of digital hardware and software." (NSW Government School)

> "Through the implementation of digital videoing and the ease of Imac's Imovie programming we will enable our children to take their ideas to the screen enhancing their language, planning, teamwork and to develop high level thinking skills necessary to produce quality videos, including skills of editing, sequencing, adding appropriate text, speech and effects to suit audience – this will also add value to a video, allowing an audience to review the experience and gain further meaning….To develop students literacy skills through high interest activities where students have a real purpose to add text and speech to presentations which will be shown to a target audience." (Victorian Government School)

Computers

Seventy-seven schools (16.7%) applied for various types of computers – Workstations, Multimedia Computers, Laptops and Fileservers. Catholic schools were found to be applying for significantly larger grants for 'workstations' than Government schools. Catholic schools were less likely to request funds for multimedia computers than Government schools. Laptop computers were described as being flexible in their use.

> "Our initiative focuses on the provision of hardware that is able to be flexible in its delivery and portable for all classes of the school to utilise. The positive development of wireless networking and the features of laptop computers highlight an important opportunity to take computer hardware one-step further for our staff and students." (ACT Catholic School)

Requests for laptop computers were far greater from Catholic and Independent schools when compared to Government schools. Compared to the percentage of schools in the sample, Catholic and Independent schools were far more likely to develop projects that involved both laptop computers and data projectors. Almost all of the projects requesting fileservers involved the creation or increased use of the school's Intranet.

Major Budget Groupings

The budget categories described above were further were aggregated into four main groupings. These were:

1) Human Resources:
    a) Professional Development;
    b) Teacher Release Time; and
    c) Expert Assistance.
2) Software
3) Hardware
    a) Digital Video Cameras, Digital Cameras, Web Cameras;
    b) Scanners;
    c) Data Projectors;
    d) CD Burners, DVD Burners;
    e) Memory, Hard Drives;
    f) Multimedia Computers, Workstations, Laptop Computers, Fileservers;
    g) Colour Printers, Laser Printers, Colour Laser Printers;
    h) Cabling; and
    i) Wireless Network.
4) Internet Access

The number of requests and the actual cost (funding) for items within each category were then compared.

Table 11 Major Budget Categories

	% of Requests	% of Funding
Human Resources	40.9%	36%
Software	14.5%	11%
Hardware	43.9%	51%
Internet Access	0.7%	1%

The percentage of total requests for hardware items was lower than the percentage of funds requested. Hardware, such as digital cameras and data projectors, multimedia computers, etc. are relatively expensive and represent a significant investment for schools. While the number of requests for human resources such as teacher release days and professional development were almost the same as the number of requests for hardware, the cost of these human resources was generally less than the hardware.

4. THE ICT INFRASTRUCTURE DIMENSION

WHAT technologies are Australian schools using?

"School intranets have enormous potential for promoting the ready and immediate sharing of information and resources among teachers, parents and students…... Such information sharing contributes greatly to the sense of common purpose and commitment which characterise highly successful school communities."

Australia's Teachers: Australia's Future – Agenda for Action (DEST 2003, p.50)

Levels of ICT Infrastructure

In the applications teachers described their ICT infrastructure in their schools. Each application had to be individually assessed to determine its level of ICT infrastructure. The four levels that emerged from the infrastructure descriptions are outlined below.

Level 1: The disconnected environment

The school's ICT infrastructure is limited and composed of only a small number of computers and most of these are not connected to any type of network. In these environments there is an emphasis on increasing access to the technology, i.e., providing more computers to reduce the ratio of computers to students and constructing a network. This is reflected in the applications where the intent is clearly aimed at increasing access to ICT's. Descriptions of this level of ICT infrastructure, of the disconnected environment, are characterised by:

- Small numbers of computers, usually one or two per classroom (i.e., ratios of between 1:25 and 1:30);
- Limited access to the Internet, usually through the library; and
- Those computers that exist in the school are generally not networked and operating as 'stand alone' workstations.

Level 2: The initially connected environment

The ICT infrastructure is slightly more developed and utilised, but descriptions of this environment recognise greater potential for the use of networked computers within the school environment and often focus on increasing the quantity and connectivity of computers. The descriptions are characterised by:

- Increased numbers of computers in the school (typically between 1:10 and 1:15);
- Small numbers of networked computers;
- Internet access is available but only to a small number of computers in areas such as the library or specific classrooms; and
- Internet access is usually slow with restricted bandwidth.

Level 3: The established connected environment

The ICT infrastructure is well established and a school's local area network is in operation. These schools often describe the desire to add additional resources to the infrastructure to expand its use. The descriptions are characterised by:

- Increased numbers of computers in the school. The density of computers is consistent with government statistics;
- Computers are generally less than three years old;
- Almost all computers are connected to the school's LAN;
- Broadband access to the Internet is available and reticulated throughout the school;
- Emphasis on access to the Internet particularly as an information resource;
- All networked computers have internet access. Internet access on all computers is considered a priority;

- Increased use of peripheral devices such as scanners, digital cameras and networked printers;
- Multimedia resources (digital video and data projectors) are beginning to be used in teaching and learning;
- High density computer areas such as 'computer labs', technology centres', 'technology resource centres' are created; and
- A concentration of expertise and competence in a small number of teachers usually manifested in the form of a 'computer teacher'.

Level 4: Multifaceted connected environment

In schools in this level the ICT infrastructure has matured to become an integral part of the school environment, with well established infrastructure and communication mechanisms (Websites and email use) reaching beyond the school. The opportunities for teaching and learning provided by the infrastructure are beginning to change the operation of the school and how teachers conceptualise teaching and learning. The descriptions are characterised by:

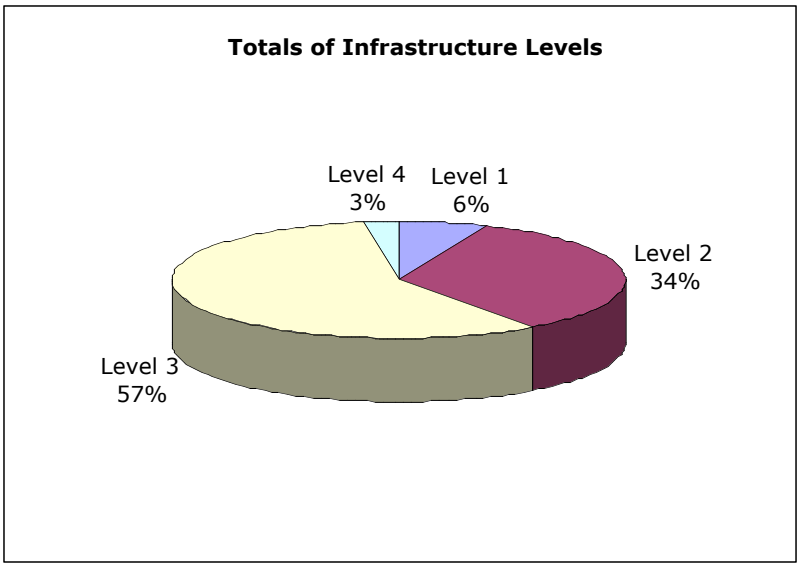
- Broadband access to the Internet available on all computers;
- All computers connected to a high speed/bandwidth LAN;
- Increased provision of network management systems provided both internally and externally which result in increased reliability and stability;
- Increased use of multimedia devices such as digital video, digital cameras;
- Increased use of the LAN for teaching and learning as well as administration and communication. The LAN is a critical component of teaching and learning programs;
- Email used regularly by staff and students;
- Exploration and experimentation with the options provided by the Internet and school LAN and broadband Internet access;
- Emphasis on the Internet as an information resource is shifting to incorporate communications potential;
- The school website is a critical part of the school;
- ICT's are bringing about a change in the way the technological infrastructure and the teaching and learning environments of the school are conceptualised; and
- Experimentation with school organisation, classroom design and furniture, etc.

A National Picture of ICT Infrastructure

Very few schools described infrastructures that would be categorised as 'Level 1 – Disconnected' (6.47%) or as 'Level 4 – Multifaceted connected' (2.59%). The vast majority of schools (91%) described computer environments that were 'connected' environments, with just over half the schools describing 'Level 3 – Established connected' infrastructures.

Table 12 Totals of Infrastructure Levels		
	Number	%
Level 1 Disconnected	30	6.47%
Level 2 Initially connected	156	33.62%
Level 3 Established connected	266	57.33%
Level 4 Multifaceted connected	12	2.59%

Graph 11



Infrastructure Levels across the States/Territories

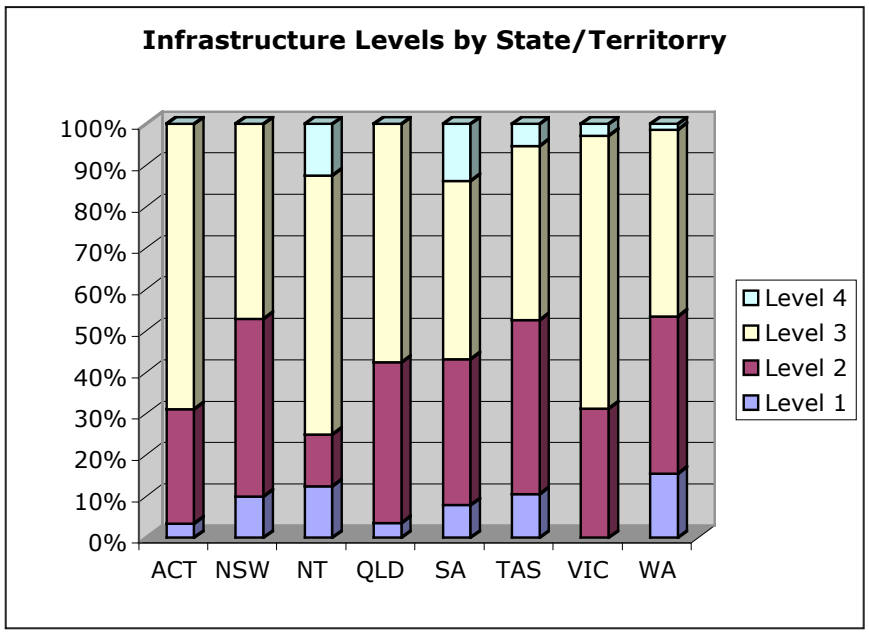
While there is some variation between the states/territories, they all follow the national pattern of a predominance of 'Level 2 – Initially connected' and 'Level 3 – Established connected' infrastructures. Some of the obvious variations are listed below:

- The ACT had a higher proportion of Level 3 and did not have any schools that could be classified with Level 4 infrastructures;
- Victoria did not have any schools that could be classified with Level 1 infrastructures and dominance of Level 3;
- Western Australia and Northern Territory had greater than anticipated numbers of schools in Level 1; and

- South Australia and Northern Territory had greater than expected numbers of schools in Level 4.

Table 13 Infrastructure levels by state/territory %				
State	Level 1	Level 2	Level 3	Level 4
ACT	3.45%	27.59%	68.97%	0.00%
NSW	10.00%	42.86%	47.14%	0.00%
NT	14.29%	14.29%	71.43%	14.29%
QLD	3.53%	38.82%	57.65%	0.00%
SA	7.84%	35.29%	43.14%	13.73%
TAS	10.53%	42.11%	42.11%	5.26%
VIC	0.00%	31.25%	65.91%	2.84%
WA	15.49%	38.03%	45.07%	1.41%
Average	6.22%	36.27%	54.92%	2.59%

Graph 12

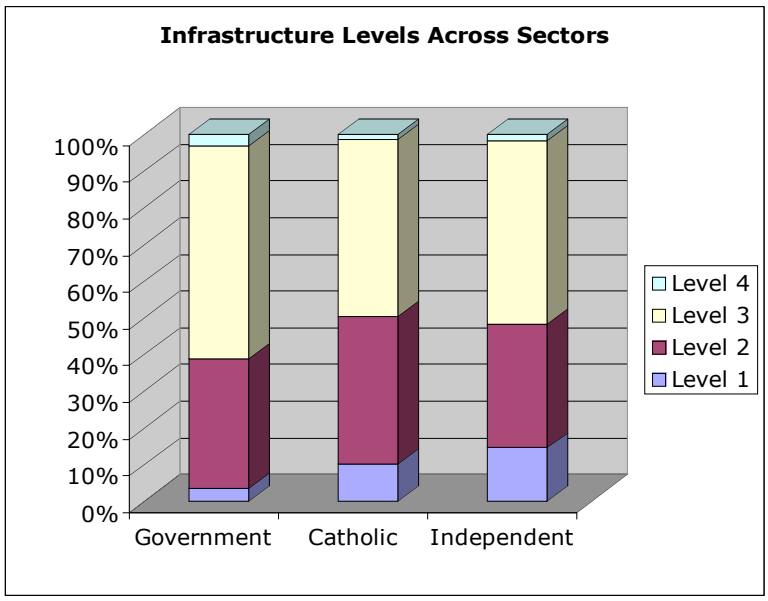


Infrastructure Levels across Sectors

Government schools tend to have slightly higher rates of Levels 3 and 4 infrastructure than the other sectors. There are slightly more Catholic schools in Level 2 than other sectors, while Independent schools appear to have extremes in infrastructure provision: many with little infrastructure (Level 1) and many with higher levels of infrastructure (Levels 3 and 4).

Table 14 Infrastructure Totals by Sector: (%)				
	Level 1	Level 2	Level 3	Level 4
Government	3.61%	35.31%	57.99%	3.09%
Catholic	10.08%	40.31%	48.06%	1.55%
Independent	14.52%	33.87%	50.00%	1.61%
Average:	6.22%	36.27%	54.92%	2.59%

Graph 13



Emerging Patterns of ICT Infrastructure

The ICT resources schools have, and, how they are distributed and organised in schools, provides an insight into how they are being used and, from this, some indication of the curriculum and pedagogies employed.

The physical distribution of computers within schools can have dramatic effects upon how the computers are used by students. Deciding upon a particular configuration depends primarily upon students' learning styles, and teachers' instructional style (McKenzie. 1998). A significant issue for many of the schools in this study appeared to be whether they disperse their computer resources throughout the school or to aggregate many of them into one space and build a computer lab where the density of computers to students can be as high as 1:1. There are real issues for schools in either course of action.

The computer lab usually had a specialist teacher who has a skills level that differentiates them from their colleagues. Students are timetabled for specific periods of time on a weekly basis and experience what is described as predominantly skills based programs. This contrasts with the approach adopted by many schools to ensure that their IT resources are distributed throughout the school and the density of networked

computers increases to near the national average of 1:6. While the number of computers is less than when the students are in the specialist facility the computer resources are constantly available to students and teachers. Using these dispersed resources requires a considerable investment in teacher expertise, skills development and confidence. Somewhere in the middle small 'mini-labs' have also been created.

Three broad patterns have emerged from the data:

1) Centralised or specialist facilities with specialist teachers; ratio of computers to children very high in specialist facility but much lower in classrooms;
2) Distributes resources and small 'mini-labs'; ratio of computers to children lower but not as low as in specialist facility, 'mini-labs' used on a needs basis; and
3) Distributed and networked resources; computers distributed throughout the school, ratio of computers to children high in classrooms.

Specialist facilities: Computer Labs

A total of 135 (29.1%) primary schools specifically indicated that they had a 'lab', 'learning technology resource room', 'computer classroom' or some other 'technology resource centre'. The computer labs or resource centres contained a large number of computers, between fifteen and thirty, and were used for 'whole class' teaching. Classes were timetabled for specific periods of time a week usually with the support of a 'specialist' technology teacher. Where computer labs are described there is a strong emphasis or association with 'skills' acquisition by students.

> "Using the lab we can walk the children through each step of the process using a hands-on approach with a computer:student ratio of 1 : 2. The teacher can demonstrate exactly what he/she wants the class to do by using the data projector and the laptop computer on the big screen. The advantage of this will be that all children will be able to use the new skill immediately." (Queensland Government School)

Mini-labs

A small number of schools described 'mini-labs' or small concentrations of computers. The mini-labs were either fixed, set up in the library or other available space, or portable, so able to be moved to classes as needed. Mini-labs lie between the two main organisational approaches used by schools, i.e., computers distributed to classrooms or, computer lab(s) but a lower density of computers in classrooms. Mini-labs were described in ways that suggested that they provided greater flexibility than computer labs.

> "The portable mini lab can be set up in various configurations of computers around the school when and where they are needed. Establishment of a mini-lab in the Resource Centre initially comprising 6 new computers purchased …" (NSW Catholic School)

Distributed Resources

When computers are distributed throughout the school they create classroom environments with between three and six computers. Increasingly these computers are

networked and have Internet access. In such numbers they have a considerable impact on the physical space in the classrooms. Large monitors and towers, often with specially constructed furniture take up a lot of space in classrooms.

> "…..a new arrangement of furniture and computers within a regular classroom setting. The aims were to allow for more efficient computer access for all students and to allow their computers to be better utilised throughout the school day." (Victorian Government School)

Wireless Networks

Thirteen schools indicated in their applications that they either had or were intending to create a wireless network. Implicit in wireless networks is the notion of portability, and with portability is flexibility and responsiveness to needs as they arise. Almost all the wireless networks were developed in conjunction with the use of laptop or notebook computers.

> "…school has successfully created a fully integrated mobile wireless environment. This allows students and staff the freedom and ability to access multi dimensional Learning Technologies across the campus. This allows teaching and learning rooms, resource areas, wet areas and outside benches to be utilised educationally to benefit the teaching and learning outcomes of all students." (Western Australian Government School)

Specialist teachers

There is a clear association between the creation of a specialist teaching resource space such as a computer lab and a perceived need for 'specialist' teachers who can use these facilities and who have a greater of different skills level to most teachers in the school.

> "We have established a dedicated Computer Laboratory and employed a technology teacher." (Western Australian Catholic School)

The use of special facilities and specialist teachers to teach 'skills' was justified on the basis that many teachers did not feel confident in either using or teaching with ICT. However, not all the specialist teachers worked in isolation in skills based programs, and some schools described the desire use the specialist teacher in a more integrated way to influence the pedagogy of other teachers.

Impact on classroom design

Given that the computers are often bulky items and often require their own furniture the impact their presence has on classrooms can be readily appreciated. New schools have the advantage of being designed to accommodate computer technologies as some of the teachers clearly indicated.

> "Classrooms were designed as designated computers labs, all computer systems within the school are networked. The centre was designed with new

ergonomic computer tables and chairs. It is equipped with a projector and large wall screen to facilitate demonstration during teaching and training sessions." (Queensland Independent School)

5. THE MOTIVATION AND ICT USE DIMENSION

WHY Australian schools want to develop the use of ICT

"The motivation for focusing on the improvement in literacy through this e-Learning initiative is based in the past and present objective of integrating technology into the learning environment…Our purpose is to ensure that our students develop individual potential, self esteem and confidence, as well as the knowledge, skills and attitudes required to contribute to the development of our changing society."

Western Australian Government school e-Learning Grant application 2002

Types of Motivation and ICT Use

The descriptions of teacher motivation contained in the 2002 e-Learning Grant applications have provided an invaluable insight into the factors that influence teacher motivation in primary schools. Motivation is the entire set of factors (i.e., motives) that compels an individual to respond and has a directive, sustaining quality that energises and maintains learning activities. It influences the types of projects and innovations that teachers are prepared to become involved in and the nature and intensity of involvement (Pintrich & Schunk 2002). The descriptions of the motivations for the projects also reflect the core values and understandings that have influenced the development of the projects.

In the context of the Commonwealth Bank's e-Learning Grants program the statements and descriptions of teacher motivation to develop and implement projects involving ICT's provide an invaluable insight into both teacher confidence and the 'forces' or 'influences' that have become the focus of the project. Innovation within the motivation descriptions is the response to needs and possibilities perceived in the context of the school. The motivation descriptions reflect how teachers respond to the relative significance of the influencing forces in a particular context.

The teacher responses fell into three broad categories. The 'types' that have emerged within this dimension are not portrayed in the same manner in which levels have been used to describe the ICT infrastructure of schools. Rather, they provide an indication of how teachers believe they can be innovative within their particular context and reflect both the internal and external influences in a particular context.

Type 1: Situational – Reactive

The project motivation is based on the specific school context and the reason for the project is defined in terms of meeting the learning needs of students or specific groups of students. In this sense, the initiative is a reaction to the internal forces operating within the particular school.

The explanations of motivation usually involve identifying the areas of deficit (a reflection of the values of the teachers and school), particularly in terms of student needs. The project descriptions contain goals such as:

- Providing opportunities for disadvantaged students (e.g., distance, socio-economic disadvantage, etc);
- Increasing access to technology (particularly in remote and rural areas);
- Addressing negative attitudes to literacy or to learning in general; and
- Promoting 'life skills'.

The motivation statements of schools in this type frequently refer to the pressures deficits or disadvantages in their students, school, teachers and community create and how they, as teachers, react to these pressures. A number of themes were woven into the motivation descriptions. The three predominant themes were; Teacher-Centred, Student-Centred, Resource-Centred.

> "The relative disadvantage of our students, based on their intellectual disability and their social and emotional backgrounds, impacts directly on their sense of well-being, health, value and connectedness to the community. Some of our students have been in 'cycles of failure' for various reasons at a number of schools. Some are also known to the juvenile justice system." (ACT Government School)

Type 2: Skills Oriented

In this category, the motivation for the project is focused on students and staff acquiring technological skills and competencies related to the specific technologies available within the school and how ICT's can be used to support curriculum outcomes. Teachers in this 'type' are motivated to use the technologies to achieve curriculum outcomes more effectively. Innovation in this type involves integrating the skills necessary to perform tasks embedded in curriculum areas; it is frequently described in terms of doing what is normally undertaken within the school but the innovation is that it will now be done using ICT.

The explanations of motivation and the project descriptions focus on developing and increasing skills, for example:

- Core IT skills;
- Abilities in ICT;
- Research and locating information skills;
- Multimedia construction;
- Expertise in ICT;
- Integration of technologies in the curriculum; and
- The quality of student publications.

There were three identifiable sub-groupings of motivation according to whether focus was on developing student ICT skills, teacher ICT skills, or teacher skills in integrating ICT in the curriculum.

> "The motivation for this initiative is derived from an overall school focus and departmental focus on improving our students level of outcomes in both literacy and numeracy." (NSW Government School)

Type 3: Proactive – Higher Order

This type of motivation is characterised by experimentation and exploration of new ways of teaching and learning, often for the promotion of new ways of thinking or higher order thinking skills. In this sense the projects are proactive because of the forward-looking nature of the goals and the departure from previous methods. Teachers describe their projects not only in terms of curriculum outcomes but in much broader terms that can be described as a world-view approach, with the projects extending well beyond the classroom. In this 'type' teachers are motivated to innovate to achieve higher order thinking skills in their students and perceive that the technologies, if used in much broader ways, can promote the development of skills involving multiliteracies, critical literacies, synthesis and analysis. Innovation in this 'type' reflects the value that teachers place on a broader and more integrated curriculum, but it is also built on teacher and student competencies and an ICT infrastructure that can support such innovation.

The explanations of motivation and the project descriptions include features such as:

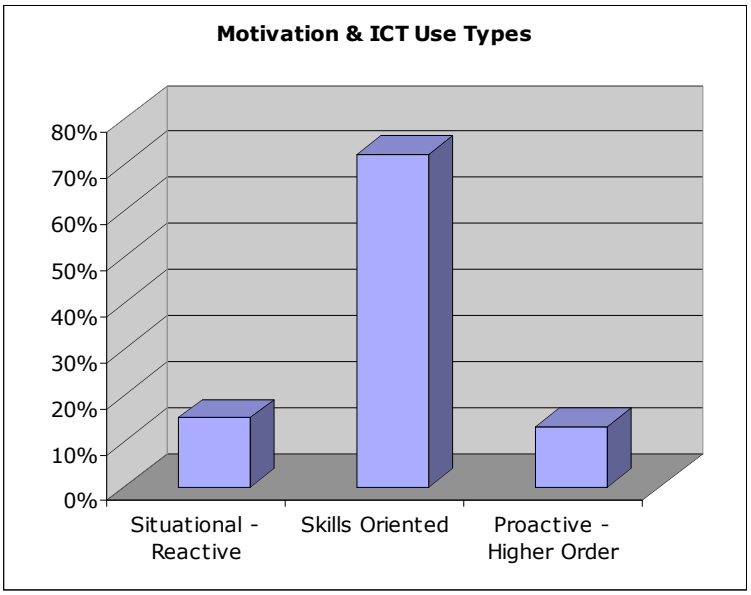
- Pedagogical frameworks;
- Personal construction of knowledge;
- Deep knowledge, synthesis, critical reflection;
- Open-ended outcomes;
- Collaboration within and/or beyond the school;
- Digital multimedia creation;
- Net conferencing;
- Global publication and critique; and
- Cultural exchanges online.

> "It seems a natural progression to meld the goals of literacy and numeracy with the extensive opportunities that can be generated by e-learning. Our school is well-resourced with texts, equipment and staff, but we lack the ability to produce 'real' products which reflect the higher-order thinking skills of our students and the application of the affective area of Gardner's Multiple Intelligences." (South Australian Catholic School)

A National Picture of Motivation and ICT Use

The majority (72%) of the schools described their motivation for the proposed project and the reasons for using ICT in the project in terms of developing the technological skills of students and teachers as a means of enhancing curriculum outcomes. Therefore, most schools were identified as being 'Type 2: Skills Oriented'. Of the remaining schools, 15% were reacting to a problem or need specific to their own school or to a group of students within the school. (Type 1: Situational – Reactive). Only 13% of the schools were categorised as being 'Type 3: Proactive-Higher Order', because of their exploration of new ways of thinking and learning afforded by the characteristics of the technologies, particularly the connectivity and access to the outside world aspects.

Graph 14



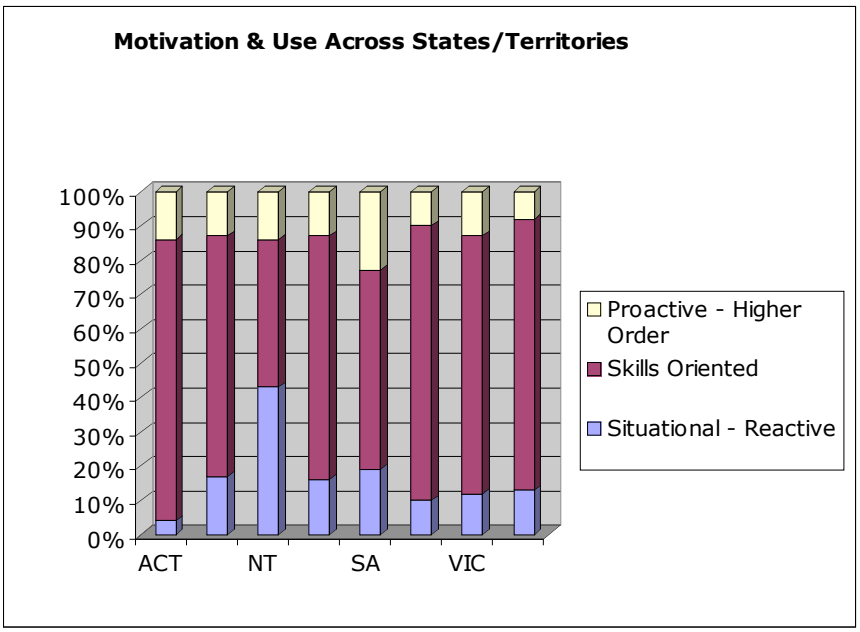
Motivation & ICT Use across the States/Territories

The data for each separate state and territory follows the same pattern of a concentration of motivation in the 'Type 2: Skills Oriented'. However, there are some differences between states. South Australia has a noticeably higher proportion (23%) of schools categorised as 'Type 3: Proactive-Higher Order' than the other states, while Western Australia has the lowest proportion (8%). The Northern Territory is unusual in having the same proportion of Type 1 and Type 2 schools (43%), though this could be an artefact of the small sample.

Table 15 Motivation & ICT Use Type in Each State

State	Type 1 Situational – Reactive	Type 2 Skills Oriented	Type 3 Proactive-Higher Order
ACT	4%	82%	14%
NSW	17%	70%	13%
NT	43%	43%	14%
QLD	16%	71%	13%
SA	19%	58%	23%
TAS	10%	80%	10%
VIC	12%	75%	13%
WA	13%	79%	8%

Graph 15



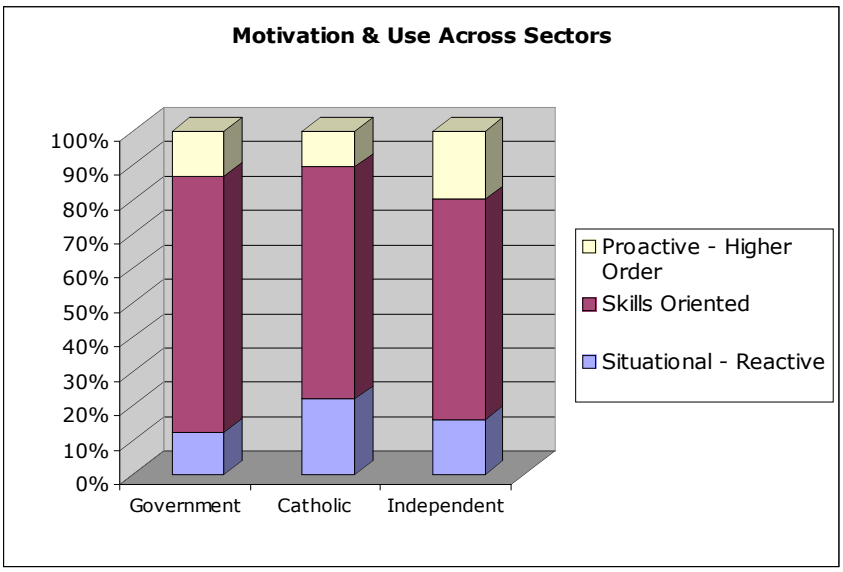
Motivation & ICT Use across the Sectors

Some further differences emerge when the data is separated into sectors. Catholic schools have a markedly higher proportion of schools in Type 1 (22.33%), which suggests that more of them are reacting to a specific need or disadvantaged group within their school. Government schools are very strongly located in Type 2 (75.64%), which suggests that they are focused on further development of skills with technologies. The Independent schools have proportions higher than the national average in both Type 1 and Type 3 categories.

Table 16 Motivation and ICT Use Totals by Sector

Sector	Type 1 Situational – Reactive	Type 2 Skills Oriented	Type 3 Proactive-Higher Order
Government	12.50%	75.64%	13.46%
Catholic	22.33%	68.93%	10.68%
Independent	16.33%	65.31%	20.41%
Average:	17.05%	69.96%	14.85%

Graph 16



The Dominant Motivation & ICT Use Type

The predominance of 'Type 2: Skills Oriented' suggests that the typical primary school in this sample are motivated to use technology as a teaching and learning tool, to be used within existing pedagogies, as a means for enhancing the achievement of curriculum outcomes for students.

The following quotes from individual school 2002 Commonwealth Bank e-Learning Grant applications illustrate the nature of the teachers' motivation for using ICT in Literacy and/or Numeracy projects.

> "The motivation for this initiative arose from the growing awareness of staff to improve the pedagogy in the areas of Numeracy (Mathematics) and the need to embrace technology as a teaching tool." (Tasmanian Independent School)

> "The motivation for focusing on the improvement in literacy through this e-Learning initiative is based in the past and present objective of integrating technology into the learning environment." (Western Australian Government School)

6. THE PEDAGOGY AND INNOVATION DIMENSION

HOW schools use ICT innovatively in teaching and learning

"An increasing number of schools are realising the potential of ICT to encourage whole-of-school innovation that enhances learning options and outcomes across the curriculum."

Learning Technologies Plan for ACT Government Schools & Preschools 2004-2006 (DET, ACT, p3)

Types of Pedagogy and Innovation

This dimension relates to how technologies are being used in the school at the time of the application and how the technologies were to be used. Innovative pedagogy can be thought of has a teacher's deliberate strategy to introduce new ways of students engaging with material with the purpose of improving learning. The teacher's own pedagogical beliefs and values play an important part in shaping technology-mediated learning opportunities.

The 2002 Commonwealth Bank e-Learning Grant applications contain teacher descriptions of the pedagogy and the use of ICT's in an Australian context. Three categories or types of pedagogy emerged in the applications. These are described as: ICT as Innovative Objects, ICT as a Curriculum Tool, and, ICT to create New Learning Environments.

Type 1: ICT as Innovative Objects

This type is characterised by an emphasis on the 'newness' of the technology itself and the project's focus on 'learning about the technology' and bringing new technologies into the classroom. The rapid changes that appear to be inherent in hardware and software create a perception of constant 'newness'. The new technologies are perceived as desirable by virtue of their 'newness' and the attribute of 'newness' is, in itself, innovative. New technological objects are more likely to be used if the classroom practice of the teacher is not challenged by the new object because the teacher's pedagogical approach can accommodate the 'new' technology, i.e., new technology but not new pedagogy.

The project descriptions in this type include references to factors such as:

- Computer labs;
- Basic skills in Literacy and Numeracy;
- Core IT skills (word processing);
- Increased confidence and ICT experience;
- Raising expectations;
- Efficiency of organization, time, access to information, planning; and
- Motivation of reluctant learners.

Examples from the e-Learning Grant applications:

> "Being at the infancy stage of introducing E-learning, we saw the potential that a grant of this size could assist us in the implementation of our program. Like most Independent schools in the country, we struggle to keep up financially with the demands of setting up and maintaining a program such as this." (Victorian Independent School)

> "A recent survey revealed that less than 50% of students have access to a computer at home and even amongst those who have computers at home, only a few have Internet access. Students are therefore significantly disadvantaged in developing E-learning skills." (Queensland Government School)

Type 2: ICT as a Curriculum Tool

This type is characterised by references to how the technology can improve educational outcomes such as those defined in curriculum documents. The technology becomes a teaching and learning tool. In this 'type' teachers use their knowledge of curriculum content to interrogate the value of any technology in order to integrate it into the curriculum and classroom practice. The increased efficiency presented by the technologies is perceived as the innovation.

The project descriptions in this category emphasise factors such as:

- Learning opportunities provided through the use of ICT's;
- Curriculum delivery enhancement;
- ICT as an educational tool, powerful tool, information tool, productivity tool, support tool, tool to enhance learning;
- Integrating ICT across learning areas;
- Online units of study;
- Designing rich learning resources;
- A tool for assessment; and
- The development of descriptors for competencies, achievement and curriculum outcomes.

The following quotes are typical of the way teachers are describing ICT as a 'curriculum tool':

> "Using information and communication technologies as a tool, the teachers are able to assist children having difficulty to meet particular Mathematical outcomes as well as giving all students an opportunity to gain more practice and assistance from computer programs." (Victorian Catholic School)

> "Technology provides a powerful tool to help achieve the outcomes of the English curriculum in that computers can be used in a myriad of ways to foster skill development as well as providing creative impetus." (NSW Catholic School)

Type 3: New Learning Environment

In this category, shifts in pedagogy are integral to the innovation of the project. The technologies bring into question current approaches to teaching and learning and school organization. Innovation in this 'type' allows or produces new or creative learning environments and new ways of teaching and learning. Projects of this type often question or experiment with philosophical or organisational frameworks. Software tends to be more open-ended and content free. The initiatives refer to developing and applying new learning strategies and new literacies or multimedia literacies, often in projects that reach beyond the school into broader learning communities.

The project descriptions feature factors such as:

- Meaningful and relevant learning strategies;
- Learning styles or multiple intelligences,
- Inquiry oriented online tools;

- Collaboration and co-operation; and
- New ways of learning, personalised, realistic, self-paced, self-directed, non-linear, self-assessed.

Learning environments are described as:

- Virtual;
- Real-time synchronous;
- Geographically remote,
- Collaborative,
- Networked;
- Global;
- Communities; and
- E-learning spaces.

The following quotes illustrate the emphasis on shifting pedagogy:

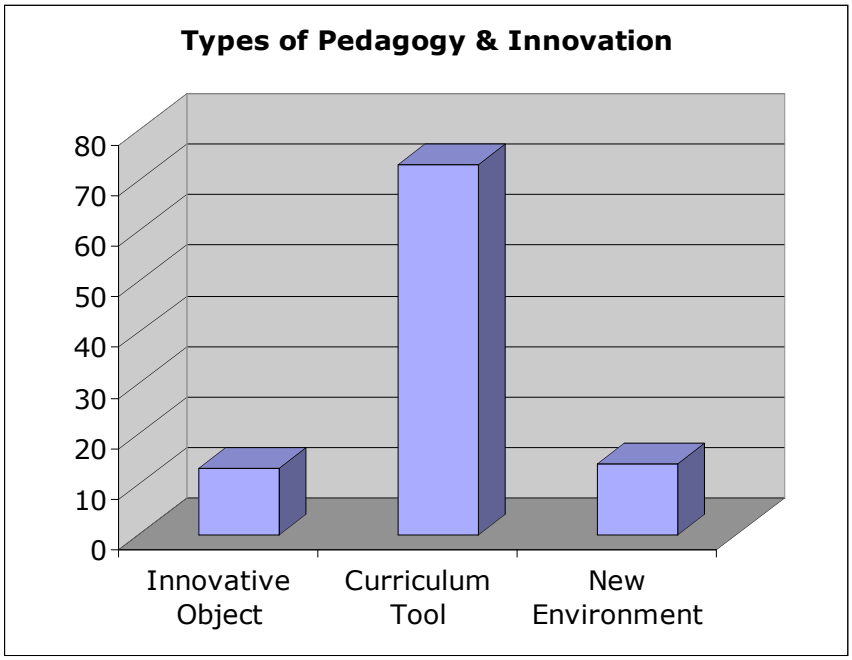
> "Our e-learning initiative compliments constructivist learning theories described in the SACSA Framework. Especially as a part of student initiated curriculum our students are supported to choose key ideas from SACSA to plan learning challenges." (South Australian Government School)

> "The introduction of the Intranet is assisting the school to change the perception and use of ICTs. Our planning is to make multiliteracies and global communities priorities in our 2003-2005 charter. This is evidence of a commitment to the development of elearning." (Victorian Government School)

A National Picture of Pedagogy and Innovation

The majority of schools (73%) described their innovative e-learning projects and approaches to teaching and learning with the view that ICT is a pedagogical tool for improving learning outcomes in literacy and/or numeracy (Type 2: ICT as a Curriculum Tool). Only 13% characterised ICT as itself being the innovation (Type 1: ICT as an Innovative Object), and 14% expressed the idea that ICT enables new or creative learning environments and thus new ways of teaching and learning (Type 3: New Learning Environment).

Graph 17



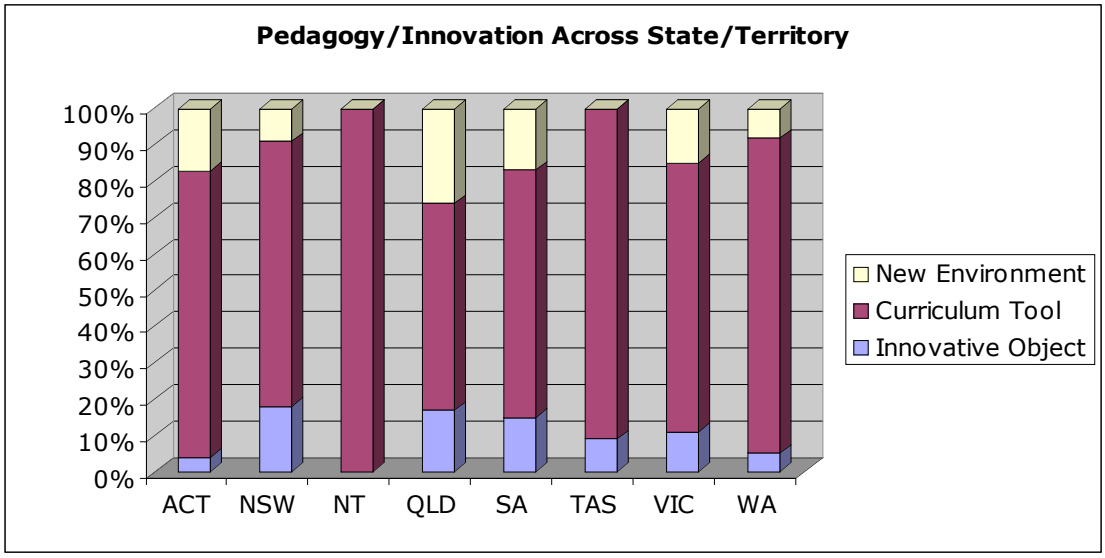
That only 13% of the schools indicated that ICT are a 'new' phenomenon in the school while the majority describe how they are being used or intend to be used within the curriculum. This indicates that the majority of schools are making use of ICT within the curriculum. For some schools there is the perception that the technologies are having an impact on the way in which the learning environment itself is constructed. For Type 1 schools the technologies are new. For Type 3 schools the technologies are potentially creating 'new' schools and learning environments.

Pedagogy and Innovation across the States/Territories

Although nationally there is a clear centring on 'Type 2: ICT as a Curriculum Tool', there are some different tendencies when states/territories are separated, NSW schools have a slight leaning towards 'Type 1: ICT as an Innovative Object', while Victoria and the ACT have a stronger tendency towards 'Type 3: New Learning Environment' than the other states. Queensland and South Australia have above the national average percentage in the two extremes of Type 1 and Type 3.

Table 17 Percentage of schools in each Pedagogy/Innovation Type			
	Type 1 Innovative Object	Type 2 Curriculum Tool	Type 3 New Learning
ACT	4%	78%	17%
NSW	18%	73%	9%
NT	0%	100%	0%
QLD	17%	57%	26%
SA	15%	68%	17%
TAS	9%	91%	0%
VIC	11%	74%	15%
WA	5%	87%	8%

Graph 18



Pedagogy and Innovation across the Sectors

When the Pedagogy and Innovation Dimension is viewed by sector, there is little difference between the Government, Catholic and Independent schools, though there is a slightly higher focus on Type 1 by Independent schools.

The Dominant Pedagogy & Innovation Type

The predominance of 'Type 2: ICT as a Curriculum Tool' (73%) suggests that the typical primary school in this sample views technology as a teaching and learning tool for improving curriculum outcomes. While the resources are new and exciting, the learning goals and pedagogy are essentially the same as without the technology.

"Students will be able to construct meaning using the Internet as a tool for learning…. Improve student outcomes in Numeracy and technology by using technology as a teaching tool." (Tasmanian Independent School)

"...students will only become truly literate in this multimedia multicultural society if they are allowed to be actively involved in the design and construction of knowledge representations using hypermedia / multimedia tools." (Queensland Government School)

7. CROSS DIMENSIONAL INTERACTIONS

Interaction Between Infrastructure, Motivation and Pedagogy

"Innovative multidisciplinary approaches to teaching and learning that have the potential to advance pedagogical understanding and practice across the country warrant support……. Technology is pervasive, but it is the human dimensions of schooling and especially the relationships between students and their teachers in the joint venture that are vital".

Australia's Teachers: Australia's Future – Agenda for Action (DEST 2003, p.43)

Interaction between Infrastructure and Motivation

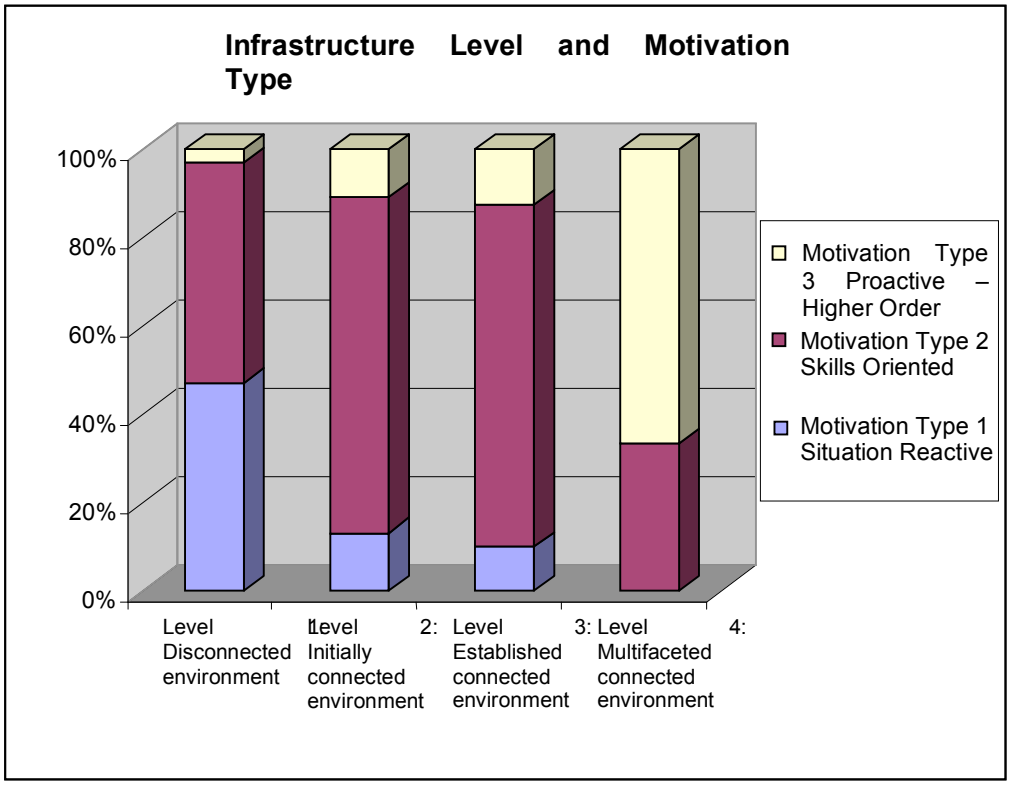
Further examination of the data was carried out to determine whether there were interactions between the level of ICT infrastructure and the Motivation Type. The resulting information can be used to answer such questions as, 'Are schools with Level 1 Infrastructure usually Type 1 Motivation & ICT Use?'

The table below lists the percentages of schools that have the characteristics that match the intersection of a particular Infrastructure Level and a particular Motivation Type.

Table 18 Interactions Between Infrastructure Level and Motive Type

Motivation Type	Infrastructure Level 1	Infrastructure Level 2	Infrastructure Level 3	Infrastructure Level 4
Type 1	23.38%	36.36%	40.26%	0.00%
Type 2	4.37%	37.01%	57.47%	1.15%
Type 3	1.35%	29.73%	55.41%	13.51%

Graph 19



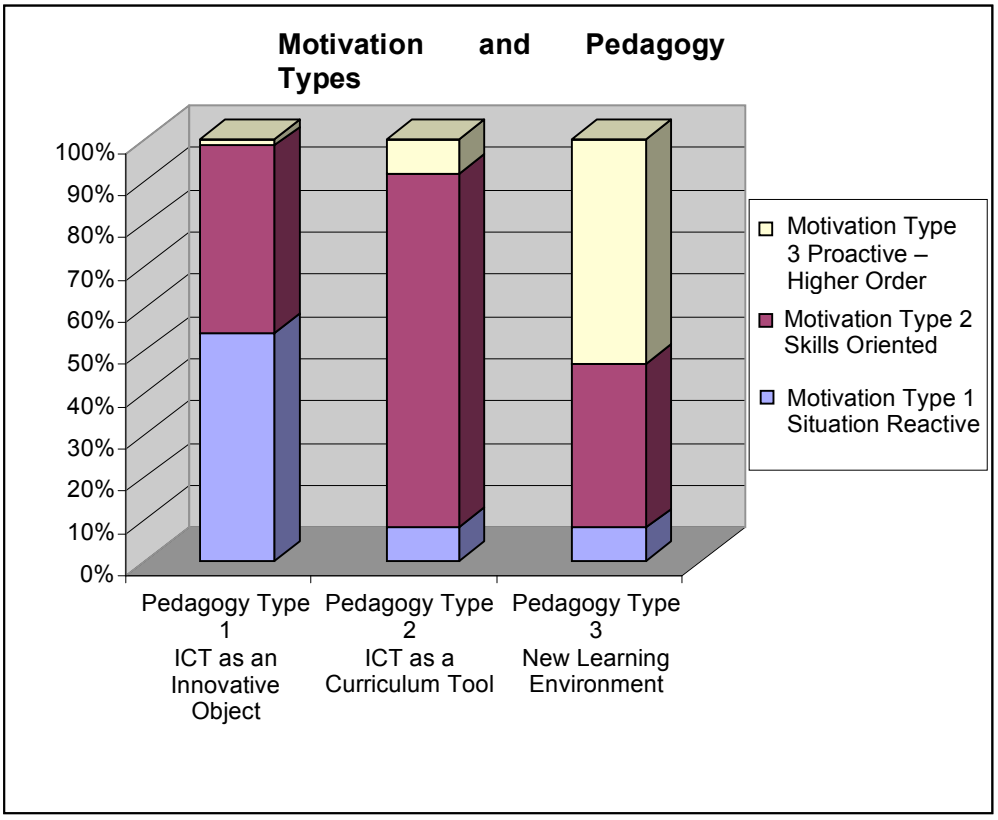
A relationship appears to exist between Motivation Type and Infrastructure Level. Schools with Type 1 Motivation (Situational – Reactive) tended to have lower levels of Infrastructure. Schools with higher levels of infrastructure were more likely to have Type 3 Motivations (Proactive-Higher Order). Just over 70% of schools in the sample have infrastructure levels of 2 or 3 and Type 2 Motivation (Skills Oriented).

Where the level of infrastructure in a school is perceived to be relatively low the motivation for using ICT is described in terms of the deficits in the level of infrastructure or the level of perceived disadvantage within the school. Where the level of ICT infrastructure is perceived to be high and is beginning to change the environment of the school, schools are more likely to describe their motive for using the infrastructure in terms of the opportunities the technologies provide for more complex, integrated learning experiences that involve higher skills and thinking.

Interaction between Motivation and Pedagogy

Table 19 Interactions Between Motivation Type and Pedagogy Type			
Motivation Type	**Pedagogy Type 1**	**Pedagogy Type 2**	**Pedagogy Type 3**
Type 1	23.38%	36.36%	40.26%
Type 2	4.37%	37.01%	57.47%
Type 3	1.35%	29.73%	55.41%

Graph 20



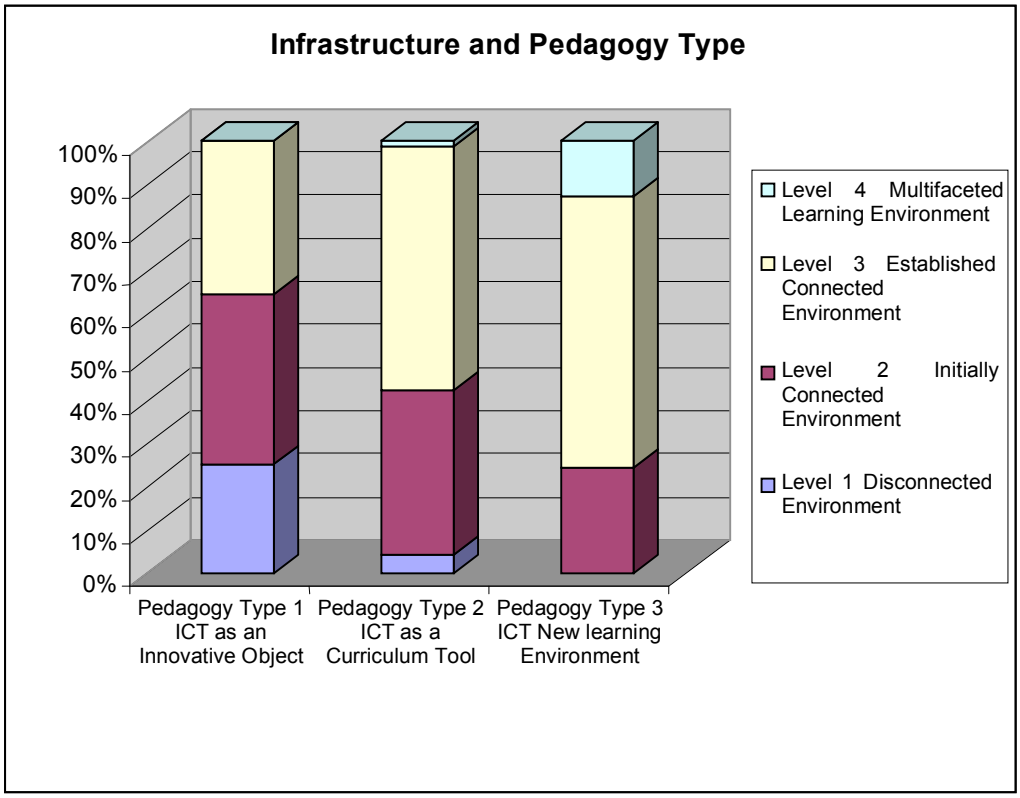
Over 60% of schools had a Type 2: Skills Oriented Motivation and a Type 2: ICT as a Curriculum Tool approach to pedagogy. There was, however, also an interaction between Types 1 and 3 for both motivation and pedagogy.

Schools with a Type 3 Motivation (Proactive-Higher Order) were more likely to have Type 3 Pedagogy (New Learning Environment). Conversely, Schools with Type 1 Motivation (Situational – Reactive) were more likely to be in Type 1 Pedagogy (ICT as an Innovative Object). While the numbers of schools in Type1 and Type 3 for both pedagogy and motivation are relatively small the data suggest that there is a link between the motivation for using technology in a school and the pedagogical approaches that will be adopted within the school.

Interaction between Pedagogy and Infrastructure

Table 20 Interactions Between Infrastructure Level and Pedagogy Type				
Pedagogy Type	**Infrastructure Level 1**	**Infrastructure Level 2**	**Infrastructure Level 3**	**Infrastructure Level 4**
Type 1	2.9%	4.6%	4.1%	0.0%
Type 2	3.1%	29.0%	43.1%	1.0%
Type 3	0.0%	2.9%	7.6%	1.5%

Graph 27



Schools with a higher level of technological infrastructure are more likely to adopt pedagogies described as Type 3 (New Learning Environment) that promote higher order thinking. The technological infrastructure of the school and how the school intends to use the technologies is perceived as having the capacity to change the totality of the school environment – to change teaching and learning.

Schools with lower levels of infrastructure (Level 1) were more likely to adopt pedagogical approaches consistent with Type 1 (ICT as Innovative Object) where the focus was on the technologies and integrating the technologies into the current practices of the school.

Existing research suggests that as availability of ICT has grown, so have the number of students and teachers using computers and the frequency with which they use them (Levin, Stephens, Kirshstein, & Birman. 1998). However, the advent of computers and the Internet has not yet dramatically changed how teachers teach and how students learn. The findings above suggest that computers and Internet access in schools are being used as a tool to enhance traditional approaches teaching and learning, where innovation is described in relation to achieving current curriculum outcomes. Those schools that have been placed in Type 3 (New learning Environments) suggest that some teachers are using technology to explore new pedagogical approaches that in turn, create new learning environments (Becker, 1999; Fulton, 1997).

Pedagogical approaches are informed theories of student learning, i.e., the difference between learning through reception of facts and repetitive practice of discrete skills (the traditional transmission approach) versus student centred engagement in meaningful tasks that integrate new ideas with those previously believed (constructivist approaches). The way in which schools organise or distribute their ICT resources and integrate these technologies into teaching practice, to some extent, reflects the dominance of either the transmission or the constructivist models. The pedagogies described in association with specialist teachers and computer lab facilities are more likely to be consistent with a transmission approach as opposed to the distribution of resources throughout classrooms where constructivist pedagogies are more likely to prevail. Teachers who use constructivist approaches are more likely to use smaller groups and differentiate tasks and resources for different groups. Hence, there is a potential conflict between the current pedagogical trends towards constructivist-based learning and the location of the majority of the school's computers in one specialist room. These observations are supported by other research, for example, Ravitz, Becker & Wong (2000).

The Three Dimensions – the Typical Australian Primary School

The majority of schools (77%) had project descriptions characterised by:

- ICT Infrastructure Level 2 – Initially connected environment or Level 3 – Established connected environment;
- Motivation & ICT Use Type 2 – Skills Oriented; and
- Pedagogy & Innovation Type 2 – ICT as a Curriculum Tool.

These schools typically have a computer to student ratio approaching the national average and have most of their computers connected to the school network. Many computers are distributed throughout the school and classroom computers are commonly used in association with the computers located in computer labs and/or the library. The computers also have access to the Internet.

Both students and teachers are developing the skills necessary to use the technology as tools for learning, teaching and communication.

There is an increasing awareness by teachers of the possibilities that the school's intranet (local area network) offers, particularly as a publishing space for student work. Devices such as scanners, digital cameras and data projectors and other multimedia devices are being increasingly used by teachers and students within units of work and projects to enhance student learning and achieve curriculum outcomes.

8. EXECUTIVE SUMMARY

Innovation and e-Learning in Australian Primary Schools

The 2002 Commonwealth Bank e-Learning Grants program provided $350,000 in additional funding to primary schools across all states and territories and education sectors. The grant application process provided the data for this study. The 2002 e-Learning Grants program, through the grant application process, has provided an invaluable opportunity to gain an insight into the way in which teachers and construct innovative e-learning projects within the context of their school. It has also provided a national 'snapshot' of the levels of school ICT infrastructure in primary schools.

Implicit in government policies and the significant investment in technology is the belief that integration of ICT into Australian schools will have a 'transforming' effect on education. By 2002 the average ratio of computers to students in state and territory government schools was 1 to 5.3. Achieving such ratios has been a direct result of the policies of state and territory governments and individual schools.

While the impact of ICT on curriculum is at an early stage the 2002 e-Learning Grant applications indicate that they have the potential to challenge the structure of schools, the curriculum and the pedagogies employed by teachers as they integrate ICT's into their classrooms.

Three consistent dimensions, 'ICT Infrastructure', 'Motivation and ICT Use' and 'Pedagogy and Innovation' emerged in the applications. Essentially, these dimensions describe the 'what', 'why' and 'how' of ICT use by schools in the context of their proposed innovative projects. These three dimensions are a critical tool for analysing the content of the applications and provide a means of 'locating' schools within each of the dimensions. This framework enables teachers and policy makers to understand the potential for innovation, within the context of an individual school. These three dimensions, and the interactions between the dimensions, provide a means for understanding the complex factors within an individual school that determine the nature of ICT use and the potential for innovation.

Literacy and Numeracy

Literacy was clearly the focus of 60% of school projects while numeracy was the focus for only 7% of schools. Projects that involved both literacy and numeracy accounted for one-third of the projects (33%). In total 432 schools (93%) involved projects that focused on either literacy or involved a project that integrated both literacy and numeracy. This was consistent across all states and territories and education systems. The study has

found that teachers will develop innovative projects in areas, such as literacy, which align with school priorities, teacher values and teacher confidence. They are less likely to develop projects in numeracy, while an area of equal priority, is an area where teachers feel less confident in using ICT.

Target Group

Almost half of the schools in the sample (220 schools or 43.1%) indicated that their project would target a specific year/grade or years/grades. The tendency to associate 'innovative projects' with upper primary was consistent across all states, territories and across education sectors.

A number of groups emerged in the project descriptions that were not grade/year based or whole school focused. These projects were developed to address perceived 'needs' or 'deficits' in the target group such as boys, gifted and talented and 'English as a second language' students. Many of these projects also had a whole school focus.

Grant Expenditure

The majority of the proposed e-Learning Grant project expenditure fell into three categories of teacher support (professional development, release time and expert assistance, multimedia technologies, and computers. Funding to support teachers amounted to 36% of the total funds applied for in the 2002 e-Learning Grant applications. Applications for funding to support teachers to develop innovative projects in schools indicate that teachers feel a significant need for support through professional development programs, advice and support from experts in the areas of curriculum development and ICT's, and, time to plan to utilise the technologies in classroom and school projects.

Almost a quarter of the funding requests from schools were for 'multimedia technologies'. The multimedia technologies described in the budgets included, digital video cameras, digital cameras, web cameras, scanners and data projectors. Some of these items are particularly expensive for schools and are not usually supplied to schools from state or territory governments.

Workstations, multimedia computers, laptops and fileservers were applied for by 16.7% of schools with Catholic schools applying for significantly larger grants for 'workstations' than Government schools suggesting that their level of basic infrastructure is still less than that of most government schools.

While the number of requests for human resources such as teacher release days and professional development were almost the same as the number of requests for hardware, the cost of these human resources was generally less than the hardware.

Infrastructure Levels in Primary Schools

The vast majority of schools (91%) described computer environments that were either 'initially connected' environments or established connected environments. Very few schools described infrastructures that would be categorised as 'Level 1 – Disconnected' (6.47%) or as 'Level 4 – Multifaceted connected' (2.59%).

Government schools tend to have slightly higher levels of infrastructure than the other sectors. There are slightly more Catholic schools categorised as 'initially connected' environments than other sectors, while Independent schools appear to have extremes in infrastructure: many with little infrastructure (Level 1) and many with higher levels of infrastructure (Levels 3 and 4).

A total of 135 (29.1%) primary schools specifically indicated that they had a 'lab', 'learning technology resource room', 'computer classroom' or some other 'technology resource centre'. The pedagogies described in association with specialist teachers and computer lab facilities are more likely to be consistent with a transmission approach as opposed to the distribution of resources throughout classrooms where constructivist pedagogies are more likely to prevail. Teachers who use constructivist approaches are more likely to use smaller groups and differentiate tasks and resources for different groups. Hence, there is a potential conflict between the current pedagogical trends towards constructivist-based learning and the location of the majority of the school's computers in one specialist room.

Teacher Motivation

The motivation descriptions reflect how teachers respond to the relative significance of the influencing forces in a particular context.

The majority (72%) of the schools described their motivation for the proposed project and the reasons for using ICT in the project in terms of developing the technological skills of students and teachers as a means of enhancing curriculum outcomes. Of the remaining schools, 15% were reacting to a problem or need specific to their own school or to a group of students within the school. Only 13% of the schools were motivated to explore new ways of thinking and learning afforded by the technologies.

Catholic schools had a markedly higher proportion of schools that were reacting to a specific need or disadvantaged group within their school. Government schools in particular focused on ICT skills development. The predominance of 'Skills Oriented' schools suggests that the schools are motivated to use technology as a teaching and learning tool, to be used within existing pedagogies, as a means for enhancing the achievement of existing curriculum outcomes for students.

Pedagogy and Innovation

Three categories or types of pedagogy emerged in the applications. These are described as: ICT as Innovative Objects, ICT's as a Curriculum Tool, and, ICT to create New Learning Environments. The predominance of schools categorised as 'Type 2: ICT

as a Curriculum Tool' (73%) suggests that the majority of primary schools are using ICT as a tool to enhance traditional approaches teaching and learning, where innovation is described in relation to achieving current curriculum outcomes. While the resources are new and exciting, the learning goals and pedagogy are essentially the same as without the technology. Approximately 14% are using technology to explore new pedagogical approaches that in turn, create new learning environments while 13% of schools are exploring the 'new' technologies.

Interactions between Infrastructure, Motivation and Pedagogy

Where the level of infrastructure in a school is perceived to be relatively low the motivation for using ICT's is described in terms of the deficits in the level of infrastructure or the level of perceived disadvantage within the school. Where the level of ICT infrastructure is perceived to be high and is beginning to change the environment of the school, schools are more likely to describe their motive for using the infrastructure in terms of the opportunities the technologies provide for more complex, integrated learning experiences that involve higher skills and thinking.

Schools that are motivated to explore the potential higher order thinking and new learning tasks were more likely to engage in pedagogies that would result in the creation of new learning environments. Schools that were motivated to address specific deficits in their students, school or community were more likely to be reacting to the technologies as new and innovative objects. The data suggests that there is a link between the motivation for using technology in a school and the pedagogical approaches that will be adopted within the school.

Schools with a higher level of technological infrastructure are more likely to adopt pedagogies likely to be regarded as transformative and lead to the creation of new learning environments. Schools with lower levels of infrastructure were more likely to adopt pedagogical approaches where the focus was on the technologies and integrating the technologies into the current practices of the school.

Conclusions

One of the unforseen benefits of the 2002 Commonwealth Bank e-Learning Grants program was the opportunity it provided for teachers to articulate their motivation, their pedagogies and the technological infrastructure of schools across Australia in 2002. Their descriptions have provided a 'what', 'why' and 'how' framework to understand the context in which innovation in the use of ICT's occurs within the context of an individual school. This three dimensional framework 'locates' individual schools within a matrix that can be used to provide an indication of potential movement in infrastructure, pedagogy and motivation.

There was, in 2002, a tendency for schools to use their e-Learning Grants to develop multimedia projects for upper primary students that focused on the development of literacy. The focus on upper primary grades would appear to indicate that students in these grades have established basic ICT skills as a result of programs which, as the data suggests, have had a predominantly skills focus. The focus on literacy suggests that teachers are 'comfortable' with literacy as a curriculum area and are more likely to

develop projects using ICT in areas in which they feel more confident. As a result, where teachers feel confident, and students have achieved basic levels of computer skills, teachers believe that they can develop innovative projects using ICT, particularly multimedia technologies.

This study has found that, irrespective of the level of technological infrastructure that exists in an individual school, teachers believe that they have the potential to develop innovative projects. The innovation may be in the use of a new technology, using a technology in a new way within the curriculum or using the technologies to assist in the creation of new learning environments.

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