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Partnerships in ICT Learning Study

Report

OCTOBER 2007

John Pegg, Chris Reading, Michelle Williams







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Disclaimer

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The Steering Committee included Ms Jillian Dellit (The Le@rning Federation), Professor Denis Goodrum (Australian Council of Deans of Education), Associate Professor Kathryn Moyle (National Institute for Quality Teaching and School Leadership), Ms Heather Woods (ICT in Schools Taskforce Secretariat).

The Recommendations Committee also included Mr Will Morony (Australian Association of Mathematics Teachers), Associate Professor Lyn Schaverien (University of Technology Sydney).

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We appreciate greatly these efforts and will do our utmost to ensure that this report leads to significant and effective action.

Ralph Leonard (PICTL Study Chair) John Pegg Chris Reading Katherine Schoo Michelle Williams

October, 2007

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Executive summary

Introduction

Partnerships in ICT Learning (PICTL) was a project funded by the Department of Education, Science and Training (DEST). The tender was awarded to a consortium comprising the Australian Council for Computers in Education (ACCE), the Australian Curriculum Studies Association (ACSA), and the National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England. The research program (Leonard, Schoo, Pegg & Reading, 2005) was designed to meet the objectives and deliverables of the tender.

The purpose of the PICTL study was to demonstrate good-practice approaches to embedding Information and Communication Technology (ICT) throughout the educational experience of pre-service teachers, teachers and teacher educators. To address this, the research program investigated ICT partnership approaches in a variety of Australian contexts through developing, trialling and evaluating forms of partnerships among universities, education authorities (government and non-government) and schools.

The PICTL study involved eight small-scale Professional Development (PD) projects, one in each state and territory. These projects brought together pre-service teachers, teachers and teacher educators within partnership arrangements that sought to transform learning environments and teaching practices through more considered applications of ICT. This context also facilitated the exploration of approaches to professional learning that enabled strong links to be forged among pre-service teachers, teachers and tertiary educators. At the same time as working to achieve these outcomes, the PICTL study also focused on using the data from state and territory projects to have a broader national focus that would support new initiatives in embedding ICT in learning as well as offer potential pathways for Australia to follow in the future that would help achieve more global and sustainable reforms.

Design and implementation

The PICTL study was designed to explore innovative processes for enhancing the ICT capability of pre-service teachers, teachers and teacher educators by creating a situation in which these groups could work collaboratively and hold professional conversations. The notion of working partnerships among these three groups offered opportunities to strengthen the strategic relationships between teacher-training institutions and schools.

The partnerships aimed to improve student-learning outcomes through the use of technology-rich approaches for students by pre-service teachers, teachers and teacher educators. It was expected that bringing together these three groups would transform teaching, learning environments and practice. A professional dialogue amongst stakeholders that enables them to reflect more deeply on existing practices and experiences would accompany these changes.

The central research theme for the PICTL study was:

How can classroom-based professional learning projects be collaboratively designed among pre-service teachers, teachers, and teacher educators to focus on quality student uses of ICT within new curriculum reforms and pedagogical agendas, and which influence designs for professional learning for all stakeholders?

The PICTL study was designed to address 11 research questions. These questions have been organised into four themes. While some questions are able to inform more than one theme, to simplify the reporting process, questions have been allocated to the theme that is most relevant.

1. Evidence of success and innovative approaches

- RQ 1 What does the evidence of relative success of the state and territory projects, based on the feedback of participants, mean for responding to the broad research theme?
- RQ 6 What innovative approaches were used, and how successful were they?

2. Strategic partnerships

- RQ 2 To what extent do the various groups (schools, universities, government/non-government authorities) succeed in working together to achieve the desired outcomes?
- RQ 3 What are some of the challenges in trying to implement successful partnerships between differing levels of educational bureaucracy (e.g., governance issues, organisational issues)?
- RQ 7 To what extent was it possible or necessary to transform teaching and learning environments and practice?
- RQ 8 What were barriers and critical success factors impacting upon the success of the strategic PD partnerships?

3. Towards sustainable professional learning

- RQ 5 To what extent is effective professional development in this area dependent on wholeschool or system-wide reform? What change management issues were faced in trying to achieve these reforms? What cultural change was/is necessary?
- RQ 10 What are possible strategies for sustaining the partnerships beyond the life of the project?
- RQ 11 What are recommendations on ways to develop innovative professional development projects on a wider scale?

4. Effective management

- RQ 4 What are key project management issues (e.g., importance of defining scope, methodology)?
- RQ 9 What are the advantages and disadvantages of using online networking tools (e.g., online communities of practice, closed discussion groups, extranets) to support these partnerships?

The PICTL study involved eight projects, one from each state and territory. At the local level, the study involved selected university teams applying action-research methodologies to individually-designed projects. These projects investigated the durability, efficacy and sustainability of variations to a general professional development framework aimed at helping pre-service teachers have a quality experience with ICT in the classroom as an important transition from them being pre-service teachers to in-service teachers.

Nationally, the PICTL Management Team's responsibility was to manage the eight state and territory projects, facilitate the associated activities and synthesise the results to develop national recommendations.

The PICTL study had four distinct stages.

- Stage 1Developing a national study plan and timeline, establishing the national research agenda
and setting up the consultative and management mechanisms for the project.
- Stage 2 Facilitating the design of state and territory projects.
- **Stage 3** Supporting state and territory project leaders as they implemented their projects including conversations through online events, teleconferences, and site visits.
- **Stage 4** Conducting a National PICTL Forum and collating data from the state and territory projects into a final report.

A broad *Professional Development Framework* underpinned the planning of the projects within the study. This was offered as a possible basis for activity development within state and territory projects. Within these projects, the framework varied and was situated in different contexts, dependent upon the capacity to co-locate practice teaching and other in-school projects within the project timeline.

There were four variations to the Professional Development Framework. These were:

- The perceived or diagnosed need for a professional learning program to raise awareness of ICT in learning within new curriculum and pedagogical reforms.
- The role and experience of the person responsible for implementing the curriculum in the school. Whether it was a pre-service teacher, teacher or a partnership involving both.
- The depth of reflective experiences built into the their project design.
- Whether practice teaching was the setting for the in-school experiences of pre-service teachers.

These variations tempered contributions to the data provided through state and territory reports and interviews. However, both the interviews and the National PICTL Forum provided an opportunity for synthesised comments and conclusions across all the variations to the *Professional Development Framework* within the contexts and partnerships surrounding the state and territory projects.

Principal findings

What does the evidence of relative success of the state and territory projects, based on the feedback of participants, mean for responding to the broad research theme?

Collaborative partnerships in ICT learning projects, based around real teacher professional work, were a productive context for a model of professional learning for innovation because they provide a proactive opportunity for reflective dialogue rather than having participants react to other's issues. The projects provided an opportunity for pre-service teachers, teachers and teacher educators to rethink aspects of their teaching and learning, especially program design.

Quality planning led to quality implementation and the chance for quality learning. Clear starting points for projects were underpinned by beliefs and pedagogy. Careful choice of focus ensured that higher-order activities were used in the projects. The mentoring and development of new knowledge for teachers, about what to do with ICT in a pedagogical framework, were essential parts of improving the quality of planned ICT use.

A focus on pedagogical change provided the critical momentum needed to involve all stakeholders in a conversation about professional learning. Clarifying and affirming the partnership required the roles for each stakeholder: personal/institutional/industry. The reflection process embedded into the professional learning, assisted teachers to assess the quality of their curriculum and pedagogical ideas. Disseminating the professional learning was important for individuals, school communities and systems. The professional learning process is assisted when ICT pedagogy is given a central focus in preservice education programs, including embedding ICT into teaching and learning. The current nature of the practicum complicated the project implementations. In particular, the assessment paradigm had an inhibiting effect on the nature of the partnership and ultimately the level of innovation.

What innovative approaches were used, and how successful were they?

It is important to realise that 'innovation' can be a relative term. What is innovative for one community that has issues with resources and staffing may be different from what is innovative for a well-resourced and well-established professional learning community. However, there might also be implementations that are considered innovative across many, perhaps even all contexts. While there was some mention of the use of online tools and digital portfolios, the focus of the innovation findings was on the nature of the professional learning.

Teachers and pre-service teachers were learning together about new pedagogical approaches and using their personal, learning and pedagogy beliefs to interpret the use of ICT. The intense activity that resulted during the action learning helped to target ICT leadership and to place a focus on student learning.

To what extent do the various groups (schools, universities, government/ non-government authorities) succeed in working together to achieve the desired outcomes?

Partnerships were established through collaborative groups calling on expertise and infrastructures with the potential to enhance a sense of local community. Professional learning within a clearly defined structure that had the flexibility to solve problems was beneficial to all participants.

Formal structures such as management teams and steering committees or existing relationships provided a strong basis for partnerships. However, where they existed, local, less-formal relationships also supported partnerships. The partnerships allowed teachers to renew their commitment to working with universities and pre-service teachers, and the benefits of the partnerships extended beyond those involved in the project activities.

What are some of the challenges in trying to implement successful partnerships between differing levels of educational bureaucracy (e.g., governance issues, organisational issues)?

The most significant challenges in achieving successful partnerships related to the incompatibility of bureaucratic processes. Project management teams were able to negotiate bureaucratic processes when sufficient time was allowed and the relevant education authorities provided support. The bureaucratic process was streamlined when formal agreements were negotiated between institutions. Partnerships supported by steering committees with clear terms of reference and expertise in ICT innovation had better capacity to solve practical and bureaucratic problems.

To what extent was it possible or necessary to transform teaching and learning environments and practice?

The need to activate pedagogical reform around the use of ICT was evident. A whole-school approach and focus on local issues facilitated adoption of ICT in learning and teaching in schools. However, a deeper level of change was achieved by improving the quality of professional learning and setting pedagogical reflection as a context. Many technical challenges were encountered by the various projects, including poor access to ICT and relevant networks, and lack of connectivity between the different jurisdictions' networks.

What were other barriers and critical success factors impacting upon the success of the strategic professional development partnerships?

Barriers that impacted on the success of the partnerships were related to issues affecting people, the availability of time, and access to resources. Many of the issues were resolved given sufficient planning time. Pre-service teachers, teachers and teacher educators needed planning time to work collaboratively using a list of perceived constraints as a focus agenda and to establish a consensus about achievable outcomes for the project in the light of local conditions. Poor access to school and system level tools and networks significantly reduced the productivity of the partnerships.

Alongside the barriers a variety of success factors were identified. There was a number of contributing factors that strengthened partnerships but all success factors did not operate within the one context. Contexts differed within and across states and territories, and partnerships comprised not only the people involved, but also the support structures. A professional learning community was fostered through appropriate recognition of the needs of pre-service teachers, teachers and teacher educators and by structuring factors external to people, such as the professional experience, technical support and timetabling, to meet the needs of individuals. As a core concept for partnerships, collaboration contributed to sustainability over time and beyond the individuals involved.

To what extent is effective professional development in this area dependent on whole-school or system-wide reform? What change management issues were faced in trying to achieve these reforms? What cultural change was/is necessary?

System-wide reform must address policy as well as recognition of the contribution of teachers in supporting pre-service teacher professional experiences. Managing the change necessary for such reform impacts significantly on universities, through staff workload commitments, research centre resources and technical provisions for pre-service teachers. Critical to these reforms are cultural changes from the perspective of pre-service teachers, teachers and teacher educators. Most importantly, teachers must be prepared to allow pre-service teachers to experiment with ICT innovation in the classroom.

What are possible strategies for sustaining the partnerships beyond the life of the project?

A clear purpose and the opportunity to share the outcomes related to that purpose sustained partnerships beyond the limits of the project. Partnerships developed a stronger profile when enough time was allowed for relationships to evolve, communication was nurtured, ownership was established and benefits for all participants could be identified. Although brokerage of partnerships by universities was the preferred option, the choice of project focus was best left to the schools. Facilitation of sustainable partnerships was enhanced through collaboration with unions, university faculties and education authorities.

What are recommendations on ways to develop innovative professional development projects on a wider scale?

Major impediments to reproducing, on a wider scale, the models of professional development trialled in state and territory projects, were the time and workload implications for pre-service teachers, teachers and teacher educators. The more activities and management responsibilities that could be built into normal workload for participants the more sustainable the project became.

What are key project management issues (e.g., importance of defining scope, methodology)?

Sufficient time had to be factored into the life of the project to allow for contractual and other procedural matters. This planning time allowed for resolution of issues related to the length of the project to ensure quality outcomes and that the individual requirements of all partners could be met. When time-release and recognition for commitment to projects fostering professional learning were built into standard procedures in both schools and universities, teachers and teacher educators were more predisposed to become involved.

What are the advantages and disadvantages of using online networking tools (e.g., online communities of practice, closed discussion groups, extranets) to support these partnerships?

Although the disadvantages appeared to outweigh the advantages, all partnerships valued the opportunity to use online communication. The many disadvantages, especially in relation to culture and accessibility, were frustrating for those concerned and not always under the control of the individuals or institutions concerned. Improved "conversations" at the systemic or institutional level are needed to contribute to equality of access for all participants. However, the strengthening of a school communication culture to include the use of online tools needs to be promoted from within schools or school systems.

The PICTL professional learning model

In the PICTL study a core *Professional Development Framework* was offered as an initial platform upon which to develop a collaborative culture among pre-service teachers, teachers and teacher educators.

Given the experience from the PICTL study the phases of core framework proposed as a guide for the collaborating partnerships have been revised to become the PICTL *Professional Learning Model*:

- **Phase 1** *Explore new knowledge* Involve partners in direct awareness-raising events about ICTs, curriculum frameworks, pedagogy or other relevant subject matter.
- **Phase 2** *Select a learning experience for students* This might be a unit of work, task, project or series of lessons where ICT is used to enhance the learning experience.
- **Phase 3** *Plan the learning experience* Develop the learning experience detail including the underpinning pedagogy.
- **Phase 4** *Implement the learning experience* This might occur in a range of environments and should involve the pre-service teachers working with the students.
- Phase 5 *Reflect and share* This reflection should occur on the data, findings and collaboration.

The context in which the model is placed will be critical to its success in creating successful partnerships to produce effective and sustainable professional learning for our educators and innovative changes in the use of ICT in our schools.

There were several features about the *Professional Learning Model* that were appealing to the PICTL Management Team. The starting point was explicit and it involved identifying underpinning beliefs about ICT and pedagogy practice. The model allowed the focus to be set on pedagogical change and the importance of involving all stakeholders in a conversation about professional learning. Opportunities were made available to clarify and affirm the partnership and in particular the roles for each stakeholder, participants, schools, system and universities and where appropriate industry.

Finally, four points are worth restating. First, there were aspects within the model that were seen as advantageous to all projects. Second, the model was generic and seemed highly likely to be applicable to the variety of any future projects that might be expected to emerge. Third, the model was sufficiently tight to provide a strong structure for projects as well as allow a clear progression. Finally, and as balance to the above, the model was loose enough to allow project team leaders sufficient degrees of flexibility.

Project management recommendations

The following seven recommendations concerning managing partnership projects are framed at a general level.

Recommendation PM1: A project-based approach involving pre-service teachers, teachers and teacher educators should be used to establish a positive and productive culture of professional learning aimed at improving ICT-mediated approaches in the classroom. Such projects should:

- offer continuing and relevant learning for participants that contribute to the renewal of commitment to using ICT-mediated learning;
- be based around real issues and exploring authentic learning experiences;
- include more than one person representing each stakeholder group;
- be based on a core model of professional learning that includes careful planning, and a project design, implementation, reflection and documentation cycle.

Recommendation PM2: Projects should have ICT pedagogy as a central focus and pedagogical reflection set as a context for the widespread adoption of ICT learning. This focus should address:

- teacher beliefs about ICT-mediated learning within a context of improving student learning outcomes;
- teacher pedagogical practices;
- how to embed ICT into teaching and learning.

Recommendation PM3: Projects should be planned to include:

- clear terms of reference that take into account the level of adoption of ICT in the participating schools;
- formal agreements between institutions, schools and education systems to help streamline bureaucratic processes;
- aims that provide similar parameters for all partners;
- aims that are 'innovative' (as they relate to participants' backgrounds), creative and extend the boundaries of current practice.

Recommendation PM4: Projects should have a strong management structure including:

- a project Team Leader who may require the support of a Project Officer;
- a project Management Team including representatives from each of the partner groups and supported by the relevant education authority;
- a project Steering Committee including relevant representatives drawn from school systems and sectors, universities and teacher registration with expertise in ICT innovation with capacity to solve practical and bureaucratic problems. The purpose of this committee is to support the work of partnerships.

Recommendation PM5: Project Team Leaders and Management Teams should ensure:

- sufficient planning time is set aside for pre-service teachers, teachers and teacher educators to work collaboratively;
- attention is given to perceived constraints on the project as a focus agenda to establish a consensus about achievable outcomes for the project in the light of local conditions;
- elements that sustain the momentum of change are articulated clearly and supported by realistic levels of resourcing;
- sufficient time allocation is factored into projects to account for bureaucratic processes;
- professional learning communities are fostered through appropriate recognition of the needs of pre-service teachers, teachers and teacher educators;
- supporting factors external to people, such as the practicum, technical support and timetabling, are structured to meet the needs of individuals.

Recommendation PM6: To maximise the benefits of the partnerships there should be:

- a focus on roles expected of participants, including those that are to take a leadership position;
- ICT leaders or champions should be utilised where possible to enhance motivation and school capacity;
- protocols that nurture equal status of all participants and that highlight the nature and importance of genuine collaboration among partners;
- a culture of inclusiveness and equal status is to affirm to all groups and facilitate a sense of ownership of the project;
- time allocated for professional dialogue and contact to develop the professional nature of the learning community established.

Recommendation PM7: The transformation of the teaching and learning environment and practice involves both the level of adoption of ICT in schools and the pedagogy to support the adoption. To facilitate an extensive and sophisticated level of adoption, partnerships should:

- be consistent with a whole-school approach to ICT-mediated learning;
- focus on new pedagogical frameworks, potentially proposed at a state, territory or education jurisdiction level;
- celebrate the contributions made by partners;
- proceed cautiously if the pre-service teachers involvement in partnership activities coincides or includes the practicum experience;
- ensure that approaches are evaluated and the findings promoted by partners in appropriate forums.

Seven principles underpinning ICT in learning

This section outlines seven basic principles that underpin future recommendations concerned with embedding ICT in learning. These principles seek to take into account international trends as well as those from the discussions with project teams, at Advisory Committee meetings and at the National PICTL Forum.

Principle 1

That there needs to be a re-invigoration of a national commitment to, and realistic adoption of embedding ICT in learning in Australia. At the centre of this work:

- are approaches that mainstream ICT both in schools and within teacher education faculties of universities so that the use of ICT becomes an accepted part of work culture;
- is the involvement of all stakeholder groups including key personnel from state, territory and national education jurisdictions, tertiary institutions and the ICT in Schools Taskforce; and
- is facilitation of the process by a National ICT Framework for pre-service teachers, teachers and teacher educators.

Principle 2

That there needs to be a serious investment of thought and research within Australia into addressing difficult education concerns in embedding ICT in learning. Such investment must include education professionals, ICT champions and strong advocates of ICT uses in learning and teaching. In particular there needs to be a focus on:

- understanding and enacting innovation in Australia in embedding ICT in learning;
- acknowledging teacher efforts, particularly with respect to student-learning gains on such dimensions as improved understanding, higher learning outcomes, higher retention and class involvement; and
- collecting evidence concerning changes that have taken place in learning for students and teachers and whether these have been sustained over time.

Principle 3

That technical connectivity needs to be improved nation-wide to produce more open access, for relevant personnel, to system networks and tools generally in education and specifically for individual projects. There needs to be:

- improved suite of online tools for school systems;
- improved access to school and system level ICT tools and networks;
- improved network services delivering at a relevant speed;
- improved technologies linking facilities among schools, school districts and university partners; and
- improved access for pre-service teachers to obtain privileges in relevant education jurisdiction systems.

Principle 4

That care needs to be exercised in utilising the practicum as a professional learning activity to improve the ICT-mediated learning contexts within schools. This may be possible with some pre-service teachers in some contexts but there were concerns about generalisability. The issues are to:

- balance the need to assess teaching performance with action-research investigations that may be undertaken concurrently;
- encourage combined professional learning activities that avoid the conventional assessment paradigm of practicums as this would have an inhibiting effect on innovation;
- create a situation where exploration of ICT uses in learning is encouraged; and
- create opportunities for pre-service teacher explorations, if different from that of the pre-service teacher's supervisor's practice, that do not impact adversely on their teaching grades.

Principle 5

That there needs to be a revised view of pre-service teachers, not only as future users (leaders) of ICT-rich provision in schools, but also as sources of ideas and enthusiasm for change. To achieve this:

- schools and universities should cooperatively manage the pre-service teachers' professional experience;
- universities should expect pre-service teachers to have the potential to become joint developers of ICT with experienced teachers, and eventually leaders of ICT-rich learning designs in schools;
- care must be taken not to expose pre-service teachers to expectations beyond their practical, theoretical or competence range, e.g., undertaking significant leadership roles in what is a difficult and demanding area of school development.

Principle 6

That as a matter of urgency a policy consensus needs to be established, informed by leadingedge ideas about learning, of what constitutes strong student-learning outcomes within the context of ICT uses in learning. Additionally, there is a need:

- for a more concerted effort both to understand and to enact highly innovative educational approaches of worth in this domain;
- to lead principled educational development in technologically-rich contexts; and
- to equip educators with an available, state-of-the-art underpinning theoretical framework so that they are better placed to guide teaching and learning efforts, to convert hunches and intuition into demonstrable student gains and, genuinely, to innovate.

Principle 7

That ICT uses in learning need to be interrogated specifically for their underlying learning models and theories. While curriculum and pedagogic frameworks are useful they are different to learning models and theory. There is a need to:

- recognise and describe learning when it occurred;
- evaluate gains or progress;
- draw conclusions about the educational power of ICT-mediated learning opportunities;
- design principles for future ICT-rich learning opportunities and thereby gain control of the educational quality of such environments.

There are 20 recommendations emerging from the PICTL study. These can be considered under five broad headings.

Creating ICT partnerships

Recommendation 1

That DEST initiate a strategic funding program in which collaborative teams of pre-service teachers, teachers (within schools or school clusters) and teacher educators, and of professional associations, and industry and community groups can seek funding for projects to improve the application of ICT in student learning. Guidelines for the program include:

- proposals be competitive and assessed according to established criteria;
- projects be funded in each state and territory;
- a national coordination process/person oversee all projects;
- a project officer be appointed to record, monitor and evaluate project elements that contributed to success at the local level;
- funding complement existing resources provided to universities to pay for in-school experiences for pre-service teachers;
- funding, either included in projects or through other means, be provided to increase the opportunity for university staff to be involved in professional activities with schools;
- schools or school clusters applying for funding have varying levels of ICT resourcing and staff skills;
- projects be established for a two-year period, and 'on application' extension funding be
 offered to accommodate proposals to continue where they have achieved distinction —
 particularly, if they can address the need for strongly innovative, theoretically sound and
 demonstrably effective directions with respect to students', pre-service teachers', teachers'
 and teacher educators' learning;
- projects be designed as collaborative partnerships involving pre-service teachers, teachers and teacher educators;
- special consideration be given to projects involving remote schools, schools with high Indigenous enrolment, and schools in disadvantaged areas;
- specified contributions be made by pre-service teachers, teachers, and teacher educators;
- participants in projects contribute to the sharing of elements of success through nationally coordinated events; and
- participants be required to specify an appropriate theoretical framework to describe, analyse and understand student learning in ICT-mediated contexts and by which to formatively and summatively evaluate student-learning outcomes.

Recommendation 2

That all stakeholder groups ensure that any future activities directed at investigating ways of embedding ICT in learning incorporate a research component focusing on the benefits for school students of the learning activities, including:

- student-achievement outcomes;
- student-management outcomes; and
- student-affective outcomes.

That education authorities fund professional learning partnerships between universities and schools in the area of embedding ICT in learning. For professional learning to be sustainable:

- professional learning partnerships with universities must be promoted to schools as a model for professional learning of teachers and a strategy to mentor schools to develop a focus and direction for ICT pedagogy; and
- promotion must include the sharing of success stories and good practice in the professional communities of ICT leaders, professional learning coordinators and principals, and the building, thereby, of sound theories of professional learning that then guide future professional learning, including learning design, curriculum and assessment structures.

Recommendation 4

That tertiary institutions negotiate with education authorities to play their part in sustainable professional learning by:

- developing long-term partnerships with clusters of schools, districts or regions with formal agreements;
- establishing coordination positions, and sharing facilities, expertise and opportunities to circumvent the need for universities to seek permissions, obtain ethics clearances, and negotiate intellectual property rights constantly for each partnership activity;
- providing pre-service teachers with opportunities to be in schools through flexible program structures; and
- encouraging teachers to take advantage of pre-service teachers' activities in schools to develop new knowledge, trial new approaches and conduct action research into ICT pedagogy ideas.

Recommendation 5

That tertiary institutions, specifically those servicing the needs of rural and regional areas, take targeted steps to build continuity in their relationships with clusters of schools, so as to overcome the difficulties of transient teaching populations by:

- rotating short-term projects amongst school communities;
- having continuously available remote schools to meet pre-service teachers' needs; and
- building relationships amongst teams of administrators and teachers over time.

That education authorities with cross-sectoral representation establish policies and procedures that enable cycles of professional activities to be designed and implemented so that sufficient time is factored into the life of the project without excessive need for permissions and clearances at each iteration.

Recommendation 7

That education authorities and tertiary institution partners ensure equity of access to ICT systems for all participants and equity of school access to tools used in activities. All participants should be requested to strengthen the culture within schools concerning the use of online tools. This is achieved by:

- making use of the services of Education Networks of Australia (EdNA) as a common ground for collaboration for administrative, professional and curriculum use;
- developing strategies to provide pre-service teachers and teacher educators with access to their computer networks and services, and technical support, without undue bureaucratic process and at no cost;
- continuing to promote the use of online tools, networking and real-time communication tools for professional work at every opportunity possible;
- modelling efficient and effective online processes as a way of changing the culture of communication in schools;
- continuing to use online tools and videoconferencing, where appropriate, to communicate with pre-service teachers; and
- supporting teachers by modelling contemporary professional practice and encouraging people to develop knowledge and experience of these tools through the activities of school-university partnerships.

Recommendation 8

That education authorities provide a system of incentives to schools to encourage participation by a critical mass of teaching staff, as appropriate to school size and staff experience profile, in powerful ICT learning experiences. Incentives include:

- teaching relief (i.e., teacher time release);
- ICT resource allocation to schools for successful project completion; and
- an annual recognition/award scheme for schools that demonstrate excellence in ICT use as a result of participation in the activity or as a result of what has been achieved.

That education authorities provide formal recognition for teachers who participate in powerful activities that seek to embed ICT in learning:

- as contributing towards the attainment of ICT professional teaching standards; and
- as evidence of innovative practice in teachers' professional learning portfolios.

Recommendation 10

That professional associations support their membership by in their participation in partnership projects by:

- modelling the state-of-the-art with respect to ICT-mediated business transactions in their communications with members and with other education, community and corporate sector organisations;
- nurturing the growth of diverse partnerships and forums for teachers, schools and school systems to collaborate in suggesting, discussing, prototyping, trialling and improving ICTrich learning environments across a range of disciplines, fields of practice and educational levels;
- initiating, and assisting in resourcing and sustaining research and teaching connections with organisations including education authorities, other professional associations, and the ICT industry likely to lead to the regeneration of members' knowledge with respect to ICT-rich learning and teaching opportunities;
- mentoring ICT leadership by providing those involved with networks to share and explore ideas on technological and pedagogical issues and by publishing results of research and professional activities; and
- mentoring pre-service teachers by encouraging their participation in all association activities and advocating amongst teachers the need for involvement of pre-service teachers in all levels of school activity.

Recommendation 11

That tertiary institutions negotiate with project Team Leaders with a view to recognising the school professional experience of pre-service teachers involved in using ICT in learning activities in schools. Where appropriate, tertiary institutions must:

- allow realignment of professional experience dates and specifications to suit activities;
- include aspects of activity participation in students' assessment requirements for related courses;
- develop ICT learning courses around participation in powerful ICT learning activities in schools and school systems;
- develop ICT leadership specialisation courses around managing the ICT learning process in schools; and
- promote, within universities, ICT learning activities as a pedagogical approach and a strategy to improve the use of ICT throughout faculty programs, for example, by using findings from various activities as relevant data for designing learning programs.

Supporting effective management

Recommendation 12

That DEST and education authorities be formally recognised as activity partners and provide system support for project management as well as support for collaboration with partners. These partners provide:

- input into the scope and focus of projects;
- system support to participating schools;
- procedural support to university partners seeking permission for the research component of projects;
- administrative support with regard to pre-service teacher authorisations;
- a liaison person who has developed knowledge of the potential of projects as a professional learning approach for supporting ICT in learning; and
- support for initiatives to have education authorities recognise successful teacher participation in the ICT activities.

Recommendation 13

That tertiary institutions encourage teacher educators to take on several roles including:

- lead project team to take major responsibility in writing proposals and subsequent reports;
- liaise with pre-service teachers and teachers;
- coordinate with education authorities concerning formal system support; and
- encourage wider use of school-based action learning among faculty members at their university and perhaps more widely through research publications and other professional activities.

Recommendation 14

That tertiary institutions compensate teacher educators for their professional leadership by the research dimension of activities, by the contribution of work with schools towards professional service, and by appropriate workload allocation. These activities if carefully planned and implemented should be seen to increase the research quantum for the academic and his/her institution. Tertiary institutions must provide teacher educators with:

- a reasonable formal workload allocation to encourage involvement in partnership activities using ICT in learning, and particularly recognising their roles as leaders;
- time and opportunity to distil the complex mix of theoretical and practical ideas in these projects; and
- relevant resources to address the obviously taxing pragmatic demands posed by a collaboration across different stakeholder groups.

That tertiary institutions encourage pre-service teachers by providing them with opportunities:

- to participate in powerful ICT related professional learning experiences by formal recognition from universities, e.g., course credit for activities; and
- to undertake a range of ICT-focused studies, either formally offered within their universities, by appropriate further-education providers, or as independent, self-taught studies.

Planning ICT learning activities and innovation

Recommendation 16

That DEST convene a forum to discuss critical issues facing embedding ICT in learning. The focus of the forum would be:

- theoretical bases of ICT learning in terms of viable learning theories or models;
- what constitutes innovation in ICT learning;
- forms of information needed to establish the benefits of ICT learning accruing to students;
- approaches needed to seed, support and sustain genuine ICT in learning innovation at all levels of educational systems' provision; and
- synthesis of information on ICT learning approaches that describe more clearly the nature of expected learning outcomes for students, teachers and pre-service teachers and hence assist in the crucial research-based development of valid and reliable assessment rubrics.

Recommendation 17

That DEST fund strategically targeted research studies, arising from the above forum, aimed at:

- exploring, in operation, those theoretical learning frameworks considered viable;
- targeting genuine system innovation in ICT learning in schools, school systems and teacher education programs, both pre-service and through professional development;
- addressing ideas about what constitutes strong student-learning outcomes, interrogating those assessment rubrics that hold the greatest promise for assessing the impact on student learning outcomes of the embedding ICT in learning; and
- piloting significant alternative visions for pre-service teacher education and professional development to support and enhance Australia's leading edge, technologically mediated educational provision for diverse educational populations throughout the lifespan into the future.

That DEST, while encouraging stakeholder groups to mainstream ICT activities into their programs as appropriate, initiate projects to research professional learning models and theories, program designs and partnerships in order to inform:

- new models and theories of professional learning partnerships;
- innovative, future-oriented educational activities, with appropriately rigorous, welltheorised assessment structures behind them, that give power and meaning to the use of new learning technologies in schools; and
- university faculties', teacher professional groups' and education jurisdictions' refinement, in theory and practice, of using ICT in learning.

Recommendation 19

That education authorities and professional associations ensure that the most recent developments in ICT learning are being considered and acknowledged, by using the findings and recommendations from major ICT research initiatives to inform the development and review of:

- teacher professional standards, including registration requirements;
- statements of learning for students; and
- curriculum and pedagogy statements or frameworks.

Recommendation 20

That DEST and education authorities work together to improve the accessibility and quality of ICT learning exemplars by:

- developing a central repository, or at least links to different databases, so that current collections are not fragmented;
- including detail about how these practices might be adapted or adopted by teachers; and
- developing frameworks, possibly based on national ICT pedagogy statements or statements of learning, to review exemplars and decide which are to be included.

The advent of the development of new technologies and what we know about this generation's familiarity with new technologies represent a serendipitous set of circumstances. It has the potential to provide a legitimate opportunity to rethink teaching in much the same way as the professions of medicine, nursing or health, engineering and architecture have done.

Through the PICTL study we now have data to confirm that partnerships are most likely to be successful if they involve:

- formalised arrangements;
- agreed outcomes;
- incentives for pre-service teachers, teachers and teacher educators;
- commitments from schools, education jurisdictions and universities;
- long-term relationships;
- proposals from school and university staff but managed by universities;
- collation and dissemination of knowledge managed by academics in collaboration with school partners; and
- long-term sustainability through collaboration with unions, tertiary faculties, education authorities and DEST.

Clearly, we are at a time in the use of ICT in learning when the focus must be on teachers' learning, and their beliefs and teaching approaches, as well as students' needs and learning outcomes. ICT is a tool that has strengths and weaknesses depending on the context and the manner of use. Facilitation of activities with a clear learning orientation will help provide valuable insights that will aid sustainability. Future activities that explore ICT uses in learning should explicitly target:

- the nature of innovation;
- an intensive focus on teacher and student needs;
- the degree of improvement of learning outcomes for teachers and students; and
- the setting of project plans and leaning goals grounded in theory.

A developmental perspective is critical to the success of this work. Furthermore, the core PICTL Study parameter — the notion of collaborative partnerships — highlights the worth of a targeted focus on collaborative, community-focused learning as a way of thinking about system reform and renewal. These ideas are urgent and timely, and should now be debated nationally. Importantly, the actions of embedding ICT in learning should be subjected to high standards of evaluation. Information is needed on the benefits accrued for students' learning. We need information on approaches that describe both students' and teachers' work more clearly and in terms that recognise and build on those sound, newly available ideas about how learning occurs as part of a lifelong journey.

Overall, there is a need for broader and more thoughtful debate about using ICT in learning in our culture as a way of seeding much more radical and relevant ideas into learning and teaching. The level of discussion of ICT-rich and ICT-appropriate learning in education needs to become far more holistic, sophisticated and subtle. Clearly, further system renewal is dependent on the provision of a firm and educationally powerful theoretical basis for such learning, and a context for discussion and rigorous research investigation that prioritises future-oriented learning designs and organisational structures in schools. Given the urgent social and environmental challenges currently confronting future generations, there needs to be a much more concerted effort to encourage people's imaginative and rigorous thinking about viable alternative educational ideas and strategies.

ICT applications in learning have the potential to act as a positive force for addressing many challenges facing communities in education. Partnerships in ICT learning might well hold the most promising long-term solution for many of these challenges.

Introduction to the PICTL study

1.1 Overview

The *Quality Teaching Programme* Project funded by the Department of Education, Science and Training (DEST) offered a tender for the provision of advice to the Federal Government under the title: *Strategic Partnerships in ICT Development*. The tender was awarded to a consortium comprising the Australian Council for Computers in Education (ACCE), the Australian Curriculum Studies Association (ACSA), and the National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England. The research program (Leonard, Schoo, Pegg & Reading, 2005) designed to meet the objectives and deliverables of the tender was titled *Partnerships in ICT Learning* (PICTL).

The purpose of the PICTL study was to demonstrate good-practice approaches to embedding Information and Communication Technology (ICT) throughout the educational experience of pre-service teachers, teachers and teacher educators. To address this, the research program investigated ICT partnership approaches in a variety of Australian contexts through developing, trialling and evaluating forms of partnerships among universities, education authorities (government and non-government) and schools.

Eight small-scale Professional Development (PD) projects involving ICT comprised the study. There was one project in each state and territory, and each of these brought together pre-service teachers, teachers and teacher educators within partnership arrangements that sought to transform learning environments and teaching practices through more considered applications of ICT. Underpinning projects was the notion that rich uses of ICT in Australian classrooms would benefit student-learning outcomes.

The approach taken by projects, which appeared most relevant to Australia, was to create 'meeting places' where pre-service teachers, teachers, and teacher educators were able to draw upon and share their expertise while developing deeper understandings of the possibilities and potential of ICT-rich curriculums. This context also facilitated the exploration of approaches to professional learning that enabled strong links to be forged among pre-service teachers, teachers and tertiary educators. At the same time as working to achieve these outcomes, the PICTL study also focused on using the data from state and territory projects to identify ways of achieving more global and sustainable reforms that would impact at the education jurisdiction level and the course program requirement level within universities, and not just on piecemeal changes to teacher professional growth, teaching practices, or university programs of study.

1.2 Background

In 2002, DEST published a report entitled *Making better connections: Models of teacher professional development for the integration of information and communication technology (ICT) into classroom practice.* Of particular relevance to the PICTL study was a finding that arose out of two apparently conflicting observations concerning the degree to which ICT has become a widespread and mainstream activity in schools.

It was noted that teacher education providers reported that many schools were inadequately prepared for ICT delivery (in terms of resources, expertise and classroom practice) for pre-service teachers to undertake their professional experience. This under-preparedness meant that schools did not provide rich opportunities for pre-service teachers to develop skills to integrate ICT successfully into the curriculum as part of their classroom practice.

Balancing the above, school systems reported that from their perspective many newly qualified graduates often did not have the necessary ICT skills and understandings required for effective teaching in their classrooms. Schools noted that often pre-service teachers were disinclined to consider any ICT initiatives in their teaching. Further, there were other pre-service teachers with high technical competence but who were unable to use that knowledge for teaching across or within subjects. Also, there were others who had many ideas about ICT applications within the curriculum but lacked the personal technology skills to carry out their plans in the classroom.

Interestingly, it appears that both of these differing perceptions are true. Consequently, the writers of *Making better connections* suggested that, as a practical way of addressing these two positions, there was a critical need to develop stronger links between pre-service teacher education and the continuing professional development of teachers. Restating this, Australian education systems and teacher education providers need to improve ICT usage in the curriculum by creating stronger partnerships in which each supports and draws upon the skills and knowledge of the other.

This focus on cooperation is also becoming evident in, and has been a catalyst for, important moves in the United Kingdom and the United States to reform teacher education over the last few years. Among key education agendas in these countries are trends that focus on:

- 1. reforming teacher education programs simultaneously while reforming the schools they serve; and
- 2. developing partnerships between schools and teacher education programs so that pre-service teachers benefit from close alliances and extensive in-school experiences.

One outcome of these reforms in the United States, for example, has been the steady development of Professional Development (PD) Schools. These schools are intended to model good practice associated with achieving high standards for student learning. They provide opportunities where teachers and teacher educators can combine their expertise for the benefit of both students and pre-service teachers. The programs run by these schools do not seek isolated changes to school or university activities. Rather, they seek to achieve broad and sustainable reforms.

While the notion of PD Schools has not been tried in Australia, more general partnership experiences with ICT could work well in the Australian context. In such a scenario, pre-service teachers, teachers and teacher educators could share information and ideas, and undertake projects on effective integration of ICT across the curriculum. These groups could also collaborate in ways that further develop the knowledge and understandings of all participants. This approach appears promising because it has the potential to:

- 3. address known principles of effective professional development;
- 4. address the system reform needed at the school and the teacher education institution levels; and
- 5. focus on improvements in learning outcomes for all students using ICT.

1.3 Setting the context

All school education systems in Australia have an extensive history of developing policies, strategies and resources to provide their students, teachers and schools with access to a range of ICT activities. After many years of sustained efforts to provide infrastructure, Australia now appears among the forefront of countries in terms of the quantity of ICT resources provided and the expanse of Internet connectivity. In comparison to other countries surveyed for the *Programme for International Student*

Assessment (PISA) by the Organisation for Economic Co-operation and Development (OECD, 2000), Australia's median ratio of 15 year-old students to computers was one-to-five, equalling that of the United States. Further, 80 per cent of computers in Australian schools were connected to the Internet.

Significantly more ICT resources have been allocated across the country since the 2000 PISA report. Despite current concerns regarding the lack of broadband access in certain areas of Australia, the OECD data imply that Australian classrooms are sufficiently equipped to enable students and teachers to gain benefits from ICT integration into the learning and teaching processes. Although positive, these findings do not mean that efforts to improve infrastructure can be relaxed in the future.

One example of new developments at the national level is the work of *The Le@rning Federation*. This group has begun to offer digital content and associated management structures to cater for present and future e-learning environments. This initiative is complemented by interesting developments in each state and territory. However, even with high standards of resources, there is still a compelling need to ensure that the ICT capabilities of the teaching workforce are sufficiently developed to enable the expected educational benefits to materialise.

Nevertheless, while ICT resources are adequate, a project (Angus et al., 2004) examining the resourcing of Australian primary schools, found numerous complaints that ICT support is seriously underresourced. For example, schools generally did not have staff with appropriate expertise when networks or servers failed — this affected teaching programs adversely. Furthermore, these necessary support services "are not always available locally, especially in the case of rural schools", and hence "delays of several weeks during term time are common and longer periods are not uncommon" (Angus et al., 2004, p. 33).

Two issues are emerging that demand a rethink of current practices. The first concerns the need to attract and retain quality teachers who are competent in ICT and the second relates to the nature of the link between ICT and learning.

The *Review of Teaching and Teacher Education* chaired by Professor Kwong Lee Dow has highlighted the growing need to address concerns about attracting and retaining teachers. The Review's report, titled *Australia's Teachers: Australia's Future* (DEST, 2003), referred to the fact that a potentially high proportion of Australia's government sector teachers may decide to retire within the next ten years. The need to replace a substantial number of teachers in the coming decades focuses attention on processes for preparing new teachers and providing beginning teachers with necessary skills and abilities to compensate for their lack of experience in the classroom. Furthermore, the *Review* noted high attrition rates for new teachers, "possibly as high as 25 per cent within the first five years of teaching" (DEST, 2003, p. 87). It is therefore likely that all education jurisdictions and teacher training institutions will be seeking improvements in the methods, structures and partnerships associated with pre-service teacher education.

This *SiMERR National Survey* (Lyons, Cooksey, Panizzon, Parnell & Pegg, 2006) addressed this issue further. The survey found that ICT teachers in provincial areas were about twice as likely, and those in remote areas about four times as likely, as those in metropolitan areas to report that it was 'very difficult' to fill vacant teaching positions in those subjects in their schools. In addition the survey reported the highest need indicated by ICT teachers was for support personnel to help them manage ICT resources and assist teachers and other staff to use these resources effectively. ICT teachers in non-metropolitan schools had a higher unmet need for a range of resources and support, particularly for addressing student diversity and managing ICT resources.

The second emerging issue centres on the fact that 'the ICT in Learning' movement has itself undergone transformation. There has been a shift from a focus on developing student competence with ICT in the 1980s to integrating ICT into curriculum in the 1990s to, more recently, considering that ICT may play an integral role in curriculum interpretation and implementation. There is now a change in emphasis and language from looking at the role of ICT in curriculum, to adopting the tone, language and meaning for an ICT pedagogical approach, placing the use of ICT as an integral part of the way teachers teach and how they facilitate learning. Such a shift is about using ICT as a vehicle to transform teaching.

These two emerging trends require the education community to nurture training opportunities for beginning teachers. The ICT in Learning agendas provide one possible opportunity for the newest members of the teaching profession to be valued and show leadership on their appointments to schools. New teachers and pre-service teachers may be able to bring fresh perspectives about how ICT can assist the implementation of curriculum reforms through technologically-influenced curriculum interpretation and as an "enabler of good pedagogy". Both of these perspectives highlight "issues for consideration when planning for the integration of ICTs in the learning environment" (MCEETYA, 2005, p. 3).

Making better connections also addressed these trends associated with the development of an appropriately skilled teaching profession and ICT learning initiatives in schools. The conclusions in the report identified as paramount the need for the continuing professional development of teachers and the pre-service training of new teachers in utilising ICT into classroom instruction. The report suggested that learning systems in a modern technological age demanded four broad dimensions (DEST, 2002, p. 29) to the use of ICT in schools. These were:

- assisting students to develop digital skills throughout their schooling;
- integrating ICT processes into existing curriculum to improve student learning;
- reforming curriculum by changing curriculum and pedagogy; and
- changing the nature of schooling itself through changes in organisational and structural features.

As systems and statutory authorities focus on improved curriculum and schooling structures, it is appropriate for the education profession to revisit its understanding of the third and fourth dimension. This way, tenets of curriculum reform might influence better how and what students learn within more cohesive and integrated developments.

The message to the profession seems clear: the use of ICT is expected in classrooms and professional work, and what is taught and learned could be strongly influenced by technological innovations and thinking. It is also becoming increasingly evident that "changing the nature of schooling itself", identified in *Making better connections* as a fourth and possibly idealistic future dimension is at the heart of many current curriculum reforms.

This transformative reality sees teacher professional development in ICT provide the opportunity for teachers to improve greatly their acceptance of, and capabilities in, using ICT. This focus has the intent of allowing teachers to experience uses of ICT as part and parcel of their own learning experiences and those that they offer students. The implication is that ICT has an integral part to play in pedagogical approaches as well as potential to transform learning environments. Critical in any implementation of such a new focus is that the end product, improved student-learning outcomes, occurs.

1.4 Establishing the PICTL study

Making better connections did not extend its influence to suggesting ways of learning for individual partnerships nor system-wide approaches for managing institutional partnerships. However, the report suggested that professional learning partnerships between teachers and pre-service teachers would provide fertile ground for the rich dialogue necessary to improve the nature of schooling and learning in a modern technological age.

Further, the report identified that ICT innovation in education might not necessarily be the sole province of the experienced teacher. This view offers potential opportunities for pre-service teachers to link with experienced practitioners in helping take some responsibility for integrating ICT use into

mainstream classroom activities. Such a partnership may be a realistic way to shift the focus of classroom practice closer towards the high expectations of ICT use held by the community and by students.

Many universities now offer specialisations in ICT for primary and secondary trainees because of the growing demand for ICT in curriculum leadership in schools. This is done so that these new teachers are better equipped for the complexities associated with an ICT role in a school. One implication is that new teachers could be expected to undertake stronger roles in a school's ICT in curriculum design, rather than concentrate on technical responsibilities. However, seeking high-calibre environments for these future teachers during their practice-teaching sessions is often problematic.

A proactive way forward for these pre-service teachers could be through the development of genuine partnerships between schools and universities in their training. It is likely that the synergy of experienced classroom teachers with fresh creativity of pre-service teachers would be a fertile context to accelerate the personal professional developmental pathways of both groups of individuals. Further, there was an expectation that professional learning practices in the PICTL study would influence the development, content and practices of pre-service teacher education programs. The end result for all participants is their expected immersion in state and territory curriculum reforms as well as a growing ability for them to contribute to debates about the value of various innovative approaches associated with ICT.

Thus the PICTL study provided an opportunity to consider different ways that a partnership form of professional development might evolve. In particular, interest was on ways to support the professional learning of pre-service teachers, teachers and teacher educators simultaneously on how pedagogies can embed ICT into state and territory curriculum implementation in ways that would improve student-learning outcomes.

1.5 Scope of the PICTL study

The PICTL study was designed to explore innovative processes for enhancing the ICT capability of pre-service teachers, teachers and teacher educators by creating a situation in which these groups could work collaboratively and hold professional conversations in school settings. The notion of working partnerships among these three groups offered opportunities to strengthen the strategic relationships between teacher-training institutions and schools.

For universities, this approach involved programs that transform the teaching and learning process in teacher education by embedding ICT throughout the entire educational experience of all future teachers, in partnership with schools and education jurisdictions. Further, universities in this context had the opportunity to focus research, test theoretical perspectives and develop contemporary case studies for use in teacher education programs.

For schools, this approach involved integrating ICT into teaching practices possibly by applying innovative approaches to curriculum and pedagogical reforms, and/or through providing pre-service teachers with opportunities to take stronger roles in trying new ideas in classrooms. This approach broadened the professional communities in schools to include teacher educators and pre-service teachers as co-learners and co-researchers in the quest to improve student use of ICT.

In summary, the research agenda was therefore to explore partnership approaches in the Australian setting concerned with embedding ICT throughout the educational experience of students. The partnerships aimed to improve student-learning outcomes through the use of technology-rich approaches for students by pre-service teachers, teachers and teacher educators. It was expected that bringing together these three groups would transform teaching, learning environments and practice. A professional dialogue amongst stakeholders that enables them to reflect more deeply on existing practices and experiences would accompany these changes.

The scope of the PICTL study can be considered under three headings — contexts of activity, partnerships, and a professional development framework underpinning the projects within the PICTL study.

Areas of activity

Broadly speaking, the PICTL study had two main contexts of activity:

- 1. National *PICTL professional community* a professional community of stakeholders sharing their knowledge and experience to draw conclusions about the potential of partnerships between universities and schools to improve teacher education and use of ICT in schools.
- 2. Local *state and territory projects* a partnership between schools, a university and often an education system to develop and address ICT agendas at a local level.

From the PICTL Management Team's perspective, the activities of the PICTL study included:

- developing state and territory project designs to explore variations on the 'core' professional development framework in local contexts;
- identifying a National Study Evaluator;
- working with a PICTL Project Officer to manage the study;
- conducting Steering Committee meetings to add national perspectives to project designs;
- developing an interim report to capture the project designs and partnership purposes;
- developing a website for the project;
- conducting online events as a catalyst for discussions on project issues;
- collecting data from each state and territory project team on the outcomes of the project;
- hosting a National PICTL Forum to identify and discuss issues related to ICT; and
- developing a final report.

From a state and territory project team's perspective, the activities of the PICTL study included:

- designing a state or territory project to develop, implement and evaluate a 'local' model for pre-service and in-service professional development;
- establishing partnerships or extending existing partnerships;
- developing local advisory committee;
- conducting the project;
- hosting the PICTL Project Officer during visits to state/territory;
- preparing an interim project report;
- participating in online events;
- preparing an issues paper;
- participating in a National PICTL Forum;
- developing a final project report; and
- hosting a project-level evaluator who was mentored by the National Study Evaluator.

Partnerships

The areas of activities listed above can also be described in terms of the notion central to the study — partnerships. Partnership is described for the PICTL study as a 'collaborating community of practice' because reflective activities and conversations were a hallmark of the interactions. This concept underpins the design, and can be considered at four levels:

• Partnerships at the national management level consisted of three professional groups that made up the PICTL Management Team. This group involving the ACCE, ACSA and SiMERR were in constant communication with one another and the PICTL Project Officer.

- Partnerships at the national level consisted of the PICTL Management Team working with the state and territory project teams, members of the Steering Committee, the National Study Evaluator, and participants at the National PICTL Forum.
- Partnerships at a state and territory level occurred among a university, cooperating schools, and (often) an education authority. These partnerships are best considered to be functioning at a regional level.
- Partnerships within state and territory projects involved teams of pre-service teachers, teachers and teacher educators. These partnerships formed a learning team to work together with an ICT focus to improve learning for students while allowing reflection on the participants' own learning.

Professional Development Framework

As indicated previously, the PICTL study design was inspired by recommendations from *Making better connections* that suggested both pre-service and in-service teacher professional development were significant factors in improving ICT use in schools. Also, there were obvious synergies to be explored by investigating models of learning that met the needs of different groups simultaneously. This study sought to develop a framework referred to as the *PICTL Professional Learning Model* that was informed by the different state and territory models.

To establish an initial platform, a collaborative approach referred to as a *Professional Development Framework*, for pre-service teachers and teachers involving situated learning, was suggested. It centred on using the practicum or other school experience opportunities of pre-service teachers as an opportunity for collaborative planning, implementing and reflecting on the use of ICT in classrooms. It also provided the opportunity for the pre-service teachers to learn and work collaboratively with teachers and teacher educators.

There were five phases in the suggested *Professional Development Framework*. Throughout all five phases of the *Framework*, mentoring and deep reflection were to aid the professional learning process.

- **Phase 1** Involving partners in direct awareness-raising events about ICT, curriculum frameworks, pedagogy or other relevant subject matter.
- **Phase 2** Selecting a specific student learning experience to plan and implement. This might be a unit of work, task, project or series of lessons where ICT would be used powerfully within a curriculum program.
- **Phase 3** Developing the curriculum unit plan including the detail of the pedagogical philosophy that would underpin implementation.
- Phase 4 Implementing the plan in classrooms.
- Phase 5 Reflecting on the experience.

There was a strong element of reflection embedded within project designs and implementation cycles. The scope and nature of such reflection were expected to vary. Data collection was also expected to vary as project teams chose to use strategies appropriate for their project including surveys, interviews, reflection circles, diaries or reflective journals and oral and written structured narratives. The variation in the state and territory projects would provide considerable data for the national report, and an opportunity to draw conclusions about partnerships and professional learning situations that met the varying needs of stakeholder groups.

It was this *Framework* that became the staring point or basis for the planning of how the partnerships would go about their operation for each of the state and territory projects. Project leaders and their teams were free to change this 'core' framework in any way that best suited their project. As a result each project emerged with a different framework and these are referred to as Project Professional Development models. The *PICTL Professional Learning Model* presented and discussed in Chapter Four of this report represents a synthesis of these separate project models in the light of the data obtained from all projects.

1.6 Structure of the report

The following chapter provides the research methodology for the PICTL study. It outlines the main elements involved in designing and implementing the study, including the research framework; design, timeline and participants; rationale for state and territory project selection; state and territory projects — initial design and preparation for research; national forum; and data analysis. The chapter concludes with discussion of the three approaches used to assist quality assurance.

Chapter Three describes the state and territory projects. Provided is a brief overview of these projects from numerous perspectives including descriptions, contexts, nature of partnerships, purpose of professional learning, classroom activities generated, research questions and uses of online technologies.

Chapter Four presents a summary of the findings of the projects framed in response to the 11 research questions. A core framework referred to as the PICTL Professional Learning Model is proposed. Also included are recommendations framed at a general level that emerge from the findings concerning managing partnership projects.

Chapter Five is the final chapter and ties together the issues and ideas that have developed in the PICTL study. In the first instance a context is established for general recommendations before seven basic principles underpinning ICT in learning are provided. Finally, recommendations are proposed concerning creating ICT partnerships, sustaining professional learning partnerships, supporting professional learning, supporting effective management and planning ICT learning activities and innovation.

An expanded version of this report is available in *Partnerships in ICT Learning Study: Full report* (Pegg, Reading & Williams, 2007).

Research methodology

2.1 Introduction

The central theme behind the PICTL study concerned the development and evaluation of goodpractice models for simultaneous professional development for pre-service teachers, teachers and teacher educators. This theme was addressed by eight projects, one in each state and territory, to develop, trial and evaluate forms of partnerships among universities, education jurisdictions (government and non-government) and schools.

It was anticipated that by working together, pre-service teachers, teachers and teacher educators might be able to provide advice on areas such as reform of school teaching programs, teacher education programs and the continuing professional development of teachers, especially as it relates to the use of ICT. Also, the study was expected to showcase different ways to increase the exchange of professional knowledge between schools and universities.

Further, it was expected that the evaluation of the projects as a group and individually would identify examples of worthwhile ICT pedagogy as it relates to curriculum and pedagogical frameworks in different states and territories. By exploring these professional partnerships, professional learning strategies may be identified that can be employed by schools, universities and systems for integrating and embedding ICT into and across the curriculum in varied and sustainable ways.

This chapter discusses seven aspects of the methodology. These are the research framework; design, timeline and participants; rationale for state and territory project selection; state and territory projects — initial design and preparation for research; national forum; data analysis; and quality assurance.

2.2 Research framework

The central research theme for the PICTL study was:

How can classroom-based professional learning projects be collaboratively designed among pre-service teachers, teachers, and teacher educators to focus on quality student uses of ICT within new curriculum reforms and pedagogical agendas, and which influence designs for professional learning for all stakeholders?

The PICTL study was designed to address 11 research questions. These questions have been organised into four themes. While some questions are able to inform more than one theme, to simplify the reporting process, questions have been allocated to the one theme that is most relevant.

1. Evidence of success and innovative approaches

- RQ 1 What does the evidence of relative success of the state and territory projects, based on the feedback of participants, mean for responding to the broad research theme?
- RQ 6 What innovative approaches were used, and how successful were they?

2. Strategic partnerships

- RQ 2 To what extent do the various groups (schools, universities, government/non-government authorities) succeed in working together to achieve the desired outcomes?
- RQ 3 What are some of the challenges in trying to implement successful partnerships between differing levels of educational bureaucracy (e.g., governance issues, organisational issues)?
- RQ 7 To what extent was it possible or necessary to transform teaching and learning environments and practice?
- RQ 8 What were barriers and critical success factors impacting upon the success of the strategic PD partnerships?

3. Towards sustainable professional learning

- RQ 5 To what extent is effective professional development in this area dependent on wholeschool or system-wide reform? What change management issues were faced in trying to achieve these reforms? What cultural change was/is necessary?
- RQ 10 What are possible strategies for sustaining the partnerships beyond the life of the project?
- RQ 11 What are recommendations on ways to develop innovative professional development projects on a wider scale?

4. Effective management

- RQ 4 What are key project management issues (e.g., importance of defining scope, methodology)?
- RQ 9 What are the advantages and disadvantages of using online networking tools (e.g., online communities of practice, closed discussion groups, extranets) to support these partnerships?

These questions required responses from state and territory project teams using evidence obtained from their projects. These findings were synthesised to provide a national perspective.

2.3 Design, timelime and participants

Study design

The PICTL study involved eight projects, one from each state and territory. At the local level, the study involved selected university teams applying action-research methodologies to individually-designed projects. These projects investigated the durability, efficacy and sustainability of variations to a general professional development framework aimed at helping pre-service teachers have a quality experience with ICT in the classroom as an important transition from them being pre-service teachers to in-service teachers. The PICTL study's premise was that if pre-service teachers, teachers and teacher educators worked together to employ improved uses of ICT within a school's curriculum and pedagogical framework, all partners in the activity would leave the program with improved skills and understandings.

The approach advocated involved participants in a professional learning process to develop an idea, or some aspect of curriculum planning, implementation and reflection. Such a situated learning sequence also provided a professional learning environment for cooperating teachers and developed an awareness of possibilities for other teachers in the school. The approach also provided teacher educators with opportunities to renew their knowledge of curriculum frameworks and the use of ICT in schools, to develop new and relevant content for lectures and units of study, and to have evidence and experience to reconsider the ICT components of programs conducted at their university.

Nationally, the PICTL Management Team's responsibility was to manage the eight state and territory projects, facilitate the associated activities and synthesise the results to develop national recommendations.
The PICTL study had four distinct stages.

- Stage 1Developing a national study plan and timeline, establishing the national research agenda
and setting up the consultative and management mechanisms for the project.
- **Stage 2** Facilitating the design of state and territory projects.
- **Stage 3** Supporting state and territory project leaders as they implemented their projects including conversations through online events, teleconferences, and site visits.
- **Stage 4** Conducting a National PICTL Forum and collating data from the state and territory projects into a final report.

As indicated in Chapter One, a broad *Professional Development Framework* underpinned the planning of the projects within the study. This was offered as a possible basis for activity development within state and territory projects. Within these projects, the framework varied and was situated in different contexts, dependent upon the capacity to co-locate practice teaching and other in-school projects within the project timeline.

There were four variations to the *Professional Development Framework*. These were:

- The perceived or diagnosed need for a professional learning program to raise awareness of ICT in learning within new curriculum and pedagogical reforms.
- The role and experience of the person responsible for implementing the curriculum in the school. Whether it was a pre-service teacher, teacher or a partnership involving both.
- The depth of reflective experiences built into the their project design.
- Whether practice teaching was the setting for the in-school experiences of pre-service teachers.

These variations tempered contributions to the data provided through state and territory reports and interviews. However, both the interviews and the National PICTL Forum provided an opportunity for synthesised comments and conclusions across all the variations to the *Professional Development Framework* within the contexts and partnerships surrounding the state and territory projects.

Despite these differences, each state and territory team designed a project based on a core *Professional Development Framework* that each team had modified to suit their context. This provided a rich data set, often with deep insights into adaptations of the *Professional Development Framework*, the issues that arise in local contexts and the complex conditions of partnerships. Also elaborated were future expectations of new professional learning projects that simultaneously address the learning needs of pre-service teachers, teachers in schools and teacher educators, who chose to work together to improve the pedagogical uses of ICT in Australian classrooms.

Timeline

Initial planning for the PICTL study commenced with the *Application for Tender* in August 2004. During this time team leaders in each state and territory were identified and some initial planning begun. The PICTL study began officially in late May 2005. Eight state and territory projects were designed, conducted and evaluated between June 2005 and May 2006. The national PICTL Forum was conducted in late April 2006 in which teams reported on their progress. State and territory reports were developed and refined from June to September 2006.

Project timeframes ranged from being over a fixed term (from five months) to being extended beyond the life of the PICTL study. It is important to emphasise that some of the project partnerships were in place prior to the commencement of the PICTL study. Some projects were able to co-locate a practicum period within the timeframe of the project and others could not. Some had a single cycle of a curriculum planning and implementation, while others had ongoing complex webs of activities that provided all participants in the project with many opportunities to try ICT activities in classrooms.

Participants

University staff involved in teacher education, whose charter includes both pre-service teacher programs and teacher professional development, facilitated the implementation of the state and territory projects. These staff had responsibility to drive the projects and in particular the research elements. State and territory teams were encouraged to amend the five-phase *Professional Development Framework* to meet local professional learning needs and ICT in Learning agendas.

Projects were conducted in each state and territory by one university per state/territory. The number of pre-service and practising teachers varied widely from two pre-service teachers and one teacher to groups of 20 pre-service teachers and 20 teachers. In one project there were extensive activities in schools undertaken by an entire cohort of pre-service teachers.

A PICTL Project Officer was employed to facilitate the design of state and territory projects, conduct research, facilitate professional dialogue between project teams and conduct the day-to-day management of the project.

2.4 Rationale for state and territory project selection

Universities in Australia have an interest in the in-service education of teachers because of their community service charter, desire to improve schools that influence pre-service teachers, and genuine interests in the quality of education in their state/territory.

A recommendation from *Making better connections* suggested that a framework for simultaneous professional learning of pre-service teachers and teachers could really only be instigated by universities through partnerships at two levels: partnerships between the university and target schools supporting learning; and partnerships between small teams of pre-service teachers, teachers and teacher educators.

In selecting the eight state and territory project leaders the emphasis was to capitalise on already existing school-university relationships and take advantage of relevant 'community' strengths. The PICTL Management Team used local influences and local knowledge to approach university faculty members who had a record of innovation, were seen to be experienced in providing in-service support for teachers, worked in diverse communities and were available to conduct a project in the timeframe offered.

Also of importance were differences in the nature of project contexts. The notion of partnerships needed to be explored in areas other than the large urban universities and local city schools. Further, the contractual arrangements of the PICTL study specifically required diversity in the sites chosen in order to seek broader ways of building partnerships to support professional learning across Australia.

2.5 State and territory projects — initial design and preparation for research

In the design of state and territory projects, the PICTL Project Officer visited each state/territory project leader and university team to establish the research agenda for the project and to support the development of the project design. The 11 research questions underpinning the PICTL study provided a basis upon which to begin discussion, research design and project design. Project leaders participated in a structured conversation organised around the following protocols.

Planning the project — To help the state and territory project leaders plan their project, a proforma was used. Linked to this proforma were the PICTL study's research questions. In addition, an 'Inspiration' mind map was used to collect notes and organise responses. This was converted to a Word document and provided to project leaders to assist them to complete their planning process.

Interim report — State and territory project leaders were asked to complete an Interim Project Report proforma to identify any issues that may contribute to the agenda for the National PICTL Forum.

Interview protocol — The PICTL Project Officer visited all states (except the Northern Territory) to conduct interviews about the final project report. This structure provided information for both project reports and the *PICTL Study Report*.

Final report — All state and territory project leaders were provided with a Final Report structure. State and territory project reports are available in *Partnerships in ICT Learning Study: Case studies* (Reading, 2007).

PICTL Forum — The National PICTL Forum, titled *Partnerships in ICT Learning Forum 2006: Sustaining Partnerships in ICT Learning*, was held on the 26th and 27th April 2006 at the National Museum of Australia, in Canberra. The report on this forum is available in *Partnerships in ICT Learning Study: Case studies* (Reading, 2007).

2.6 National PICTL Forum

The purpose of the National PICTL Forum was to enable state and territory project teams to share the results of their work and their responses to the research questions underpinning both the national study and the state and territory projects. These presentations formed the basis of the professional dialogue about the key issues and findings of the PICTL study. The PICTL Forum was, in some sense, a conversation in draft, to enable new ideas and syntheses to emerge and be debated. It was designed to inform the PICTL study.

To benefit from diverse experiences and perspectives, a range of people were invited to attend the National PICTL Forum. Some were drawn from the state and territory projects including teachers, pre-service teachers, and teacher educators, while others were drawn from staff supporting pre-service teacher education and those with extensive academic experience in pre-service teacher education and professional learning models.

The National PICTL Forum involved:

- reports from each state and territory project;
- reports from evaluation and research teams as previews to workshops;
- workshops on key findings to draw on ideas from the audience of experts; and
- conclusions drawn from the evidence provided and the resulting discussion.

On the first day of the National PICTL Forum project leaders shared the preliminary results of their projects and highlighted emerging issues. Day two of the National PICTL Forum was designed to analyse these issues further and consider possible national implications. A summary version of the National PICTL Forum report is included in the accompanying volume.

2.7 Data analysis

Data were collected in multiple ways. Project leaders submitted a project plan and an interim report that provided complementary data highlighting changes to project designs brought about during implementation. They were also interviewed to illuminate outcomes and to help identify issues. These data were presented at the National PICTL Forum and processed in discussion groups and follow up e-mail conversations. A report from the National PICTL Forum, including discussions, was also a valuable source of data on a range of ideas drawn from the views expressed by the Forum participants. Reports, interviews and the National PICTL Forum were structured to facilitate comparisons, analysis and synthesis. The reports from state and territory projects submitted at the end of the project were important sources of information. The report format required project teams to complete the descriptions of their activities under specified headings.

The 11 research questions, organised into four major themes, were used to organise data, stimulate debate and assist in the process of drawing conclusions and recommendations.

- Theme 1 Evidence of success and innovative approaches encompassed RQ 1 and RQ 6.
- Theme 2 Strategic partnerships encompassed RQ 2, RQ 3, RQ 7 and RQ 8.
- Theme 3 Towards sustainable professional learning encompassed RQ 5, RQ 10 and RQ 11.
- **Theme 4** Effective management encompassed RQ 4 and RQ 9.

2.8 Quality assurance

There were four approaches taken to monitor, support and report the development of the PICTL study. This involved the establishment of a Steering Committee, a Recommendations Committee, a Report Writing and Coordination Group and a PICTL study evaluation process.

Steering Committee

A National Steering Committee was selected to place the PICTL study within localities, provide advice to the consortium partners managing this project, and promote debate and discussion leading to recommendations. Members were:

- *Ralph Leonard (PICTL Study Chair and PICTL Management Team)* Australian Council for Computers in Education (ACCE)
- Katherine Schoo (PICTL Management Team) Australian Curriculum Studies Association (ACSA)
- *John Pegg (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England
- *Chris Reading (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England
- *Michelle Williams (Project Officer)* Australian Council for Computers in Education (ACCE)
- Toni Downs (National Study Evaluator) Charles Sturt University (CSU)
- Jillian Dellit The Le@rning Federation
- Denis Goodrum Australian Council of Deans of Education (ACDE)
- Louise Hanlon Department of Education, Science and Training (DEST)
- Kathryn Moyle National Institute for Quality Teaching and School Leadership (NIQTSL)
- Louise Wells Department of Education, Science and Training (DEST)
- *Heather Woods* ICT in Schools Taskforce Secretariat.

Recommendations Committee

The Recommendations Committee was drawn from the PICTL Management Team, Steering Committee and attendees at the National PICTL Forum. This group met for an intensive two-day workshop in Canberra on 7th and 8th August 2006.

- Ralph Leonard (PICTL Management Team) Australian Council for Computers in Education (ACCE)
- *Katherine Schoo (PICTL Management Team)* Australian Curriculum Studies Association (ACSA)
- *John Pegg (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England

- *Chris Reading (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England
- *Michelle Williams (Project Officer)* Australian Council for Computers in Education (ACCE)
- Kathryn Moyle (Steering Committee) University of Canberra
- Will Morony Australian Association of Mathematics Teachers
- *Lyn Schaverien* University of Technology Sydney.

Report Writing and Coordination Group

The group charged with the final drafting and presentation of the PICTL Study Report were:

- *John Pegg (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England
- *Chris Reading (PICTL Management Team)* National Centre of Science, ICT and Mathematics Education for Rural and Regional Australia (SiMERR) at the University of New England
- Michelle Williams (Project Officer) Australian Council for Computers in Education (ACCE).

Assisting this group was Associate Professor Lyn Schaverien. Also providing support were members of the National SiMERR Centre: Dr Terry Lyons (Post Doctoral Research Fellow) and Dr Greg McPhan (Research Fellow) who provided advice on the findings and recommendations; and Professor Ross Thomas (Honorary Professorial Fellow) and Ms Terry Wright (Project Officer) who took on editing roles.

Study evaluation process

The key goal of the evaluation component of the PICTL study was to analyse critically the procedures and outcomes of as many aspects as possible. As with the study design, there were two contexts of the project evaluation — a state/territory and a national component. This dual focus increased the possibility that any benefits or features evident at either level would be documented and reported.

There were other reasons why a dual focus for evaluation was important. While the national study had a beginning, end, and a relatively short time span, actions and activities at the state and territory level were often situated within ongoing partnerships. It was important that there was an independent person familiar with the local context and who could provide advice as well as document occurrences. Hence, the evaluation process included a component of site-level evaluation that facilitated self-improvement through cycles of evidence-based assessment and possible actions beyond the life of the PICTL study.

The evaluation team comprised the National Study Evaluator and state/territory project evaluators. At the state and territory level, each project team selected a suitable academic to be their state/territory project evaluator. This person was drawn from the same university as the project leader and was familiar with the context of the state/territory project.

At the national level, the National Study Evaluator collected data and documentation from management/steering committee meetings, the PICTL website, regular discussions with the PICTL Project Officer, two sets of interviews with the PICTL Management Team, and discussions at the National PICTL Forum. The National Study Evaluator also led a number of teleconferences with state/territory project evaluators where data were discussed, and trends and patterns identified.

The National Study Evaluator, in conjunction with state/territory project evaluators, collected, organised and analysed data and report findings with regard to the key and subsidiary evaluation questions.

The key evaluation question for the PICTL study (and each of the state and territory projects) was: What did the PICTL study (and each state/territory project) achieve in terms of its stated outcomes? To address this broad question seven questions were posed. These were:

- EQ 1 What have been the critical moments within the PICTL study (state/territory project)?
- EQ 2 How effective has the framework for the PICTL study (state/territory project) been? How has the PICTL study (state/territory project) been steered and managed? How did consultative mechanisms operate? How effective has the infrastructure been?
- EQ 3 What methodologies of practice have the PICTL study (state/territory project) adopted and were they appropriate to the PICTL study's (state/territory project's) objectives?
- EQ 4 What is the likely 'legacy' of the PICTL study (state/territory project)?
- EQ 5 How sustainable is the PICTL study (state/territory project)?
- EQ 6 How will this PICTL study (state/territory project) relate to other like projects?
- EQ 7 What advice, if any, should be given about future actions, initiatives and partnerships?

Summary of state and territory projects

3.1 Introduction

The PICTL study explored the nature of partnerships that were attempting to improve student-learning outcomes by transforming teaching and learning environments using ICT. This was to be achieved through the use of technology-rich approaches by pre-service teachers, teachers and teacher educators.

This chapter provides brief descriptions of the state and territory projects presented using seven sections. These provide descriptions, surrounding contexts, nature of partnerships, purpose and strategies for professional learning, innovative classroom activities generated, local research questions, and uses of online technologies.

3.2 Descriptions

Initially the state and territory projects were expected to focus upon providing opportunities for pre-service teachers to use ICT in classrooms while on practice teaching experiences. The delayed implementation of the PICTL study resulted in the timeframe being adjusted to span a financial, rather than a school year. As expected this caused variations in the use of scheduled practice teaching periods. While not the most desired timeframe, working within this period did provide some benefits. For example, data were collected about school-based experiences involving pre-service teachers outside of practicum periods. This offered the chance for pre-service teachers to be involved on more of an 'equal footing' with teachers and university staff in collaborative ways without the pressure of the assessment process associated with course-related professional experience in schools.

The following provides a brief description of the projects undertaken in each state and territory. Additional details of the projects complementing these summaries are available in *Partnerships in ICT Learning Study: Case studies*.

Australian Capital Territory

The partnership in this project was between teachers at three schools and the University of Canberra staff, with pre-service teachers as the audience. This project involved exploration of applications of interactive Web 2.0 technologies as communication and knowledge creation tools by teachers and pre-service teachers within a redevelopment of the Secondary Teaching Studies unit offered by the University. This work exemplifies how new insights and understandings need to be generated before exemplars of good practice are available for use in coursework or professional experience. Early drafts of the National Pedagogy framework provided the rational and impetus for the project design. The project was not implemented in a practicum situation. Pre-service teachers believed its experimental nature did not support their vision of a practicum goal of obtaining high grades based on their actions in the classroom.

New South Wales

The partnership in this project had two levels. The first was among the Country Area Program (CAP) regional network team and schools and the SiMERR National Centre at the University of New England. The second level involved a professional learning partnership of a teacher, pre-service teacher and university lecturer for each of eight schools. The focus for the collaboratively designed classroom projects was to promote the synergy of using ICT with Learning to Learn strategies (being implemented in CAP schools) to achieve higher-order thinking in students. Teachers and pre-service teachers undertook a 'learning and sharing' program and collaboratively planned a curriculum unit. Teachers implemented the ideas because pre-service teachers could not be in schools in this timeframe, though many visited the schools. This project devised measures for ICT embeddedness that identify the extent of higher-order thinking in student work. This project was an example of how the core *Professional Development Framework* may need to be adapted to support pre-service teacher experiences in regional and remote areas.

Northern Territory

The partnership in this project was between the Department of Employment, Education and Training and Charles Darwin University. Two schools were selected to accept pre-service teachers trying collaborative technologies and online spaces to develop digital portfolios. The learning paradigm in these two schools did not always accommodate open-ended pedagogies that portfolio-driven learning requires. However, one remote Indigenous school valued the opportunity to explore the technologies and associated ideas, and extended their local use of such into part of the school's 'transition' program. The teachers and pre-service teachers participated in workshops to raise awareness of the technologies. Pre-service teachers and teachers were then expected to plan (remotely) a unit that would be implemented by pre-service teachers during the practicum.

Queensland

The partnership in this project involved two clusters of 'New Basics' schools and James Cook University. The relationship between the two clusters of schools, pre-service teachers, and university staff enabled pre-service teachers to be mentored as they used a project management approach while drawing on the expertise of school-based champions of ICT use. This project provided a context for pre-service teachers to show leadership in improving the breadth and depth of ICT in student work within the Rich Task structure of the Queensland syllabus. It used the productive pedagogies approach to deepen the design of learning experiences. The project also aimed to initiate a 'Professional Development College' for New Basics schools, including development of a database of resources, professional learning events and a basis for future research. In this approach pre-service teachers did not rely on teachers as role models but sought to be entrepreneurial and exploratory, pushing the school beyond its everyday practice to deal with new technologies and new curriculum applications. The project moved beyond practicum experiences to involving pre-service teachers in university coursework, community-centred projects and practicum segments.

South Australia

The project involved a partnership between the University of South Australia and cooperating schools, which was enacted by the pre-service teachers and teachers, but with considerable hands-on involvement of university lecturers and a Technology School of the Future (TSoF) project officer and support staff. The partnership included leadership involvement by the TSoF and commitment of a project officer to ensure there was "regular sustained exchange of people, ideas and projects". The pre-service teachers received intense training in the use of a new online learning system and were supported as they constructed curriculum applications of the system. They tested the system by embedding pedagogical principles that would result in classroom experiences that shifted the perspective of their supervising teachers and helped the South Australian Department of Education and Children's Services develop exemplary cases for

further professional learning about the new system. The pre-service teachers received intensive support as they planned a classroom experience including a number of 'just-in-time' sessions (instructional and curriculum design) as TSoF staff realised technical training alone was not sufficient to bring about pedagogical change. This project is an example of pre-service teachers taking on the role of innovators for new system-wide initiatives through their exploration and practice in classrooms.

Tasmania

The partnership in this project involved providing resources for pre-service teachers and teachers to jointly plan classroom activities, which would be implemented by pre-service teachers in a practicum situation. A previous agreement between the University of Tasmania, the State Department of Education and the Australian Education Union was not sufficiently robust to provide a framework for this project. This project was located in a state where supply of teacher graduates considerably outstrips demand. This meant that teachers do not feel obligated to accept pre-service teachers. It also meant that pre-service teachers not only compete for employment, they compete for practicum placements. The project provided an example of the application of the core *Professional Learning Framework* in primary, secondary and college settings, suggesting that in-school joint planning may be a practical alternative to professional learning that 'extracts' teachers from the school. The teachers and university staff shared mentoring responsibilities. Mentoring of the pre-service teachers' plans provided the opportunity to exert quality control, particularly with respect to the State Education Department's information literacy across the curriculum approach, within the Essential Learnings Framework.

Victoria

The partnering organisations for this project were the Australian Catholic University — Ballarat Campus, the Catholic Education Office Ballarat and the Department of Education Victoria. The research team and participants were drawn from the School of Education at the University, and Catholic and state schools in Ballarat.

The project emphasised the human aspects of working with technology, using the empowerment of the partnership between teachers and pre-service teachers to develop a philosophy towards ICT use in classrooms. The Victorian Essential Learnings provided an opportunity to examine the role of ICT within the pedagogical assumptions of the new curriculum framework.

The project involved two face-to-face workshops, one early and one later in the program, and deliberate and careful mentoring of participants as they worked through school-based activities. The school experiences were deliberately hosted outside the practicum period, in the belief that the evenness of the relationship would be jeopardised by the assessment process of a practicum.

Western Australia

The partnership in this project involved academics from Edith Cowan University and teachers from two schools. The purpose was to embed ICT into a 'whole-of-school' philosophy and provide a fertile environment for pre-service teacher experiences. The project also aimed to connect academics with ICT practice in schools underpinned by an action-research framework. The University has a long-standing, formal partnership arrangement with a number of schools around professional learning, practicum and research projects. Further, the University has a set of professional learning modules including extensive resources from the Credentialed Learning Program, able to be efficiently instigated on demand. This created the opportunity to offer specific training in the use of ICT in a professional learning program involving teachers who agreed to host pre-service teachers wanting to co-plan classroom activities using ICT in their practicum. The individual projects associated with different schools each tested variations of the core *Professional Development Framework*, resulting in a rich collection of ideas that provided understandings about the diversity of approaches and structures for professional learning programs that partnerships can host.

3.3 Surrounding contexts

The potential of the PICTL study to provide considered advice on both pre-service teachers' education and professional learning programs was contingent on the capacity of different partnerships to work together and the type of activity cycle that could be implemented. Thus context is an important aspect when interpreting the design of the state and territory projects and their findings. The contexts were reported with emphasis on participant involvement, school level of ICT integration, school level of ICT access, and curriculum and pedagogical framework reform taking place in the education jurisdiction.

Contextual elements affected the design and consequent results of the state and territory projects. Important influencing elements included: the skills and knowledge of participants, the level of school's integration of ICT, and the quality of the curriculum and pedagogical framework in which projects were set.

The contexts that made the most impression on design and conduct of the state and territory projects included the need to adjust the core design to account for the timeframe of the PICTL study. This need determined whether or not a practicum period was possible within the stated timeline and the university's organisational procedures. Five projects involved using a practicum period and three did not. Only the Australian Capital Territory project did not involve pre-service teachers in a school-based experience of some type.

Schools' previous experience in integrating ICT within curriculum, and teacher and pre-service teacher knowledge and skills, influenced the capacity of participants to embed ICT within new curriculum and pedagogical reforms. In six projects new reforms existed, with two project schools having multiple years of implementation experience. In these projects, teachers deeply involved in the curriculum reforms were targeted, regardless of their ICT experience.

Pre-existing partnerships and relationships between stakeholders also had considerable effect on the speed with which projects could be initiated and how management processes might unfold. However, two different but related contextual variables identified in the state and territory reports had a direct and considerable effect on each project.

The first variable concerned timetabling difficulties between schools and the university. Clashes with calendars meant that activities were restricted to a few part-terms of the year when both teacher and pre-service teacher programs enabled collaboration.

A second variable was timing. The timing of the PICTL study meant that state and territory projects straddled two half-years of an academic year. In most university programs, this conflicted with the traditional education program cycles. Consequently, the projects' leaders were usually prevented from implementing their research in a 'natural' setting covering an academic year. A further implication was that universities could include, at best, only one practice teaching segment within their project design. Both these points are revisited in Chapter Five.

Timing, however, was not the only factor in the decision about whether to use a practice teaching period or not. Some project teams believed the nature of the practicum and the purpose of their project provided strong rationales for collaboration in a non practice-teaching setting.

3.4 Nature of partnerships

In designing the PICTL study, an online event and some follow-up conversations between the PICTL Project Officer and the state and territory project leaders developed a practical definition for partnerships. For the PICTL study, a partnership is defined as *regular and sustained exchange of people, ideas and projects*. People build relationships in partnerships through exchanges, and use the synergy generated to initiate further, ongoing and sustained activity.

At first, this definition provided a way of helping design the nature of relationships and partnerships in the state and territory projects. Later it became useful to use the definition to describe and analyse the nature of the partnerships that were formed. To examine this view of partnerships further, seven questions were asked. These were:

- What were the partnerships?
- When were partnerships established?
- Who was involved?
- Where did activities occur?
- What was the purpose?
- What did partners do?
- How was partnership sustained?

The relationships between pre-service teachers, teachers and teacher educators were often referred to as 'partnerships' or 'learning partnerships'. In most states and territories, a pre-existing informal professional relationship between teacher educators and teachers or departmental staff, provided the 'hook' that enabled the initiation and hosting of more structured partnerships (exchange of people, ideas and projects) between institutions. Except in Western Australia where a formal partnership existed, the partnerships between most institutional groups were established for the PICTL study.

Generally, management and steering committee structures enhanced the creation of formal partnerships, although it should be acknowledged that there are potential dangers in structures that are too formal. These committees hosted the activities of the projects and provided a way for the institutional links to be established or maintained. In state and territory reports, project leaders generally held the position that the relationships and activities between the institutional partners would be sustained beyond those established for their project and quite possibly beyond the relationships of the individuals that had been involved.

3.5 Purpose and strategies for professional learning

In the state and territory projects, it was anticipated that projects would aim at mainstreaming ICT into the curriculum and that action learning would be a powerful strategy for reflection on classroom practice. Purposes are often used as a framework for describing longer-term and complex-professional learning programs. Different strategies were suitable and this depended on the purpose of the professional learning program, the context in which it was set and the audience of the program. However, variations evolved.

In all projects, pre-service teachers, teachers and teacher educators were seen as learner groups within the project design. The synergy of learning together was anticipated as an important context to achieve the aims of each project. The state and territory project designs simultaneously provided professional learning journeys for pre-service teachers, teachers and university staff. The needs of these participants varied and so projects used a variety of strategies to meet different purposes. Where pre-service teachers had opportunities to explore ideas and display knowledge in classrooms, the project designs ensured pre-service teachers had sufficient knowledge and their supervising teachers developed an awareness of quality uses of ICT through observing and assisting.

The converse also occurred. Where teachers used ICT as part of normal practice, pre-service teachers developed awareness through observation and assistance. Teacher educators generally developed awareness of ICT use in schools and conducted action research to develop case studies for use in coursework, though in some cases, they designed activities to focus deliberately on the core *Professional Learning Framework* itself.

Each of the projects had varying depths of reflective practice, ranging from mentored learning conversations in the professional community within the project to interview and survey activities after the project were completed. The decisions taken in project designs that facilitated these actions revealed much about the sustainability of some of the project designs.

3.6 Innovative classroom activities generated

The state and territory projects developed and showcased exemplary uses of ICT in classrooms. It was anticipated that the professional learning programs would enable teachers and pre-service teachers to plan cooperatively classroom activities that embedded new pedagogical approaches into current curriculum frameworks. Project designs varied in terms of: who planned the activities, who implemented the activities, and the depth of reflection facilitated in the learning partnerships.

Examples, from each state and territory project of the type of classroom experiences designed, illustrated the synergy of the learning teams of teachers and pre-service teachers. These summaries described selected activities, their goal(s), their relevance to pedagogical or curriculum frameworks, the software environment used and other relevant issues that arose.

These descriptions of classroom activities showed the potential of the collaborative planning, implementation and reflection cycle to produce quality uses of ICT in classrooms. These examples highlighted issues for adoption of innovation in schools generally, and innovative uses of ICT pedagogies specifically.

Generally, the tone of activities in classrooms was strongly influenced by the pedagogical approaches developed. Sometimes this resulted in observable changes in students' learning. The projects that involved extensive collaboration had a capacity to result in deeper learning activities. Variations in implementation style and focus did result in differing qualities of activities being planned.

3.7 Research questions

Research underpinned each of the state and territory projects. This enabled each team to seek answers to specific research questions that would shape future partnerships and programs, as well as contribute to the overall research agenda of the PICTL study. The following information summarises the research agendas of these projects indicating significant state and territory priorities and suggesting important national issues. To facilitate interpretation of the research questions they are grouped under four themes. These themes are innovative technology systems, adoption of innovation, professional learning models, and links to pedagogical reform.

Innovative technology systems

- How can various technologies such as wikis, blogs and team-learning systems be used to foster collaboration? How can teachers (pre-service and in-service) be assisted to reflect upon their understanding of conditions that motivate teachers to expand their use of ICT?
- What use will pre-service teachers, the School of Education and employing authorities make of electronic portfolios?
- How effective is the online learning environment in facilitating learning involving schools, the university and pre-service teachers?

Adoption of innovation

- What are the pedagogical benefits, barriers and challenges to implementing collaborative ICT-based knowledge creation pedagogies in selected ACT secondary classrooms?
- What is the take-up of ICT by the selected schools, the students attending them, pre-service teachers and university staff?
- How is technological innovation diffused in local schools? What transformations are necessary for existing teaching/learning environments and practices to enable more effective ICT and innovation diffusion in schools?
- Does the online collaborative learning environment allow for the transition of pre-service teachers at the university into a school?
- What barriers and opportunities affect pre-service teachers' use of ICT in schools?

Professional learning models

- What are the implications for practice around the promotion of continuing and deep professional conversations between teacher educators, teachers, pre-service teachers and students on innovative uses of ICT to support curriculum reform?
- How effective is the learning-team approach for supporting a professional development model?
- What are some of the practical difficulties in creating a successful community of learners in rural and urban locations?
- To what extent can a virtual Professional Development College (schools, universities, government/ non-government authorities) succeed in working together to achieve better ICT outcomes for learners in schools? Can pre-service teachers play a role in the diffusion of ICT such that more sustainable ICT-rich learning opportunities emerge?
- What was the take-up and persistence of in-service and pre-service teachers in this project? What factors did they attribute to their entry and maintenance of the project?
- Can pre-service teachers and their lecturers lead school-based action learning projects as an integral part of a professional practice experience? What are the conditions that need to be sustained in a professional partnership between universities and schools, if pre-service teachers are to be able to demonstrate their knowledge and skills? In a Professional Development School, does the quality of professional conversations about ICT in learning improve because of the input of university staff and pre-service teachers into the school community?

Links to pedagogical reform

- To what extent is ICT being used to develop higher-order thinking and reasoning in the school? What criteria can be used to measure the effect on students' learning of an environment with ICT embedded in the learning process?
- Is there a distinct pay-off for children attending the participating schools?
- How effective is the online pedagogical approach in facilitating pre-service teacher learning and as a professional development tool for teachers?
- What in the view of the teacher participants were the unique pre-service teacher learning gains directly attributable to this project? To what extent did these learning gains represent achievement in the system curriculum framework?

- What professional learning models do teachers in schools believe will support their learning journey to broaden their knowledge and use of ICT in curriculum and pedagogical reforms? How successful are the models?
- Is a strong relationship with a university likely to support a school in developing consistently good practice in the use of ICT in the provision of the curriculum?

The research questions emerging from state and territory projects complement those of the main study. Clearly, there was much common ground, providing a rich data set for interpretation. Models for professional learning in pre-service and in-service education receive primary attention, especially as they related to supporting curriculum reforms and innovation in schools. State and territory responses to their research questions can be found in the accompanying volume, *Partnerships in ICT Learning Study: Case studies*.

3.8 Uses of online technologies

It was expected that projects would use online environments as a communication facility to establish and conduct their business. For some projects it was possible that the online environments would also offer a pedagogical tool. Informally, project leaders declared that e-mail-based communications were often sufficient for their purposes. Online technologies were considered in terms of: what was used, who used them, what were they used for, why were they used and what issues arose.

Lack of connectivity between systems and the unavailability of services in schools meant that the use of communication tools in projects was often restricted. This issue was exacerbated by policies of universities and education jurisdictions. Generally speaking, teacher access and use of the Internet are not commonplace, making any use of telecommunications seem special and needing to be specifically negotiated.

For most projects, face-to-face events provided a sense of professional community, thus developing the project culture. Some projects made valuable use of telecommunications tools, especially New South Wales, which used telecommunications as a window on classrooms for pre-service teachers who could not travel readily to the schools. This provided an indication of the potential for telecommunications in supporting projects of this type.

Findings and recommendations for project management

4.1 Introduction

State and territory project reports, interviews with project management teams and the National PICTL Forum all contributed data for the PICTL Study. Results were presented in previous chapters across four themes: evidence of success and innovation, strategic partnerships, towards sustainable professional learning and effective management. The findings outlined in this chapter are framed in response to the 11 research questions arranged under the four themes. This is followed by a discussion of the PICTL *Professional Learning Model*. Finally, recommendations arising from these findings and directed to planning and conducting project-based partnership investigations are presented.

4.2 Evidence of success and innovative approaches — responses to the research theme

What does the evidence of relative success of the state and territory projects, based on the feedback of participants, mean for responding to the broad research theme?

Successes reported by the state and territory projects were around consequences for the broad research theme. The research theme was:

How can classroom-based professional learning projects be collaboratively designed among pre-service teachers, teachers, and university lecturers to focus on quality student uses of ICTs within new curriculum reforms and pedagogical agendas, and which influence designs for professional learning for all stakeholders?

The evidence of success is described below for professional learning, pedagogical reform around ICT, and partnerships.

Professional learning

- 1. A positive culture of professional learning was generated through practice, conversation, collaborative projects, use of teachers' journeys to inspire others, and reflective dialogue.
- 2. A collaborative approach, involving pre-service teachers, teachers and teacher educators, and including pre-service teacher involvement in school activities, provided a strong structure in which projects involving innovative use of ICT could operate.
- 3. A model of continuous learning stimulated sustained and ongoing activities, especially when more than one teacher in a school was involved.
- 4. A variety of different implementations of the core *Professional Development Framework* with pre-service teacher involvement were possible. These depended on school needs, pre-service teacher interest, and university team approaches.

- 5. A traditional practicum experience was not always suitable for satisfying pre-service teacher and/or teacher educator needs in promoting positive attitudes about using ICT, or satisfying the requirements of school-based projects.
- 6. An opportunity to be part of school-based projects was valued by pre-service teachers.

Pedagogical reform around ICT learning

- 1. A design/implement/reflect/document cycle was successful in the development of collaborative environments.
- 2. A preparedness to undertake projects using ICT in the curriculum that were unique to a region established schools as leaders in innovation.
- 3. A willingness to rethink practice and try new approaches provided evidence of reform based on a recognised need to accommodate a wide range of (often idiosyncratic) learning approaches and pathways.
- 4. A potential existed for student learning to improve as a result of pedagogical changes and engagement in higher-order learning activities.
- 5. A focus on pedagogy and beliefs provided a more productive learning place for sustaining teachers' and pre-service teachers' approaches to ICT.

Partnerships

- 1. An involvement in projects exploring innovative technologies, engaging in educational debate and shifting teacher inertia provided a dynamic focus for schools.
- 2. An increased awareness of the value of partnership links between stakeholders developed, such as teachers developing positive attitudes about working with pre-service teachers, and universities developing increased confidence about offering quality professional development.
- 3. A focus on commonalities during projects and other professional learning events strengthened partnerships.
- 4. A measure of the success of partnerships was the preparedness to repeat activities, to recommend involvement to peers, to accept pre-service teachers as partners, and to expand the scale by including more teams.
- 5. An infrastructure system that is not easily accessible hindered project progress, such problems included the need for written agreements, clearances, specialised technologies, and technical advice.
- 6. A partnership involvement strengthened and consolidated existing links with the ICT industry.
- 7. A strengthening of networks, both systemically and socially, resulted from partnership activities.

Summary

Collaborative partnerships in ICT learning projects, based around real work, were a productive context for a model of professional learning for innovation because they provide a proactive opportunity for reflective dialogue rather than having participants react to other's issues. The projects provided an opportunity for pre-service teachers, teachers and teacher educators to rethink aspects of their teaching and learning, especially program design.

Quality planning led to quality implementation and the chance for quality learning. Clear starting points for projects were underpinned by beliefs and pedagogy. Careful choice of focus ensured that higher-order activities were used in the projects. The mentoring and development of new knowledge for teachers, about what to do with ICT in a pedagogical framework, were essential parts of improving the quality of planned ICT use.

A focus on pedagogical change provided the critical momentum needed to involve all stakeholders in a conversation about professional learning. Clarifying and affirming the partnership required the roles for each stakeholder: personal/institutional/industry. The reflection process embedded into the professional learning, assisted teachers to assess the quality of their curriculum and pedagogical ideas. Disseminating the professional learning was important for individuals, school communities and systems. The professional learning process is assisted when ICT pedagogy is given a central focus in pre-service education programs, including embedding ICT into teaching and learning. The current nature of the practicum complicated the project implementations. In particular, the assessment paradigm had an inhibiting effect on the nature of the partnership and ultimately the level of innovation.

4.3 Evidence of success and innovative approaches — professional learning focus

What innovative approaches were used, and how successful were they?

Innovative approaches were identified by the states and territories in terms of their professional learning and the learning context, rather than the ICT used.

Professional learning

- 1. A reflective component to the professional learning supported the rethinking of pedagogy, especially the planning and the articulation of practice.
- 2. A focus on leadership and on the roles of those involved in the projects promoted professional learning.
- 3. A culture of transformation and innovation was developed through the sustained momentum of teams, and by interacting with ICT and the latest ICT pedagogy reforms.
- 4. An action learning approach provided a short, intense, focused period of learning and support that enabled core learnings to be identified.
- 5. A culture of inclusiveness and equal status in the group affirmed pre-service teachers' professionalism that translated into the possibility of different approaches from the hierarchical approach of the traditional practice teaching being relevant.
- 6. A legacy of mentoring and time for professional contact with teachers was provided for schools and professional communities.

Learning context

- 1. A productive learning environment was created through greater ownership by participants, use of online learning tools, consideration of jurisdiction-encouraged pedagogical approaches, use of digital portfolios, and a focus on multimedia.
- 2. A sense of leadership within their region was created for teachers as they were encouraged to be innovate and creative, and to extend the boundaries of school experiences.
- 4. An identification of ICT leaders and champions in schools enhanced leadership, motivation and school capacity.
- 5. A school-based project was valued as contributing to the school's professional learning.

Summary

It is important to realise that 'innovation' can be a relative term. What is innovative for one community that has issues with resources and staffing may be different from what is innovative for a well-resourced and well-established professional learning community. However, there might also be implementations that are considered innovative across many, perhaps even all contexts. While there was some mention of the use of online tools and digital portfolios, the focus of the innovation findings was on the nature of the professional learning.

Teachers and pre-service teachers were learning together about new pedagogical approaches and using their personal, learning and pedagogy beliefs to interpret the use of ICT. The intense activity that resulted during the action learning helped to target ICT leadership and to place a focus on student learning.

4.4 Stategic partnerships — working together

To what extent do the various groups (schools, universities, government/ non-government authorities) succeed in working together to achieve the desired outcomes?

The success of the various groups working together was evident in the development, the maintenance, and the management of the partnerships.

Developing partnerships

- 1. A deeper relationship developed with partner schools when formal partnerships or personal relationships already existed.
- 2. A memorandum of understanding facilitated a supportive infrastructure that generated activities.
- 3. A common purpose of improving ICT use in schools provided a unified context for learning opportunities for pre-service teachers, teachers and teacher educators.
- 4. A focus on a particular approach to ICT pedagogy to address local issues allowed universities to develop strong partnerships with schools.
- 5. A certain level of school cooperation was needed to ensure pre-service teachers were supported.

Maintaining partnerships

- 1. A preference for supporting activities with a strong sense of community enhanced local loyalties and strengthened partnerships.
- 2. A mutual respect and a desire to provide collegial support between teachers and pre-service teachers were essential to partnerships.
- 3. A partnership built over time and through working together initiated new ideas and facilitated continuation of collaborative work.
- 4. A need for intervention or additional work by one partner to assist pre-service teachers strained relationships.
- 5. A less successful pre-service teacher professional experience was sufficient to cause schools to decide not to re-host, especially given that teachers did not always view the experience as an opportunity to renew their links with the profession.

Managing partnerships

- 1. A sharing of management duties within a partnership enhanced its overall operation.
- 2. A sense of sustainable activity was fostered by better involvement of systems to promote resolution of issues and generation of additional opportunities.
- 3. A regional systemic involvement, compared to a centralised approach, enhanced local impact and partnership value.
- 4. A formal steering committee, meeting regularly, added value to a project.

Summary

Partnerships were established through collaborative groups calling on expertise and infrastructures with the potential to enhance a sense of local community. Professional learning within a clearly defined structure that had the flexibility to solve problems was beneficial to all participants.

Formal structures such as management teams and steering committees or existing relationships provided a strong basis for partnerships. However, where they existed, local, less-formal relationships also supported partnerships. The partnerships allowed teachers to renew their commitment to working with universities and pre-service teachers, and the benefits of the partnerships extended beyond those involved in the project activities.

4.5 Strategic partnerships — challenges

What are some of the challenges in trying to implement successful partnerships between differing levels of educational bureaucracy (e.g., governance issues, organisational issues)?

The challenges of dealing with the different levels of bureaucratic process were greater than had been anticipated.

- 1. Diverse processes and procedures were needed to maintain integrity and capable management in the midst of bureaucratic university structures.
- 2. A separate contract was needed for each university to allow funds to be managed at a state/territory level.
- 3. A long lead-time to navigate bureaucratic processes (contracts, ethics, criminal checks, intellectual property) was a significant hurdle, even in the cases when government departments were the managing partner. Often the administrative effort was so great staff considered that this out-weighed the positive outcomes achieved.
- 4. A lack of access rights to the various education systems' networks and processes, for both lecturers and pre-service teachers, hampered collaboration.
- 6. A formal steering committee eased some of the difficulties encountered with the bureaucratic processes.
- 7. An existing personal relationship simplified the bureaucratic process at a local level.

Summary

The most significant challenges in achieving successful partnerships related to the incompatibility of bureaucratic processes. Project management teams were able to negotiate bureaucratic processes when sufficient time was allowed and the relevant education authorities provided support. The bureaucratic process was streamlined when formal agreements were negotiated between institutions. Partnerships supported by steering committees with clear terms of reference and expertise in ICT innovation had better capacity to solve practical and bureaucratic problems.

4.6 Strategic partnerships — transforming teaching and learning

To what extent was it possible or necessary to transform teaching and learning environments and practice?

The transformation of the teaching and learning environment and practice involves both the level of adoption of ICT in schools and the pedagogy to support the adoption. Necessary to this is the generation of enough momentum to ensure ongoing transformation and the establishment of suitable learning environments with ICT.

Level of adoption of ICT in schools

- 1. A sophisticated level of adoption was not widespread in the schools thus impacting on the nature of what could be achieved by ICT-related activities but providing the potential for context-related innovation.
- 2. A view that ICT was neither required nor necessary in classrooms existed for many pre-service teachers thus creating an 'avoidance' culture.
- 3. A mismatch existed between the celebration of work by early adopters of ICT and the general limited view of pre-service teachers about the applications of ICT.
- 4. A whole-school approach to change was created by the synergies and collegial support for ICT leaders and groups of teachers within schools.

Changing pedagogy to support adoption

- 1. A focus on new pedagogical frameworks or defined philosophies of teaching and learning generated deeper uses of ICT and influenced the outlook of pre-service teachers.
- 2. A transformation of pedagogical approaches individually, and in groups, was a catalyst for important changes in the way ICT is used.
- 3. A state and territory focus on pedagogical issues offered a timely opportunity to direct attention to ICT and changes in teaching practice.

Generating momentum

- 1. A change of teaching and learning culture was possible through a mix of the pre-service teacher/teacher/teacher educator learning community, an intensely targeted model of learning, classrooms as learning places, a philosophy of trying new activities and mentored reflection.
- 2. A deeper level of change was achieved by the use of quality learning programs, strong mentoring, and inspirational ideas and attitudes of participants.
- 3. A whole-school approach, with ICT leadership and multiple teachers in a school developing a professional community, created a productive momentum.

ICT in the learning environment

- 1. A lack of access to ICT in all projects resulted in difficulties for pre-service teachers and teachers to demonstrate their standard of expertise in using ICT for learning.
- 2. A lack of access to education jurisdiction networks restricted the activities that could be tried.
- 3. A high expectation by teachers of pre-service teachers' familiarity with ICT (e.g., specific software, logging in, accessing support, loading software, seeking file storage) caused frustration for pre-service teachers.
- 4. An in-school time before the main professional experience period allowed technical issues to be resolved in a timely manner.

- 5. A reliance on innovative environments outside the schools' networks was necessary for pre-service teachers, teachers and teacher educators to be able to use innovative ICT.
- 6. An exploration of collaborative online environments was restricted by primitive ICT services.

Summary

The need to activate pedagogical reform around the use of ICT was evident. A whole-school approach and focus on local issues facilitated adoption of ICT in learning and teaching in schools. However, a deeper level of change was achieved by improving the quality of professional learning and setting pedagogical reflection as a context. Many technical challenges were encountered by the various projects, including poor access to ICT and relevant networks, and lack of connectivity between the different jurisdictions' networks.

4.7 Srategic partnerships — barriers and successes

What were other barriers and critical success factors impacting upon the success of the strategic professional development partnerships?

Barriers and success factors were identified in the school community and university contexts, as well as in relation to communication, time and innovation.

In-school capacity barriers

- 1. A need to work with less-confident ICT users reduced the incentive for innovation.
- 2. A need to conform to school-based logistics and pre-service teachers' personal commitments meant that planning time was limited.
- 3. A chance to replicate experiences improved project uptake.
- 4. A high staff turnover and non-supportive whole-school culture impeded the in-school project progress.
- 5. An ICT leader facing reluctant peers, the notion that innovation was not for everyone, implementation issues adding another layer of stress, and the need to justify pedagogical approaches were all factors that impeded progress for teachers.
- 6. A lack of mentor training, absence of long-term planning, lack of online knowledge and limited pedagogical views of teachers hampered implementation.
- 7. A lack of role model when on professional experience and the growing unwillingness of teachers to take on pre-service teachers were barriers to integrating curriculum change involving ICT and different teaching practices.

University capacity barriers

- 1. A lack of time for project-related activities was a critical factor.
- 2. A lack of staff, intensification of workloads and staff turnover were significant factors in providing staff for the projects and necessitated persuading others to get involved.
- 3. A complex process to gain approval for online access and previous project failures influenced the capacity of universities to sustain the partnership.
- 4. A practicum structure that was too short meant that requirements, including project-based learning, could not be managed.

Communication barriers

- 1. A multitude of technical problems hampered online communication including the inability of pre-service teachers to work from home, an incompatibility of formats between organisations for materials produced, and a lack of a common technical system for pre-service teachers and teachers due to policy.
- 2. A lack of experience meant that pre-service teachers and teachers were not always sufficiently familiar with available online learning environments.
- 3. Frequent incompatibility between the variety of approaches to professional learning used by schools and universities impeded progress.

Time barriers

- 1. A lack of planning time was identified as an organisational barrier.
- 2. A mismatch of school and university calendars meant that suitably overlapping blocks of time were not available.
- 3. A lack of time for pre-service teachers to access schools in pre-planning hindered the achievement of outcomes.
- 4. A need to mesh the demands of a project with work and family commitments and be able to timetable travel to remote locations were added difficulties for pre-service teachers.

Innovation barriers

- 1. A lack of experience in online systems and instructional design and pedagogy, an unreliability of school networks, and a lack of access to ICT resources contributed to the lack of innovation within schools.
- 2. A view that innovation was a distraction caused teachers not to support mainstream uses of ICT.

In-school capacity success factors

- 1. A promotion of additional activities, positive attitudes, the notion that pre-service teachers have a role to play in ICT diffusion, and equality within the partnership all helped to strengthen partnership relationships and helped to promote success.
- 2. An allocation of sufficient time for planning, organising sharing days to develop ideas, and support from universities and steering committees were all motivating factors in project planning.
- 3. A focus on pedagogical frameworks and curriculum change generated opportunities for ICT applications.
- 4. A sense of belonging to a community, the sharing of the similar beliefs by teachers and teacher educators, and the reinforcement of the role of ICT leaders were successful in promoting partnerships.
- 5. A critical mass of teachers in a school to ensure professional growth takes place, a willingness to become involved and access to a range of ideas were integral to success.

University capacity success factors

- 1. A project-based learning approach with provision of mentoring was beneficial for pre-service teachers in their professional experience.
- 2. A common pedagogical and philosophical basis for schools and universities and a clear management structure to support innovation in schools strengthened university capacity.
- 3. A critical mass of teachers, sustainability through a number of partnerships, continuity of the projects to enhance teacher capacity, and pre-service teacher and teacher access to the same professional learning experiences all promoted success.

- 4. A capacity to build relationships and the provision of planning time and a period of awarenessraising about project-based learning promoted positive professional experiences for pre-service teachers.
- 5. References to ICT in professional teaching standards for pre-service teachers gave authority to the project.

Communication success factors

- 1. A feeling of being valued as a teacher, the passion of management teams, and a culture of mutual respect and collaboration helped to develop a sense of community through face-to-face visits.
- 2. A mix of online, face-to-face and telephone meetings provided an holistic support system for pre-service teachers and teachers to become involved in knowledge construction.

Time success factors

- 1. An avoidance of the first and last terms in the school year maximised the benefits of professional experience.
- 2. The short timeframe for the project meant that a defined structure was in place that provided a productive context for students.
- 3. A value-adding component to the projects was volunteer time, the enthusiasm of participants, and the expertise available through partnerships.

Innovation success factors

- 1. A culture of innovation in schools, recognising authentic needs, being ready, promotion within the school community, a passion for ICT in learning, and a commitment from universities were all factors that promoted innovation.
- 2. A depth of knowledge about pedagogical frameworks, experience in implementing ICT strategies, access to online mentoring, and being able to work with ICT leaders all strengthened the individual capacity to be innovative.

Summary

Barriers that impacted on the success of the partnerships were related to issues affecting people, the availability of time, and access to resources. Many of the issues were resolved given sufficient planning time. Pre-service teachers, teachers and teacher educators needed planning time to work collaboratively using a list of perceived constraints as a focus agenda and to establish a consensus about achievable outcomes for the project in the light of local conditions. Poor access to school and system level tools and networks significantly reduced the productivity of the partnerships.

Alongside the barriers a variety of success factors were identified. There was a number of contributing factors that strengthened partnerships but all success factors did not operate within the one context. Contexts differed within and across states and territories, and partnerships comprised not only the people involved, but also the support structures. A professional learning community was fostered through appropriate recognition of the needs of pre-service teachers, teachers and teacher educators and by structuring factors external to people, such as the professional experience, technical support and timetabling, to meet the needs of individuals. As a core concept for partnerships, collaboration contributed to sustainability over time and beyond the individuals involved.

4.8 Towards sustainable professional learning — education reform

To what extent is effective professional development in this area dependent on whole-school or system-wide reform? What change management issues were faced in trying to achieve these reforms? What cultural change was/is necessary?

There was a variety of indicators of dependence on whole-school or system-wide reform. Also evident were change management issues and cultural change needed to support that reform.

Whole-school or system-wide reform

- 1. A standardisation of policies and centralisation of ICT network services by departments of education fuelled conservatism and made it difficult for teachers to arrange to try out web-based tools and services.
- 2. A lack of support through education authority policies hampered teacher attitudes to accepting pre-service teachers for professional experiences and other activities.
- 3. A lack of recognition of time spent mentoring and hosting pre-service teachers, as a contribution to professional learning in teachers' awards was an inhibiting factor.
- 4. An alternative to direct payment for teachers to take pre-service teachers could include access to professional development opportunities and access to ICT resources, as well as release days.
- 5. A commitment on the part of pre-service teachers to domestic or 'paid work' situations meant it was crucial that projects were embedded in university programs rather than provided as additional or optional activities.

Managing change to support reform

- 1. An increased amount of time was needed for teacher educators to work in schools.
- 2. A break in the cycle of low ICT use, in spite of observed practices, must be encouraged with pre-service teachers.
- 3. A research centre at a university can bring a greater focus and more resources to projects than individual lecturers.
- 4. A greater emphasis is needed on university-based mentor-training programs to be made available for teachers.
- 5. A greater level of access to technology, laptops, up-to-date software, services and support is needed if pre-service teachers are to achieve the expectation that they use ICT in teaching.
- 6. An inclusion of project stories into lectures and coursework material can raise the profile of ICT innovation in universities.
- 7. There is a critical need for pre-service programs to address the educational bases on which ICT-related activities can be justified. If this were the case it would address pre-service teachers having to 'prove' the value of an ICT-related activity.

Cultural change to support reform

- 1. An increased awareness was promoted of universities as places to seek professional development support.
- 2. A higher profile, as leaders in ICT innovation and thought, was developed by the universities.
- 3. A professional learning model was more successful when team building was involved.
- 4. A collaborative approach to planning with the partners, especially between teachers and pre-service teachers, was needed.

- 5. An effort by teacher educators to support and encourage pre-service teachers reduced the number of pre-service teachers "turned off" by the response of classroom teachers to attempts at ICT innovation.
- 6. A reversal of the fear that using ICT in teaching practice will disadvantage pre-service teachers must be facilitated.
- 7. A recognition that student work provides evidence of the value of ICT in mediating pedagogical reform is necessary.
- 8. An assurance from the school that pre-service teachers can explore and experiment, and that less conventional outcomes will be tolerated, examined and perhaps even valued, would promote innovation.
- 9. A culture of innovation and encouragement developed for all teachers will allow them to extend innovation past the ICT leader, who sometimes acts as a gatekeeper.

Summary

System-wide reform must address policy as well as recognition of the contribution of teachers in supporting pre-service teacher professional experiences. Managing the change necessary for such reform impacts significantly on universities, through staff workload commitments, research centre resources and technical provisions for pre-service teachers. Critical to these reforms are cultural changes from the perspective of pre-service teachers, teachers and teacher educators. Most importantly, teachers must be prepared to allow pre-service teachers to experiment with ICT innovation in the classroom.

4.9 Towards sustainable professional learning — strategies

What are possible strategies for sustaining the partnerships beyond the life of the project?

Those partnerships with strong purpose, functionality and management structures were more likely to be sustained beyond the life of the project. The nature of the implementation of the *Professional Development Framework* also impacted on extending the project.

Partnership purpose

- 1. An audience was provided to showcase ICT in the district and among schools.
- 2. A cycle of innovation and diffusion of new knowledge promoted sustainability.
- 3. An opportunity for pre-service teachers to take leadership roles in the community and manage their own projects was sustainable from the university perspective.
- 4. A culture of sharing and an awareness of the value of partnerships was generated by collating project documentation onto a website.
- 5. An invitation to schools to initiate projects was an important management strategy for sustainability.
- 6. An expectation that teachers mentor pre-service teachers was better supported when built into teaching standards and promotional pathways.

Partnership functionality

- 1. A multiplicity of professional learning arrangements was developed between schools and universities.
- 2. A willingness to build common ground and develop common cultural approaches to professional learning was required.
- 3. A strong communication system and an effective method of liaising with people were critical.

- 4. An inclusion of unions in developing partnership agreements facilitated negotiations about teaching conditions.
- 5. An involvement of a university with a school over a long period of time to build capacity for the school to host pre-service teachers helped sustain partnerships.
- 6. An identifiable benefit for teachers and lecturers, from the partnership, justified ongoing projects.

Management for the long-term

- 1. A recognised need, on the part of schools or school systems, for universities to instigate activities promoted partnerships.
- 2. A sustained submission writing process was possible in a university research centre situation.
- 3. A long-term project that contained many activities strengthened the partnership.
- 4. An excess of management energy for extra projects was rare in many schools.
- 5. A focus of university activity around existing innovative programs was sustainable because it minimised extra-curricular expectations on the pre-service teacher programs.
- 6. A greater involvement of teacher educators from a range of disciplines improved sustainability.
- 7. A project based on partnership agreement involving groups of participants in universities and schools rather than one of individual agreements between people reduced overly restrictive conditions.
- 8. A greater contribution at policy level from state/territory and commonwealth jurisdictions promoted effective management.

Professional Development Framework implementation

- 1. A project-based approach was a powerful model for pre-service teacher learning.
- 2. A model of delivering additional support to pre-service teachers before and during project implementation in partner schools was required for quality projects.
- 3. A funding contribution as an incentive made the project possible for schools.
- 4. The various implementations of the *Professional Development Framework* set a new standard for professional learning.

Summary

A clear purpose and the opportunity to share the outcomes related to that purpose sustained partnerships beyond the limits of the project. Partnerships developed a stronger profile when enough time was allowed for relationships to evolve, communication was nurtured, ownership was established and benefits for all participants could be identified. Although brokerage of partnerships by universities was the preferred option, the choice of project focus was best left to the schools. Facilitation of sustainable partnerships was enhanced through collaboration with unions, university faculties and education authorities.

4.10 Towards sustainable professional learning — wider scale

What are recommendations on ways to develop innovative professional development projects on a wider scale?

The lessons learnt by the state and territory projects provided the stimulus for their recommendations on developing wider-scale innovative projects. Ways to have professional development projects have a wider scale are considered under partnership functionality and management for the long-term.

Partnership functionality

- 1. An interrelationship between the types of partnerships, models of learning, and cultures of schools is critical.
- 2. A development of projects with districts rather than with individual schools should be a focus.
- 3. A nurturing of community groups including parents, teachers' aids and local businesses is needed to provide a greater range of opportunities.
- 4. A focus on ICT in schools for pre-service teacher professional experiences, especially internships, promotes ICT innovation in schools.
- 5. A focus on smaller groups of pre-service teachers and teachers who are specialists, such as ICT leaders, computing studies teachers or technology teachers, provides participants who are more likely to undertake self-motivated ICT use.

Management for the long-term

- 1. A streamlining of management strategies is needed to make it possible to maintain more projects.
- 2. An assessment strategy in pre-service programs that includes the use of e-portfolios would nurture ICT use.
- 3. An additional pool of funding for professional experiences, especially internships, is needed to support pre-service teachers in remote schools.
- 4. A restructuring of university programs is needed to include stronger components on new technologies.

Summary

Major impediments to reproducing, on a wider scale, the models of professional development trialled in state and territory projects, were the time and workload implications for pre-service teachers, teachers and teacher educators. The more activities and management responsibilities that could be built into normal workload for participants the more sustainable the project became.

4.11 Effective management — key issues

What are key project management issues (e.g., importance of defining scope, methodology)?

The issues faced by the management teams in the various state and territory projects were many and varied. Following are some of key issues that surfaced related to timing and personnel.

- 1. A complex initiation process was noted, requiring contracts and a range of permissions and clearances. Participants found these requirements time consuming to navigate.
- 2. An unanticipated restriction on the length of time available for the project affected possible outcomes.
- 3. A complication in meshing calendars for the different institutions involved in a project impacted on the flexibility of the activities that could be achieved.
- 4. A sufficient amount of lead-time was needed to be able to incorporate pre-service teacher professional experiences in projects.
- 5. A delay in communication between partners during project implementation impacted negatively on partnership management.
- 6. A cross-sectorial committee to address issues around bureaucratic processes and technical issues facilitated management.
- 7. A high turnover of staff, especially in schools, impacted on the management of projects.

- 8. A high cost in projects was the provision of release time to allow teachers and teacher educators to become involved.
- 9. A system of university-based rewards for pre-service teachers facilitated their buy-in as participants in projects.
- 10. A sharing of knowledge across sites and fostering of insightful reflection on results across projects complicated the management process for multi-site projects.
- 11. A national coordination process for management provided important direction for management at the state and territory level.

Summary

Sufficient time had to be factored into the life of the project to allow for contractual and other procedural matters. This planning time allowed for resolution of issues related to the length of the project to ensure quality outcomes and that the individual requirements of all partners could be met. When time-release and recognition for commitment to projects fostering professional learning were built into standard procedures in both schools and universities, teachers and teacher educators were more predisposed to become involved.

4.12 Effective management — online networking

What are the advantages and disadvantages of using online networking tools (e.g., online communities of practice, closed discussion groups, extranets) to support these partnerships?

The level of use of online networking tools to support the partnerships varied considerably between state and territory projects, with both advantages and disadvantages being recognised.

Advantages

- 1. A greater flexibility was provided for communication by online networking.
- 2. Online networking facilitated a record of the project being maintained which could be communicated to a larger group of people.
- 3. Online networking allowed a medium for contact across campuses and with remote communities.

Disadvantages

- 1. A number of policy and other technical issues for both schools and university networks acted as a barrier to collaborative use, particularly disadvantaging pre-service teachers who needed to move smoothly between sites and network systems.
- 3. A lack of an employee number prevented pre-service teachers from having access to education system networks and to work online with their students.
- 4. A lack of data transferability between systems made communication and sharing among pre-service teachers, teachers and teacher educators very complex.
- 5. A lack of the requisite tools in some schools resulted in the need to use external providers of online capabilities.
- 6. A communication culture in schools that did not include the use of online tools or videoconferencing hampered the promotion of online collaboration.
- 7. A lack of knowledge of relevant tools and a lack of technical help meant pre-service teachers were not comfortable with many of the online systems used.

Summary

Although the disadvantages appeared to outweigh the advantages, all partnerships valued the opportunity to use online communication. The many disadvantages, especially in relation to culture and accessibility, were frustrating for those concerned and not always under the control of the individuals or institutions concerned. Improved "conversations" at the systemic or institutional level are needed to contribute to equality of access for all participants. However, the strengthening of a school communication culture to include the use of online tools needs to be promoted from within schools or school systems.

4.13 The PICTL professional learning model

Professional learning needs to be facilitated. The context in which learning episodes are conducted is critical, as it needs to nurture learners and minimise barriers that impede learning. Partnership activities need to be purposefully crafted to achieve their goals. Clear pathways of learning need to be chosen to meet the precise purpose of the partnerships, raising awareness and knowledge of ICT for learning, gaining and maintaining participants' commitment, implementing activities associated with mainstreaming ICT and developing skills for sharing reflections and other evaluative comments.

In the PICTL study a core *Professional Development Framework* was offered as an initial platform upon which to develop a collaborative culture among pre-service teachers, teachers and teacher educators. There were five phases in the suggested core framework. These phases along with brief descriptions are:

- **Phase 1** Involving partners in direct awareness-raising events about ICT, curriculum frameworks, pedagogy or other relevant subject matter.
- **Phase 2** Selecting a specific student learning experience to plan and implement. This might be a unit of work, task, project or series of lessons where ICT would be used powerfully within a curriculum program.
- **Phase 3** Developing the curriculum unit plan including the detail of the pedagogical philosophy that would underpin implementation.
- **Phase 4** Implementing the plan in classrooms.
- Phase 5 Reflecting on the experience.

The experience from the various state and territory projects brought to light the benefits of basing professional learning around the *Professional Development Framework* and important aspects of the context in which the professional learning takes place.

Benefits of the Professional Development Framework

- 1. An opportunity to engage with core learning enhanced projects and contributed to the formulation of quality ideas and an increased capacity to work professionally.
- 2. An involvement together in core learning activities allowed pre-service teachers, teachers and teacher educators to develop stronger relationships.
- 3. A collaborative approach to planning provided an opportunity to integrate curriculum/ pedagogical/ICT paradigms and contributed to better professional learning outcomes and depth of collaboration.
- 4. An opportunity to implement projects provided stimulating professional dialogue and learning experiences and highlighted aspects of the practicum assessment paradigm.
- 5. A reflection component of activities provided schools with the opportunity to consider culture, professional learning models, and innovation uptake as part of their professional journeys.

Context to support the professional learning

- 1. A capacity and willingness to engage in professional learning are essential as a catalyst.
- 2. A formal partnership agreement sets in place appropriate structures at the organisational level for finance, human resource and technical infrastructure.
- 3. A linking of ICT and pedagogy forms a strong basis for relevant professional learning.
- 4. A focus on pre-service teachers as agents of change facilitates a change in the status of pre-services teachers in collaborative professional situations.
- 5. A change in school culture to be more accepting of ICT innovation provides a catalyst to engage in professional learning.
- 6. A whole-school focus rather than a teacher-level focus provides critical support for teachers in creating sustainable change in professional learning.
- 7. A willingness of educational institutions to rethink and streamline their current policies and processes fosters stronger and more timely collaboration in professional learning partnerships.

Given the experience from the PICTL study the phases of core framework proposed as a guide for the collaborating partnerships have been revised to become the PICTL *Professional Learning Model*:

- Phase 1
 Explore new knowledge Involve partners in direct awareness-raising events about ICTs, curriculum frameworks, pedagogy or other relevant subject matter.
- **Phase 2** *Select a learning experience for students* This might be a unit of work, task, project or series of lessons where ICT is used to enhance the learning experience.
- **Phase 3** *Plan the learning experience* Develop the learning experience detail including the underpinning pedagogy.
- **Phase 4** *Implement the learning experience* This might occur in a range of environments and should involve the pre-service teachers working with the students.
- **Phase 5** *Reflect and share* This reflection should occur on the data, findings and collaboration.

The context in which the model is placed will be critical to it success in creating successful partnerships to produce effective and sustainable professional learning for our educators and innovative changes in the use of ICT in our schools.

Summary

There were several features about the *Professional Learning Model* that was appealing to the PICTL Management Team. The starting point was explicit and it involved identifying underpinning beliefs about ICT and pedagogy practice. It allowed the focus to be set on pedagogical change and the importance of involving all stakeholders in a conversation about professional learning. Opportunities were made available to clarify and affirm the partnership and in particular the roles for each stakeholder, participants, schools, system and universities and where appropriate industry.

Finally, four points are worth restating. First, there were aspects within the model that were seen as advantageous to all projects Second, the model was generic and seemed highly likely to be applicable to the variety of any future projects that might be expected to emerge. Third, the model was sufficiently tight to provide a strong structure for projects as well as allow a clear progression. Finally, and as balance to the above, the model was loose enough so as to allow project team leaders sufficient degrees of flexibility.

4.14 Conclusion and recommendations

Partnerships can be established through collaborative groups calling on expertise and infrastructures that have the potential to enhance a sense of local community and professional learning. Where there is just one university for the education jurisdiction (i.e., in regional areas) a degree of cohesion results that may be more difficult to establish in larger metropolitan areas where there more than one university exists. Projects undertaken within such a clearly defined structure have the flexibility to solve problems or address issues relevant to participants. Successes strengthen partnerships and are a catalyst for the partnerships to develop new projects.

It is unlikely that all success factors identified in the PICTL study can be guaranteed within any one context. However, there are a number of contributing factors that strengthened partnerships. Because contexts differ within and across states and territories, and because partnerships comprise not only the people involved, but also the support structures, the following recommendations concerning managing partnership projects are framed at a general level.

Three general areas generated barriers that impacted on the success of partnerships, and these relate to issues affecting people's workload, the availability of time, and access to resources. While it is important to address these individually, most issues can be resolved given sufficient planning time for participants to undertake the project.

Recommendation PM1: A project-based approach involving pre-service teachers, teachers and teacher educators should be used to establish a positive and productive culture of professional learning aimed at improving ICT-mediated approaches in the classroom. Such projects should:

- offer continuing and relevant learning for participants that contribute to the renewal of commitment to using ICT-mediated learning;
- be based around real issues and exploring authentic learning experiences;
- include more than one person representing each stakeholder group;
- be based on a core model of professional learning that includes careful planning, and a project design, implementation, reflection and documentation cycle.

Recommendation PM2: Projects should have ICT pedagogy as a central focus and pedagogical reflection set as a context for the widespread adoption of ICT learning. This focus should address:

- teacher beliefs about ICT-mediated learning within a context of improving student learning outcomes;
- teacher pedagogical practices;
- how to embed ICT into teaching and learning.

Recommendation PM3: Projects should be planned to include:

- clear terms of reference that take into account the level of adoption of ICT in the participating schools;
- formal agreements between institutions, schools and education systems to help streamline bureaucratic processes;
- aims that provide a unified context for all partners;
- aims that are 'innovative' (as they relate to participants' backgrounds), creative and extend the boundaries of current practice.

Recommendation PM4: Projects should have a strong management structure including:

- a project Team Leader who may require the support of a Project Officer;
- a project Management Team including representatives from each of the partner groups and supported by the relevant education authority;
- a project Steering Committee including relevant representatives drawn from school systems and sectors, universities and teacher registration with expertise in ICT innovation with capacity to solve practical and bureaucratic problems. The purpose of this committee is to support the work of partnerships.

Recommendation PM5: Project Team Leaders and Management Teams should ensure:

- sufficient planning time is set aside for pre-service teachers, teachers and teacher educators to work collaboratively;
- attention is given to perceived constraints on the project as a focus agenda to establish a consensus about achievable outcomes for the project in the light of local conditions;
- elements that sustain the momentum of change are articulated clearly and supported by realistic levels of resourcing;
- sufficient time allocation is factored into projects to account for bureaucratic processes;
- professional learning communities are fostered through appropriate recognition of the needs of pre-service teachers, teachers and teacher educators;
- supporting factors external to people, such as the practicum, technical support and timetabling, are structured to meet the needs of individuals.

Recommendation PM6: To maximise the benefits of the partnerships there should be:

- a focus on roles expected of participants, including those that are to take a leadership position;
- ICT leaders or champions should be utilised where possible to enhance motivation and school capacity;
- protocols that nurture equal status of all participants and that highlight the nature and importance of genuine collaboration among partners;
- a culture of inclusiveness and equal status is to affirm to all groups and facilitate a sense of ownership of the project;
- time allocated for professional dialogue and contact to develop the professional nature of the learning community established.

Recommendation PM7: The transformation of the teaching and learning environment and practice involves both the level of adoption of ICT in schools and the pedagogy to support the adoption. To facilitate an extensive and sophisticated level of adoption, partnerships should:

- be consistent with a whole-school approach to ICT-mediated learning;
- focus on new pedagogical frameworks, potentially proposed at a state, territory or education jurisdiction level;
- celebrate the contributions made by partners;
- proceed cautiously if the pre-service teachers involvement in partnership activities coincides or includes the practicum experience;
- ensure that approaches are evaluated and the findings promoted by partners in appropriate forums.

Principles and recommendations

5.1 Introduction

Schooling should develop fully the talents and capacities of all students. In particular, when students leave school, they should: ...

... be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies on society. (Section 1.6, *The Adelaide Declaration on National Goals for Schooling in the Twenty-first Century*, MCEETYA, 1999)

The vision of the impact of schooling in Australia, exemplified in the above quote, is just one of many challenges facing Australia in embedding ICT in learning. While Australia has made important advances in using ICT for learning across state and territory education jurisdictions in the past several years, especially in the area of ongoing equipment roll-out, much more needs to be done. This chapter provides a series of recommendations that offers a guide to how this progress, built around partnerships, might unfold in the areas of why and how ICT should be used, and to further develop ICT pedagogy.

It is inevitable that over the coming decades the use of ICT applications in learning will be more deeply embedded in the curriculum and take on a more significant role in the lives of students, teachers and teacher educators. Nevertheless, the direction, nature and practicalities of this emerging and evolving role remain unclear. Education authorities are responding to challenges by including ICT requirements in curriculum and pedagogic frameworks, and in professional teaching standards.

Data from the PICTL study indicate that progress in embedding ICT within the curriculum remains limited and when considered nationally, despite large investments of funds, the situation might best be described as being in the early phases of adoption. There are great differences in ICT take-up throughout Australia and in the use of, and knowledge about, ICT in learning within and between systems, schools and tertiary institutions, and between teachers and tertiary educators.

The situation in Australia appears similar to the United States and Europe. There is evidence of some enhancements and developments to the learning process but the teaching profession at large remains sceptical. Also, despite positive opinions being offered by proponents of ICT there are limited documented profound improvements across the curriculum in the areas of learning or teaching. However, as a balance, it must also be said that the evaluation of an innovation against benchmarks which pre-date it, cannot always hope to gauge its potential; and embedding ICT in the curriculum may well lead to significant reforms in ideas about learning, teaching and specifically assessment itself.

The views of participants in the state and territory projects, as well as discussions at the National PICTL Forum, established an experiential base for providing recommendations concerning ICT uses in learning. In particular, there was a strong feeling that the cultural change needed to support ongoing development and extensions of powerful ICT applications in learning involves:

- changing pre-service teacher, teacher, and teacher educator perceptions about the use of ICT in schools;
- helping teachers accept pre-service teachers using ICT approaches while on practicums; and
- incorporating content about ICT pedagogy more deeply into university coursework.

In considering the future developments of ICT within the curriculum we identify five main stakeholder groups. These are:

- *DEST*, as representative of the Australian Government;
- *Education authorities,* such as state and territory education jurisdictions, national bodies, including MCEETYA, AICTEC, and ICTST;
- *Regulatory authorities,* such as Teaching Australia, teacher registration boards and state institutes of teachers;
- *Professional associations,* including teacher and teaching associations (ACCE, principals' associations, etc), and teachers; and
- Tertiary institutions, representing universities, pre-service teacher educators and pre-service teachers.

Each stakeholder group has its own contributions to make towards future approaches to professional learning. While the PICTL study has demonstrated that partnerships in ICT learning involving pre-service teachers, teachers and teacher educators are one important way forward, there is potential for new or different partnerships involving these groups of stakeholders to make important advances. The formation of partnerships among such groups has the potential to move the field of ICT learning forward, for the benefit of education provision Australia-wide.

Clearly, a refinement and extension of the development of these types of relationships through DESTinitiated projects is one viable way forward and this idea is addressed within the recommendations proposed later in this chapter. Nevertheless, as embedding ICT in learning is a significant national issue, it requires input and support from all stakeholder groups. Indeed, if genuine, profound improvements in learning and teaching are to be advanced, a united, supportive and collegial approach needs to be adopted by many groups working in partnership.

The primary purpose of this chapter is to take up this theme of partnership cooperation and collaboration, and present a set of broad recommendations relating to embedding ICT in learning from a stakeholder perspective. In section 5.2 a broad context is established by considering 'pluses', 'minuses' and 'interestings' drawn from the findings of the PICTL study. This context leads to seven basic principles that underpin the general recommendations provided in the remainder of the chapter. Section 5.3 extends the seven project management recommendations provided in the previous chapter by offering two specific recommendations about partnership projects as a viable way forward to embed ICT within the curriculum. Both of these recommendations come with important caveats concerning possible extensions or developments in the area of considering partnership approaches involving pre-service teachers, teachers and teacher educators. The following four sections, 5.4 to 5.7, look at recommendations in terms of the involvement of different stakeholders and their role in developing the future of ICT in learning for Australia. The final section, 5.8, offers concluding remarks.

5.2 Seven principles underpinning ICT in learning

While the PICTL study was overtly about exploring different aspects of applications of ICT in learning, a deeper purpose was to draw from the actions, findings and discussions that surrounded the state and territory projects, ideas and principles to guide policy actions and decisions for Australia. In particular, it was expected that evidence would emerge from the PICTL study on which recommendations would flow: (i) about the nature and role of partnerships; and (ii) how Australia might better embed ICT uses in learning into mainstream practices in schools.

This section has two primary purposes. The first is to consider more holistically the findings detailed in the previous chapters by considering the numerous 'pluses', 'minuses' and 'interestings' associated with the conduct and findings of the state and territory projects. The second purpose of this section is the identification of seven basic principles that provide a strong context for recommendations in this chapter. These principles seek to take into account international trends as well as discussions with project team members, at Advisory Committee meetings and at the National PICTL Forum.

Pluses

Many 'pluses' emerged from the PICTL study. Strong collaborative strategies for planning and conducting projects, and for disseminating information were developed and described and these have been discussed and recommendations offered at the end of the previous chapter. Primarily, the PICTL study was significant in raising awareness of issues concerning ICT in learning across Australia. This occurred in

- student-learning situations in schools;
- program development in initial teacher education;
- school professional experiences for pre-service teachers including, but not limited to, the practicum; and
- programs of teacher professional learning.

Participants reported numerous specific benefits that arose from being part of the PICTL study. These included:

- new ways to think about pedagogical approaches;
- valuable dialogue surrounding ICT applications in learning;
- pre-service teachers, teachers and teacher educators learning together, accelerating the learning journey for all groups;
- the role of personal beliefs about learning and pedagogy acknowledged as precursor to improved use of ICT;
- simple measures of assessment within a project designed to place a focus on pedagogy and student learning;
- targeting and utilising the expertise of ICT leadership and champions;
- a professional development framework available to help ground action learning;
- a narrative used to help make explicit participants' practice and thinking;
- existing programs of study used to explore the pedagogical potential of new technologies;
- on-line learning tools and digital portfolios used to invigorate student interest; and
- multiple starting points for the learning process.

Importantly, state and territory projects demonstrated that synergy is created in school-based explorations involving ICT amongst pre-service teachers, teachers, and teacher educators. There is no doubt that the overwhelming majority of participants found their projects to be useful, valuable, enriching and rewarding. Most indicated a strong willingness, if the context was appropriate, to be involved in similarly constituted partnerships and also to encourage their peers to be involved.

There was a strong belief among the participants that when ICT is embedded within teaching and learning programs there is greater student involvement in, and commitment to, the learning process. Consequently, there was strong support from participants that ICT use needs to become mainstream, i.e., given a central focus in learning in Australian schools. Some participants indicated the belief that embedding ICT into the curriculum in schools should be mandatory.

Principle 1: Re-invigoration of a national commitment to embedding ICT in learning

That there needs to be a re-invigoration of national commitment to, and realistic adoption of embedding ICT in learning in Australia. At the centre of this work:

- are approaches that mainstream ICT both in schools and within teacher education faculties of universities so that the use of ICT becomes an accepted part of work culture;
- is the involvement of all stakeholder groups including key personnel from state, territory and national education jurisdictions, tertiary institutions and the ICT in Schools Taskforce; and
- is facilitation of the process by a National ICT Framework for pre-service teachers, teachers and teacher educators.

Minuses

As a balance to the positive comments provided above, the PICTL study revealed 'minuses' in the form of challenging issues. The study uncovered and documented, frankly and openly, many of the complexities surrounding strategies for teacher learning. This revealed the need for a much more serious investment of thought and funds to address difficult education concerns associated with using ICT in learning.

There was little significant innovation (in the sense of bringing in new methods or ideas) in the PICTL study. In the state and territory projects it was important to realise that 'innovation' was a relative term. What is innovative for one community that is under-resourced may be different for a well-resourced and sustained professional learning community. For many projects 'innovation' meant newness to the participants in that particular project.

This point highlights two issues. First, the PICTL study findings suggest that using the term 'innovation' and thereby expecting new methods and approaches to be developed may set the bar too high, though it indicates a level and direction for our aspirations. The second issue is that the state and territory project data suggest the need for a more appropriate term to use in bringing about change in current thinking and practice in ICT use in schools, one that is more achievable by, more relevant to, and better reflects the needs of, local groups of teachers and learners.

The PICTL data suggest that the impact of ICT use in schools throughout Australia may be more limited than previously believed. There were examples of teachers unwilling to be involved in projects because they saw ICT use as more work, peripheral to the 'main' game in schools, avoidable, not guaranteeing improved learning outcomes and outside their experience and expertise. Pre-service teachers often reported little use of ICT on their practicums. They expressed concerns about using ICT as it could mean that their practice was too different from that of their supervising teachers and this might impact adversely on the assessment of their teaching performance.

Most state and territory projects are yet to see the rewards of their efforts, particularly in terms of student-learning gains on such dimensions as improved understanding, higher retention and class involvement. This was partially due to the constrained timeframe for the projects, as well as projects having to span a financial, as opposed to a school, year. Nevertheless, it is the writers' strong view that in future activities involving embedding ICT in learning both processes and learning gains should be tested in some form. It is not sufficient to report that there are benefits to embedding ICT into the curriculum based on hunches or feelings that it was effective. The same is true for teacher beliefs. We need to know more about the quality of the learning rather than the fact that teachers enjoyed the experience and thought it was valuable. As useful as this information is, it is paramount that there is evidence concerning students and teachers about what changes have taken place and whether they have been sustained over time.
Finally, technical connectivity represents an issue for sustained future developments in ICT. There was poor access to school and system level ICT tools and networks. Schools had difficulty linking electronically with their university partners. Project leaders reported a lack of computers for pre-service teachers, difficulties in participants obtaining privileges in one another's systems, and incompatibility across systems. This issue compromised the productivity of state and territory partnerships. There is clearly the need for more open level access, for relevant personnel, to system networks and tools generally in education and specifically for individual projects.

Principle 2: Increased investment of thought and research addressing ICT uses in learning

That there needs to be a serious investment of thought and research within Australia into addressing difficult education concerns in embedding ICT in learning. Such investment must include education professionals, ICT champions and strong advocates of ICT uses in learning and teaching. In particular there needs to be a focus on:

- understanding and enacting innovation in Australia in embedding ICT in learning;
- acknowledging teacher efforts, particularly with respect to student-learning gains on such dimensions as improved understanding, higher learning outcomes, higher retention and class involvement; and
- collecting evidence concerning changes that have taken place in learning for students and teachers and whether these have been sustained over time.

Principle 3: Improved nation-wide access to ICT at personnel, system and ICT tool level That technical connectivity needs to be improved nation-wide to provide better access for relevant personnel to system networks and tools generally in education and specifically for individual projects. There needs to be:

- improved access to a suite of online tools for school systems;
- improved access to school and system level ICT tools and networks;
- improved network services delivering at an appropriate speed;
- improved technologies linking facilities among schools, school districts and university partners; and
- improved access for pre-service teachers to obtain privileges in relevant education jurisdiction systems.

Interestings

The PICTL study alluded to a number of 'interestings' across many interrelated issues. These could profitably be the basis of further discussion and in some cases further exploration. Among those of most significance were:

- ICT-rich learning by participants and institutions;
- sparse resources (conceptual and strategic) employed by different partnership groups; and
- the nature of existing, entrenched cultures.

All of these have been mentioned previously. What follows is a brief consideration of three further issues raised by the findings: the practicum, pre-service teachers as leaders of innovation, and the critical role of learning theory.

There were important warnings about the use of the practicum for project-based learning activities in the reports, especially from pre-service teachers. It is clear that the practicum, as currently envisaged, plays an important role in the development of future teachers. It is also clear that there needs to be practicum assessment mechanisms in place that report pre-service teachers' effectiveness, strengths and areas needing attention. The issue is how to balance the need to assess teaching performance with action-research investigations that may be undertaken at the same time.

There were calls from both pre-service teachers and teacher educators that activities involving embedding ICT in learning should avoid the conventional assessment paradigm of practicums, as this would have an inhibiting effect on innovation. However, data from projects with certain pre-service teachers illustrated that this need not be the case. Nevertheless, concerns in using the practicum for new ICT-focused initiatives were widely and strongly held.

Some pre-service teachers were seen as leaders of ICT innovation. While many pre-service teachers reported greater comfort with technology use than teachers, the notion of new teachers or teachers in training taking a leading role in ICT learning within a school appears problematic. There is much more to successful teaching and successful incorporation of ICT into lessons than technical skill. Also, being familiar with the language and ideas of current pedagogic frameworks, while valuable, does not equate with years of experience where these ideas have been tested, refined and integrated within a teaching style.

Teachers take years to develop appropriate management, planning and presentation skills. Indeed some jurisdictions are attempting to reduce the workload on new teachers to facilitate the development of these particular skills. Expecting new teachers to undertake significant leadership roles in what is a difficult and demanding area of school development might not be in their long-term best interests.

A significant issue was understated, though implicit, in the projects. There was no reference to learning theory in any of the project accounts or interviews with project leaders. Granted, curriculum and pedagogic frameworks did figure, but learning models and theory are different from these. A critically important consequence of this omission meant that project teams had difficulty in recognising and describing learning when it occurred and therefore neglected learning outcomes in favour of a focus on other things (here, notably attitudes). Without a well-theorised approach to identifying learning, it is difficult if not impossible to make hard-edged conclusions about the educational power of embedding ICT in learning contexts. In addition, in the absence of theory, design principles are not easily developed for future ICT-rich learning opportunities or reliable control gained of the educational quality of such environments.

Principle 4: Care should be exercised in expanding the role of the practicum

That care needs to be exercised in utilising the practicum as a professional learning activity to improve the ICT-mediated learning contexts within schools. This may be possible with some pre-service teachers in some contexts but there were concerns about generalisability. The issues are to:

- balance the need to assess teaching performance with action-research investigations that may be undertaken concurrently;
- encourage combined professional learning activities that avoid the conventional assessment paradigm of practicums as this would have an inhibiting effect on innovation;
- create a situation where exploration of ICT uses in learning is encouraged; and
- create opportunities for pre-service teacher explorations, if different from that of the pre-service teacher's supervisor's practice, that do not impact adversely on their teaching grades.

Principle 5: Pre-service teachers' have a role in embedding ICT in learning

That there needs to be a revised view of pre-service teachers, not only as future users (leaders) of ICT-rich provision in schools, but also as sources of ideas and enthusiasm for change. To achieve this:

- schools and universities should jointly plan pre-service teachers' professional experience;
- universities should expect pre-service teachers to have the potential to become joint developers of ICT with experienced teachers, and eventually leaders of ICT-rich learning designs in schools;
- care must be taken not to expose pre-service teachers to expectations beyond their practical, theoretical or competence range, e.g., undertaking significant leadership roles in what is a difficult and demanding area of school development.

Principle 6: Student-learning gains through using ICT should be made explicit

That, as a matter of urgency a policy consensus needs to be established, informed by leadingedge ideas about learning, of what constitutes strong student-learning outcomes within the context of ICT uses in learning. Additionally, there is a need:

- for a more concerted effort both to understand and to enact highly innovative educational approaches of worth in this domain;
- to lead principled educational development in technologically-rich contexts; and
- to equip educators with an available, state-of-the-art underpinning theoretical framework so that they are better placed to guide teaching and learning efforts, to convert hunches and intuition into demonstrable student gains and, genuinely, to innovate.

Principle 7: ICT uses in learning should be supported by underlying models and theories That ICT uses in learning need to be interrogated specifically for their underlying learning models and theories. While curriculum and pedagogic frameworks are useful they are different to learning models and theory. There is a need to:

- recognise and describe learning when it occurred;
- evaluate gains or progress;
- draw conclusions about the educational power of ICT-mediated learning opportunities;
- design principles for future ICT-rich learning opportunities and thereby gain control of the educational quality of such environments.

Finally, any guiding principles can only make suggestions about setting up the conditions that might be conducive to success. Such is the case here, although these principles do require action. Further, these principles should be seen in conjunction with the recommendations directed at stakeholder groups offered in the following sections. Mostly, these recommendations are about partnerships and we would encourage groups to build on existing local less-formal relationships as well as on any past successes. Genuine collaboration was a strength of all partnerships reported in the PICTL study and it is this important feature that offers the real chance of sustainability of growth in embedding ICT approaches in learning over time and beyond individuals currently involved in activities.

5.3 Creating ICT partnerships

Establishing projects

The PICTL study highlighted the possibilities of utilising the strengths and capabilities of pre-service teachers, teachers and teacher educators through collaborative ventures within a framework for professional learning. This collaborative project-based structure was seen to facilitate learning in classrooms as well as create a rich supportive learning environment for participants. The partnership approaches enabled teachers and teacher educators to rethink their practice, move beyond their current situation and re-focus on learning and teaching.

Three aspects were critical to success. The first was that participants addressed issues of concern or interest for them and the classroom. The second was the inclusion of capable pre-service teachers who were comfortable with technologies and hence made it more likely that authentic and appropriate educational solutions evolved. The third issue suggested that quality joint school and university activities need at least a six-month planning cycle and at least a calendar year implementation cycle to provide a context that best encourages success.

Recommendation 1

That DEST initiate a strategic funding program in which collaborative teams of pre-service teachers, teachers (within schools or school clusters) and teacher educators, and of professional associations, and industry and community groups can seek funding for projects to improve the application of ICT in student learning. Guidelines for the program require that:

- proposals be competitive and evaluated according to established criteria;
- projects be funded in each state and territory;
- a national coordination process/person oversee all projects;
- a project officer be appointed to record, monitor and evaluate project elements that contributed to success at the local level;
- funding complement existing resources provided to universities to pay for in-school experiences for pre-service teachers;
- funding, either included in projects or through other means, be provided to increase the opportunity for university staff to be involved in professional activities with schools;
- schools or school clusters applying for funding have varying levels of ICT resourcing and staff skills;
- projects be established for a two-year period, and 'on application' extension funding be
 offered to accommodate proposals to continue where they have achieved distinction —
 particularly, if they can address the need for strongly innovative, theoretically sound and
 demonstrably effective directions with respect to students', pre-service teachers', teachers'
 and teacher educators' learning;
- projects be designed as collaborative partnerships involving pre-service teachers, teachers and teacher educators;
- special consideration be given to projects involving remote schools, schools with high Indigenous enrolments, and schools in disadvantaged areas;
- specified contributions be made by pre-service teachers, teachers, and teacher educators;
- participants in projects contribute to the sharing of elements of success through nationally coordinated events; and
- participants be required to specify an appropriate theoretical framework to describe, analyse and understand student learning in ICT-mediated contexts, and by which to formatively and summatively evaluate student-learning outcomes.

There are many demonstrated benefits to the professional learning of participants in such projectbased approaches if the activity is well planned and carried out thoughtfully. However, there are two important issues that need to be considered and these primarily concern sustainability issues.

First, in project-based research there is often much goodwill expected of, and offered by, participants. In the PICTL study this was due, in part, to the novel nature of the enterprise, the national perspective and the potential significance of the work to the greater good of Australian pre-service teachers, teachers, teacher educators and students. It is unclear how many times this level of commitment would or could be extended, without support in the form of funds for teacher release, travel and other expenses.

A second sustainability issue concerns the nature of follow-up activities. Participants in the PICTL study reported that they grew because of the experience. The implication being that future work would need to take this into account. However, the nature of this 'second' and any subsequent rounds is unclear, particularly if the membership composition changes.

Underpinning focus

Underpinning meaningful ICT approaches to learning, is a need for knowledge, competence and experience on the part of teachers. This professional background extends not only to proficiency in ICT use, and knowing when and how to employ ICT approaches to learning, but to the particulars of subject knowledge and the cognitive pathways taken by students in acquiring that knowledge. These needs also impact on teacher educators whose job it is to prepare future teachers to take up learning challenges by the careful and thoughtful application of ICT.

The activities of partnerships experimenting with embedding ICT in learning should explore a variety of learning resources and modes of instruction evident in classrooms. In doing this, the most important target for action should be improved learning environments for students leading to improvements in learning outcomes in some recognised or accepted form. These improvements in performance could include: improved levels of skill/knowledge; improved attitudes to learning; and, improved behaviour and attendance.

How the activity performs on such outcomes should be reported as part of the project. The production of academic publications and presentations should also be an outcome of the research agenda in order to produce examples of practice for other teachers to consider, and use, in their own situations. Furthermore, innovative and rigorous theory-based approaches to measuring such outcomes would be significant outcomes of such projects in their own right.

Recommendation 2

That all stakeholder groups ensure that any future activities directed at investigating ways of embedding ICT in learning incorporate a research component focusing on the benefits for school students of the learning activities, including:

- student-achievement outcomes;
- student-management outcomes; and
- student-affective outcomes.

This recommendation requires qualification. Quantifying and then analysing differences in either learning gains for students or improved teaching influences as a result of ICT-mediated instruction, is particularly difficult. In the former case, when identifying the nature of learning gains the metric used to gauge learning improvements can be problematic. If tests are constructed from a perspective of a traditional non-ICT instruction paradigm then the full impact of student improvements may not be

evidenced. As a consequence, traditional assessment approaches may require revision to enable the collection of more robust information concerning the true nature of the student learning that has taken place.

In the latter case of teacher actions, as applications of ICT use in learning represents only one of a number of teaching strategies that a teacher might pursue, it may be very difficult to find a way to measure or attribute the direct influence of ICT on learning gains. The degree of transferability of the findings associated with a certain teaching practice using ICT highlights a further difficulty. With ICT applications in learning it is not simply what technologies are used but how they are used and to what purpose given the particular context. For this reason, an holistic understanding is needed of ICT-mediated learning in those contexts in which it is judged to be significant.

It is the position of the writers that we are as yet at an early stage in collecting and making sense of the evidence for student learning gains or improved teaching practices in ICT-mediated learning. Hence, evaluations of these aspects must be pursued with diligence, imagination and above all patience, through comparisons and contrast in order to perceive the commonality that will, over time, allow us to generalise. On this journey it is critical that ideas are published and made available to partnerships seeking funding.

5.4 Sustaining professional learning partnerships

By foregrounding collaboration between pre-service teachers, teachers and teacher educators, the PICTL study offered a different focus on the professional learning experience for all participants. This study is significant as it represents a priority professional learning area for all levels of government. As we move to consider sustainable ways to encourage ICT learning, then there needs to be new thinking in terms of 'recognition' for members of the partnership and new forms of 'support' offered at system level. Providing opportunities for pre-service teachers, teachers and teacher educators to work together within the scope of their day-to-day duties and activities would clearly be more sustainable over time and be more likely to involve cohorts of pre-service teachers and teachers than merely individual early adopters and enthusiasts.

The system of rewards from this three-way collaboration needs to reflect the particular nature of the professionalism it offers, as distinct from the roles participants currently perform in a traditional practicum experience.

- For the pre-service teacher, such collaboration could become an integral part of their tertiary study program where there would be credit for the activity. Also, it could offer, at best, a leading-edge professional experience or, at least, additional in-school experiences.
- For the teacher, the change could be from a 'payment for services' model to one for creating opportunity for quality professional learning. Paying for teacher release could be a valued enabler to create time for teachers to support partnership activities and generate the quality of experiences where all partners benefit.
- For the teacher educator, the rewards have to do with the service component of workload and the opportunities created for school- and system-based research, and a flow of research-based writing.

Such a change in approach needs to be complemented by a robust and well-theorised professional learning framework, adequate mentoring and effective organisation for its value to be realised.

The use of powerfully embedded ICT in learning may have greater sustainability from a management perspective, when applied in the short-to-medium term to specialist groups of pre-service teachers and teachers; for example with ICT leaders, Computing Studies teachers, and technology orientated teachers. It is important to highlight a potential risk here. This identified group of teachers might be more likely to be interested in transmission-centred issues (e.g., focus on the software) before learning-centred ones. PICTL findings, and other reports in ICT education, suggest that not only is a subtle

partnership required between ICT and learning and teaching philosophy, but particular learning and teaching philosophies may well impede successful embedding of ICT in the curriculum. Smaller cohorts of school executives might also be targeted, as often they are self-motivated to support ICT use and might value the opportunity to be involved in new and interesting projects.

For partnerships to be sustained, continuous activities need to provide professional growth activities for all stakeholders. Building professional activities into the pre-service teacher program is one potentially significant way for the involvement to be justified and sustained over time.

Recommendation 3

That education authorities fund professional learning partnerships between universities and schools in the area of embedding ICT in learning. For professional learning to be sustainable:

- professional learning partnerships with universities must be promoted to schools as a model for professional learning of teachers and a strategy to mentor schools to develop a focus and direction for ICT pedagogy; and
- promotion must include the sharing of success stories and good practice in the professional communities of ICT leaders, professional learning coordinators and principals, and the building, thereby, of sound theories of professional learning that then guide future professional learning, including learning design, curriculum and assessment structures.

Recommendation 4

That tertiary institutions negotiate with education authorities to play their part in sustainable professional learning by:

- developing long-term partnerships with clusters of schools, districts or regions with formal agreements;
- establishing coordination positions, and sharing facilities, expertise and opportunities to circumvent the need for universities to seek permissions, obtain ethics clearances, and negotiate intellectual property rights constantly for each partnership activity;
- providing pre-service teachers with opportunities to be in schools through flexible program structures; and
- encouraging teachers to take advantage of pre-service teachers' activities in schools to develop new knowledge, trial new approaches and conduct action research into ICT pedagogy ideas.

Recommendation 5

That tertiary institutions, specifically those servicing the needs of rural and regional areas, build continuity into their relationships with clusters of schools, so as to overcome the difficulties of transient teaching populations by:

- rotating short-term projects amongst school communities;
- having partnership relationships in place for a number of remote schools so as to meet pre-service teachers' needs of experiences in these locations; and
- building relationships among teams of administrators and teachers over time.

5.5 Supporting professional learning

Mainstreaming ICT in learning into the design of professional learning programs and courses of tertiary study provides the opportunity for quality learning in the core business of pre-service teacher education and school professional learning. Three important aspects are the focus of the following recommendations. They involve timing, access to online facilities and tools, and the availability of implementation support. Of these three, timing is the most difficult to build into the working lives of participants and perhaps the most critical, as it:

- allows for contractual and other procedural matters to be dealt with adequately;
- allows quality outcomes to be met;
- ensures that the individual requirements of all partners are met; and
- enables benefits to student learning to become evident and even quantified.

Recommendation 6

That education authorities with cross-sectoral representation establish policies and procedures that enable cycles of professional activities to be designed and implemented, so that sufficient time is factored into the life of the project without excessive need for permissions and clearances at each iteration.

Recommendation 7

That education authorities and tertiary institution partners ensure equity of access to ICT systems for all participants and equity of school access to tools used in activities. All participants should be requested to strengthen the culture within schools concerning the use of online tools. This is achieved by:

- making use of the services of Education Networks of Australia (EdNA) as a common ground for collaboration for administrative, professional and curriculum use;
- developing strategies to provide pre-service teachers and teacher educators with access to their computer networks and services, and technical support, without undue bureaucratic process and at no cost;
- continuing to promote the use of online tools, networking and real-time communication tools for professional work at every opportunity possible;
- modelling efficient and effective online processes as a way of changing the culture of communication in schools;
- continuing to use online tools and videoconferencing, where appropriate, to communicate with pre-service teachers; and
- supporting teachers by modelling contemporary professional practice and encouraging people to develop knowledge and experience of these tools through the activities of school-university partnerships.

In most activities, schools are expected to provide the project venue and context. Involvement by a school creates the opportunity to showcase results and to take a higher profile in the local and broader educational community. Schools should elicit support from parent and community groups and, where possible, local businesses.

There should be financial and resource incentives for schools to reward involvement in activities, especially in the form of time release. Benefits should include:

- enhancement of a school's reputation in the broader community such as public recognition of school initiatives;
- improved student-learning and student-affective outcomes; and
- improved teacher competence in ICT learning.

This can extend to include public recognition of education authorities that achieve positive outcomes. Importantly, such recognition will increase the return on ICT capital outlay because of the improved incorporation of ICT learning in the school curriculum and teaching programs.

Recommendation 8

That education authorities provide a system of incentives to schools to encourage participation by a critical mass of teaching staff, as appropriate to school size and staff experience profile, in powerful ICT learning experiences. Incentives include:

- teaching relief (i.e., teacher time release);
- ICT resource allocation to schools for successful project completion; and
- an annual recognition/award scheme for schools that demonstrate excellence in ICT use as a result of participation in the activity or as a result of what has been achieved.

Teachers play an important role in project-based professional learning. It is their classes that experience the innovation. As a consequence they are in a very strong position to suggest project foci or to identify how such a focus is consistent with the learning program of their class. It is part of their role to mentor and assist pre-service teachers who are working with them on ICT learning implementation. Teachers are also strongly placed to liaise closely with teacher educators and to timetable visits from partners to the school.

There are many potential benefits for teachers in being a participant in such a project or activity. These benefits include:

- helping demonstrate professional teaching standards criteria in ICT implementation;
- helping demonstrate leadership by exploring innovative ICT practise;
- improving ICT knowledge and its application to learning;
- mentoring opportunities with new teachers;
- increasing status or pay;
- improving pedagogy knowledge and practice; and
- improving student learning and behaviour.

Recommendation 9

That education authorities provide formal recognition for teachers who participate in powerful activities that seek to embed ICT in learning:

- as contributing towards the attainment of ICT professional teaching standards; and
- as evidence of innovative practice in teachers' professional learning portfolios.

Traditionally, the membership of ICT professional associations consists of the ICT leadership and early adopters/enthusiasts, ICT coordinators in schools and computer studies teachers or teacher educators. These associations mostly have a membership category for pre-service teachers and have detailed an advocacy role for supporting pre-service teachers.

Increasingly, ICT professional associations are working collaboratively with other teacher associations to actively promote ICT in learning activities. Joint conferences, collaborate projects and participation in other association conferences have become common practice. Further, some subject and non-ICT associations have launched special ICT projects resulting in journals and conferences with an ICT focus. All associations show evidence of supporting improved ICT use in schools.

Recommendation 10

That professional associations support their membership in their participation in partnership projects by:

- modelling the state-of-the-art with respect to ICT-mediated business transactions in their communications with members and with other education, community and corporate sector organisations;
- nurturing the growth of diverse partnerships and forums for teachers, schools and school systems to collaborate in suggesting, discussing, prototyping, trialling and improving ICT-rich learning environments across a range of disciplines, fields of practice and educational levels;
- initiating, and helping resource and sustain research and teaching connections with organisations including education authorities, other professional associations, and the ICT industry. Such connections are likely to lead to the regeneration of members' knowledge with respect to ICT-rich learning and teaching opportunities;
- mentoring ICT leadership by allowing those involved with networks to share and explore ideas on technological and pedagogical issues and by publishing results of research and professional activities; and
- mentoring pre-service teachers by encouraging their participation in all association activities, and advocating among teachers the need for involvement of pre-service teachers in all levels of school activity.

It is our belief that universities should administer partnership activities. There is an administrative cost in this process. Hence, there is an expectation that there be some flexibility to realign dates or specifications to accommodate university timetables. Also, certain courses and assessments might be configured to accommodate projects, or at least allow some aspects of the projects to be embedded as an (ongoing) component of a particular course. Some accommodation to staff workload would be expected.

The benefits to the university would include increased research funding, improved quality programs that are cognisant of the latest activities in schools, and an increased university profile and partnership with schools. There is reason to believe that there would be increased pre-service teacher satisfaction as well as potentially increased post-graduate numbers from teachers/mentors as a result of being involved in a research activity.

Recommendation 11

That tertiary institutions negotiate with project Team Leaders with a view to recognising the school professional experience of pre-service teachers involved in using ICT in learning activities in schools. Where appropriate, tertiary institutions must:

- allow realignment of professional experience dates and specifications to suit activities;
- include aspects of activity participation in students' assessment requirements for related courses;
- develop ICT learning courses around participation in powerful ICT learning activities in schools and school systems;
- develop ICT leadership specialisation courses around managing the ICT learning process in schools; and
- promote, within universities, ICT learning activities as a pedagogical approach and a strategy to improve the use of ICT throughout faculty programs, for example, by using findings from various activities as relevant data for designing learning programs.

5.6 Supporting effective management

Effective management issues were clearly identifiable within the state and territory reports. These issues were directed towards two areas, national and local. The first centred on the development of a national community of state and territory project leaders. Of interest were the best ways to facilitate these projects and provide a context for them to achieve success. In state and territory projects it was local circumstances of participants that were the cornerstone of effective management. Both national and local issues are addressed in the following four recommendations.

Recommendation 12

That DEST and education authorities be formally recognised as activity partners and provide system support for project management as well as support for collaboration with partners. These partners provide:

- input into the scope and focus of projects;
- system support to participating schools;
- procedural support to university partners seeking permission for the research component of projects;
- administrative support with regard to pre-service teacher authorisations;
- a liaison person who has developed knowledge of the potential of projects as a professional learning approach for supporting ICT in learning; and
- support for initiatives to have education authorities recognise successful teacher participation in the ICT activities.

Recommendation 13

That tertiary institutions encourage teacher educators to take on several roles including:

- lead a project team to take major responsibility for writing proposals and subsequent reports;
- liaise with pre-service teachers and teachers;
- coordinate with education authorities concerning formal system support; and
- encourage wider use of school-based action learning among faculty members at their university and perhaps more widely through research publications and other professional activities.

Recommendation 14

That tertiary institutions acknowledge teacher educators for their professional leadership by the research dimension of activities, by the contribution of work with schools towards professional service, and by appropriate workload allocation. These activities if carefully planned and implemented should be seen to increase the research quantum for the academic and his/her institution. Tertiary institutions must provide teacher educators with:

- a reasonable formal workload allocation to encourage involvement in partnership activities using ICT in learning, and particularly recognising their roles as leaders;
- time and opportunity to distil the complex mix of theoretical and practical ideas in these projects; and
- relevant resources to address the obviously taxing pragmatic demands posed by a collaboration across different stakeholder groups.

Pre-service teachers can play several roles in school-based ICT learning activities. They can be innovation facilitators working collaboratively with teacher partners to improve student learning. They can also be Web documenters, with teachers or teacher educators, capturing the project in some electronic form for the benefit of others.

The possible benefits for pre-service teachers of their involvement in an activity include:

- increased opportunities for school experience;
- enhanced recognition of professional skills;
- course credit in tertiary study program; and
- improved self-esteem from facilitating innovation in ICT in schools.

Recommendation 15

That tertiary institutions encourage pre-service teachers by providing them with opportunities:

- to participate in powerful ICT-related professional learning experiences by formal recognition from universities, e.g., course credit for activities; and
- to undertake a range of ICT-focused studies, either formally offered within their universities by appropriate further-education providers, or as independent, self-taught studies.

5.7 Planning ICT learning activities and innovation

Underpinning the recommendations offered in this chapter is the ideal of reconfiguring learning goals in contemporary ways in different learning areas. The purpose is to develop technological fluency meaningfully at all levels of ability and hence address the notion that ICT is not an optional add-on to education. Clearly, the recommendations have centred on establishing and supporting school and/or cluster-based education partnerships. These endeavours, involving pre-service teachers, teachers, and teacher educators working alongside each other to achieve learning goals (for all participants and students) using ICT, are a worthwhile objective for Australian education. This section considers possible extensions to ICT related activities and potentially new ICT in learning initiatives. In particular, four visions are presented.

First, incorporation of powerful ICT-mediated approaches in pre-service teacher education, together with the recognition that technological fluency is basic to what it now means to be an educated person. This conceivably should lead, over time, to ways of reconfiguring pre-service teacher education at its core. Such activities might eventually be linked to other components of teacher education programs, most fruitfully pre-service teachers' choices of specialisation/major elective study, but later, foundation studies such as sociology, philosophy or psychology of education. It seems most likely that ICT in learning will not only be acknowledged to be much more than an optional component in education but that technological fluency might unify pre-service teachers' study of learning and teaching in both subtle and significant ways.

Second, as was foreshadowed, it is not hard to visualise how these beginning steps, within courses of study at university, might eventually lead towards a much broader and deeper reshaping of the nature of pre-service teacher preparation. Within this vision, sustained collaborative ICT-focused activities could form the core of a carefully planned learning study. This could span a set of university subjects within a teacher education program, aimed for pre-service teacher, teacher and teacher educator participants. Aspiring to such a scale of reform would entail much closer collaboration between partner institutions. Perhaps there might be joint appointments of staff, much like the clinical model successfully in place in hospitals and faculties of medicine. There could also be widespread changes to the ways educational knowledge is generated, as schools and universities share responsibility for understanding how pre-service teachers and students learn in situ.

Third, these visions raise another possible extension of powerful partnerships in applying ICT to learning. In this view, universities, not schools, are the context for the innovation. The focus here is on taking collaborative ICT approaches in learning within tertiary classrooms with pre-service teachers as learners and teacher educators as facilitators. Such an approach would involve different academic groups within a university and even different universities.

Finally, consideration of the interests of school students raises the possibility of a further new initiative that needs to be explored. It is evident that a great many school students, as the 'digital' generation, have high interest, confidence and capability with respect to the use of ICT in learning. A growing body of research attests to their ingenuity in a range of formal and informal learning contexts, strongly suggesting the worth of including them as collaborative partners in their own right. Such inclusion could provoke highly innovative, student-led implementations, assisting other stakeholders to reconfigure ICT-rich learning opportunities in ways that may not have previously been anticipated. Detailed accounts of such work could play a strong role in broadening and deepening the thinking of educators about the educational nature and purposes of technology-rich contexts for learning in schools and universities.

In summary, there is need for a broad discussion and debate about ICT learning in our culture leading to a possible nation-wide policy consensus. Such a focus has the potential to evoke strategies and approaches in bringing about sustainable change in current thinking and practice in ICT use in schools. These actions would be driven by visions of pro-active ways forward that better meet the future needs of Australian culture, teachers and learners.

Recommendation 16

That DEST convene a forum to discuss critical issues facing embedding ICT in learning. The focus of the forum would be:

- theoretical bases of ICT learning in terms of viable learning theories or models;
- what constitutes innovation in ICT learning;
- forms of information needed to establish the benefits of ICT learning to students;
- approaches needed to seed, support and sustain genuine ICT in learning innovation at all levels of education; and
- synthesis of information on ICT learning approaches that describes more clearly the nature of expected learning outcomes for students, teachers and pre-service teachers and, hence, assists in the crucial research-based development of valid and reliable assessment rubrics.

Recommendation 17

That DEST funds strategically targeted research studies, arising from the above forum, aimed at:

- exploring, in operation, those theoretical learning frameworks considered viable;
- targeting genuine system innovation in ICT learning in schools, school systems and teacher education programs, both pre-service and through professional development;
- addressing ideas about what constitutes strong student-learning outcomes, interrogating those assessment rubrics that hold the greatest promise for assessing the impact on student learning outcomes of the embedding ICT in learning; and
- piloting significant alternative visions for pre-service teacher education and professional development to support and enhance Australia's leading edge, technologically mediated educational provision for diverse educational populations, throughout peoples' lifespan, into the future.

Recommendation 18

That DEST, while encouraging stakeholder groups to mainstream ICT activities into their programs as appropriate, initiate projects to research professional learning models and theories, program designs and partnerships in order to inform:

- new models and theories of professional learning partnerships;
- innovative, future-oriented educational activities, with appropriately rigorous, welltheorised assessment structures behind them, that give power and meaning to the use of new learning technologies in schools; and
- university faculties', teacher professional groups' and education jurisdictions' refinement, in theory and practice, of using ICT in learning.

Most state and territory education jurisdictions have databases of ICT in learning exemplars. Education Networks of Australia (EdNA) also has a collation tool for providing access to a variety of exemplars. It is unclear whether there exists quality control measures for selection of exemplars and/or frameworks to justify the choice of exemplars for inclusion. Further, it is possible that not all exemplars may be able to sustain their position as suggested models/approaches given new information emerging from research.

Easy access to quality documentation sharing examples of validated approaches and experiences is needed that can be used to help teachers who are functioning at different levels in different learning areas. We advocate a strong, culturally validated form of communal knowledge building that seeks to encourage higher-order attributes and deeper forms of learning and knowing by teachers and students. This is more likely to encourage stakeholder groups to mainstream ICT activities into their programs as appropriate, initiate projects to research professional learning models and theories, program designs and partnerships.

Recommendation 19

That education authorities and professional associations ensure that the most recent developments in ICT learning are being considered and acknowledged, by using the findings and recommendations from major ICT research initiatives to inform the development and review of:

- teacher professional standards, including registration requirements;
- statements of learning for students; and
- curriculum and pedagogy statements or frameworks.

Recommendation 20

That DEST and education authorities work together to improve the accessibility and quality of ICT learning exemplars by:

- developing a central repository, or at least links to different databases, so that current collections are not fragmented;
- including detail about how these practices might be adapted or adopted by teachers; and
- developing frameworks, possibly based on national ICT pedagogy statements or statements of learning, to review exemplars and decide which are to be included.

5.8 Conclusion

The advent of the development of new technologies, and what we know about this generation's familiarity with new technologies, represent a serendipitous set of circumstances. Herein lies an opportunity to legitimately rethink teaching in much the same way as the professions of medicine, nursing or health, engineering and architecture have done. In this final section it is appropriate to look back briefly over the PICTL study and to look beyond this report.

Despite the small-scale nature of the state and territory projects, their diversity of focus, their commitment to the ideal of ICT learning embedded within the curriculum, and the willingness of pre-service teachers, teachers and teacher educators to work as genuine partners resulted in an impressive list of factors that contribute to collaborative endeavours. We now have data to confirm that partnerships are most likely to be successful if they involve:

- formalised arrangements;
- agreed outcomes;
- incentives for pre-service teachers, teachers and teacher educators;
- commitments from schools, education jurisdictions and universities;
- long-term relationships;
- proposals from school and university staff but managed by universities;

- collation and dissemination of knowledge managed by academics in collaboration with school partners; and
- long-term sustainability through collaboration with unions, tertiary faculties, education authorities and DEST.

These factors were particularly relevant to the state and territory projects in remote sites that are traditionally more complex to initiate and sustain due to high staff turnover. The learning benefit for the people involved, especially the remote school communities whose access to quality professional learning opportunities is limited, was reported as being worth the investment of time, energy and money. The use of remote settings for project-based investigations in this way also encouraged pre-service teachers to consider placements in remote locations.

The projects sought to be innovative. Innovation in the area of utilising ICT-mediated approaches was about bringing in new methods and ideas, and making changes to ICT learning within the context of the participants. While there is value in the findings for ICT learning outside of individual contexts, the main emphasis was on the learning journeys of participants. Overall, however, there was uncertainty in the projects about standards and quality learning outcomes generally and innovation in particular.

The recommendations made in this chapter strongly urge the extension of well-resourced professional learning in embedding ICT in learning throughout Australia. Such activities should evolve around partnerships in which each participant brings a particular valued set of ideas and competences that are shared and discussed. While the projects had strong leadership in terms of management teams and project team leaders, there was also a powerful cooperative and collaborative feel to the projects as members worked through their project focus. All members of the partnership took on leadership or facilitation roles where appropriate rather than relying on a single, omnipotent ICT leader as the sole source of wisdom.

Clearly, we are at a time in the use of ICT in learning when the focus must be on teachers' learning, and their beliefs and teaching approaches, as well as students' needs and learning outcomes. ICT is a tool that has strengths and weaknesses depending on the context and the manner of use. Facilitation of activities with a clear learning orientation will help provide valuable insights that will aid sustainability. Future activities that explore ICT uses in learning should explicitly target:

- the nature of innovation;
- an intensive focus on teacher and student needs;
- the degree of improvement of learning outcomes for teachers and students; and
- the setting of project plans and learning goals grounded in theory.

A developmental perspective is critical for at least two reasons. First, it is important to recognise that some teachers are more committed to and more confident in using ICT applications, less sceptical about the value of ICT uses in learning, and more willing to explore new ideas and approaches using ICT. Hence, some teachers would utilise only limited examples of ICT applications in their class, while others would be able to undertake numbers of applications under support or guidance and some would be able to modify and adjust different approaches depending on the class context. These teachers would require different professional learning strategies and encouragement from those who are able to genuinely transform their teaching practice. Hence, even given this simple four group analysis it is clear that a one-size-fits-all strategy for teachers would be counter productive.

Second, embedding ICT within the curriculum needs more than technical proficiency and competence. Using ICT applications does not preclude poor learning outcomes for students. Teachers need to make decisions on when, where, and in what ways ICT applications are needed. This implies that the teacher is at an appropriate level of development in the subject they are teaching as well as in knowing how

students learn the subject. The difficulty here is that to truly embed ICT use in learning, the teacher may have to reconceptualise their pedagogical approaches. It is our strong view that this is easier for those teachers who have strong subject knowledge, to achieve this over time.

While valuable for participants, innovation that simply moves individuals' or small groups' beliefs or actions from one position to another is not sufficient. At a national level it is important to seed genuine systemic educational innovation, and to test these ideas within a professional learning framework. What is genuine innovation in ICT learning? It is about embracing learning and teaching directions, that envisage ICT learning truly embedded in the curriculum and avoiding casting ICT as an add-on or an end in itself. Furthermore, the core PICTL study parameter — the notion of collaborative partnerships — highlights the worth of a targeted focus on collaborative, community-focused learning as a way of thinking about system reform and renewal. These ideas are urgent and timely, and should now be debated nationally.

Importantly, the actions of embedding ICT in learning should be subjected to high standards of evaluation. Information is needed on the benefits accrued for students' learning. Is it right to expect improved or higher-order outcomes as a result of using ICT approaches in learning? How do we account for individual differences? Similarly, it is important to know the ways in which teachers have benefited from this form of professional learning, how they have taken their knowledge and grown in imagination and critique, and how this new knowledge is manifest in their philosophical and practical orientations to classroom practice. We need information on approaches that describe both students' and teachers' work more clearly, and in terms that recognise and build on those sound, newly available ideas about how learning occurs as part of a lifelong journey.

Education is not a craft or a trade with well-honed and always-successful routines that are simply handed on to each new generation. It is a knowledge-generating profession and an empirical, scholarly field in its own right — with theories and models that can be tested and refined iteratively in practice. Much like the mediaeval cathedral builders who enabled an engineering science, and brain-imaging technologies that re-invigorated neuroscience, new ICT learning technologies have the potential to offer a much deeper science of learning. Moreover, as students are the 'digital' generation it is even possible that this new science will disclose a most subtle and profound understanding of what students know.

Overall, there is a need for broader and more thoughtful debate about using ICT in learning in our culture as a way of seeding much more radical and relevant ideas into learning and teaching. The level of discussion of ICT-rich and ICT-appropriate learning in education needs to become far more holistic, sophisticated and subtle. Clearly, further systemic renewal is dependent on the provision of a firm and educationally powerful theoretical basis for such learning, and a context for discussion and rigorous research investigation that prioritises future-oriented learning designs and organisational structures in schools. Given the urgent social and environmental challenges currently confronting future generations, there needs to be a much more concerted effort to encourage people's imaginative and rigorous thinking about viable alternative educational ideas and strategies.

ICT applications in learning have the potential to act as a positive force for addressing many challenges facing communities in education. Partnerships in ICT learning might well hold the most promising long-term solution for many of these challenges.

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