The challenge confronting countries, regions and universities is to address the following basic principles for ICTs in teacher education (Society for Information Technology and Teacher Education, 2002):

- ICTs should be infused into the entire teacher education programme.
- Technology should be introduced in context.
- Students should experience innovative ICT-supported learning environments in their teacher education programme.

The most critical factor in the successful integration of ICTs into teacher education is the extent to which the teacher educators have the knowledge and skills for modelling the use of ICTs in their own teaching practices. To enable them to develop these skills requires a well-conceived and sustained programme of professional development. This section focuses on the professional development of teacher educators and the programmes for which they are responsible, such as pre-service programmes and certificates for practising teachers. The section discusses teacher educator professional development in various contexts of infusing technology into the educational system and process. The discussion is underpinned by new approaches to teaching and learning and by the recognition of the stages of professional and organizational development. Eight case studies from around the world illustrate a range of approaches and models that may be used. The section closes with a brief discussion of the importance of robust evaluations and the role of all stakeholders in the evaluation process.
Countries that have initiated efforts to infuse ICTs into teacher education have found four professional development strategies helpful in successful technology integration. First, professional development needs to focus on teaching and learning rather than on hardware and software. It should be designed by first considering what student teachers are expected to know and be able to do in a specific discipline, and then infusing ICTs into the learning process so that acquiring the knowledge and skills is more efficient.

Second, professional development is practically useless unless leaders and teacher educators are provided with access to technology resources and have the time and support—when needed—to apply the new knowledge and skills that they have learned. A just-in-time approach to professional development is a model that works well. In this approach, professional development is provided to teacher educators when they have a need or opportunity to use a specific technology tool or application to enhance learning. Third, professional development in the use of ICTs is not a one-time activity. To keep current with new developments means that professional development in ICTs must be an ongoing process.

A further strategy for professional development is to start in a small way. Start by providing professional development in the use of ICTs to a small group of teaching staff. Perhaps this group will have volunteered or demonstrated that they have basic ICT competencies for personal use, or have expressed personal interest in using ICTs in their teaching. Working with this small group allows the professional development staff to determine the specific interests and needs of the teacher educators and what works best in the professional development process. Based on this experience, professional development may be provided to other small groups of faculty, thus expanding and refining the professional development efforts. Figure 5.1 shows a group of student teachers working on group project in such a model.

The most important criterion for effective professional development is to tailor it to the learning needs and skill levels of individual teaching staff within a faculty. This suggests that, ideally, an institution should, based on availability of resources, provide a variety of options for professional development for the faculty. In structuring professional development options and resources, it is helpful to explore collaboration opportunities with partners outside the university.

The opportunities for ICTs to create new paradigms of teaching and learning will depend largely on leadership and a shared vision, and on appropriate and continuing professional development.
The planning and implementation of ICT-related professional development of teacher educators should be led by a planning group that includes representation and expertise from teacher educators, programme administrators, teachers, school administrators, technology experts, and business leaders. The diverse perspectives of the group should provide an understanding of the realities of the classroom, new views of the teaching-learning process, knowledge of the array of technologies that may be used to enhance learning, and community opinions. It is important for a planning group to negotiate a shared understanding of the role of ICTs in the agenda for educational renewal based on their individual cares and concerns (as described in Section VII on managing change through use of the CREATeR model). It is also helpful to have a larger advisory or liaison group that may facilitate collaborative professional development efforts and sharing of resources across related organizations, for example, between the university and the partner schools where students are placed for teaching practice.
NEW APPROACHES TO TEACHING, LEARNING, AND ASSESSMENT

An important aspect of professional development is not only enabling teacher educators to understand and use ICT tools in their teaching practices, but understanding how technology coupled with new approaches to teaching and learning, may enhance student learning. Many teacher educators recognize that approaches to education are changing and that new technology has the potential to improve education and student learning. They may also recognize the implications of increasing use of technology in society and employment, including employment directly related to their own disciplines and content areas. Less obvious are the implications for literacy and numeracy at the core of the educational process, and the need for teacher educators themselves to model good practice in their teaching so that their students can easily transfer these strategies into their own teaching practice. Teacher educators are experts in a domain, and it is important to respect this domain while helping them to revitalize and modernize their teaching with ICTs. The principles that this document espouses for the curriculum and professional development of teachers become even more relevant when applied to teacher educators. Similarly, the risk that established teacher educators must take to develop their practice needs to be recognized and mitigated as much as possible.

The most significant change required of individuals and organizations providing teacher education is to redefine student roles and responsibilities (as discussed in Section I). This is referred to as student-centred learning, and in the context of teacher education means that control of the teaching-learning process must move away from the teacher educator to the student of teaching. Both students and teachers have always had rights and responsibilities, but the redefinition of the learning environment requires a change in the balance of rights and responsibilities, with the student assuming more of both. ICTs demand this shift because technologies are constantly changing. Students need to develop the ability to think for themselves, continually learn as technologies change, and provide support to one another. This last element, peer teaching, is a natural product of ICTs because often the younger generations bring increasingly high levels of competence into the learning environment. This is a positive shift, and it should be noted that these strategies (learning from peer support and reciprocal mentoring between teacher and learner) are also appropriate for competencies that do not involve ICTs.
STAGES OF PROFESSIONAL DEVELOPMENT FOR ICTs

Teachers and teacher educators develop ICT competence in stages. Those who are fluent with technology may not appreciate how difficult it is for technology novices to appropriate ICTs into their professional practice. Teacher educators often find this task even more difficult than teachers do, because they typically have higher levels of content and pedagogical expertise that must be respected. Teacher educators, because they have to work in multiple contexts—both the home institution and the field where students are placed to observe and practice teaching—may also be more influenced by the absence of the essential conditions for ICTs in teacher education (described in Section IV).

Four stages are common, but they may be repeated with new forms of ICTs or applications of ICTs to new areas. The first stage for each individual is awareness, and the appropriate response at this stage is to provide information about a relevant application of ICTs and appropriate ways that it may be used in the individual’s current professional or personal concerns. Please note the learner-centred nature of this approach; the concerns are not those of the supporter (the ICT expert) or the organization, but of the individual teacher educator. Teacher educators then explore the use of the application. They need support to put this ICT application into practice in a timely manner and to reflect on its effectiveness. Only after teacher educators have gone through these stages are they able to adapt their practice to make better use of ICTs, and then move toward the final stage to become innovators and modellers of excellent practice for their students and colleagues. (These stages are described in the Concerns-Based Adoption Model, CBAM, and confirmed in ICT specific research, such as the Apple Classroom of Tomorrow described in Section VII, Managing Change.)

The advent of ICTs provides the opportunity to engage in this process from a new perspective and to model processes of learning for colleagues and students. It is acceptable for teacher educators to adopt only those aspects of ICTs that are relevant to their practice, but they must first be allowed to explore the range of possibilities, so that they and their students may become critically aware of, and competent in, diverse ICT applications. Of course, any teacher educators continually strive to be responsive to developments and innovations in education within and beyond their discipline.
CASE STUDIES

To understand the strategies of professional development it is important to understand how they are embedded in the broader context of the planning and implementation of ICTs in teacher education. The following section provides eight case studies. These illustrate an eclectic range of strategies. The first four case studies focus on strategies for individual teacher educators and their organizations. The second four include strategies for building capacity for ICT teacher education across regions and nations.

Each case study is analyzed by use of the framework for ICTs in teacher education illustrated in Figure 2.1. This holistic framework is used to understand the complex interaction of the professional development process. Teacher educators need to develop competence in the core themes of: pedagogy, collaboration and networking, technical competence, and social issues. This needs to be done within the local and global cultural contexts of: lifelong learning, leadership and vision, and planning and management of change.

Strategically Supported Workshops

A growing number of pre-service teacher education programmes in the USA have employed the ISTE technology standards, and ISTE describes the best of these programmes on the ISTE web site. One such programme was initiated at the University of Texas at Austin, where the teacher educators expert in ICTs have actively planned and promoted the professional development of their colleagues and facilitated the management of change. The culture is one in which all participants respect the leadership and vision provided by the dean and the college’s technology support centre. The current programme evolved from the experiences gained in working with the teacher education faculty. It underscores the importance of learning from the mistakes, as well as the successes, in implementing professional development. For example, a faculty development workshop was held to teach faculty to use a tool to incorporate web-based elements into their teaching. An initial training session was offered that provided the faculty with an extensive demonstration of the full range of capabilities of the tool. The faculty participants left the two-hour session with cognitive overload and little that they could immediately apply to their courses.

Based on this experience, another workshop was designed that focused on a few useful applications that faculty could incorporate into their instruction. The teacher educators were asked to bring class syllabi and selected course resources
to the workshop. The teacher educators learned how to post these materials online in WebCT and set up online class discussions. After the teacher educators had time to see how this worked in practice with their students, a second workshop was provided to help them consider appropriate ways to facilitate collaboration and networking, along with the social issues that might arise in using these methods. These redesigned workshops were highly successful and led to ongoing faculty development.

This effort was successful because this strategy permitted the teacher educators to gain new information about the software within a pedagogical approach that addressed their immediate concerns, and allowed them to pilot the approach and evaluate their efforts. A similar strategy works for other widely used software application tools, such as word processing and desktop publishing.

**Reciprocal Mentoring**

Professional development for ICTs in teacher education is ongoing, as denoted by the theme of lifelong learning in Figure 2.1. Successful models for professional development must reflect this dynamic nature by building capacity rather than teaching skills. Reciprocal mentoring is an example of a professional development model that builds capacity within an organization.

Iowa State University has an award-winning programme of teacher education and supports this excellence by providing professional development in ICTs for its teacher educators and the in-service teachers who work with students. Over a decade ago, the course Technology and Teacher Education was established to provide graduate students with an internship experience. Many of these students become teacher educators who are expert in ICTs. These students mentored teacher educators in ICT skills and, in return, the teacher educators mentored the students in their profession. The graduate students’ advisor, who strategically selected or negotiated the participation of teacher educators, facilitated and planned the interaction. Over the years, the balance moved from encouragement of reluctant teacher educators to participate, to the strategic choice of participants from a long list of volunteers. Similarly, the context and culture became increasingly akin to a sociable family that supports one another; an organization in which members learn from one another while collaborating and networking.

The mentoring course takes place in the fall semester. During weekly meetings, the graduate students learn about mentoring and a variety of approaches to infusing
technology into education. These meetings foster collaboration and networking among the graduate students, lend moral support, provide opportunities for the development of technical skills, and engage students with relevant literature. Each student also meets with his or her teacher educator mentee weekly and responds to their needs at an appropriate pace.

In the early stages of this process, many teacher educators develop confidence with ICTs very slowly, often starting with word processing of scholarly work or with the creation of slides using software. Technical competence is purposefully developed slowly, to keep pace with the emerging confidence and autonomy levels of the teacher educator. The graduate students’ advisor insists that mentoring graduate students assist the teacher educator to engage with ICTs, rather than allow the teacher educator to delegate the ICT tasks to the student mentor. ICT applications used in instruction are favoured over those for research, so that the mentoring graduate student can support and experience the development of pedagogic competence. The mentor pairs are expected to engage in many rich conversations as they work together, covering diverse themes and competencies, including social issues with ICTs and discipline specific topics.

Toward the end of the semester, the teacher educators join the mentors’ class for a celebration of their collaborative professional and course development. At this time the teacher educators are exposed to a wide range of ICT applications, cultures, and contexts, and reflect on the four themes and competencies. The graduate students’ advisor also reflects on the programme’s success in reaching department and university goals and gains new ideas for future planning. This model has been extremely successful, as measured by increased faculty competence in the use of technology and by the attitudes of graduate students and faculty. It has been adapted to various settings, including those in which undergraduate students are the mentors.

International Technology Transfer

Occasionally opportunities for collaborative projects are stimulated by requests for technology transfer proposals. This case study is of one such opportunity provided by the European Commission, which offered funding for faculty development to countries in Central and Eastern Europe (European Commission Telematics Programme, 2002). This case study illustrates the importance of considering all the elements presented in Figure 2.1 in designing and realizing ICT projects.
The MATEN (Multimedia Applications for Telematic Educational Networks) project provided technical and pedagogical support to countries in Central and Eastern Europe. It researched ways in which information and communication technologies affect instructional design in this region and the ways existing patterns of social interaction in education are shaping the evolution of software engineering (Multimedia Applications for Telematic Educational Networks, 2002).

The project provided funding for infrastructure to universities in Ukraine, Lithuania, and Russia, and provided support to encourage retention of faculty and teachers in countries in transition. Because of the project, they were able "to expand the Flexible Distance Learning Systems (FDLS) model to describe possible applications of different multimedia in curriculum and courseware design" (Multimedia Applications for Telematic Educational Networks, 2002). Two courses particularly relevant to this discussion are a course in ICTs for teachers in the former Soviet Union led by the Ukrainian Institute of Cybernetics in Kiev and a course at Kaunis University of Technology in Lithuania. The first stage of the course development took two years, followed by an additional contract to update and improve the courses with multimedia. This process set up the infrastructure and provided tailored ICT teacher education to the teacher educators who developed the first courses.

Rather than address the participants' stage of development, the project first took a more direct approach, with an assumption that content and technology could be simply linguistically translated for delivery. The participants, at an early stage in the professional development sequence, experienced more stress than success during these early days of the project. This demonstrated the need to carefully consider all elements of the framework in Figure 2.1 when inviting and judging proposals for ICT transfer into new educational contexts, in addition to considering the support for hardware, software, and related infrastructure.

The teacher educator participants had little experience of ICTs and were largely uninformed about recent pedagogical approaches, so their teaching tended to rely on textbooks and highly structured exercises. For this reason, a technology transfer course was created to enable the teacher educators to create a course suited to their own context and culture. A team developed the courses, and included teacher educators and ICT faculty from universities in these three countries as well as project staff.

This strategy permitted international experts to model appropriate pedagogic approaches, including collaboration and networking. The technology
A转移课程是建立在英国一所大学的在线ITC硕士课程之上的，该课程通过互联网提供给在职教师。这个在线学习环境随着时间的推移而适应，以满足目标教师教育者的需求。教师教育者被帮助发展自己的教学技能，因为他们创建的内容将ITC置于他们所在地区学校和大学的背景和文化中。完成高质量工作的教师从英国大学获得证书。这一证书激励了他们，并提供了一种质量保证的形式。

虽然远程学习构成了这一项目的中心，但现场ITC教师为教师教育者同事提供培训，以提高技术能力，并处理出现的技术问题。这方面的支持对教师教育者来说至关重要，因为他们经历了发展的各个阶段。现场的ITC教师也创建了技术课程材料，这些材料被用于教师教育者的课程。

这个项目还说明了设计ITC教师专业发展时需要考虑社会问题。由于教师教育者的低地位，很难获得良好的ITC访问。这导致了他们作为ITC新手所经历的压力，并可能影响了参与者的退学。其他与社会问题相关的问题在框架中也出现了，包括对版权和知识产权的反复关注。

MATEN是一个复杂且雄心勃勃的项目。项目人员提供了规划和管理变革的愿景和领导力支持。由乌克兰教师教育者进行的传播活动将这些活动推广到整个前苏联地区，大量的教师从中受益。这些成功，尽管显著，可以通过使过程更透明来改进。那些对ITC不熟悉的新手。

MirandaNet: A Community of Practice

区域和国际合作可以为那些在教师教育中使用ITC的同行提供持续的指导和支持。一个典型的社区是MirandaNet，它在英国为教师教育者和ITC领导者开发了第一个社区（MirandaNet，2002）。这是一个非营利组织，更类似于专业协会而不是培训机构或机构。它与技术公司合作并获得了他们的支持。
in the development of ICTs in teacher education. MirandaNet builds communities of educator volunteers to develop educational use of ICTs in their own practice and that of colleagues. They do this through the sharing of information and resources, and discussions on the Internet. Social events provide face-to-face meetings that are also extremely important in developing the community spirit.

Communities in the Czech Republic and Chile have been created with support from the community in the UK, and the creation of a new community in China is currently being explored. Partnerships between MirandaNet and commercial ICT companies support the development of these communities. For example, Compaq supports selected teachers with personal portable computers and Oracle provides a free and safe Internet site for children and their teachers in the UK and the USA, with both English and Spanish interfaces.

All of the teachers and teacher educators who take part in the MirandaNet community demonstrate a commitment to lifelong learning, and they discuss the four themes and four competencies in the framework presented in Figure 2.1. As an example of the communication that occurs among project participants, the email list for MirandaNet in the UK is currently discussing ‘Interactive whiteboards’. The question came from a member of the community (a teacher coordinating ICTs in a high school) who wanted recommendations on the hardware (technical issues), its placement (social issues) and the pedagogic applications for schools and ICT teacher education. The responses sent via the email list provide answers from a range of viewpoints, and the discussion also touches upon issues of safety and the management of change. The community also provided web sites for further information and invited colleagues to their organization to see a whiteboard’s use. This collaborative network of teachers is modelling lifelong learning within a community of learners.

The members in the Czech Republic and Chile did not join in this particular discussion, because this item is rarely within their resources. They engage in discussions on topics more relevant to their needs and practices, such as ways to adjust foreign computers and software to local contexts. Such collaborative problem solving is important to many ICT teacher educators who have relatively little access to technical support or opportunities to view new developments. Visits between countries have strengthened community members. The exchange of information is two-way, as it flows from the wealthy to the less well-resourced and back again. All educational systems need more ICTs, and the resourcefulness of colleagues in challenging situations inspires all to better education. In addition, the inter-cultural education that takes place dramatically increases the quality of collaboration and networking.
Planning Professional Development for Regions and Countries

A number of states and regions have engaged in a renewal of education. Part of their strategy includes ICTs as a catalyst. However, ICT use is not, in itself, a useful goal. According to a study by the Organization for Economic Co-Operation and Development (OECD) (in preparation), ICTs can be viewed as neutral, i.e., they may support both effective and ineffective education. Effective plans must include strategic objectives and educational vision to inform the use of ICTs for educational renewal. Leadership and vision are an even more important theme at this transformative level of ICT use in teacher education.

Below is an eclectic mix of illustrations to inform professional development planning at the regional and national levels. The framework is used to analyze the mix of themes and competencies that may be developed by particular strategies at the regional, national and international level.

Collaborative Action Research for ICTs in Pre-service Teacher Education

Project InTent was the first national initiative to integrate ICTs into pre-service teacher education. It took place in England between 1989 and 1992, following increasing pressure to prepare teachers before they started practising in schools (Somekh and Davis, 1997). The national association of ICT teacher educators published a survey that identified the lack of resources and support for their work. This was followed by a national commission led by Janet Trotter, a forward-thinking leader of a pre-service teacher education college. The commission’s report recommended that the government implement requirements for ICTs within pre-service teacher education curriculum.

Bridget Somekh carefully crafted a proposal. Somekh was an educational researcher with a growing reputation for supporting the development of a community for action research in education. She was also an ICT-using teacher educator, having led a regional project to build learner autonomy with microcomputers. The proposal was built on Somekh’s knowledge of the teacher education culture and context of the time. This context included individual teacher educators’ dedication to their students and their specific discipline and an increased requirement to research and publish.

This first national programme to integrate ICTs into pre-service teacher education requested proposals. Five different types of institutions in England
were selected to represent the different types of teacher education organizations. Somekh provided leadership and vision and informed the planning and management of change through an approach of action research infused throughout the project.

Each institution was granted the salary of one person for a year, plus travel funding for the institutional team to attend meetings of the consortium each term for two years. Each leader, normally the dean, was required to attend these consortium retreats along with the ICT teacher educators. Periodic visits to each organization by the coordinator provided her opportunities to act both as a leader and a mentor for all ICT teacher educators.

An inclusive learning community developed that supported the adoption of a participative action research approach by all project participants and other stakeholders. The project established and published a special journal series called 'Developing information technology in teacher education.' In this way, the project adopted a collaborative networking approach to organizational development to integrate ICTs into teacher education, and the five institutions reinforced each other’s commitment to serve the pedagogic needs of all their colleagues, regardless of discipline or approach to content. There was never any doubt of the aim: colleagues modelling excellent practice with ICTs as they taught methods and content-specific topics. The consortium worked through technical and social issues while integrating ICTs into courses for pre-service teachers, and they supported action research analysis of their own and their colleagues’ professional development while planning and managing change.

One particularly innovative approach to support transfer into school-based practice was to bring an elementary class into the primary base at one of the universities. This practice teaching was intensively supported with lectures, equipment, software, and technical support. All the teacher educators and support staff received ICT professional development to facilitate a rich environment of good educational practice. Students were able to practice teaching in pairs with a group of four children. This strategy may be particularly appropriate at early stages of ICT adoption in a region where there are few resources and little ICT practice in local schools.

The national agency and the national professional association supported the dissemination of the project through presentations at conferences and special one-day workshops, journals, and the publication of the final report. In addition to the final report, a series of work cards were produced for specific audiences: deans and department heads, teacher educators, and ICT teacher educators.
They included guidance, quotes from participants, and references to further reading, especially to articles within the special journal. A book on using ICTs effectively in in-service and pre-service teacher education was also edited and published (Somekh and Davis, 1997) and became widely used, especially within graduate courses for ICTs in education.

This first national initiative included all parts of the proposed framework (Figure 2.1), although the focus was on pedagogy. Lifelong learning was modelled through the Action Research approach, which also provided a sensitive approach to the planning and the management of change. The design of project InTent was congruent with the context and culture of the time, reflecting the recent government legislation mandate for ICTs and the increasing demands for research and publication. Participants were carefully supported to develop their research and writing as well as to facilitate change. All four ICT competencies were developed in participants and passed on to colleagues. The project addressed technical issues by providing professional development for the supporting technicians and establishing a mandatory introductory course for all pre-service students. The course was taught in content and phase specific groups so that appropriate and pedagogically transferable illustrations could be used and practiced by the students before they used them in the field.

The use of action research accelerated the organizational change in this project, as participants at all levels gathered and analyzed data and reflected on the results. The new government requirement for ICTs in pre-service teacher education provided ample justification for change and an argument for expanding resources in teacher education. The national project leader contributed to institutional development through her research of organizational change, informed by structured interviews of strategically important people. This gathering of evidence was both action and research, because the act of interviewing prompted these people to reflect on ICTs and their place in their organization. It also raised awareness and reflection upon the importance of ICTs in pre-service teacher education and in society.

PT3: A Federal Capacity Building Approach for the USA

In 1999, educators and policy-makers in the United States recognized the growing crisis in teacher retention and recruitment. The need to develop capacity for ICTs in teacher education within universities and colleges was informed by several research studies in teacher education, undertaken by leading ICT teacher educators with support of their professional societies (U.S. Congress Office of
Technology Assessment, 1995). It became clear that the improvement of pre-service teacher education would be an effective use of resources, particularly at a time when schools were losing a high percentage of teachers within five years (over 60% in many regions). A federal programme called *Preparing Tomorrow’s Teachers to Use Technology* (PT3, 2001) was established under the leadership of Tom Carroll, a cultural anthropologist with experience in government agencies, including negotiation of the Erate to provide more equitable access to the Internet for poorly resourced schools. Carroll brought together an advisory group of leading ICT teacher educators so that he could better understand the context and culture of their work. Together they developed a national initiative that would build capacity for ICTs teacher education, particularly pre-service teacher education.

The call for proposals the first year announced three types of grant:

- Capacity building
- Implementation
- Catalyst

Capacity building grants provided funding to plan for change, thus increasing the readiness of universities. This category was supported only during the first year of the initiative. Implementation grants supported such projects as the development of models for the exemplary use of ICTs by teacher educators and faculty in colleges of education, in other colleges where students take courses, and in the field experiences of students. Complementary funding was provided in many ways, often through vendors’ discounted hardware and software prices, and contributions of time and expertise from within and beyond the universities (partner schools that host practice teaching and the regional agencies for education). The strategy of shared funding required the participants to gain the support of each organization’s leadership.

Catalyst grants provided resources to initiatives that were already using ICTs in innovative ways to enable them to share their expertise in building capacity across a large geographic area. Some of the catalyst projects developed high-quality resources to support the infusion of ICTs into teacher education, such as multimedia case studies of ICTs in schools and universities, and software to assist reflective practice, many of which can be accessed on the Internet. Another important catalyst project is development of a digital equity toolkit, which is a growing web site of resources to promote access to ICTs and teaching with intercultural sensitivity (http://www.digital-equity.org). The PT3 project that is a national technology leadership initiative (NTLI) aims to develop multiple voices and ownership of the ICT curriculum as it is inter-
The PT3 programme has built regional and national capacity for the planning and managing of change for ICTs in teacher education. Each project was directed to spend at least 20% on evaluation, with an emphasis on evidence to inform the development of the project and provision of summative reports. The leaders of PT3 recognized that organizations needed to learn about the essential conditions for change in their organization and to engineer these conditions (see Sections III and V). Similarly, at the start, many projects were unaware that individual teacher educators were often at an early stage of concern for ICTs.

PT3 leadership formed a national group of evaluators to analyze the changing national picture. Activities have been initiated to develop evaluators’ appreciation of systemic change in education. Annual meetings of the PT3 projects provide a community of shared professional development for evaluators of ICTs in teacher education and an opportunity for all project leaders to benefit from ongoing research and evaluation through communication and networking.

The PT3 programme as a national initiative addresses all aspects of the proposed framework (Figure 2.1). Each implementation project targets the development of the four ICT competencies and the catalyst projects support these efforts with additional expertise and resources. For example, one of the catalyst projects is a national centre that promotes collaboration among all major ICT professional society for teachers (International Society for Technology in Education, 2002). This initiative is strongly correlated to the four surrounding themes of the framework. The initiative is embedded in national and local cultures and contexts, with commitment to addressing digital equity, developing capacity for leadership and vision, and for planning and managing change.

**South Africa: Building Capacity of an Educational Agency**

South Africa, following the break-up of apartheid, provides many challenges for education and an inclusive society. This case study describes a SchoolNet programme established to support educational renewal in some the most challenged
schools in the country. These schools were not closely linked with existing institutions of teacher education; therefore, this case illustrates the establishment of a new agency for reform, rather than the development of ICTs within existing teacher education.

Gerald Roos, an expert ICT teacher educator, created the programme. He had been involved in a variety of ICT initiatives in South Africa and understood the context and culture of teacher education. The SchoolNet programme aims to renew education in rural and minority contexts with multiple African languages and cultures, in a way that will result in long-term benefits for lifelong learners who will become valuable information-literate members of a global community. The context is also of continuing dramatic loss of teachers, influenced both by the upheaval of a society in transition and the AIDS epidemic. The strategy uses the strengths of the Internet to promote ongoing support for teachers to become ICT teacher educators for one another through a mentoring process, facilitated by the central team and external volunteer experts.

The first stage of the programme improved the conditions for successful change. The core team in the agency that was established carefully set a foundation for educational renewal through ICTs. A project website provided a literature review of successful research into ICT teacher training (Educator Development for ICT, 2002). The review was also used to inform policy makers and other stakeholders, including potential participants. Two new strategic documents were also created:

- Key principles of educator development programmers
- Educational strategy for educator development for ICTs (2002).

In the second stage of the project, schools were invited to propose projects for selection and coordination by the agency. The proposals provided the local cultural context and addressed the pedagogical objectives. The agency strategy provided the support to overcome technical issues and to establish collaboration and networking for these geographically separated teachers. Two-day workshops were an important induction stage for these novice teachers and ICT teacher educators, but, as one of the principles states, workshops alone are not sufficient for sustainable outcomes. Those training the mentors addressed a hierarchy of needs, starting with the lowest and ending with the highest, as follows: emotions, technical issues, learning strategies, collaborative planning and mentor. Potential ICT mentors were taken through stages of development in a way that permitted them to reflect on their own ICT professional development, to build their capacity for the mentoring of colleagues. The training took place over the Internet,
supplemented by occasional workshops. Expert mentors from other regions and countries also joined in to support ICT teacher educators in the online community, facilitated and coordinated by the regional agency.

This regional agency continues to play an important role in facilitating digital equity in South Africa by spreading ICT teacher education, informing related policy, and sharing information with local, regional, national and international communities.

Chile: A Model National Strategy Responsive to Culture and Context

The final example comes from Chile, a nation with many economic challenges that has used ICTs to accelerate educational reform. The national ICT initiative is called Enlaces. In common with all of the cited examples of good practice, the design was informed and led by ICT experts, and in this case, the team came from a leading university centre, the Instituto de Informatica Educativa of the Universidad de La Frontera. The centre conceived the initiative and has played a central role in the development of the Enlaces programme since 1993. In conjunction with the Ministry of Education, it is responsible for the national coordination of the Enlaces Educational Network. The Institute also conducts research and development activities to support the use of information and communication technology in the network’s schools. The centre was informed by scholarly research in this area, and at least one of the ICT teacher educators undertook a doctoral degree on this topic with leading experts in the University of London Institute of Education. To inform early stages of development and ongoing evaluation the Enlaces initiative drew on a wide range of international consultants in ICTs in education, as well as this close doctoral level supervision (Gobierno de Chile Ministero de Educacion, 2002).

The majority of ICT teacher educators in Enlaces were drawn from 24 universities, which became known as the Technical Assistance Network. This network was built upon a strategic alliance between the Ministry of Education and universities across the country. The Technical Assistance Network’s mission was to train teachers and provide them with technical and educational support. Six universities, designated as Regional Centres, served as coordinators, managing Enlaces activities and teacher training in a particular geographical area of the country. They also carried out applied research in the field of educational ICTs. Eighteen universities, called Implementing Units, provided training within sub-zones under the supervision of a Regional Centre.
GOALS AND PRINCIPLES OF THE ENLACES PROGRAMME

One of the fundamental premises of the Enlaces programme was that merely supplying information technology to schools is not enough to bring about significant changes in the quality of education. Although ICTs can potentially simplify and enhance the learning process in all subject areas and in some cases act as a catalyst for innovation, additional efforts such as teacher training and support – must be done in order to produce sustainable changes in pedagogical practices and student learning outcomes.

The following principles guided the definition of overall strategies:

- Information and communication technologies are tools to be used by all participants in the educational process: students, teachers, school administrators, parents, and sponsors; thus, great emphasis was placed on teacher training and the development of a technical assistance network. The notions that learning computer skills is an end in itself and only experts can use ICTs were rejected.

- The goal is to not only equip schools with computers, but also to connect them with each other and the world through an educational network, thus enabling schools to exchange ideas and experiences regardless of their location. This goal also addresses one of the Chilean Educational Reform’s key objectives: increasing equity in educational opportunity for all Chilean students.

- No single formula can be applied uniformly to all schools, and the uses to which computers and networks are put will depend upon each school’s educational projects, needs, and social, cultural, and geographical environment.

These considerations, combined with the enthusiasm and initiative of teachers, administrators and students across the country, have often led to surprising results, with broader and deeper implications than those foreseen by the programme.

Enlaces reached 100% of the secondary schools and 50% of the primary schools by 2000 (7 years), thus covering 90% of the school population. Within this group, Enlaces created an advanced group of ICT-using teachers in 51 schools from different areas of the country. The schools provided local reference sites to demonstrate ICT practice embedded in the local context and culture. Enlaces equipped these schools with more computers, technical support, and pedagogical assistance than the regular schools, with the expectation that they would
become field-based ICT teacher education sites. As a result, these schools formed the core of the collaborative professional development activities that occurred through the Internet. The leading ICT teachers and teacher educators also received international collaborative support from the MirandaNet community of practice, as discussed in the case study.

ENLACES’ KEY STRATEGIES

The following were key strategic elements of the Enlaces plan to infuse ICTs into teacher education and throughout the educational system:

- **Teacher Training and Support**
  The teacher training strategy in Enlaces includes three different initiatives:
  
  Initial training over one year helps educators incorporate educational information technology into all aspects their teaching, with special training for one or more Enlaces coordinators per school.
  
  Follow-up technical assistance allows the schools to continue the active incorporation of educational technology into their educational projects and to develop greater autonomy in this area.
  
  Educational Information Technology Encounters encourage teachers to exchange experiences and to keep abreast of each other’s practices. Students can observe the achievements of their peers in other schools, and the community gains a greater appreciation for the use of technological resources in its schools.

- **National Support Infrastructure**
  The Technical Assistance Network was built upon a strategic alliance between the Ministry of Education and universities across the country, with a mission to train teachers and provide them technical and educational support. Twenty-four universities provided national coordinating centres to support six regional centres and eighteen implementation zones.

- **La Plaza: A Non-Intimidating Computer-User Interface**
  La Plaza software was created to provide friendly access and a familiar interface to computers. The metaphor is a familiar market square where the images act as icons for each application. For example, clicking on the image of the post office gives access to electronic mail. The software was used to provide a non-intimidating first encounter with
ICT technology. It was particularly successful in reducing teachers’ anxiety toward a technology perceived as difficult.

- **Private Sector Support**
  The development of the *Enlaces* network required support from the school communities themselves and from the private sector. Expanding the number of computer rooms, acquiring new educational software, servicing equipment, buying necessary supplies and providing Internet connections are ongoing challenges demanding hard work and commitment from the whole community.

  Telephone companies in Chile donated telephone lines and unlimited Internet connections to the great majority of the country’s primary and secondary schools. In addition, the companies provided free e-mail accounts to all Chilean teachers and students. Numerous primary and secondary schools would not have been able to construct the computer rooms or upgrade computer infrastructure to join the *Enlaces* programme without donations from private companies and contributions from the school communities themselves.

- **Formative and Summative Evaluation**
  The results of various evaluations of the *Enlaces* programme between 1993 and 1999 on the impact of ICTs on the educational system showed that there was growth in students’ creativity, capacity for gaining knowledge about the world, and reading comprehension levels. Changes in learning levels in the area of mathematics could not be established.

  Descriptive evaluation showed that ICTs sparked a high level of motivation among students, produced a more horizontal social organization within the classroom, and made students feel proud of their participation in projects, with a corresponding increase in self-esteem. The evaluations also indicated an increase in teachers’ managerial roles and improvements in the internal climate at schools. Furthermore, external evaluations showed that many of the teachers believed that communications via computers in their classes had improved the quality of the teaching-learning process. Two major challenges revealed by these evaluations are the need to supply schools with more computers and a greater variety of educational software, and the concern among teachers about their heavy unpaid workload.

  The participating schools gained greater prestige in their communities, which translated into increases in enrolment (increased income
via larger subsidies). School officials also valued the increase in equity that occurred as a result of the project’s providing equipment that schools otherwise would not have been able to acquire and the country-wide spread of free access to Internet resources. The project also produced improvements in parents’ perception of their schools’ performances, which facilitates the learning and teaching process.

From a more global perspective, the evaluations made by the World Bank and the Agency for International Development praise the *Enlaces* project as one of the most successful programmes in Chile’s efforts at educational reform. An important point in this positive evaluation is that the project has expanded its coverage to the national level without sacrificing quality or equity. Among the factors in this success, the evaluations mention the programme’s focus on teachers, the construction of a social network of educators and pupils facilitated by user-friendly technology and decentralized support, and respect for participating schools’ autonomous decisions in the use of the programme’s technologies. The evaluations also emphasize the high quality of the project’s technical and administrative team, which has maintained a balanced mix of a clear vision, flexibility, and creativity in the face of new educational challenges and fast-changing technology.

**DISCUSSION OF ENLACES**

An important conclusion that has emerged through observations of the schools is that innovation must arise out of current pedagogical practices. Teachers are more inclined to use technology if they can relate it simply and directly to their class work and to the materials and teaching models they use.

To this end, *Enlaces* seeks to show teachers more clearly the multiple ways in which technology can be used, as much in the classroom as in extracurricular activities. The point is not to merely “do the same thing, only with computers,” although in the beginning it may seem that way. The teacher invariably perceives changes in his or her class, at least in the organization and motivation of the students. On the basis of these small initial changes and on clear evidence of the students’ improved motivation, the teacher may try out more effective strategies or adapt those of other teachers.

Another interesting observation is that, due to the comprehensive initiative of the Chilean educational reform effort, computers are acting as catalysts for other initiatives that are not directly related to ICTs. Often, in the midst of many
other programmes endeavouring to induce changes in a given school, it is the introduction of computers and telecommunications into the classroom that initiates change. This is not to say that computers by themselves are capable of causing innovation and change; however, they certainly contribute in a substantial way to support the changes envisioned by other initiatives.

The Enlaces programme continues to accept new challenges. Its achievements, combined with continuing advances in information and communications technology on a global level, have generated new goals for further expansion of educational information technology in Chile.

The project has adopted a modified cascade strategy to develop large numbers of ICT teacher educators. The central coordinating unit has led the development of workshops and materials to start the innovation, which is informed by their ongoing international research. The centre also leads software development and national negotiations to support the initiative. The regional centres modified these processes and materials to align with their contexts. They trained the teacher educators in the eighteen implementing units through workshops informed by wider teacher education activities. For example, staff conducted supportive visits to schools seeking the commitment of school leaders and an understanding of their educational objectives. Such visits proved particularly important in the early phases of the project. In late phases, facilitating the growth of online collaborative communication became an important strategy, along with ongoing support to overcome technical and policy issues as they arose.

This case study demonstrates a well-integrated approach when analyzed with the framework in Figure 2.1. The context and culture have been taken into account at each succeeding level: from international to national, then regional, local, and into individual schools. As this was developed, so were leadership and vision, and the continuing showcases and evaluations inform leadership and vision, the planning process, and the management of change. Lifelong learning, with a continuing focus on relevant pedagogy and educational objectives, was maintained within the vision, thus integrating the core competencies. Collaboration and networking were also modelled in the overall strategy.

Private Sector Initiatives in Teacher Educator Professional Development

Intel Corporation has launched an international initiative to provide professional development resources to teacher educators in several countries. The pro-
gramme is based on the Intel Teach to the Future programme begun January 2000 in the United States. The original programme provided training to in-service teachers on the integration of computer technology into teaching and learning. University faculty who worked with this in-service programme were so impressed by the quality and depth of the pedagogy and materials that they worked with Intel to develop a version of the programme that can be used at the university level with pre-service teachers.

Since then, the materials and curricula have been adapted to thirteen different languages including Spanish, Portuguese, English (British and US), Chinese, Hindi, Japanese, Korean, Urdu (Pakistan), German, Polish, Hebrew, and Russian. As a result, the programme is currently used in teacher preparation programmes in Argentina, Brazil, Canada, China, Costa Rica, Germany, India, Ireland, Italy, Mexico, Taiwan, United Kingdom, and the United States. There are plans to use Intel Teach to the Future in eleven additional countries within the next two years.


PHILOSOPHY

The ultimate goal of the Intel Teach to the Future programme is to engage elementary and secondary students in culturally and pedagogically appropriate learning experiences that are enhanced by using computers. "The core focus of this curriculum is to ensure that technology is used successfully to improve student learning." Teachers are guided to develop face-to-face, student-centred activities that model effective use of technology for teaching and learning. Faculty members who participate in this programme are recognized as curriculum experts. This programme helps them thoughtfully integrate their pedagogical expertise with computer technology.

DESCRIPTION

The Intel Teach to the Future pre-service curricula are designed so that teacher educators and pre-service teachers can use it in a variety of learning Settings. Materials include paper and digital (CD-ROM) resources as well as Web support. Participants learn to use and integrate all three types of resources in their teaching and learning.
Topics covered include:

- Developing and teaching technology-enhanced curricula
- Locating and evaluating web resources
- Copyright and citing of sources
- Designing and creating multimedia presentations, desktop-published products, and web sites
- Designing and creating teacher support materials
- Developing plans for project implementation
- Project development and assessment

Pre-service teachers learn to develop project plans, materials, and examples of student-created materials and presentations. For many teachers this involves a shift in approach from lecturer and expert to facilitator and learner. Examples created by participants are included with programme materials to assist other pre-service teachers as they develop their own plans and resources. Participants are encouraged to adapt these examples so that they reflect their knowledge of their own cultures. As local teachers develop new examples, they are added to the resource packet for their specific country. This adds relevance and role modelling, and encourages collaboration among pre-service teachers, their colleagues, and university faculty.

**APPROACHES**

As they progress through the programme, pre-service teachers build on their existing technology skills, developing them as they develop their curricula. The central focus of this curricular approach is project planning. Working with a professor, who serves as facilitator, pre-service teachers develop project plans for elementary and secondary students that emphasize active learning and collaboration. Teachers are encouraged to develop learning activities that take advantage of the unique aspects of computer-based learning, such as creating interactive multimedia presentations and publications.

Using this approach, pre-service teachers are developing their own technology skills in an embedded and relevant way. For example, a pre-service teacher completing the programme will have achieved 85% of the skills required for the European Computer Driving License, but will have learned these skills as they relate to teaching and learning in the elementary and secondary classroom. They
draw on their knowledge of their culture, language and curriculum to make sure that these activities are culturally appropriate and fit the overall goals of their education system.

**HOW IT IS USED**

One of the key elements of this programme is the view of faculty as curriculum experts. Participants begin by learning how to use the computer applications they will integrate into their programme plans. Then they identify a subject or concept they plan to teach and develop a project plan that integrates the use of computer technology. By starting with a topic they are familiar with, participants are better able to focus on identifying and developing resources and activities that serve as models of engaging learning activities for children. This familiarity leads to greater success and understanding of both technology and programme planning.

As they develop their project plans, participants also develop the curriculum materials they will need to teach their lessons, resources that their students will use, and model examples of the projects their students will be creating. This provides faculty and pre-service teachers authentic experiences using technology and helps them better understand the processes and challenges their students will encounter when implementing their projects. Throughout this experience, participants share their ideas and plans, discuss how they will assess student learning, and develop alternate activities so that their lessons can be used with a variety of students and settings. This reflective approach to teaching and learning further assures that pre-service teachers enter the classroom with the knowledge and skills needed to successfully integrate technology into culturally appropriate learning activities.

The modular approach of this curriculum allows teacher education faculty to adapt it to their specific university programme. The full curriculum could be embedded in a single course, spread out over several courses, integrated into internship experiences, or some combination of all these. To provide the greatest benefit, faculty who use this curriculum should be teacher education faculty who model the effective use of technology for teaching and learning as they teach the pedagogy of subjects. This helps pre-service teachers make the cognitive connections they need to further understand the teaching and learning process, and gives them the knowledge and skills they need to be effective educational leaders in their classrooms and schools.
KEY LESSONS LEARNED

The following lessons learned are congruent with the framework in Figure 2.1 and may be helpful to other private sector or international organizations interested in providing professional development programmes or resources to universities or educational systems in other countries:

Infrastructure: Don’t wait for it to be perfect—press on with what you have and make the most of it.

It is important to prepare teachers who can take advantage of new technologies as they become available. One of the biggest challenges to this is the lack of infrastructure and connectivity to support teaching and learning with computer technology. However, as the price of technology drops and schools begin to invest in computers, those challenges are beginning to disappear. Because the curriculum is adaptable, teachers are able to immediately use resources they do have, and implement the project plans that they develop. This allows them to effectively use the resources that are currently available to them, while gaining an awareness of the newer technologies that will soon be available. As a result, these teachers often become advocates for change and leaders within their own schools and programmes.

Policies: Universities and Ministries of Education must work together for change.

In some countries the responsibility for preparing new teachers lies outside the Ministry of Education, creating a barrier for implementing change throughout an educational system. Despite this, Ministries of Education have indirect power over universities and can influence teacher education curricula. The Ministry often decides who gets hired, what skills new teachers should have, and where new teachers will work. By providing this curriculum as a model, Ministries of Education can help guide the preparation of technology-using educators and assure that all the children in their country have the benefit of technology-enhanced curricula that have been adapted to fit their language and culture.

Systemic Change: University faculty are critical to improving the system.

It is often difficult to get support for change from all university faculty. They tend to be the most critical, understanding the implications of change and showing concern for honesty and account-ability. They
also tend to be good leaders for teachers in elementary and secondary schools, and share their insights through scholarly writing. By focusing on faculty who adapt and adopt this change to teaching and learning, universities and Ministries of Education can successfully implement change while maintaining a healthy scepticism that assures new curricula are culturally appropriate. When teachers adapt and adopt this curriculum they, too, become advocates who help promote systemic change.

**Online Content:** Teachers and students can be important developers of good educational content.

Providing students with high quality Internet resources in their own language has been a problem in the past. Fortunately, non-English language sources are improving and increasing, giving teachers throughout the world the opportunity to integrate these resources into authentic learning experiences for their students. As more teachers in a country participate in this programme, the quantity and quality of online resources will increase.

**Cultural Differences:** Take materials from the US, UK and Germany and adapt them to work in other regions.

The terminology that educators use to describe the planning process varies from country to country, but the concepts are much the same. For example, the Essential Questioning technique developed by Wiggins and McTighe is often used in the United States, along with the concept of goals and objectives. No matter what terminology is used to develop a programme plan, teachers must know what they want their students to learn as a result of the experiences they are planning. Helping teachers to understand the planning process and to adapt their plans to the context of specific students will help teachers move beyond the limitations of terminology to a better overall understanding of the teaching and learning process.

**Subject:** Teachers vs ICT Teachers.

Who teaches the curriculum is also an issue. For effective integration to happen, this curriculum needs to be adopted by methods and pedagogy teachers, not just computer and technology teachers. It is not about the technology. It is about how technology supports teaching and learning.
Time for Professional Development and Training.

Faculty and teachers who participate in Intel Teach to the Future often give up their own time outside work to be a part of this programme. In doing so, they become role models for lifelong learning. This impacts all levels of learning: faculty modelling for pre-service teachers, and teachers modelling for children.

Adapt and Adopt: Make it work for specific regions.

English language and American culture are not always appropriate in other countries. It is critical that teachers have examples of curricula that are in their language and are culturally appropriate for their students learning styles. When the Intel Teach to the Future programme is first introduced into a country it comes with curriculum samples from the United States. Examples of technology enhanced programme plans that have been created by faculty and teachers in the country are added to the programme as they are created. This gives each country the opportunity to develop its own set of resources that are both developmentally and culturally appropriate. Encouraging more of a country’s educators to use this curriculum will greatly increase the resources that are available in its language and culture.

It is important for faculty and pre-service teachers to see beyond the vocabulary that describes technology and its use and move toward an understanding of the philosophical approach of using technology for teaching and learning. The Intel Teach to the Future curriculum goes beyond rote learning and challenges both teachers and students to think. If a student can answer a question by cutting and pasting a response, then it is not a good question. This programme challenges faculty and teachers to think about how children in their country and culture best learn, and develop appropriate technology-enhanced activities to assist them with the learning process.
Quality Assurance: Formative and Summative

The case studies described above had an eclectic mixture of strategies to assure quality, both within the developmental process and in summative reports. These can be categorized as academic quality assurance, common in universities and colleges, and project evaluation approaches including research. The majority of the case studies have used both of these types of quality assurance. The mix of approaches include:

- Teacher educators, both expert ICT project leaders and those receiving ICT teacher education, studying under university supervision and in courses in higher education, have the quality of their work assured through assessment and grading.

- Annual reviews, now common in higher education, assess the performance of teacher educators. Internal policies are moving to encourage the inclusion of ICT use as a criterion of quality teaching. Similarly, courses and degree programmes have associated mechanisms for quality assurance, including peer review by visiting teams of experts.

- A peer review process evaluates research, including action research, as it proceeds into academic publications.

- Formative evaluations are usually conducted by project teams and collaborating evaluators, and are particularly valuable in informing project management and for dissemination among the participants and other stakeholders.

- Funded projects at all levels—from local internal university programmes to support project leaders to international evaluations carried out on behalf of organizations such as the World Bank—are required to have summative project evaluations.

Combinations of approaches to quality assurance are also recommended. Summative and formative evaluation may be particularly successful when used together with action research. For example, a multinational European project to develop ICTs in teacher training across the European Community had evaluation activities that focused on case-based reasoning and included data collection through various instruments from all stakeholders. Wim Veen, the leader of the evaluation team, described the T3 approach to evaluation as follows:

A ‘multi-perspective illumination’ approach (Parlett and Dearden, 1977; Melton and Zimmer, 1987) was adopted focusing on the emerg-
ing new teaching practices within the participating teacher education institutions. The evaluation effort focused on:

- Formative evaluation of the development and implementation of the new teaching practices using Telematics (ICTs) within the partner universities involved, and
- Summative evaluation of outcomes and impact of the project as a whole and of the development of pedagogical approaches for Telematics learning environments. (Davis, Hawkes, Heineke and Veen, 2001, p. 52)

The variety of stakeholders who must be considered for evaluation includes those whose involvement and cooperation were necessary for the project to succeed, as well as those who are expected to use or act on the evaluation results. Different stakeholders have different questions relevant to the interest they take in the initiative. They also have different views about what is useful and feasible and how success is to be defined. For T3, the recognized stakeholders included the teacher trainers involved, the students and collaborating colleagues, and the sponsoring partners, including the funding agencies and those who provided resources in kind (time, equipment facilities etc.).

Just as the application of ICTs to teacher education must consider the culture and context, so, too, must evaluation. The development of capacity for evaluation of ICTs in teacher education was described in the PT3 case study. The T3 evaluation also started with a review of the stakeholders. It was known that expert ICT teacher educator participants would carry out their own action research, occasionally informed by doctoral degree studies. The T3 project evaluation team then adjusted their plans to focus their activities on three domains of interest:

- To improve performance by helping project partners develop mutual understanding of useful applications of Telematics at specific teacher education institutions, while identifying generic uses of Telematics in teacher education across Europe.
- To help project partners implement the results of their efforts both within their institutions and among the T3 partners. In this case, evaluation activities focused on strategies and experiences of implementation and on dissemination of results outside the project partners.
- To contribute to the overall learning process within the T3 project that would be useful for future projects and initiatives. (Davis, Hawkes, Heineke and Veen, 2001, p. 53)
Initiatives to develop ICTs in teacher education should also adopt this sensitive approach to both formative and summative evaluation. Evaluation teams should aim to involve as many of the stakeholders in the evaluation process as possible, particularly project participants, and the evaluation team should coordinate these efforts to inform project management and promote dissemination locally and to funding agencies.

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