Implementing the teacher education programme’s technology infusion plan and managing change are highly complex tasks, possibly the most challenging to face any leadership. This section provides guidance for educational leaders who want to introduce ICTs into teacher education programmes.

The first part considers the nature of innovation and change. It is followed by a consideration of who the key stakeholders are in managing change in higher education institutions. The main part of the section examines some major models or perspectives on educational change. These models, derived from studies of educational change conducted mostly in the USA and Europe over a number of decades, provide practical guidance on many aspects of managing innovation and change. The section concludes with a focus on the role of the organization’s leader in managing change, and the critical task of professional development of the academic staff who are ultimately responsible for implementing change in teacher education programmes.

THE NATURE OF INNOVATION AND CHANGE

Innovation and change are not new, of course. Good educational leaders are constantly innovating as they strive to improve teaching and learning to obtain the best educational outcomes for students. Nor is the study of innovation and change in educational contexts new, and consequently there is a rich store of studies to draw upon for guidance.

The most important concept understood about change is that change is a process. Because of the interlocking nature of teaching and learning, the intro-
duction of change in one part of an educational system has an effect on other parts, rather like throwing a stone into a pond and observing the expanding ripples. Hence, change is not a linear process but more likely a cyclical one.

Preceding sections in this document have described the impact of ICTs and the issues to address in integrating technology into teacher education. In the last decade, ICTs have begun to transform many facets of life in countries around the world-economic, social, and cultural-and their impact is now seen in many aspects of school activities. The term “re-engineering schools” has been coined to encompass the kinds of changes that the introduction of ICTs in schools leads to.

What evidence is there that ICTs have led to lasting educational change? In Europe, the Centre for Educational Research and Innovation (CERI) within the Organization for Economic Co-operation and Development (OECD) has engaged in a series of case studies in a number of countries. These case studies demonstrate that the introduction of ICTs in schools is acting as a lever for change. The evidence points to changed approaches by teachers, the introduction of different forms of assessment, increased student motivation, and better student learning outcomes. For more information, see OECD Databases (2001), an online searchable database of references to research publications on ICTs.

The subsequent parts focus on the introduction of ICTs in teacher education programmes that adopt the framework for ICTs in teacher education detailed in Section II. It is important to keep in mind that the use of ICTs in teacher education is likely to have the same far-reaching changes in teacher education faculties as the introduction of ICTs in schools, and that there are many stakeholders involved, including funding or accreditation agencies and participants such as teacher educators and student teachers.

Another lesson from the introduction of ICTs in schools is that countries are likely to progress at different rates. Largely, these stages of progress are mirrored in those organizations providing teacher education. Fluck (2000), for instance, in a paper available online, concludes from his cross-country study that there appear to be three stages through which countries progress as computers become more prevalent in education:

**Phase 1:** where students in school first use computers, and information technology becomes a curriculum choice.
Phase 2: where information and communication technologies are used transparently to enhance learning opportunities in all convenient curriculum subject areas.

Phase 3: where the universal curriculum clearly includes topics of study that would not exist without information and communication technologies, and schooling for most students no longer fits the conventional model. (Fluck, 2000, p. 2)

Similarly, countries will be at different stages in their use and experience of ICTs in teacher education.

**KEY STAKEHOLDERS IN MANAGING CHANGE**

Fullan’s writings on educational change (2001), although focused primarily on schools, help to identify the principal stakeholders in managing change. With the introduction of ICTs in teacher education faculties of higher education institutions, the seven groups of stakeholders listed below are clearly distinguishable. They need to be involved in the formative evaluation and dissemination of initiatives for ICT teacher education.

*The dean* or professor who has responsibility for managing change in the faculty, department, school or college. Other leaders may also be stakeholders if their role has an influence on teacher education.

*The teaching staff* who are most closely involved in managing change in their individual teaching topics.

*Senior administrators* within the institution who have responsibility for attracting resources so that the necessary infrastructure may be established for planned changes.

*Student teachers* who have an interest in acquiring appropriate skills and knowledge to use ICTs when they graduate and enter the teaching force.

*School teachers, ICT coordinators in schools,* and *principals,* including those who lead professional development for their colleagues and those who collaborate with field experiences for teachers in training.

*Government agencies* that set policies regarding higher education, teacher professional development and the economy.
Business and industry, which have a strong interest in the quality of graduates from higher education institutions, and as a result may sometimes be prepared to provide some of the necessary infrastructure for training facilities.

Although all seven groups of stakeholders are important in the implementation of innovation and the management of change in higher education institutions, this section focuses primarily on the first two groups: middle level managers (usually deans of colleges of teacher education) who provide leadership for innovation and change in their faculty, and the lecturers or academic teaching staff of teacher education programmes who implement change. We might think of these two groups as the leaders and those who implement change. Systemic approaches to change need to encourage shared leadership at all levels: top down, bottom up, and in middle management. Excellent ICT teacher education will facilitate development of the organization into an organization in which all participants can learn from one another and support one another’s learning.

EDUCATIONAL CHANGE MODELS

Where do leaders and those who implement change start in introducing ICTs in teacher education? Where do they seek guidance in managing innovation and change? Over several decades of research, a few classic educational change models have been developed that help to answer just such questions.

In this section, we focus on four leading educational change models.

- Diffusion of innovations (associated with Rogers, 1995).
- Change agent’s guide (associated with Havelock and Zlotolow, 1995).
- Concerns-based adoption model (associated primarily with Hall and his associates, 1987).

Although the following discussion of these four educational change models might suggest a sequential, linear process, it is important to remember, in reading about these change models, that teacher education is part of an interlocking system, as stated above about the nature of innovation and change, and that different parts of the four models will often be conducted in parallel. For a more comprehensive survey of educational change models, Surviving Change (Ellsworth, 2000a) is recommended. A much briefer account is available online (Ellsworth, 2000b). Both these sources influenced the writing of this section.
Strategies for Adoption of Innovations

Educational leaders who have decided (or been encouraged by other stakeholders) to introduce ICTs in teacher education, naturally want the innovations to succeed. What characteristics or attributes of the innovations are helpful to know about? What strategies associated with these attributes could be utilized in the introduction of ICTs in teacher education to encourage their adoption by teacher educators? The educational change model, commonly termed diffusion of innovations, may best help here. Rogers (1995) has written most about diffusion of innovations.

Rogers identified five key attributes of innovations. Knowledge of these, together with intervention on the part of educational leaders, will assist in the rate at which the innovation (here the introduction of ICTs in teacher education) is adopted (by teacher educators). Rogers terms these five attributes relative advantage, compatibility, complexity, trialability, and observability. Table 7.1 lists these attributes together with the kinds of intervention strategies educational leaders in teacher education can adopt.

What is important about these attributes is that many reports have shown that awareness of them, along with appropriate intervention by educational leaders, dramatically improves the chances of the innovation’s adoption. Ellsworth (2000a), for instance, concludes from his survey of educational change that between 49%-87% of the variance in the adoption rate of innovations is accounted for by these five attributes alone. This means that if educational leaders can effect the kinds of strategies listed in Table 7.1, there is a high probability that ICTs will be successfully diffused through an institution and adopted by teacher educators, with the possibility of achieving lasting change.

Necessary Conditions for Successful Change

What else is required to help make an innovation succeed, beyond consideration of the five attributes discussed above? Are there any necessary conditions that need to be in place to facilitate the adoption of an innovation such as the use of ICTs in teacher education? The educational change model developed by Ely (1990) helps answer questions like these.

In a cross-cultural study of the diffusion and implementation of technological change, Ely identified eight conditions that influence a change such as the use of ICTs in teacher education.
Table 7.1 Attributes of Innovations and Helpful Leadership Strategies

<table>
<thead>
<tr>
<th>Attributes of Innovations</th>
<th>Leadership Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative advantage</td>
<td>Try to demonstrate that ICT-enhanced learning is more effective than traditional approaches to teaching and learning. It would be helpful here to be familiar with some of the research evidence on the nature of change noted in the first part of this chapter.</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Try to demonstrate that ICTs are not at variance with current views, values and approaches. No technology is culturally neutral, and so it is important to address this attribute openly and honestly.</td>
</tr>
<tr>
<td>Complexity</td>
<td>Try to demonstrate that ICTs are relatively easy to implement in teaching. To do this implies that leaders have some knowledge of ICTs, or can call on assistance as needed.</td>
</tr>
<tr>
<td>Trialability</td>
<td>Give teacher educators the opportunity to try out ICTs in a way that is not threatening. Time is required here, and so again is technical assistance.</td>
</tr>
<tr>
<td>Observability</td>
<td>Give teacher educators the chance to see the use of ICTs in teaching. It would be useful to see leaders using ICTs or to see other teacher educators using ICTs.</td>
</tr>
</tbody>
</table>

Ely’s first condition is dissatisfaction with the current way of doing things. For example, the difficulty experienced in some countries maintaining up to date learning resources might lead to feelings of dissatisfaction. Anderson and Askov (2001), in a case study available online, describe making online resources available on CD-ROM to help overcome the unavailability of current education textbooks and the expense of subscribing to English language education research journals at the Rajabhat Institutes of Thailand. Figure 7.1 displays a range of learning resources made available on CD-ROM to help overcome the shortage of locally based learning resources.

A second condition specified by Ely is assistance for teacher educators to acquire knowledge and skills to use ICTs. It is a sad comment on many previous educational technology innovations in many parts of the world, that professional development of those using ICTs is frequently overlooked and placed last, after purchase of equipment and software. Teacher educators will need comfortable personal access to ICTs, which fits into their professional habits of teaching and research. Case studies of this are provided in Section V.
Ely’s third condition is that the necessary *infrastructure* be available. So critical is this condition that Section III is devoted to the essential components required to support ICTs in teacher development. Quite clearly, for ICTs to be used in teacher education, necessary equipment (including both hardware and software), cabling, and telecommunication links must be in place in teaching spaces, open areas for students, and offices. The profile of ICTs in teacher education may need to be raised to gain these resources because competition from colleagues in other disciplines such as science, who may not appreciate the need for technology in the college of education.

A fourth necessary condition, according to Ely, is that teacher educators be given sufficient *time* to learn about ICTs and to integrate ICTs in the topics they teach. An online case study from Penn State University in the United States (Anderson and Askov, 2001) describes how teaching faculty were given release time so that they could develop, or rather redevelop, teaching and learning materials when their courses were placed on the Web. Teaching staff at universities and colleges cannot be expected to develop new teaching materials while coping with regular teaching commitments at the same time.
A fifth condition identified by Ely is a need for incentives for those introducing ICTs in teacher education. Recognizing innovators for their efforts may, on occasion, be sufficient, but for some teacher educators who perhaps are satisfied with their current teaching approach, further extrinsic motivation may be required, such as a raise in salary or technical and clerical support.

A sixth condition of Ely is that participation of teacher educators in the use of ICTs needs to be expected and encouragement needs to be given; and a seventh condition is that there needs to be commitment by all involved. Again, the case study from Penn State University provides a pointer. When the adult teacher education department made a commitment to put a degree program on the Web, it was a shared decision, and all teaching staff were expected to comply. There needs to be adequate support from the institution for technical assistance and the necessary upgrading of equipment and software.

The eighth and final condition that Ely identified is that leadership must be evident. Educational leaders need to inspire and encourage the teacher educators for whom they are responsible. Leaders also need to be enthusiastic users of ICTs themselves. So critical is leadership in managing change that the issue is again addressed under a heading below.

A Guide for Planning Change

C-R-E-A-T-E-R, an educational change model developed by Havelock and Zlotolow (1995), provides a practical guide for the institution (university or college) or educational leader (dean with responsibility for teacher education), who has decided to embark on the use of ICTs in teacher education. C-R-E-A-T-E-R helps determine what the key stages are in any planned change and what should be done at each stage. It may also inform change at a regional and national level.

Havelock and Zlotolow have produced the Change Agent’s Guide as a kind of checklist for those planning change. Contained within the Guide is a description of seven key stages. The seven stages are not linear but interrelated and cyclical, forming what they term the C-R-E-A-T-E-R model. Table 7.2 depicts the seven-stage model. The first letter of each stage descriptor forms an acrostic, C-R-E-A-T-E-R. This model has been successful in focusing strategic change in teacher education in US universities (Thompson, Schmidt & Davis, 2002).
There are similarities between, for example, the first stage of C-R-E-A-T-E-R and Ely’s first condition of dissatisfaction with current approaches to teaching and learning in teacher education. This kind of overlap emphasizes that the education change models presented in this chapter should not be followed in a strictly linear fashion.

Table 7.2  Seven Stages of the C-R-E-A-T-E-R Educational Change Model and Tasks Needed at Each Stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) Care</td>
<td>Identify and make explicit the reasons that motivate individual stakeholders to renew education and for what purpose.</td>
</tr>
<tr>
<td>1) Relate</td>
<td>Bring the key stakeholders together to share their cares and appreciate the cares of others, determining a shared agenda for change. Note that this stage potentially results in action for educational renewal.</td>
</tr>
<tr>
<td>2) Examine</td>
<td>Analyze the current situation, opportunities and challenges for educational renewal in relation to the shared agenda. Use prior experience, the literature, and ethnographic approaches to the gathering of new information to inform the process.</td>
</tr>
<tr>
<td>3) Acquire</td>
<td>Gather as much information and resources to support the experiments that will be ‘tried’. This should involve many aspects, such as hardware, software, telecommunications, personnel, books, accommodation, and furniture.</td>
</tr>
<tr>
<td>4) Try</td>
<td>Trial the development of ICTs in one or more ways to evaluate what works both formatively to inform the trial itself, which will then be adapted, and as a summative report for all stakeholders.</td>
</tr>
<tr>
<td>5) Extend</td>
<td>Bring stakeholders and others together to share successes and challenges learned so far. Use this opportunity to expand the number of stakeholders, possibly to raise awareness of the potential of ICTs for educational renewal. Note that this stage should also result in action for educational renewal and will raise new cares as the process starts to move into a new cycle of educational renewal.</td>
</tr>
<tr>
<td>6) Renew</td>
<td>This is the core process of educational renewal, where lasting changes result within the organization. It is valuable to consider the formal systems that will benefit from change, such as assessment and quality assurance, formal committee structures and public strategies. The lasting changes are impacted most by the Relate and Share stages described above.</td>
</tr>
</tbody>
</table>

C-R-E-A-T-E-R is a highly practical guide for those leading the innovation to introduce ICTs in teacher education. In their publication, *The Change Agent’s Guide*, Havelock and Zlotolow include checklists for decisions and steps that need to be taken to guide those seeking to implement change.
Keeping Track of Change

While C-R-E-A-T-E-R guides educational leaders through each stage in implementing change, the Concerns-Based Adoption Model, or CBAM, helps those who implement change keep track of where they are. CBAM is particularly useful in tracking the stages teacher educators go through in their use of ICTs, and their level of ICT use.

In particular, CBAM provides a guide for what individual teachers may need as they move through the CBAM stages, starting with raising awareness of the potential of ICTs, and ending with a means to collaborate with colleagues within and beyond their local organization. The focus on the individual's viewpoint and each individual may move back to the first stage with a new facet of ICTs. For example, teachers who adopt and move to the most advanced stage in the use of word processing for their work, may need to drop back to the awareness stage to adopt new applications such as data handling tools and web-authoring.

Hall and his co-researchers (1987) developed CBAM primarily to help track two aspects of change. First, to track the concerns of individuals (in this case, teacher educators) in terms of what they feel about using ICTs in their teaching and, second, to track their level of ICT use. In other words, CBAM can be very useful for diagnosing two different aspects of an innovation in process. The first diagnostic instrument is called Stages of Concern (see Table 7.3) and the second is termed Levels of Use (see Table 7.4).
The four educational change models presented in this section were put forward by separate groups of writers. As stated above, the change models are not intended to be applied in a linear fashion-starting with diffusion of innovations, and proceeding through conditions of change, change agent’s guide, and the concerns-based adoption model. Together, the four change models complement each other quite well, rather like four different views of the same phenomenon. What this section does is summarize, all too briefly, some of what is involved in managing innovation and change. For more detail, the fuller descriptions of the models described in this section should be consulted. Perhaps what the four change models together do best is exemplify that managing change is a complex process.

### Change Models in Perspective

<table>
<thead>
<tr>
<th>Stages of Concern</th>
<th>Diagnostic Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Awareness</td>
<td>Knows about ICTs but is not concerned about them.</td>
</tr>
<tr>
<td>2) Informational</td>
<td>Wants to know more about ICTs.</td>
</tr>
<tr>
<td>3) Personal</td>
<td>Wonders how ICTs will impact personally in terms of time demands and own abilities.</td>
</tr>
<tr>
<td>4) Management</td>
<td>Has concerns about the administrative and logistic challenges imposed by ICTs.</td>
</tr>
<tr>
<td>5) Consequence</td>
<td>Begins to consider how ICTs might impact students.</td>
</tr>
<tr>
<td>6) Collaboration</td>
<td>Considers how to collaborate with colleagues involved in ICTs.</td>
</tr>
<tr>
<td>7) Refocusing</td>
<td>Has ideas about how ICTs might be improved or better implemented.</td>
</tr>
</tbody>
</table>
Table 7.4  Levels of Use: Tracking Eight Levels in An Adopter’s Progress in Using An Innovation such as the Use of ICTs in Teacher Education Programmes

<table>
<thead>
<tr>
<th>Levels of Use</th>
<th>Diagnostic Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0) Non-use</td>
<td>Not involved with ICTs.</td>
</tr>
<tr>
<td>1) Orientation</td>
<td>Begins to find out what ICTs are about.</td>
</tr>
<tr>
<td>2) Preparation</td>
<td>Gets ready to use ICTs.</td>
</tr>
<tr>
<td>3) Mechanical</td>
<td>Focuses on immediate, rote aspects of ICTs.</td>
</tr>
<tr>
<td>4) Routine</td>
<td>Uses ICTs in a basic way.</td>
</tr>
<tr>
<td>5) Refinement</td>
<td>Considers changes in use of ICTs to improve student-learning outcomes.</td>
</tr>
<tr>
<td>6) Integration</td>
<td>Works with colleagues to find ways in which ICTs can improve student-learning outcomes.</td>
</tr>
<tr>
<td>7) Renewal</td>
<td>Considers how the use of ICTs might be improved.</td>
</tr>
</tbody>
</table>

THE ROLE OF THE ORGANIZATION’S LEADER IN MANAGING CHANGE

One thing the research literature is quite clear about: the role of the organization’s leader is the most important single factor in bringing about change. ICTs will not succeed without strong leadership and vision. In teacher education faculties or departments, this leadership and vision must come from the dean, but there must also be strong support from the teacher education faculty’s university or college.

Michael Fullan is a key researcher in the field of educational leadership (2001). Even though his work is mainly at the school level, there are likely to be close parallels between the qualities required of school principals and the qualities required of faculty heads. Principal among these qualities is vision, a vision of what can be achieved with ICTs. Without this vision, lasting change in teacher education is almost impossible.

Important as the vision of the organizational leader is, it is insufficient by itself unless the teacher education faculty share the same vision. After all, it is they who will implement the use of ICTs in their teaching courses. To achieve a shared vision across a group of people requires dialogue and discussion to build
consensus. One strategy is to take time out from regular departmental duties to work through the key issues—what Ely called dissatisfaction with the current way of doing things, and what Rogers termed relative advantage of ICTs over traditional teaching approaches. This discussion and sharing of the leader’s vision with teaching staff cannot be rushed. For innovation to be successful and for lasting change to be achieved, a shared vision of ICTs is the initial, key step.

The organizational leader also needs to share leadership with other leaders among the staff. If there are planning and technology committees within the teacher education faculty, they will be influential in shaping attitudes towards ICTs. Good leaders will previously have shared their ideas with such faculty groups to ensure that all speak with a common voice. The shared vision may be an integral part of the Relate and Share opportunities managed strategically with the CREATeR model.

Shared vision and shared leadership are key goals in the early stage of introducing ICTs in teacher education. If the innovation is to succeed in changing teachers’ curriculum, modes of assessment, and approach to teaching, ICTs need to be integrated, embedded, or infused in the teaching of all topics in the teacher education programme. Facilitating educational change, then, becomes a key role for the organization’s leader. Effective leaders lead by example and they provide support and encouragement for their teaching staff.

Further sources of information on the role of leaders in managing change and improvement are available on the Web from the North Central Regional Educational Laboratory (2001) in the United States.

**LEADING AND MANAGING CHANGE**

This section began with the statement that leading and managing change in the integration of ICTs into teacher education are highly complex tasks. There is an extensive base of research on managing change that is helpful in providing guidance on how to begin for those teacher education faculties wishing to embark on introducing ICTs into teacher education programmes. The educational change models described in this section should prove useful in suggesting strategies, in determining what conditions are necessary for successful change, in guiding such change, and in monitoring the change process. All of these change elements are essential in the successful planning and implementing of ICTs in teacher education. It is important to remember, however, that the two most important ingredients in the whole process of change are leadership and professional development.
REFERENCES


