Capacity-building for ICT integration in education

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INTRODUCTION

Over the last decade or so, governments in the Asia Pacific region have been promoting the use of the new information and communication technologies (ICTs) in education. The nature of this ICT take-up goes beyond using information and communication systems to improve education administration, to large-scale adoption of digital technologies that is impacting on curricular and pedagogical structures. A confluence of economic, social, and political challenges accounts for this development. For one, there is pressure for governments to provide education to all members of the population — even in the face of scarce financial, physical, and human resources — as a precondition for economic and social development. At the same time, globalization and the shift to a 'knowledge-based economy' require that educational institutions develop in individuals the ability to transform information into knowledge and to apply that knowledge in dynamic, cross-cultural contexts. ICTs are a means for meeting these twin challenges. ICTs can improve access to and promote equity in education by providing educational opportunities to a greater number of people of all ages, including the traditionally unserved or underserved (e.g. those in rural and remote areas, women and girls, and persons with disabilities). Second, ICTs can enhance the quality of teaching and learning by providing access to a great variety of educational resources and by enabling participatory pedagogies. Third, ICTs can improve the management of education through more efficient administrative processes, including human resource management, monitoring and evaluation, and resource sharing.

However, ICTs are not a panacea or cure-all for gaps in education provision. The right conditions need to be in place before the educational benefits of ICT can be fully harnessed, and a systematic approach is required when integrating ICTs into the education system. This fact is often overlooked and, in their eagerness to jump on to the technology bandwagon, many education systems end up with technologies that are either not suitable for their needs or cannot be used optimally due to the lack of trained personnel. Vendor persistence oftentimes overshadows calm and logical consideration of any new technology to be adopted. For example, in Malaysia, it has been pointed out that '[o]ver-dependence on vendors and lack of monitoring are causing the (Malaysian) Government millions of ringgit for the rollout of various ICT initiatives' (*The Star* 2008). In the Philippines, the fixation with technology is demonstrated by the fact that the bulk of funding for ICT in schools projects goes to hardware and very little goes to teacher training (Arinto 2006).

This technocentric perspective on ICT in education is both a cause and an effect of the lack of capacity in ICT in education planning and implementation. In the first place, there is lack of capacity to systematically plan for ICT adoption. This in turn gives rise to failure to adequately provide for building the capacity of schools and education personnel to use ICT to improve teaching and learning. Thus, there is often poor implementation of ICT projects in schools.

This chapter focuses on the need to build capacity in ICT integration[1] among policymakers and teachers in developing countries in Asia Pacific. While there are other sectors and stakeholders in ICT in education programs, policymakers and teachers have a particularly important role to play in ICT integration. Policymakers[2] shape a country's education policies, including policy on who shall be educated, what they shall be educated about, and how they shall be educated. With respect to ICT in education, policymakers set the framework and make high-level decisions covering all aspects of program implementation. Teachers, on

the other hand, implement education policy. In ICT in education programs, teachers are 'the key to whether technology is used appropriately and effectively' (Carlson and Gadio 2002, p. 119).

The chapter is divided into two parts. The first part presents the basic elements of systematic and holistic ICT in education policy formulation and strategic planning that policymakers need to know. These principles constitute the basic framework for an ICT in Education Toolkit for policymakers and planners designed by the United Nations Educational, Scientific, and Cultural Organization — Asia and Pacific Regional Bureau for Education (UNESCO Bangkok), Knowledge Enterprise LCC, the Academy for Educational Development (AED), and *info*Dev/World Bank. The second part of the chapter focuses on what teachers need to know to be able to teach effectively with technology, and what this implies for the design of teacher professional development programs, including policy on teacher training in ICT integration. The ICT Competency Standards for Teachers released by UNESCO in early 2008 is also presented. The chapter aims to provide an overview of issues of concern in capacity-building in technology integration that might be of relevance to Asia Pacific countries.

POLICY CONSIDERATIONS IN ICT INTEGRATION IN EDUCATION

In 2003, UNESCO Bangkok conducted a meta-survey of the state of ICT use in education across Asia and the Pacific. Not surprisingly, the survey found a great deal of variation in the nature and extent of technology integration in the more than two dozen countries surveyed. Specifically, 'countries are at different stages of both development and implementation in the areas of policy formulation, ICT infrastructure development and access to it, content development, programme initiatives and the training provided for education personnel' (Farrell and Wachholz 2003, p. 265). The differences arise not only from differences in the countries' financial and human resources, but also from differences in policymaking with regard to ICT in education. Farrell and Wachholz (2003, p. 267) sum up these policy-related differences as follows:

> [T]he countries are arrayed along a continuum of stages with regard to policies pertaining to the integration of ICT into their education systems. While all of them have stated that the development of ICT capacity is important to the future of their countries, fewer have grappled with the policy questions as they relate to ICT applications in education — and many of those that have lack the resources to implement their strategies, a recurrent theme throughout the reports. *This 'lack of resources' reflects, however, weaknesses of existing policies and the need to improve them.* (italics supplied)

Indeed, weaknesses in policymaking often lead to the misallocation of resources, which in turn exacerbates the existing lack of resources. For example, there is a tendency to emphasize the installation of ICT over the seamless integration of ICT in teaching and learning — i.e. making ICT a part of the educational milieu and ensuring that it results in improved learning outcomes. This results in an 'incredible influx of financial support for equipment but only a meager trickle for network support or staff training' (Monahan 2004, p. 373).

In planning for ICT integration in education, policymakers would do well to begin by determining the educational purposes that technologies are to serve before they are brought on board. This means clarifying overall education policy, as this should serve as the rationale and road map for technology integration. It is important to note that technology is only a tool and as such it cannot compensate for weaknesses in education policy. (Guttman 2003; Haddad 2007a)

Once national education goals have been clarified, policymakers need to decide on what ICT integration approach to adopt. Farrell and Wachholz (2003) found three different approaches being used in Asia Pacific countries: *(i)* teaching ICT as a subject in its own right, usually beginning at the upper secondary level, to develop a labour force with ICT skills; *(ii)* integrating ICTs across the curriculum to improve teaching and learning; and *(iii)* using ICTs to foster learning anywhere and anytime as part of the development of a knowledge society in which all citizens are ICT savvy. Each of these has different infrastructural, personnel, and management requirements, among others.

The key considerations in selecting infrastructure and hardware are appropriateness, cost-effectiveness, and sustainability. (Guttman 2003; Haddad 2007a). Appropriateness refers to fitness for purpose and context, which implies that policymakers must resist the pressure to adopt the newest technologies simply because they are 'high-tech' and other countries are adopting them. As Guttman (2003, p. 66) reminds us, 'some of the greatest educational problems are in the most remote areas, where electricity supplies may be irregular or non-existent, telephones scarce and lines difficult to maintain.' Policymakers need to be mindful that ICT does not become a source of further inequality, with the digital divide deepening existing disparities.

At the same time, in ensuring universal access to technologies, governments must keep in mind the need to ensure sustainability, which has technological, political, and social dimensions aside from the economic or financial dimensions. Technological sustainability has to do with choosing technology that will be effective over the long term, taking into account the rapid evolution of technologies and the availability of technical support. Political sustainability has to do with the policy environment and management of the change processes involved in technology integration in schools. Social sustainability comes

from the involvement of all stakeholders, including those who will use the technology (teachers, learners), those who will be affected by its use, and others with a legitimate interest in education processes (such as parents, political leaders, and business and industry leaders) (Tinio 2003).

The financial cost of ICT acquisition in schools is usually a major focus of attention in policymaking and project planning. But the cost of acquisition is only one aspect, and policymakers and administrators need to budget for the recurring costs that form part of the Total Cost of Ownership (TCO). Maintenance and support account for about a third to half of the initial investment in computer hardware and software (Haddad 2007b). Thus, even if computers may be acquired for free, as in the case of donated computers, they require a substantial financial investment for maintenance and support.

The development of content for ICT-supported teaching and learning is another key policy area. According to Haddad (2007b, p. 58), 'introducing TVs, radios, computers, and connectivity into schools without sufficient curriculum-related ICT-enhanced content is like building roads but not making cars available, or having a CD player at home when you have no CDs. Development of content software that is integral to the teaching/learning process is a must.' Policymakers will need to make a choice between acquiring or creating new ICT-enhanced educational content and software. Suitability (including curriculum relevance), availability, and cost are key considerations in making this choice. And the selection of appropriate content and software has to be made not once but many times, since different learning contexts will have different requirements, for example in terms of age and learning abilities, subject-specific demands, and culture and language.

The need for trained personnel who will implement technology integration in schools is also a key area that policymakers need to pay attention to, and they must do so from the outset. Technology by itself is not enough to transform education processes and improve educational outcomes. As Haddad (2007b, p. 60) puts it, 'appropriate and effective use of technologies involves competent, committed interventions by people. The required competence and commitment cannot be inserted into a project as an afterthought, but must be built into conception and design[ed] with [the] participation of those concerned.' Capacity-building for teachers is especially crucial and will be discussed in the next section.

All of the key components of ICT integration in education discussed above will need to be integrated into a coherent plan with clearly specified targets, timelines, and costs. Moreover, the plan should first be implemented in pilot mode rather than full scale, in order to determine whether the various elements work singly and in combination. The pilot implementation has to be closely monitored and the evaluation results used to modify the plan for full implementation. The latter requires even more careful planning, and the implementation itself needs continuous monitoring and evaluation so that implementation problems are detected and addressed in a timely manner. It is only through systematic monitoring and evaluation that the educational effectiveness of ICT interventions can be determined (Haddad 2007b).

Different countries will formulate different policies regarding how best to harness the power of ICTs to further their economic and social development goals through education. Even the process of developing policy will differ among countries. However, the ICT in education policy considerations outlined above comprise a basic set of elements that can guide the policymaking process, and that policymakers can use to gauge the information and resources they need in the policymaking, project planning, and project implementation process. In the ICT in Education Toolkit (see 'A Toolkit for Decision Makers') that

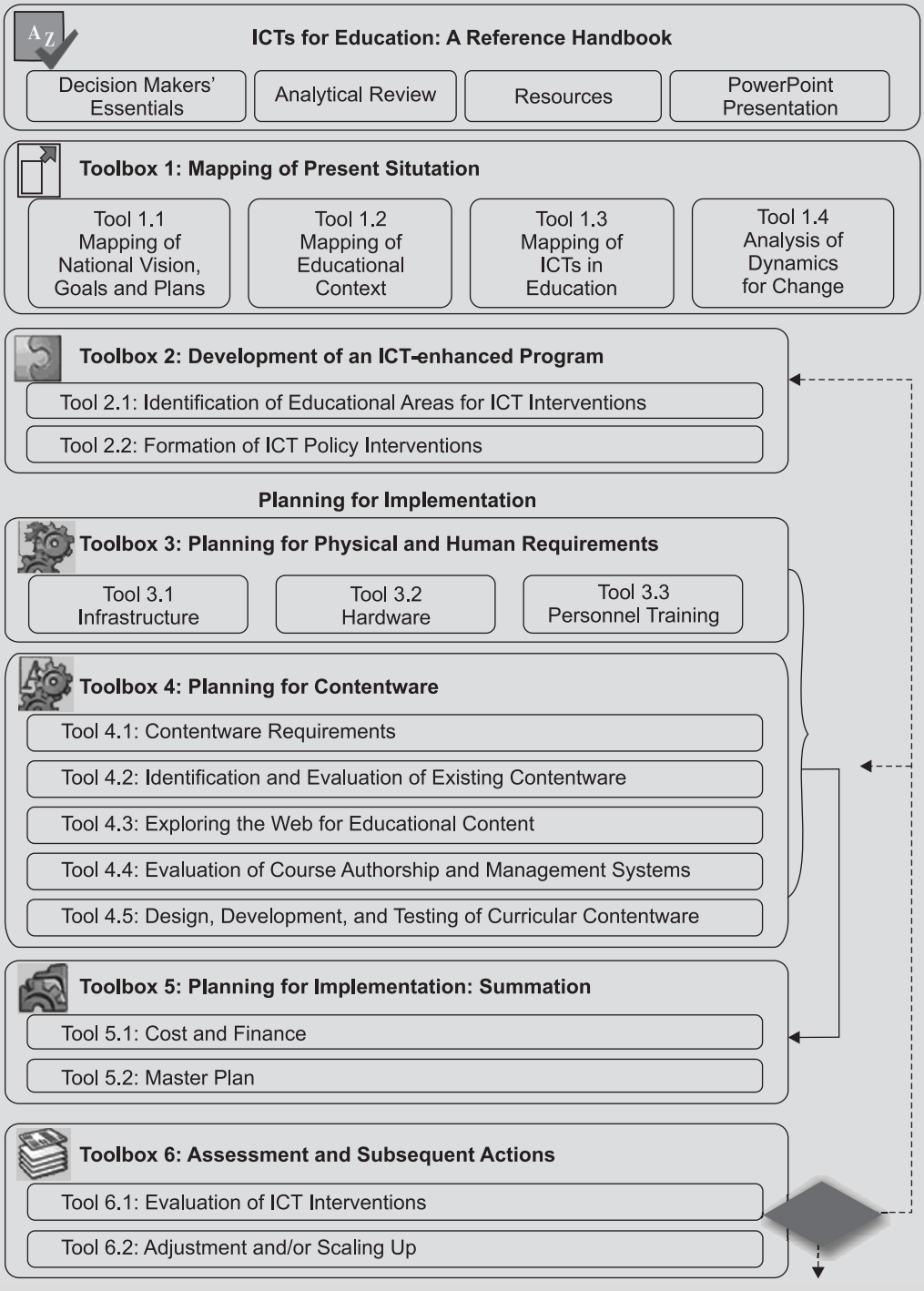
A Toolkit for Decision Makers

The ICT-in-Education Toolkit was developed by the UNESCO — Asia and Pacific Regional Bureau for Education (UNESCO Bangkok) in partnership with Knowledge Enterprise LCC, the Academy for Educational Development (AED) and *info*Dev/World Bank, 'to assist education policymakers, planners and practitioners in the process of harnessing the potential of ICTs to meet educational goals and targets efficiently and effectively.' It consists of six toolboxes of interactive instruments and step-by-step guidelines that help users to:

- Map the national, technological, and educational situation;
- Formulate and assess ICT-enhanced programs;
- Plan for physical and human requirements;
- Plan for ICT-enhanced content;
- Generate program costs;
- Create a master plan; and
- Monitor implementation, effectiveness, and impact.

The toolkit also contains a Reference Handbook that summarizes international knowledge, research, and experience on the effective use of ICTs in education. Figure 7.1 shows the structure and main components of the toolkit:

Figure 7.1
ICT in education toolkit for policymakers, planners, and practitioners



(Source: *info*Dev/World Bank 2007)

While the toolkit provides a set of analytical, diagnostic, and planning tools that can impose a certain discipline on the decision-making process, it does not provide the 'solutions' or 'answers' to the thorny issues in policymaking and decision-making. It also does not substitute for the political/organizational process of formulating policy. Instead, it encourages teams to work together on the issues identified and to coordinate human resources to come up with appropriate ICT-supported interventions in education.

UNESCO Bangkok is using in its capacity-building program for policymakers and program implementers in Asia Pacific countries, these elements are referred to as the 'parameters necessary for the potential of ICTs to be realized in knowledge dissemination, effective learning and training, and efficient education services' (Haddad 2007a, p. 11).

CAPACITY-BUILDING IN ICT INTEGRATION FOR TEACHERS

Even with a coherent and detailed policy and careful planning, ICT integration in education is a complex and protracted process. Various studies in both developed and developing countries point to four broad stages of ICT adoption and use that educational systems and individual schools typically go through (see Figure 7.2).

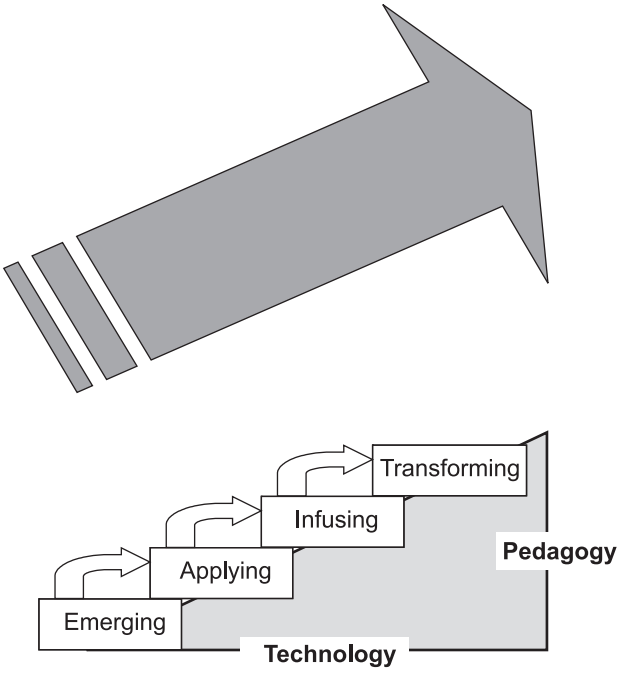
The experiences and behaviours of teachers and learners learning how to use ICTs can be mapped on to the four stages (see Figure 7.3).

At the first stage, teachers and learners are discovering ICT tools and their general functions and uses, and the emphasis is usually on ICT literacy and basic skills. Discovering ICT tools is linked with the *emerging stage* in ICT development.

The second stage involves learning how to use ICT tools, and beginning to make use of them in different disciplines. This involves the use of general as well as particular applications of ICT, and it is linked with the *applying stage* in the ICT development model.

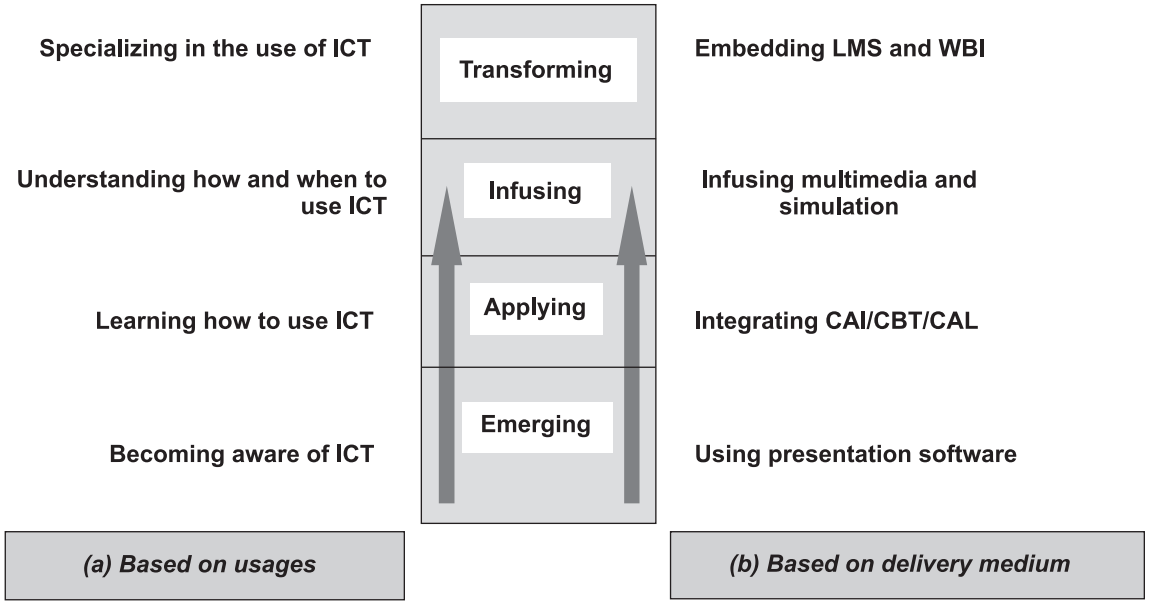
At the third stage, there is understanding of how and when to use ICT tools to achieve a particular purpose, such as in completing a given project. This stage implies the ability to recognize situations where ICT will be helpful, choosing the most

Figure 7.2
Stages of ICT integration



(Source: UNESCO Bangkok 2005)

Figure 7.3
Mapping teaching and learning to the stages of ICT integration



(Source: UNESCO Bangkok 2005)

appropriate tools for a particular task, and using these tools in combination to solve real problems. This is linked with the *infusing stage* in the ICT development model.

The fourth stage is when the learning situation is transformed through the use of ICT. This is a new way of approaching teaching and learning situations with specialized ICT tools, and it is linked with the *transforming stage* in the ICT development model.

Progression through the stages takes time. And the transformation of pedagogical practice requires more than ICT skills training for teachers. Too often the approach taken to teacher training in ICT integration is the one-off crash course on computer literacy. This approach does not enable teachers to integrate ICT in their day-to-day activities and master the use of ICT as an effective tool for teaching and learning. A 2004 study by UNESCO Bangkok of ICT integration experiences across six countries in Asia reports the following 'lessons learned' with respect to approaches to teacher training in ICT integration:

- Training teachers on ICT-related skills within the context of classroom objectives and activities ensures the development of skills in the integrated use of ICT in teaching.
- School-based training of teachers by their more experienced peers from other schools or senior instructors from the MoE (Ministry of Education) ensures that teachers are trained in the context of their workplace.
- Needs-based just-in-time learning and peer coaching ensure further development of teachers' ICT and pedagogical skills.

A school-based and classroom-focused approach to teacher training in ICT use takes into account the fact that teachers need to 'learn about technology … in the context of their subject matter and pedagogy' (Hughes 2004, p. 347). Teachers learn how to use ICTs more effectively when they see the technologies not as generic and decontextualized tools but as tools for teaching, that is, for motivating, managing, facilitating, enhancing, and evaluating learning (Otero et al. 2005). Teachers also need 'to see a direct link between technology and the curriculum for which they are responsible' (Gadio and Carlson 2002, p. 122). As the UNESCO Bangkok (2004, p. 104) study puts it, 'When teachers perceive ICT as a tool to meet curricular goals, they are more likely to integrate ICT in their lessons.'

Thus, teacher training in ICT integration needs to be hands-on, involving the application of skills learned (through formal training) in the classroom over an extended period of time. This in turn means that the teachers need access to technology resources (computers, training materials, educational software), support from technology managers (i.e. the computer lab manager or ICT coordinator), and support from colleagues and school administrators. The latter play a pivotal role in ICT integration in schools, as they are in a position to inspire a shared vision for comprehensive technology integration and 'foster an environment

and culture conducive to the realization of that vision' (TSSA Collaborative 2001).

Part of fostering an environment that is supportive of learning how to teach effectively with technology is implementing an incentive system and motivational strategies for teachers. According to Carlson and Gadio (2002, p. 122):

> While so-called 'champion teachers' ask for and seek out professional development opportunities in the use of technology, the vast majority of teachers do not. Teachers generally are reluctant to change their teaching styles and habits; are cautious of time-consuming activities that may take away from other high-priority obligations (economic, familial, or educational); have difficulty seeing the potential payoff beforehand of this kind of training; and may feel so threatened by technology that they want to distance themselves from it rather than embrace it. Put simply, many teachers require additional motivation and incentives to participate actively in professional development activities.

Providing teachers with access to technology resources within the school *post* training is one motivational strategy. Having them work with colleagues in technology-supported instructional design projects is another (UNESCO Bangkok 2004). Giving teachers time and recognition for innovation is essential. Teachers need to be given time to participate in training activities and they need to be given time to try out what they have learned in the classroom. The latter means that school administrators should take care not to overload teachers particularly with extra-curricular assignments — although perhaps this is easier said than done in the majority of public schools in developing countries where there is a shortage of teachers. Teachers who successfully complete professional development programs and implement technology-supported teaching and learning innovations should be given public recognition to give them a sense of achievement and encourage them to continue, as well as to encourage others to participate in such programs (Carlson and Gadio 2002).

An important incentive for teachers to upgrade their knowledge of and skills in ICT integration is formal certification of in-service professional development leading to a degree (UNESCO Bangkok 2004). Action on this point clearly goes beyond the school level and even the district or schools division level, to the level of the Ministry or Department of Education, since it is the latter that should certify teacher training programs.

More generally, because national imperatives for ICT integration in education, and the consequent increase in the demand for teachers to be skilled in ICT use in teaching and learning, Ministries of Education need to adopt a new framework for teacher professional development (TPD) that reflects a shift from 'training' to 'lifelong professional preparedness and development of teachers'. This framework specifies the following components of TPD (Carlson and Gadio 2002; Haddad and Draxler 2002):

- Initial preparation/training or pre-service education that builds a solid knowledge base of teaching, consisting of knowledge of content (subject matter) and the curriculum; instructional approaches and strategies, including assessment; classroom management and organization; learners and their characteristics; educational contexts, purposes, and values; and the use of educational technologies.
- Structured opportunities for retraining, upgrading, and acquisition of new knowledge and skills in-service, including workshops, courses, and postgraduate certificate and degree programs.
- Continuous support for teachers as they undertake their day-to-day work.

This TPD continuum requires that there be closer coordination between those involved in pre-service and in-service teacher education. It also implies the need for capacity-building in ICT integration for teacher educators in pre-service teacher education institutions. This is because like schoolteachers, most teacher educators, even in developed countries, are ill-prepared to teach with the new ICTs (Russell et al. 2003).

This new TPD paradigm, which is based on a broad understanding of what teachers (and learners) need to know and how they learn in a rapidly evolving knowledge society, should inform moves by education authorities and policymakers to adopt competency standards for teachers in ICT integration. For one, such standards should go beyond technology literacy or the ability to use hardware and software, to include how technology impacts teaching and learning (and vice versa). Second, such standards should not be imposed on teachers as requirements or rules to comply with, but instead given as guidelines for developing appropriate TPD programs in ICT integration. This distinction is important especially where the policy environment and implementation frameworks and systems for ICT integration are not fully developed or well established.

A model that integrates the various dimensions of building the capacity of teachers to teach effectively with technology is UNESCO's ICT Competency Standards for Teachers (ICT-CST). These new guidelines are intended for teachers and TPD providers, including Ministries of Education, as a *planning* tool that can then be used to assess levels of attainment during TPD program implementation. The guidelines recognize that the identification of ICT competencies for teachers should be framed

by a clear understanding of a country's overall approach to ICT use in education. Different countries could adopt one of three approaches: *(i)* to develop a technology-literate workforce to enhance national economic productivity and competitiveness; *(ii)* to develop knowledge workers, or individuals who can apply knowledge to add value to the economy and society; and *(iii)* to develop innovators and knowledge creators for the knowledge society. Each of these implies different educational policy directions and modes of organization and practice (see 'ICT Competency Standards for Teachers').

CONCLUSION

As governments in the region embark on large-scale adoption of ICTs in education, it is important to move away from technocentric planning and implementation approaches to models that focus on establishing sound policy and support strategies leading to capacity development and empowerment (Uimonen 2004).

For this to happen, policymakers themselves need to develop their capacity in holistic and systematic policy formulation and strategic planning for ICT integration. While they do not need to know the nuts and bolts of technology, policymakers need to understand how technologies and education systems interact. They need to have a good grasp not only of the potential benefits of technologies for education, but also of the conditions necessary for ICTs to be effective in educational contexts and the process of educational change.

A sound policy and holistic plan for ICT integration recognizes the critical role that teachers play in ensuring the appropriate, effective, and sustainable use of ICTs to provide quality education for all. Thus, such a policy and plan give priority to teacher professional development that empowers teachers not just to implement but also to *lead* educational innovations that will transform schools and ultimately, all of society.

NOTES

1. The term 'technology integration' refers to 'the use of computers and the Internet to support teaching and learning across the curriculum' (Gaible and Burns 2005, p. 18). In this chapter, the term is used interchangeably with 'ICT integration'.
2. Policymakers include *(i)* politicians who are senior members of government and members of parliament; *(ii)* senior administrators in ministries and government agencies; *(iii)* personnel in senior positions in national associations representing various interest groups; and *(iv)* academics serving as consultants or staff members for the first three groups (Postlethwaite 1985).

ICT Competency Standards for Teachers

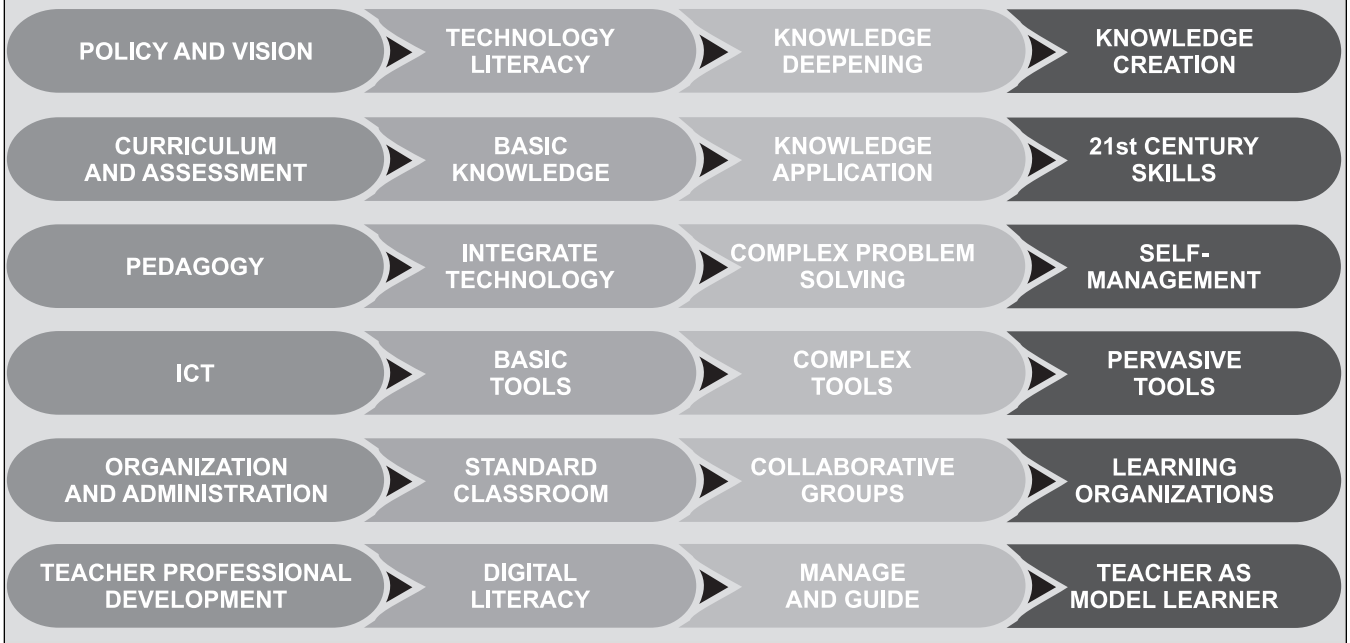
In January 2008, UNESCO launched an ICT Competency Standards for Teachers (ICT-CST) to provide a common set of guidelines that professional development providers can use to identify, develop, or evaluate learning materials or teacher training programs in the use of ICT in teaching and learning; and a basic set of qualifications that allows teachers to integrate ICT into their teaching and learning, to advance student learning, and to improve other professional duties. The ICT-CST also aims to extend teachers' professional development to enable to use ICT to develop skills in pedagogy, collaboration, leadership, and innovative school development; and to harmonize different views and vocabulary regarding the uses of ICT in teacher education.

The ICT-CST reflects a three-stage model of ICT integration in education based on the idea that education reform supports national economic and social development in one of three ways, namely:

1. by developing technology literate citizens and workers through the incorporation of technology skills in the curriculum (the technology literacy approach);
2. by developing citizens and workers who can apply knowledge to solving complex, real-world problems and thus add value to society and the economy (the knowledge deepening approach); and
3. by developing citizens and workers who can innovate and produce new knowledge (the knowledge creation approach).

At various stages of development, different countries would espouse one of these three approaches to educational change, and this will be reflected in their policy goals and visions. Moreover, each approach impacts on five other components of the education system, namely, curriculum and assessment, pedagogy, ICT (technology use), school organization and administration, and TPD.

Figure 7.4
UNESCO ICT competency standards framework for teachers



(Source: UNESCO 2008)

The technology literacy approach is the simplest. Its policy goal is to prepare students, citizens, and a workforce that is capable of using ICTs to support social development and improve economic productivity. TPD programs that are coordinated with this policy aim to develop teachers' skills in using basic ICT tools in delivering the standard school curriculum. Such teachers would know how, where, and when (and when not) to use technology for classroom activities and presentations, for management tasks, and to acquire additional subject matter and pedagogical knowledge in support of their own professional development.

The knowledge deepening approach has a greater impact on learning. Its policy goal is to increase the ability of learners, citizens, and the workforce to add value to society and the economy by applying knowledge to solve complex, real-world problems, such as those related to the environment, food security, health, and conflict resolution. This policy goal requires curricular changes to emphasize depth of subject matter understanding and application. Under this approach, teachers will need to develop skills in the use of more sophisticated methodologies and technologies that will enable them to serve as a guide and manager of the learning environment and enable students to engage in extended, collaborative project-based learning activities.

The knowledge creation approach is the most complex. Its policy goal is to increase civic participation, cultural creativity, and economic productivity by developing students, citizens, and a workforce that is continually engaged in knowledge creation, innovation, and participation in the learning society. Thus, the curriculum goes beyond a focus on knowledge of school subjects to explicitly include the 21st century skills that are needed to create new knowledge and engage in lifelong learning — i.e. the ability to collaborate, communicate, create, innovate, and think critically. TPD under this approach would coordinate the teachers' increasingly sophisticated professional skills with the pervasive use of technology to support students who are creating knowledge products and who are engaged in planning and managing their own learning goals and activities. This takes place within a school that is, itself, becoming a continuously improving, learning organization. In this context, teachers both model the learning process for students and serve as model learners through their own ongoing professional development.

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