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ICT TRANSFORMING EDUCATION

A Regional Guide

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Jonathan Anderson

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Preface

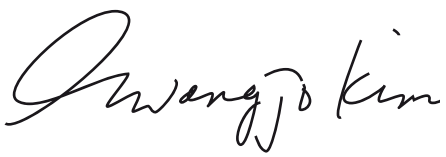
This *Regional Guide* grew out of a series of meetings of ICT experts convened by UNESCO Asia and Pacific Regional Bureau for Education to explore pedagogy-technology integration. An outcome of these meetings was the publication of *Regional Guidelines on Teacher Development for Pedagogy-Technology Integration* (Working Draft) in 2005 under the editorship of Shyamal Majumdar. At the end of 2009, the present author was contracted by UNESCO Bangkok to revise and update these guidelines. However, it soon became apparent that there had been such advances in ICT in education in the intervening years that more than a revision was required. New models of e-learning had appeared and new Web 2.0 tools were influencing pedagogy in classrooms around the world. Rather than a revision, then, a totally new Guide was required. This *Regional Guide* is the result.

This guide is designed to equip teachers and teacher educators with the competencies and resources to use ICT to transform their practices, and the school and education systems. Written for teachers, teacher educators, heads of schools, administrators and Ministry ICT coordinators in the Asia-Pacific region, it draws upon the best practices and lessons learnt in the region.

I would like to take this opportunity to express my gratitude to the author, Jonathan Anderson, Emeritus Professor of Flinders University, Adelaide, for this substantial effort.

Thanks are also due to a number of individuals who have contributed to the preparation of this publication. In particular, many innovative teachers and teacher educators across the region have written short accounts especially for this Guide of how they use ICT for learning and teaching. These accounts, referred to as regional snapshots in the pages that follow, provide glimpses of current ICT usage across the nations' classrooms. Each of the authors of these regional snapshots is named along with their institutional affiliation. As well, thanks are due to two peer reviewers, Cher Ping Lim and Feng-chun Miao, together with other colleagues who have given their time to comment on drafts of the Guide.

This *Regional Guide* is published within the framework of UNESCO South-South Cooperation project on ICT in Education Teacher Training implemented by UNESCO Bangkok. The support of UNESCO G-77 and the China South-South Cooperation Fund in Education for ICT in Education Teacher Training Project in the Asia Pacific Region is also gratefully acknowledged in making this publication possible.



Gwang-Jo Kim

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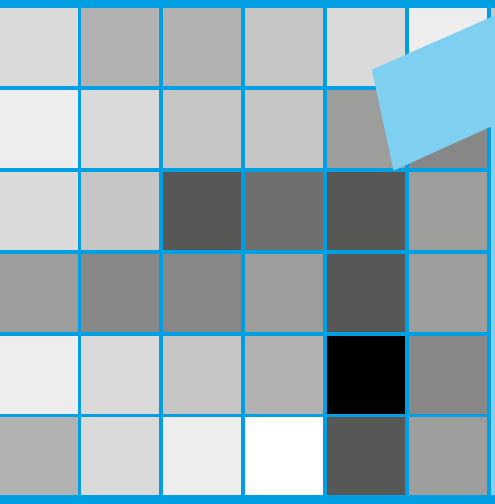


ICT and You

You will find in this chapter:

- who this Guide is for, what is in the Guide and how to read this Guide
- what ICT are
- how pioneering educators explored the use of ICT in instruction
- how ICT impact on schools, teaching and learning
- what the fourth revolution is

1. ICT and You

Who this Guide is for

This Guide is primarily for teachers and those who train teachers – teacher educators. It may be useful also to principals, administrators and Ministry ICT coordinators. The book's title, *ICT Transforming Education*, points the way to how a range of technologies called ICT (Information and Communication Technologies), in the hands of good teachers, may bring about profound changes and so transform education for ever.

Part of the book's title is *A Regional Guide* because the book consolidates the experiences of those working with ICT in the Asia and Pacific region. It is written not only for those in the region but also for those in other developing countries beyond the region who use, or want to use ICT in their classrooms.

Perhaps you are curious about the potential of ICT for learning and want to improve the learning outcomes of your students. Or perhaps you want to find out what other teachers in the region are doing with ICT. You may want to learn where on the internet to locate new learning resources for your students, or you may wish to further your own professional development. Whatever the reason, this Guide will be useful to you.

What this Guide contains

This Guide is like a building with many floors – there are the ground floors, a central group of floors and the top floors. On the bottom group of floors you find what technologies are included in ICT; what impact ICT is making on schools, on teaching and on learning; and how, outside the classroom, ICT have changed for ever the world of work and almost every aspect of our daily lives. Students, thus, need new kinds of skills and on these floors you find what these are for the new century.

In the middle group of floors are found models and frameworks that make it easier to navigate through ICT in education. There is a model showing the stages that classes and schools generally pass through in using, adopting and integrating ICT into regular classroom activities. This model can be used to gauge progress by schools and education systems in integrating ICT. A second model provides a framework that helps explain the kinds of learning in what is called e-learning. This model is useful in the classroom in guiding student learning, in aiding the professional development of teachers, and steering course development in the initial training of teachers. On these central floors you find also why assessment of students needs to change for the new student skills, and what methods teachers are beginning to use.

On the top group of floors you encounter many of the newer classroom web tools and resources, where to locate them and how innovative teachers are applying these tools to enhance their students' learning. You also discover that continuing developments in ICT

are further changing the learning environment and how educators are responding in ways that are transforming classroom and school practice. You see, too, on these top floors how yet other web tools can help advance your professional development when you leave this building.

The Guide contains a number of "snapshots" taken from around the Asia-Pacific region, where pioneering and imaginative teachers and teacher educators describe in their own words how they are using particular forms of ICT in the classroom. These snapshots gathered from different countries in the region are specially contributed to this Guide. You will recognize these regional snapshots by the camera icon in boxed inserts.

Also in the guide are easy-to-understand explanations of certain technical terms or ICT-related phrases. These explanations appear in boxed inserts marked with a clip icon and are placed where the terms and phrases are first used.

How to read this Guide

We hope you will find this book a practical guide – the sort of book that you will enjoy picking up, dipping into, perhaps reading minutely, but most of all using as a springboard for your own explorations into the exciting world of e-learning.

You can read this book in a number of different ways. One way is to read the book right through before returning to focus on particular chapters. Another way is to dip into the book where a particular chapter catches your interest and you want to learn more. In both these ways, you are reading the Guide as an armchair exercise. Yet another way to read the book is while seated at a computer. If you are connected to the internet, you can then visit any of the websites noted in the Guide and begin to explore the many exciting places for learning on the web. In this way of reading, you are actively interacting with this Guide.

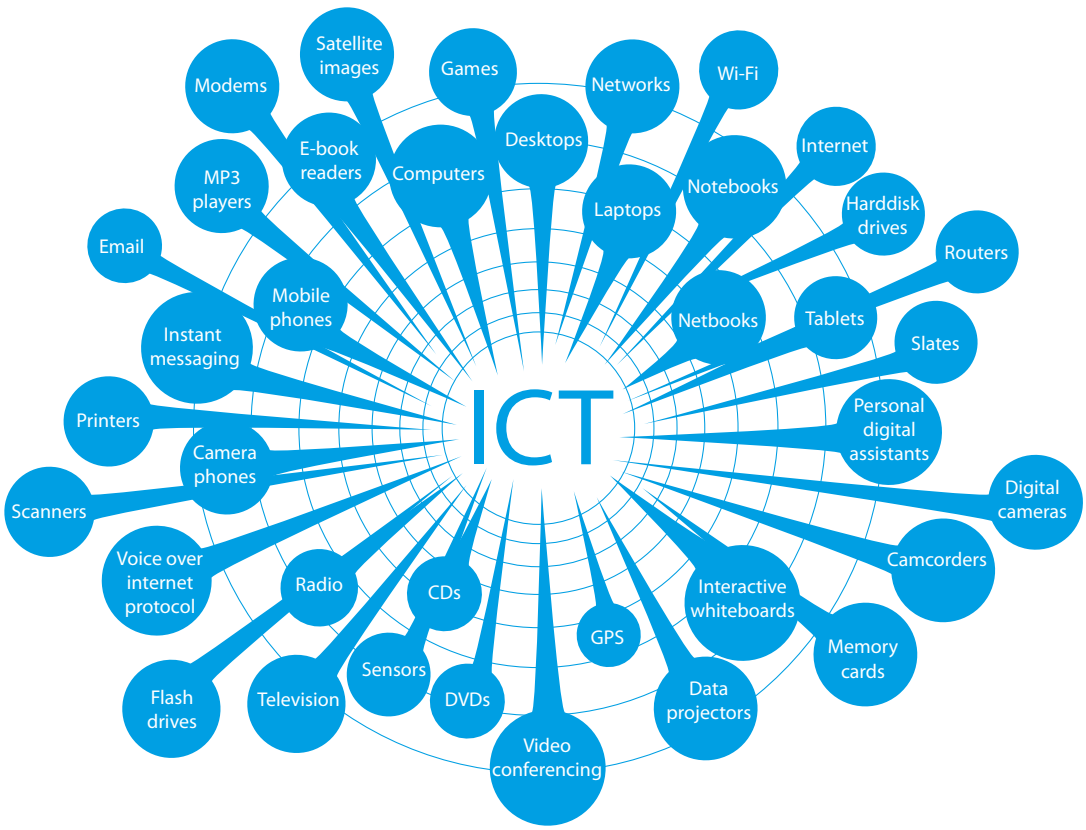
Whatever way you choose to read this Guide, it is a good idea to start with Chapter 1 where you are now. This first chapter sets the scene for your explorations later. It explains what ICT are and it begins to show how teachers can make a difference.

What ICT are

When the first computers made their entry into schools in the late 1970s, we used to speak about computers in education. With computers came printers, floppy disk drives, scanners and the first digital cameras. We began to use the term IT, or Information Technology, to describe computers and these various peripheral devices. Then the internet arrived together with computer networks, the World Wide Web, email and search engines. A new

term entered the language – ICT. The term ICT, short for Information and Communication Technologies, embraces the many technologies that enable us to receive information and communicate or exchange information with others. You see what some of these many technologies (both devices and functions) are in Figure 1.1.

Figure 1.1: ICT comprise many technologies for capturing, interpreting, storing and transmitting information



The very air we breathe literally buzzes with all kinds of information signals. ICT encompass all the technologies by means of which we can detect these signals, interpret them and exchange information with others. The term ICT is plural, referring to a great many technologies. To sum up, ICT is an all encompassing term that includes the full gamut of electronic tools by means of which we gather, record and store information, and by means of which we exchange and distribute information to others.

Pioneering educators explore the use of ICT in instruction

ICT have had an enormous impact on society. "A third revolution" is how UNESCO describes their impact in a 200+ page report, *Towards Knowledge Societies* (UNESCO, 2005b). Certainly, it is difficult to imagine how any modern society could continue to function without ICT. In that sense, ICT ushered in a revolution: there can be no going back to the old ways.

Schools, colleges and universities are an integral part of any society. You would expect, therefore, that in the same way that ICT are indispensable to the functioning of modern societies, these same technologies are equally indispensable to learning institutions. Although the primary focus in this Guide is on the use of ICT in learning and teaching, ICT have impacted on every aspect of the operation of schools, colleges and universities, including management and administration. Turning to the principal purpose of these institutions, when universities first acquired mainframe computers, pioneering educators began to explore their use in instruction. Shortly afterwards when the first small computers were introduced (called microcomputers to distinguish them from mainframe computers), a few schools purchased them or had them donated by companies or parent bodies.

Those first microcomputers began to bring about gradual change in classrooms around the world as innovative teachers and early adopters explored their use. It is true that in the early days there was an emphasis on programming, and much early software was of the drill and practice variety that imitated then-current teaching behaviour. In the typical classroom of that time, instruction was regimented. Students sitting obediently in rows listened attentively to their teachers, putting up their hands as the teacher asked questions. In those schools where writing materials were readily available, students copied what the teacher wrote on the blackboard, and most learning was by rote. This was teacher-centred instruction: the teacher very much controlled what was learned, how it was learned, and when it was learned.

However, newer kinds of software, as programs on computers are called, were being developed such as simulations, problem solving packages and adventure games. To jump to the present, the software in classrooms today includes the same kinds of tools that adults use in the world of work – messaging, emailing, word processing, database programs and spreadsheet applications. Where the internet is available, teachers and students routinely employ search engines to look for information to complete assignments. Employers now demand that graduating students are equipped with these same ICT skills needed in the workforce, a topic discussed in more detail in Chapter 3 on skills required for the 21st century.

The impact of ICT on schools, teaching and learning

In quite a short period of time, ICT have had a marked effect on schools, on teaching and on learning. At the institutional level, schools have similar needs to any small business and use the same kinds of computer software for such tasks as accounting, inventory control, communicating, document preparation and printing. Schools also use specialist software for tasks like timetabling, electronic reporting, behaviour tracking and student profiling, monitoring attendance and library management. In a whole number of ways, then, ICT tools are proving indispensable in making school administration more efficient and responsive to community needs.

At the instructional level, too, the primary focus in this Guide, the use of ICT in classrooms, lecture theatres and teaching labs across the Asia-Pacific region is bringing about change in the way teachers teach and how students learn. An important and forward-looking book from UNESCO, *Teacher Development in an E-Learning Age* (Resta and Patru, 2010), describes how teachers' roles are changing as a result of implementing ICT in their classrooms (see Table 1.1).

Table 1.1: The use of ICT in instruction brings about changes in teacher roles

Changes in Teacher Roles		
A shift from		to
knowledge transmitter; primary source of information	→	learning facilitator, collaborator, coach, knowledge navigator and co-learner
teacher controlling and directing all aspects of learning		teacher giving students more options and responsibilities for their own learning

Source: Adapted from Resta and Patru (2010).

The changing role of teachers is aptly summed up in the quip that teachers have moved from being "sages on the stage" to becoming "guides on the side". The teacher is no longer the all-knowing authority. The new role can perhaps be likened to that of a team coach or the conductor of an orchestra who tries to bring out the best performance in all players.

In the same way that teachers' roles are changing as a result of the use of ICT, so are the roles of students changing, as seen in Table 1.2.

Table 1.2: The use of ICT brings about changes in student roles

Changes in Student Roles		
A shift from		to
passive recipient of information	→	active participant in the learning process
reproducing knowledge		producing knowledge
learning as a solitary activity		learning collaboratively with others

Source: Adapted from Resta and Patru (2010).

Students in classrooms where ICT are regularly found are likely to participate in virtual excursions and be active researchers, searching the web for information to complete individual or group projects, communicating via email, blogs and social networking with students and teachers in other schools, and reaching conclusions on the basis of evidence gathered. Examples of these kinds of instructional activities are found in Chapters 9, 10 and 11.

A fourth revolution?

In the section above, we note the advent of a third revolution in the dissemination of knowledge, giving rise to what are called knowledge societies. The first revolution came with the invention of written language, which meant that for the first time people could store information and retrieve it without needing to rely on memory. The second revolution that occurred in the middle of the fifteenth century came with the invention of the printing press. With this revolution, information in books and pamphlets could be disseminated much more widely and quickly. The third revolution brought about by ICT is accelerating the dissemination of information and knowledge.

In the second decade of the 21st century, are we on the threshold of a fourth revolution? This is the intriguing question that the Director of UNESCO Asia and Pacific Regional Bureau for Education, raised in his opening address at an international conference in China (Kim, 2009). The internet and such services as Google and email, together with numerous new by-products like Wikipedia, Skype, Facebook and Twitter are transforming further the way we live, learn, work and play. (See the boxed insert for descriptions of these ICT services and products.) In suggesting the emergence of a possible fourth revolution, Kim described how in some countries learning is moving beyond the walls of the classroom, and that new terms have been coined to express these innovative ways of learning, terms like:

- *m-learning* or mobile learning, and
- *u-learning* or ubiquitous learning.

In the remaining chapters, this Guide explores these innovative ways of learning in more detail as we move beyond the walls of the classroom (Chapter 2) to 21st century skills (Chapter 3) and new modes of assessment (Chapters 6 and 7), towards transforming classroom and school practice (Chapters 8 to 12). It is an exciting journey.

Popular uses of the internet

Google is one of several web search engines or web tools for searching for information on the internet by entering keywords. A web search using a search engine results in what are commonly called hits.

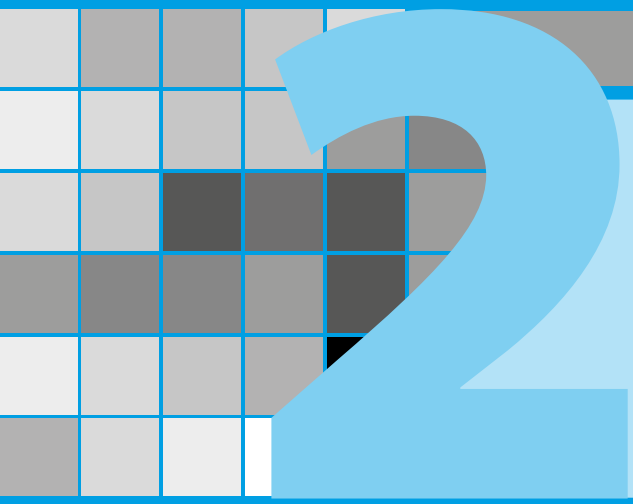
Short for electronic mail, email is the exchange of messages between users on computers linked to the internet. Users need not be connected to the internet at the same time. Messages are usually text but may also comprise graphic, audio, and video files.

Wikipedia is an internet-based encyclopedia that is written collaboratively by contributors around the world. It comes in many languages and is free to access. Chapter 8 gives more detail.

Skype is a Voice over Internet Protocol (VoIP) computer application that allows users to make free telephone calls to other Skype users over the internet. If a digital camera or webcam is attached to each computer, individuals can see one another.

Facebook is a free social networking service on the internet that enables users to post personal profiles of themselves, add names of friends, send them messages about themselves and exchange photos. More detail is given in Chapter 9.

Twitter is another free social networking service on the internet that enables users to send and read messages known as *tweets*. Tweets, limited in length to 140 characters, are sent to those who subscribe to particular users, called *followers*. You can read more about Twitter in Chapters 9 and 12.



2 The World Beyond the Classroom

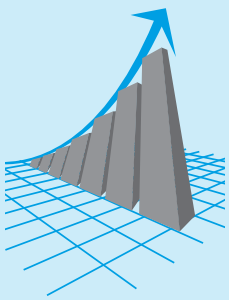
You will find in this chapter:

- how information and knowledge are growing exponentially
- what the digital divide is and what is digital inclusion
- how ICT have changed the world of work
- what governments' responses to these work changes are
- why students need new kinds of skills
- how diversity within the Asia-Pacific region impacts on the uptake and integration of ICT

2. The World Beyond the Classroom

Exponential growth in information and knowledge

A key trend that characterizes the environment beyond the classroom is the exponential growth in information and knowledge. Each year the world's store of information almost doubles that of the year before. To see what this means, you may recall the story of the Persian king who was given a beautiful chessboard by a clever courtier.



The king asked what gift he could give the courtier in return. At first the courtier modestly demurred. When pressed, he replied he would be happy with one grain of rice for the first square of the chessboard, two grains for the second square, four grains for the third, and so on for each square of the board. The king readily agreed. By the tenth square the king had given the courtier 1,024 grains of rice, a mere cupful, and he was still smiling. But by the 32nd square, just half the board, the king's servants were searching for 4 billion, 294 million, 967 thousand, and 296 grains, about as much as a rice crop from a large field. The king began to look concerned. Before long the kingdom had run out of rice.

Somewhat like this story of a chessboard, a global market intelligence company reports that by 2011 the digital universe will be 10 times the size it was in 2006. The situation is described as an exploding digital universe (IDC, 2008). Experts estimate that 24 million new blog posts are updated daily and each day more than a billion songs are shared over the internet. YouTube, a company that only commenced a few years ago, now hosts 100 million video streams a day. (Read what blogs and YouTube are in the clipped insert.)

Knowledge is not the same as information but, like information, knowledge is expanding exponentially. According to one estimate (Resta and Patru, 2010), more than 7,000 scientific and technical articles are published each day. Chemists estimate that the number of known substances has grown steadily from a few hundred in 1800 to about 25 million today.

Information and knowledge are the new forms of wealth and are the driving force for development. The extraordinary expansion of knowledge is brought about by ICT, which make it possible to generate, store, transmit, retrieve and process information at vastly increased speeds. All this has implications for lifelong learning because educators now recognize that learning does not stop after formal education ends. Critical challenges for educators are how to ensure equal access by all to this global storehouse of knowledge, and how to equip all citizens with the necessary skills for the new global environment, a theme taken up next.

Web services

A blog (contraction of *web log*) is a website where people make comments about their personal experiences and interests, a kind of electronic diary or journal. *Blog posts* are entries that individuals place on their blog websites.

YouTube is a widely used website that provides a service where users can upload videos and share these with others.

The digital divide

The term *digital divide* refers to the gap between the "haves" and the "have nots" in society: between those who have access to ICT and those whose access is limited or non-existent. Sub-groups whose access to ICT is unequal may fail to reach their full potential in school and beyond. They may not acquire the skills needed to participate fully in today's digital world, and they may be at a disadvantage when applying to enter the workforce.

The digital divide may occur between countries in the Asia-Pacific region because certain nations are less developed economically, or because they have less developed infrastructures. The digital divide may occur within a country because of differences in resources between metropolitan and rural areas, or within cities between affluent and less affluent schools. The digital divide may occur within schools because some families have internet access at home while other families do not, and this can affect school policy on homework expectations. The digital divide may also occur between boys and girls because at home parents often favour boys when it comes to accessing ICT, or it may occur at school because boys tend to dominate when ICT access is limited. And the digital divide may occur between age groups where, for instance, senior citizens have no previous experience with ICT.

Above, we discuss economic, technological, social and gender divides. There is another important gap that makes up the digital divide as former UN Secretary-General Kofi Annan stated in an address to a World Summit on the Information Society in Geneva, Switzerland, in December 2003:

> There is a content divide. A lot of web-based information is simply not relevant to the real needs of people. And nearly 70 percent of the world's web sites are in English, at times crowding out local voices and views. (Annan, 2003)

In adopting the Millennium Development Goals in 2000, the UN underscored the urgency of ensuring that the benefits of new technologies, especially ICT, are made available to all.

Within the Asia-Pacific region, education policy and decision-makers attempt to counter the digital divide by initiating programmes for digital inclusion. Sometimes digital inclusion involves positive discrimination by allocating additional resources to disadvantaged groups.

Singapore, for example, aims to accelerate digital inclusion for senior citizens in a three-year programme that is setting up 100 "hot spots" where the elderly can obtain free access to the internet. As well as free computer and internet use, the programme provides internet training for those who need it (Li, 2009). Another example is noted below from Australia where female teachers were accorded priority in professional development programmes when computers were first introduced in schools.

ICT and the world of work

ICT have brought about dramatic changes in the world of work. New jobs have been created, for example, in selling, installing and servicing the new technologies; and in managing and maintaining computer systems and networks. Careers that did not exist before ICT have opened up for programmers and systems analysts; for web designers and others who maintain websites; and in communication technology fields, service and manufacturing industries.

At the same time, many old jobs have been lost or changed. Computer or microprocessor controlled machinery in manufacturing industries has directly replaced many workers; and as computerisation has made jobs more efficient, fewer staff are needed. Unskilled workers, particularly, are vulnerable as repetitive tasks are replaced by machines.

Even in occupations where ICT have little impact such as in hairdressing, painting and decorating, management information systems lead to improved efficiencies. By contrast, in occupations such as those in the printing industry where the diffusion of ICT has been rapid, certain trade skills like typesetting and engraving are rendered obsolete. Similarly, in libraries and banks, many traditional tasks have changed markedly as staff require new skills of searching for and retrieving information online.

ICT have also changed many jobs as workers take on tasks previously done by others, for instance, word processing (formerly called typing) and photocopying. As a result, boundaries between certain occupations become blurred, with workers increasingly needing to be multi-skilled.

The need for modern societies to have more flexible workforces, together with changing patterns of work brought about by ICT, requires employees to be retrained. Since workers may need to be retrained several times during their working lives, it is important for national economies that governments respond in a timely way and that appropriate curriculum changes follow, themes taken up next.

Governmental response to work changes

Because of the wide diversity between countries in the Asia-Pacific region (discussed in more detail in the final section of this chapter), UNESCO Member States have varied in the speed of their response to ICT. In more developed economies, governments were quick

to respond to the impacts of ICT in the workplace and in other aspects of daily life and, as a consequence, encouraged the early introduction of ICT in education institutions. In less developed economies, there was an understandable time-lag.

The emerging economy of Malaysia provides a useful mini case study of the development of a national ICT plan, though the process will vary from one country to another. In the case of Malaysia, the critical first step was the announcement by the Prime Minister of Vision 2020 for the nation. There followed the unveiling of a Multimedia Super Corridor near the nation's capital to attract ICT industry, and the subsequent development of what the government terms "Smart Schools" across the country. Malaysia's plan, which provides a lead for other countries in the region, aims to:

- have a quality workforce which is knowledgeable with highly tuned thinking skills, able to use technology and new resources optimally, to combine creativity and innovation effectively and with a diversity of skills and knowledge in the use of ICT; and
- produce students who are knowledge and ICT literate and able to use technology for the betterment of themselves, their communities and their nation (cited in Downes et al., 2003, p. C5).

Elsewhere, the Malaysian Government reiterates its belief in ICT as a transforming agent in revolutionising education and learning:

> ... Malaysia recognises that the transformation of its education system is fundamental to achieving its objectives. The Ministry of Education, with the participation of non-governmental agencies, is focusing on the development of new media for use as educational, organisational and partnership-building tools, and as a means for bridging the country's digital divide and empowering learners. Due to its belief that ICT can revolutionise education and learning, the Ministry plans to integrate ICT into education on a fundamental level, incorporating systems to facilitate management, information gathering, access, and various forms of communication. (ICT for Development, 2002, p. 1)

Australia is another country in the Asia-Pacific region that established a national ICT plan soon after the introduction of computers. As early as 1983, a Commonwealth Schools Commission was established, which recommended that schools should provide all students (Years 2-12) with at least 30 minutes hands-on experience with computers per week, and that every school should have at least one teacher with sufficient computer competence to advise other teachers. Another recommendation was that professional development of teachers, particularly of women and of non-mathematics and non-science teachers, should be accorded high priority (Anderson, 1984). Over the next two and a half decades increasing funds have been granted to support ICT in schools and curriculum development. The government's current policy initiative commencing in 2009 is to equip every high school student in the country with a computer by 2012 as part of what it calls a digital education revolution.

To meet the ever evolving requirements of employers, there is now wide-ranging recognition throughout the region that national ICT policies should be developed or updated to respond to the new demands.

Students need new skills

Notwithstanding regional differences, governments generally recognize that along with national ICT policies students need education or training in new ICT skills if they are to function in the changed global environment. As a result, Ministries of Education have adopted, or are in the process of adopting, reframed national education and curriculum policies.

The new kind of skills required is driven in large part by the exponential growth of information in repositories around the world, of which we see examples above. As a consequence, students need to develop information literacy and other related skills to search for information from these seemingly unlimited sources on the internet, to evaluate this information and to select wisely from it.

At the same time, advances in ICT grow apace. To illustrate, there is a phenomenal uptake in the use of mobile phones in the region and across the world. The International Telecommunications Union (ITU) estimates there were 4.6 billion mobile cellular subscriptions worldwide at the end of 2009, which growth it describes as "the mobile miracle" (ITU, 2010). Newer mobile or smartphones, as they are called, are now used not only to chat and send text messages including images and video but also to deliver everything from internet searches, to sending and receiving mail, street maps and the weather. If newer advances in ICT such as these are to be harnessed educationally, students need new skills.

So critical is it for education institutions to prepare students to work and live in the emerging digital world that the next chapter takes up more comprehensively the range of skills needed to function in the 21st century.

Factors impacting on the uptake of ICT

Many factors affect the responses of national governments to ICT and their capacity to develop national ICT policies, adopt education plans for ICT, and modify the curriculum in order to cater for the new kinds of skills now demanded in the workplace. In this section, we examine the regional context for the implementation of ICT by considering a number of geographic factors and socio-economic characteristics as well as certain education, demographic and ICT indicators.

The Asia-Pacific region, a region of enormous geographic diversity, comprises sprawling landmasses and enormous expanses of ocean dotted with numerous islands. It contains some of the world's largest nations like China and Australia, and some of the smallest like Bhutan, the Maldives and the Pacific island states. The Pacific island nations are spread

over 30 million square miles of ocean representing more than the entire world's land area combined.

In terms of population, the Asia-Pacific region contains the world's most populous nations (Bangladesh, China, India, Indonesia and Pakistan) and also some of the least populated and most remote (including most Pacific island nations). Socio-economic characteristics also vary widely across the region. In terms of economic development (gross domestic product, or GDP), the region includes nations with the lowest GDP in the world, as well as highly industrialized nations. Some of the diversity between countries is reflected in Table 2.1, which records estimates of population, adult literacy and public expenditure on education in five nations in the region.

Table 2.1: Selected demographic and educational indicators (estimates) for five nations in the Asia-Pacific region

Indicator	Bhutan	Indonesia	Republic of Korea	Thailand	Viet Nam
Population in millions (2009 est.)	0.7	240	48	66	87
Adult literacy rate (2009)	47	90.4	98	92.6	90
Public expenditure on education as % of GDP	7.0 (2005)	3.6 (2006)	4.6 (2004)	4.2 (2005)	1.8 (2001)

Source: Data extracted from CIA World Factbook (https://www.cia.gov/library/publications/the-world-factbook).

Nearly two-thirds of the world's 785 million illiterates are found in five countries of the Asia-Pacific region – Bangladesh, China, India, Indonesia and Pakistan (CIA World Factbook, 2010).

To help comprehend the complexity of the task of education in certain countries in the region, consider a few statistics. Indonesia, for instance, is spread over more than 1,200 habitable islands where 60 percent of the villages are remote, with many lacking regular power supply or without telephone connections. Population and high birth rates make the task of teacher education enormous: there are 2.6 million primary and secondary teachers and more than 45 million students of school age. In China where teachers number nearly 10 million, the task of professional development is even more staggering.

Some information about disparities with regard to student access to computers at school is forthcoming from the OECD Programme for International Student Assessment (PISA) in which a number of countries from the Asia-Pacific region participated. Countries reporting five or fewer students per computer include Australia, Republic of Korea, New Zealand and Hong Kong (China); countries with six to ten students per computer are Japan and Macao (China); and countries with more than ten students per computer are Thailand and Indonesia (OECD, 2006).

Among Pacific island nations, national ICT infrastructures, while developing rapidly, nevertheless lag well behind other countries in the region and the world. You see this in Table 2.2, which shows world rankings for five Pacific island nations in terms of population and two ICT indicators (number of mobile telephone subscribers and number of internet users). Although the world population rankings are understandably low for these small island states (out of the approximately 220 countries for which data are available), their world rankings on the two ICT indicators are even lower. For comparison, Table 2.2 also includes world rankings for two other small but developed nations in the region. For both these nations (New Zealand and Singapore), world rankings on the two ICT indicators are higher, signifying that these two countries are relatively advantaged in terms of mobile telephone subscribers and internet users per population.

Table 2.2: World ranking in terms of population and two ICT indicators for five Pacific Island nations and two small developed nations in the region

Country	Population size ranking	Number of mobile telephone subscribers ranking	Number of internet users ranking
Pacific island nation states			
Kiribati	189	218	209
Vanuatu	185	199	192
Tonga	183	193	201
Solomon Islands	166	209	199
Fiji	156	151	152
Small developed nation states			
New Zealand	124	91	58
Singapore	117	77	55

Source: Data extracted from *CIA World Factbook* (https://www.cia.gov/library/publications/the-world-factbook). World rankings are out of approximately 220 countries for which data are available. The higher the ranking for a country, the smaller or fewer on each indicator.

The International Telecommunications Union (ITU) has developed an ICT Development Index (IDI) that provides a means of tracking progress towards becoming information societies (ITU, 2009). IDI is a composite index comprising 11 indicators that include ICT access, use and skills. ITU maintains that the index is appropriate for use both in countries that are advanced in ICT as well as in countries that are still developing their ICT infrastructure and services. In the most recent ITU publication, *Measuring the Information Society 2010 (ITU, 2010)*, ICT development statistics are given for 2008 and 2007, which allow comparisons to be made over time.

Table 2.3 extracts the IDI statistics for countries in the Asia-Pacific region as well as showing each country's ranking among 159 countries worldwide for which data are available. If we compare the IDI measure for 2007 with 2008, we see that all the countries represented improved over the two years, confirming "the ongoing diffusion of ICTs and the overall transition to a global information society" (ITU, 2010, p. 3). Some developing economies (notably Viet Nam and Macao, China) show strong improvements on the IDI measure. Among more developed economies, Republic of Korea, Singapore and Australia also continue to improve strongly.

Table 2.3: ICT Development Index (IDI) for countries in the Asia-Pacific region for the years 2008 and 2007

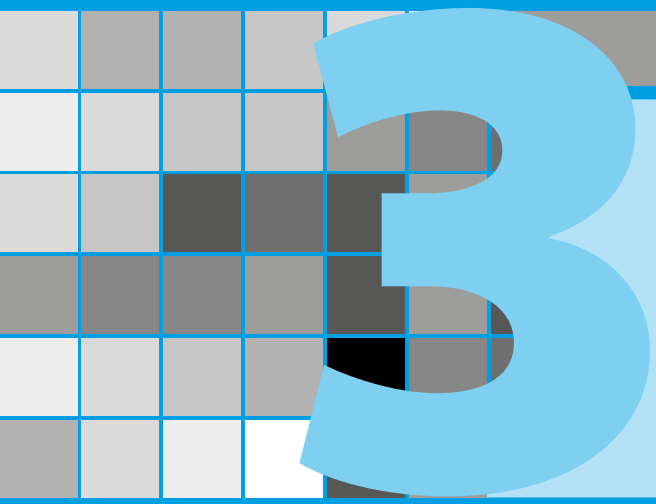
Economy	Rank 2008	IDI 2008	Rank 2007	IDI 2007
Republic of Korea	3	7.68	2	7.23
Japan	8	7.12	7	6.89
Singapore	14	6.95	15	6.47
Australia	15	6.90	14	6.51
New Zealand	16	6.81	16	6.38
Macao, China	24	6.29	28	5.73
Brunei Darussalam	42	5.07	42	4.77
Malaysia	56	3.96	55	3.66
Thailand	76	3.27	75	3.03
China	79	3.23	77	3.03
Viet Nam	86	3.05	93	2.61
Philippines	90	2.87	95	2.61
Fiji	91	2.81	88	2.69
Mongolia	95	2.71	94	2.61
Sri Lanka	105	2.51	104	2.32
Indonesia	107	2.46	108	2.15
India	117	1.75	116	1.62
Lao PDR	118	1.74	117	1.60
Myanmar	119	1.71	118	1.60
Cambodia	120	1.70	120	1.53
Bhutan	123	1.62	124	1.48
Papua New Guinea	151	1.08	150	1.06

Source: Data extracted from the International Telecommunication Union (ITU), cited in *Measuring the Information Society* (ITU, 2010).

This chapter begins with a discussion of exponential growth in information and knowledge, and problems of the digital divide. The effects of ICT on the world of work are considered along with governmental responses to work changes. The compelling conclusion is that students need new skills to equip them for today's life challenges. The educational hurdles to be faced are further exemplified in the various disparities within the region that are reported above.

High-speed internet is another disparity or gap that is widening between rich and poor countries, according to UN Under-Secretary-General for Communications and Public Information, Kiyo Akasaka. He cites Australia, a country with 21 million people, as having more broadband subscribers than the whole of Africa, a continent with nearly 900 million inhabitants (UNESCO, 2009). In contrast, China is now ahead of the United States in having the largest number of internet users in the world (a statistic, of course, that is due to its population size because it also has the largest number of non-internet users in the world). These factors are part of the context in implementing ICT and gauging the degree to which ICT adoption and use are integrated in regular classroom learning activities.

The next chapter takes up a theme commenced in this chapter of why students need new kinds of skills by considering the kinds of skills students need in the 21st century.



Skills for the 21st Century

You will find in this chapter:

- why modes of learning are different in the 21st century
- what the digital age is and how teaching those growing up in the 21st century needs to change
- what skills students require for the 21st century
- how digital literacies extend beyond print-based literacy

3. Skills for the 21st Century

Modes of learning are different in the 21st century

In the previous chapters, we note the profound effects that ICT have had on every aspect of daily life and particularly on the world of work (Chapter 2); and the similarly far-reaching effects ICT are having on schools and on teaching and learning (Chapter 1). We report that the impacts of ICT on every aspect of society are so significant as to be thought of as a third revolution following those ushered in by the invention of writing and later the invention of the printing press. The question is even raised whether in this second decade of the 21st century we are on the threshold of a fourth revolution.

Any child born since the beginning of this century is growing up in a digital world. Those born at the start of the century, already in the middle years of primary school, have been dubbed the "Net generation" or, more descriptively, "digital natives" (Prensky, 2001). Theirs is a world of television, text messaging, camera phones, iPods, MP3, and interactive video games. They can watch television, listen to their iPods, send text messages, and work online – all at the same time. As they chat online with friends, they use a form of shorthand they have created themselves like WBU (what 'bout you), BRB (be right back), IRL (in real life), NP (no problem), and ROFL (rolling on the floor laughing). Parents of these modern children, born in the last century, are labelled by Prensky (2001), in contrast to their children, "digital immigrants". Because they were not brought up in the digital age, parents are often bewildered by the new language and cannot comprehend how their sons and daughters seemingly multi-task while doing their homework.

Differences between the outlook of parents who were born in the last century and the views of their children born this century point to a further digital divide (one not addressed in Chapter 2). Since ICT allow learners to engage, communicate and relate to each other in different ways, today's digital natives as students often feel disconnected from traditional teaching practices in schools that have changed little from days gone by. Unless outmoded approaches to learning change, the full potential of ICT is not realized: it becomes an expensive add-on.

Evidence that students feel disconnected comes from students themselves and what they are saying. For example, a needs analysis of students enrolled in an English language proficiency course at a Malaysian university reports that the kinds of texts that are a regular part of students' lives are multi-modal comprising television, radio, computers, laptops, netbooks, cell phones and MP3 players (Nallaya, 2010). On the other hand, in-depth analysis of student interviews and written responses about the course enrolled in reveals that it is very print-dominated. Students feel that their teachers should not only use more multi-modal texts but also incorporate a variety of teaching methods. Nallaya concludes:

> The students use technology and multi-modal texts for recreation, entertainment, communication as well as learning. The participants of this research study are of the view that multi-modal texts contribute to the development of English language proficiency and plan to use it in the future. The participants also added that they preferred multi-modal to print texts as they encompassed all the information they needed and were easy to understand. The participants emphasized that their teachers were not currently using multi-modal texts to teach. They stressed that multi-modal texts should be employed in the teaching and learning process. (Nallaya, 2010, p. 170).

The conclusion is overwhelming: modes of teaching need to change because learners are changing by growing up in a digital world.

Teaching learners in a digital world

The digital age refers to a period that began about 30 years ago and has rapidly continued into this century. It is sometimes called the digital revolution because during this time analogue technologies began to change to digital technologies. This same period parallels far-reaching changes in society brought about by ICT, similar to past, life-changing events that occurred with the start of the agricultural revolution and again with the onset of the industrial revolution.

How is teaching changing for learners in a new digital world? From New Zealand comes a case study that sheds light on this question (Ledesma, 2005). New Zealand was particularly chosen for the case study in order to examine the approach of schools towards learning of students growing up in a digital world in a nation that is "an emerging world leader in ICT education" and one that aims for "digitally minded schools". The government has a long established policy for ICT in education; it has implemented strategies to develop school capability; and it has committed funds to prepare teachers for ICT. Furthermore, the Ministry of Education has a clearly stated vision for ICT, namely, to focus on:

> learning and teaching for a new generation of young people who are growing up in a digital world, are comfortable with technology, and need their schools to reflect these realities ... It envisions a journey that takes us through learning about ICT, learning with ICT, and learning through ICT (cited in Ledesma, 2005, p. 3).

Nine schools in differing socioeconomic locations were selected for a month-long intensive study. The aim was to observe how these schools integrate ICT into regular learning and teaching. Three levels of integration were monitored: curricular, spatial and pedagogical (see clipped insert).

Levels of ICT integration

Curricular integration — the extent to which, and ways in which, an ICT activity relates directly to appropriate curriculum goals, and to the same or complementary curriculum content or skills as other learning activities in a given unit of work or sequence of lessons.

Spatial integration — the extent to which the use of computers or ICT is separated in place or location from other learning activities in a unit of work.

Pedagogical integration — the extent to which the choice of particular ICT, and the ways in which they are used in classes, are consistent with and between the pedagogical philosophies, orientations and intentions of the teacher, and the learning styles, abilities and motivations of the students.

Ham et al. 2002. Ministry of Education, Wellington, New Zealand (http://www.educationcounts.govt.nz/publications/ict/5807)

Three main findings emerge from the case study. In regard to curricular integration, ICT was clearly linked to curriculum goals and outcomes in all schools. All observed ICT activities meshed in naturally with other classroom learning activities.

With regard to spatial integration, in contrast, many of the ICT activities observed were physically separated from other classroom activities, often taking place in a corner of the classroom, a computer lab, or the library, at times when these facilities were reserved.

Observations about pedagogical integration (which describes the match of ICT use to the vision advanced for ICT in schools' technology plans) revealed a sharp divide. "Behind the 'dazzle' of the learning medium," concludes Ledesma, "was traditional pedagogy." The textbook still dictated instruction in a mathematics class; computers were often used as substitutes for typewriters in language classes; and although some exciting ICT projects were observed, these were often more like enrichment activities than a part of everyday learning.

Ledesma's fuller case study of which the above is a partial extract is significant since it provides pointers for other countries in the Asia-Pacific region. It outlines government and other initiatives taken to ensure that pre-requisites for ICT in education are in place, namely:

- a national plan for ICT in education;
- adequate infrastructure;
- strategies and funding for developing school capability;
- preparing teachers for ICT; and
- a vision for ICT in education.

Yet these pre-requisites are not in themselves sufficient. The case study shows that, although ICT offer the potential for new ways of learning, this potential is often limited because teachers do not modify their teaching approaches sufficiently. This finding indicates why the preparation of the next generation of teachers is so important. As Ledesma (2005, p. 7) puts it, "New learning cultures need to be created to respond to the opportunities and challenges of the digital world". Students entering schools are already digital natives as argued in the previous section. Schools must build on this foundation to meet the challenges of the digital world in order to realize students' full potential. And there must be changes in the school curriculum.

Skills students need for the 21st century

An organization known widely for its analysis of skills required for 21st century student success in the new global economy is Partnership for 21st Century Skills (P21). The members of P21 include most major multinational information technology corporations, together with key education, library, publishing, industry and media organizations. Based in the United States, P21 has a mission to serve as a catalyst to position 21st century skills at the centre of K-12 education. Although US-based, many of the materials developed, with only minor adaptation, are appropriate for the Asia-Pacific region. Most of these materials are freely accessible via the internet (http://www.21stcenturyskills.org/index.php).

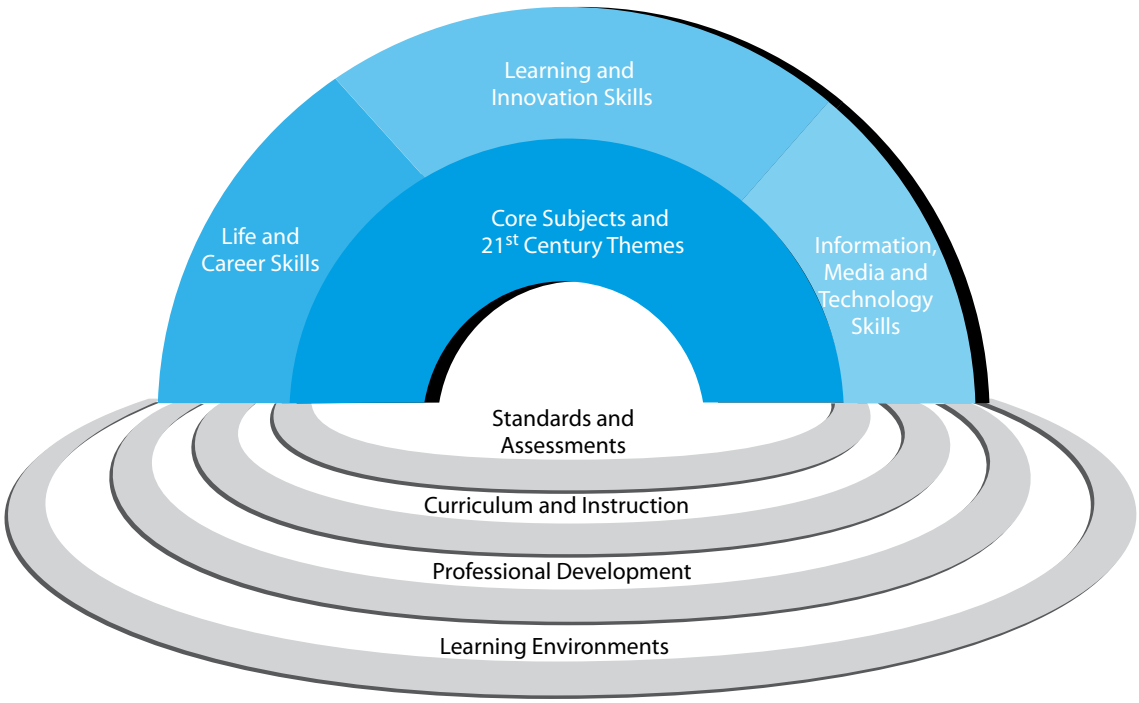
The cornerstone of the work of P21 is a framework for 21st century learning shown in Figure 3.1 that illustrates in visual form the skills, knowledge and expertise students should master to succeed in work and life in the 21st century (Partnership for 21st Century Skills, 2010).

The description that follows, reproduced with the permission of P21, outlines briefly, within the blue sections represented in Figure 3.1, the broad sets of skills identified by P21 that students need for the 21st century, namely:

- Core subjects and 21st century themes
- Learning and innovation skills
- Information, media, and technology skills
- Life and career skills

Encircling the rainbow are the support systems to ensure student mastery of 21st century skills.

Figure 3.1: 21st century student outcomes and support systems



Source: Permission to use this Figure granted from *Partnership for 21st Century Skills.*

Core subjects and 21st century themes

Mastery of core subjects and 21st century themes is essential for students in the 21st century. Core subjects include English, reading or language arts, world languages, arts, mathematics, economics, science, geography, history, government and civics.

We believe schools must move beyond a focus on basic competency in core subjects to promoting understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into core subjects:

- Global Awareness
- Financial, Economic, Business and Entrepreneurial Literacy
- Civic Literacy
- Health Literacy

[Although English is noted above as a core subject, for many countries in the Asia-Pacific region this would be replaced by the national language, and English would be included under world languages.]

Learning and innovation skills

Learning and innovation skills are what separate students who are prepared for increasingly complex life and work environments in the 21st century and those who are not. They include:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, media and technology skills

People in the 21st century live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools and the ability to collaborate and make individual contributions on an unprecedented scale. To be effective in the 21st century, citizens and workers must be able to exhibit a range of functional and critical thinking skills, such as:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and career skills

Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills, such as:

- Flexibility and Adaptability
- Initiative and Self-Direction
- Social and Cross-Cultural Skills
- Productivity and Accountability
- Leadership and Responsibility

21st century support systems

Developing a comprehensive framework for 21st century learning requires more than identifying specific skills, content knowledge, expertise and literacies. An innovative support system must be created to help students master the multi-dimensional abilities required of them in the 21st century. The Partnership has identified five critical support systems that ensure student mastery of 21st century skills:

- 21st Century Standards
- Assessments of 21st Century Skills
- 21st Century Curriculum and Instruction

- 21st Century Professional Development
- 21st Century Learning Environments

It is important to emphasize that while Figure 3.1 represents each element distinctly for descriptive purposes, P21 views all the components as fully interconnected in the process of 21st century teaching and learning. Together, the components form a comprehensive set of skills aimed to develop the whole student.

Digital literacies

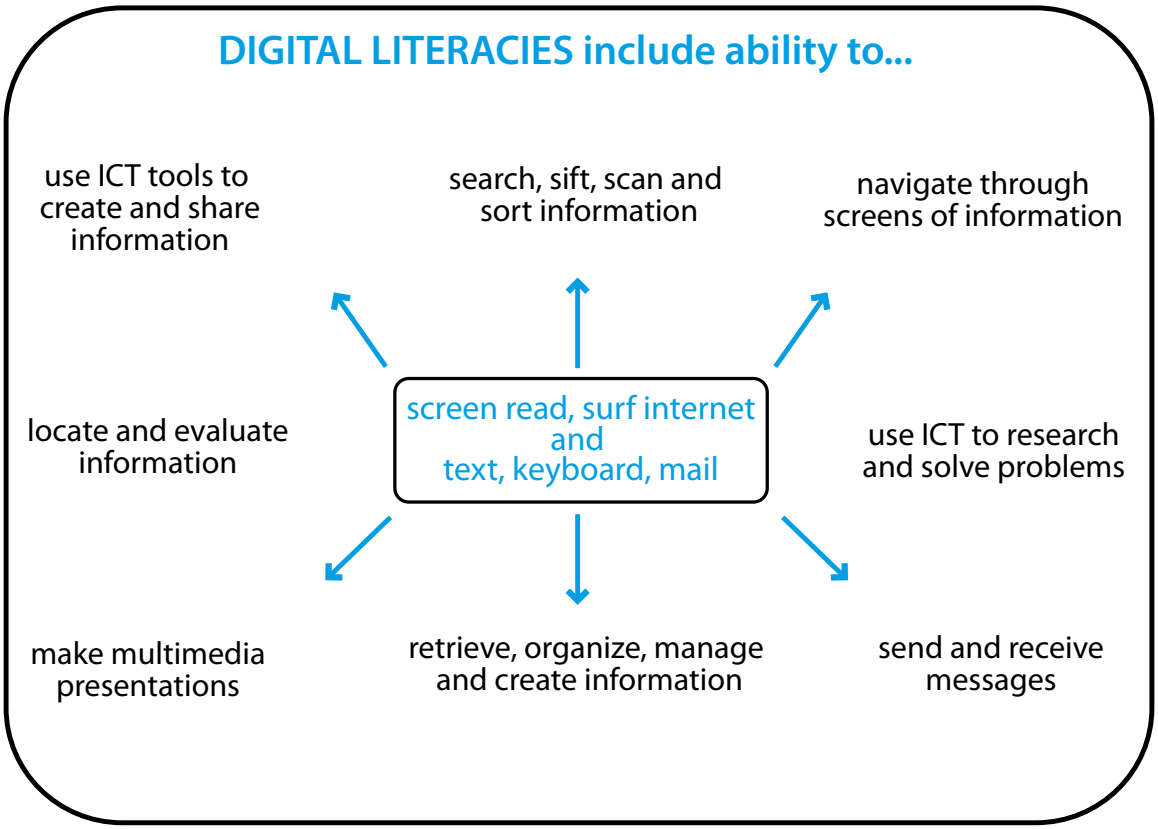
Information literacy, media literacy and ICT literacy form one of the four broad sets of skills identified by P21 that students need to acquire to be effective citizens and workers in the 21st century. Since the focus of this Guide is on ICT in education, this grouping of skills is now expanded further in order to foreshadow what implications there are for teachers and teacher educators.

Digital literacy (or in the plural digital literacies), e-literacy, new literacies, screen literacy, multimedia literacy, information literacy, ICT literacies – these are all terms to describe clusters of skills that students (and their teachers) need in the digital age of the 21st century. Because of ICT, concepts of literacy have extended well beyond the traditional notions of print-based literacy. To be literate today requires the ability to interpret and write various codes "such as icons, symbols, visuals, graphics, animation, audio and video" (Nallaya, 2010, p. 48).

Whichever term one chooses to describe the skills students of today need, it should embrace basic literacy, that is, ICT-enabled reading and writing, as well as the many new related skills identified by Nallaya. For that reason, it seems preferable to use a plural term, and hence the term we adopt in this Guide is *digital literacies*.

At the core of digital literacies are reading and writing, not only page reading and writing on paper, but also their electronic extensions – on the one hand, screen reading and internet surfing [reading], and on the other hand, texting, keyboarding, and mailing [writing]. These electronic equivalents of reading and writing are shown in the centre of the screen portrayed in Figure 3.2.

Figure 3.2: Digital literacies include a number of abilities that extend notions of (a) screen reading and internet surfing [reading] and (b) texting, keyboarding, and mailing [writing]



Radiating outwards from screen reading and writing in Figure 3.2 are a number of associated abilities that other writers refer to variously as information literacy, media literacy, or visual literacy. These associated abilities form part of digital literacies:

- using ICT skills to create and share information;
- searching, sifting, scanning, and sorting information;
- navigating through screens of information;
- locating and evaluating information;
- using ICT to research and solve problems;
- making multimedia presentations;
- retrieving, organizing, managing, and creating information; and
- sending and receiving messages.

Furthermore, the kinds of texts that learners today interact with – they are part of today's learners' lifeworlds – are multi-modal. These texts comprise the various codes identified by Nallaya (2010) above: icons, symbols, visuals, graphics, animation, audio and video. Nallaya continues:

> Teachers who do not acknowledge these texts as part of the repertoire of textual materials in the classroom can make the language learning process less authentic as well as disengage learners' real life experiences from everyday classroom learning and teaching" (Nallaya, 2010, p. 48).

The use of multi-modal texts in the classroom, then, together with the representation in Figure 3.2, ought to assist teachers and teacher educators in separating the widened range of skills now required of students. These are the skills all citizens need to be digitally literate to function under the demands of work and life in the remaining decades of this century. Figure 3.2 thus provides a template for a key component of the curriculum.

This chapter began by describing in what ways 21st century learners are different from their parents and the new modes of learning that a digital world requires. The work of Partnership for 21st Century Skills is recognized in identifying the clusters of skills that students today need to live and work in the 21st century. The chapter concludes by detailing how digital literacies extend well beyond notions of print-based literacy. Students and their teachers who develop the abilities to interact with the wider world, as portrayed in Figure 3.2, can, with some justification, be termed *digital citizens* of the 21st century.

4

Stages of ICT Adoption and Use

You will find in this chapter:

- how a model can represent adoption and use of ICT
- how the model shows stages where classrooms and schools are at in ICT integration
- how to map the model of stages of ICT integration onto learning and teaching
- why models of systems can be useful

4. Stages of ICT Adoption and Use

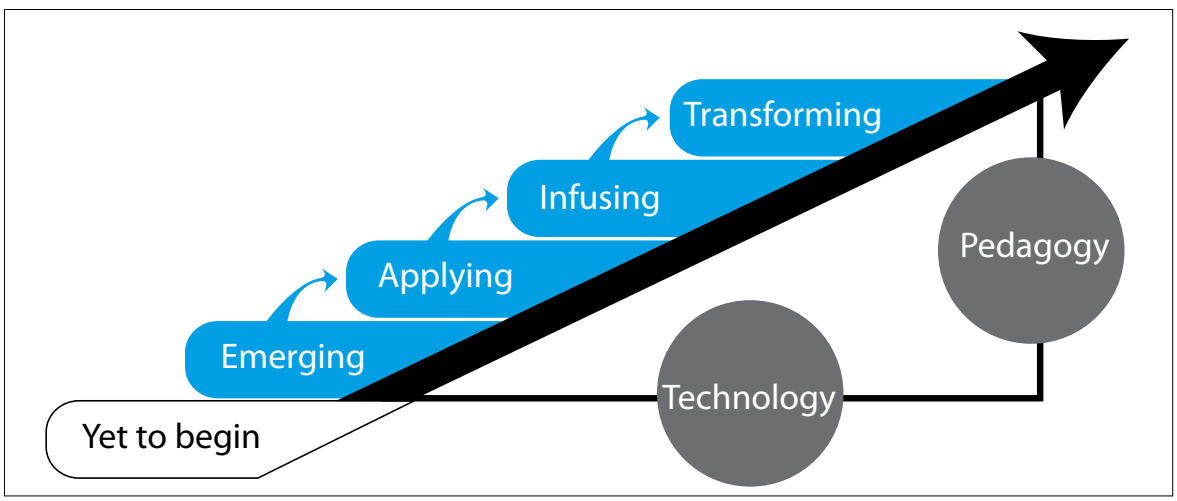
Modelling ICT adoption and use

Countries in the Asia-Pacific region differ widely in terms of a range of demographic and educational indicators as noted in Chapter 2, which in turn leads to wide differences in their take-up and implementation of ICT in education. At one end are schools in remote locations that, because of limited financial resources, irregular or no electricity supply, or lack of other basic infrastructure, are yet to make a start on introducing ICT in schools. At the other end, in contrast, are schools that have fully integrated ICT into the curriculum across all subject areas in such a way that teaching and learning, classroom and school administration, and indeed the whole ethos of the organization, are transformed.

Throughout this Guide we talk of schools to include not only primary and secondary schools but also schools of teacher education at colleges and universities; we speak of teachers to refer to teachers in schools and also student teachers in teacher education programmes; and we mention classrooms for both classrooms in schools and lecture or seminar rooms in colleges and universities.

To gauge the stage of ICT integration reached by a country, a district, an individual school, or even a class within a school, a model is presented as shown in Figure 4.1. Such a model serves as a representation of the integration of ICT in education, a kind of scaffold or framework. Knowing what stage schools are at in the integration of ICT across the curriculum is useful, for example, in the allocation of resources to schools, as well as in teacher education in the preparation of teachers. The model has achieved high recognition in the region, due largely to its dissemination in UNESCO publications (Anderson and van Weert, 2002; Anderson and Glenn, 2003; and Majumdar, 2005).

Figure 4.1: Stages that schools typically pass through in adoption and use of ICT



Source: Based on Anderson and van Weert (2002) and Majumdar (2005).

Stages of ICT integration

The model in Figure 4.1 has two dimensions: technology and pedagogy. Technology refers to all the information and communication technologies that ICT comprise, and pedagogy is the art and science of teaching.

The technology dimension in Figure 4.1 is a continuum that represents increasing amounts and variety of ICT in use. The pedagogy dimension is also a continuum and represents changing teaching practices resulting from adoption of ICT. Within these two dimensions are seen four stages that classes or schools typically pass through in their integration of ICT. Sometimes, the number of stages varies. However, there is general consensus that the integration of ICT in education proceeds progressively in a series of broad stages called in the model Emerging, Applying, Infusing and Transforming.

Emerging stage

Schools at the emerging stage have just begun to introduce computers. Initially, they may have only one or two computers and a printer, either donated or purchased by the education department. On the start of their journey along the ICT road, administrators and one or more pioneering teachers begin to explore the potential of ICT for school management and for classroom teaching.

At the emerging stage, the focus in the classroom is often on learning basic ICT skills and identifying ICT components. Teachers at this stage frequently use available equipment for their own professional purposes, such as word processing to prepare worksheets, spreadsheets for managing class lists and, if the internet is also available, for locating information or communicating by e-mail. In this way, teachers develop their ICT literacy skills and learn how to apply ICT to a range of professional and personal tasks. The emphasis is on learning to use a range of tools and applications, and becoming aware of the potential of ICT in their future teaching. At the emerging stage, classroom practice is still very much teacher-centred.

Applying stage

Schools at the applying stage have acquired additional ICT equipment throughout their organization, and are usually in countries where there are national ICT policies in place and where various ICT strategies are being trialled. School administrators use ICT for more organizational and management tasks. Meanwhile, teachers begin to adapt the curriculum in order to increase the use of ICT in different subject areas, applying specific software tools such as drawing, designing, modelling and simulations in their teaching.

What is widely observed in the development of teachers' skill and use of ICT at this stage is that initially, ICT are used almost as a separate curriculum area. That is, teachers may "do" things on computers with their students (such as word processing or using other software) in isolation from what is being studied in class. Computers may also, initially, be seen as a

"reward" for fast finishers in classroom activities, and much initial use is for playing games on the computer.

Teachers at the applying stage still tend to dominate learning activities in the classroom. However, they use ICT for professional purposes, focusing on improving their subject teaching in order to enrich how they teach with a range of ICT applications. Gradually they gain confidence in using specialized ICT tools in teaching in their subject fields. The opportunity to apply ICT in all their teaching is often limited only by a lack of ready access to ICT facilities and resources.

Infusing stage

Schools at the infusing stage are incorporating ICT across the curriculum. The terms integrating, embedding, infusing – these terms are largely synonymous – are all used. At this stage, almost all classrooms are equipped with computers, as are school offices and the library, and schools have internet connections. A wide variety of other ICT is in evidence across the institution, in classrooms, laboratories and administrative offices.

At this stage, ICT infuse all aspects of teachers' professional lives in such ways as to improve student learning and management of learning. The approach of senior staff is to support active and creative teachers who are able to stimulate and manage the learning of students, and to integrate a range of preferred learning styles in achieving their goals. The infusing stage often involves teachers easily integrating different knowledge and skills from other subjects into project-based curricula. The curriculum begins to merge subject areas to reflect real-world applications.

While teachers now integrate ICT in all aspects of their professional lives to improve their own learning as well as the learning of their students, ICT are not completely fused with other regular learning activities. Students, however, are slowly given more control over their learning and a degree of choice in projects undertaken. Teachers use ICT to assist their students to assess their own learning in achieving the aims of personal projects. At the same time, it becomes quite natural for teachers to collaborate with other teachers in solving common problems and to share their teaching experiences with others.

Transforming stage

The stages we are discussing are not necessarily a hierarchy but rather stages that teachers typically pass through in their feelings of confidence and ease with ICT as they transform their pedagogy and the learning of their students. The infusing stage is already leading to transformation. A major challenge is to move teachers through the infusing stage to a point where ICT are tools used routinely to assist learning in such a way that they are fully integrated in all classes.

When ICT are fully integrated in all regular classroom learning activities, when ICT is used to rethink and renew institutional organization in creative ways, and when ICT are a regular

part of the daily life of the institution, then schools are at the transforming stage. ICT become an integral, though invisible part of daily personal productivity and professional practice. The focus in classrooms has moved fully from teacher-centred to learner-centred that integrates subject areas in real-world applications.

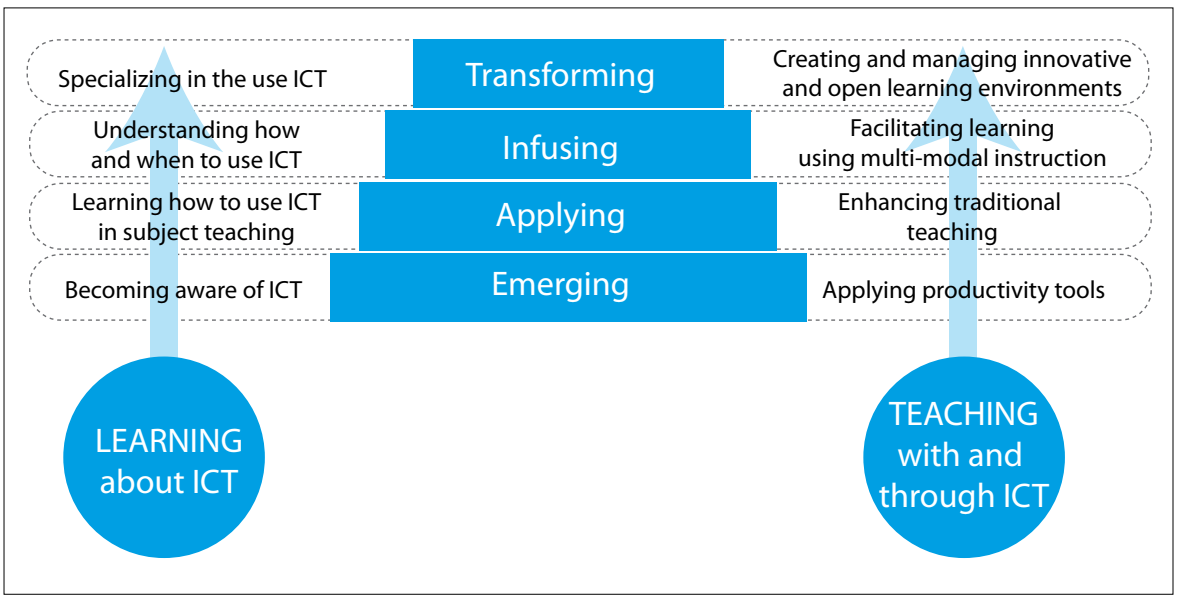
At the transforming stage, ICT may be taught as a separate subject at senior levels of secondary schools and incorporated into vocational areas. Teachers with expertise in ICT may be on staff along with other subject specialists. Part of such teachers' responsibilities is to keep track of developments in ICT, and to assist in recommending and acquiring ICT facilities and resources to support the curriculum throughout the institution. With the school head, such staff may assist in developing an ICT plan for the institution.

To conclude, when the transforming stage is reached, the whole ethos of the institution is changed: teachers and other support staff regard ICT as a natural part of the everyday life of their institutions, which have become centres of learning for their communities.

Mapping the model onto learning and teaching

We can derive a second model from the one above by overlaying or mapping the four stages of ICT integration onto learning and teaching (see Figure 4.2). This second model is useful because it shows the steps that learners typically pass through as they learn about ICT and, approximately corresponding to these, the steps teachers generally progress as they teach with ICT. These four steps, as we refer to them here to distinguish them from the stages in Figure 4.1, have a one-to-one correspondence with the four stages: Emerging, Applying, Infusing and Transforming.

Figure 4.2: Mapping ICT stages onto learning and teaching



Source: Adapted from Majumdar (2005).

Steps in learning about ICT

Studies of teaching and learning in schools around the world identify four broad steps in the way that students, and indeed their teachers, learn about and gain confidence in using ICT. You see these four steps in Figure 4.2. They are:

- becoming aware of ICT;
- learning how to use ICT in subject teaching;
- understanding how and when to use ICT; and
- specializing in the use of ICT.

As with the four stages of ICT integration, these four steps in learning about ICT and the corresponding steps following about teaching with ICT are not completely separate and distinct categories as portrayed below for descriptive purposes. They frequently merge into and overlap with each other.

Becoming aware of ICT

In the first step in learning about ICT, teachers and learners become aware of ICT tools, how they function, and how they are used. At this step, there is usually an emphasis on ICT literacy and basic skills. This step of discovering ICT tools is linked to the emerging stage in ICT integration.

Learning how to use ICT in subject teaching

The second step in learning about ICT is learning how to use ICT tools and beginning to use them in different subjects in the curriculum. This second step involves using general and particular ICT applications, and is linked to the applying stage in the ICT integration model.

Understanding how and when to use ICT

The third step in learning about ICT is understanding how and when to use ICT tools to achieve particular purposes, such as selecting particular ICT tools to complete a given project. This step implies the ability to recognize situations where ICT will be helpful, choosing the most appropriate tools for a particular task, and using these tools in combination to solve real-life problems. This third step is linked to the infusing stage in the ICT integration model.

Specializing in the use of ICT

The final step in learning about ICT involves incorporating within pedagogical practices and organizational management some specialization in the use of ICT tools and systems. Teachers develop an understanding about ways that such ICT tools and systems enhance student learning. At the same time, school heads and administrators learn how school organization, its administration, planning and other business functions, can benefit through

the deployment of ICT. This fourth step in learning about ICT is linked to the transforming stage in the ICT integration model largely through the vision and curriculum leadership that the head and senior teachers provide.

At this step, too, where ICT is taught as a separate subject at senior secondary levels, students enter more deeply into the science that creates and supports ICT, in the same way that they study mathematics or physics with specialist teachers. Such study concerns vocational or professional education rather than general education and is therefore different from the previous three steps in learning about ICT.

Steps in teaching with and through ICT

In the same way that learning about ICT involves four steps, when ICT is adopted in schools to support teaching and learning, teaching generally proceeds in four broad steps. Figure 4.2 shows what these four steps are:

- applying productivity tools;
- enhancing traditional teaching;
- facilitating learning using multi-modal instruction; and
- creating and managing innovative and open learning environments.

Applying productivity tools

When teachers first start using ICT, they generally use productivity tools like word processors, programs to make visual presentations, spreadsheets, databases, and email to support their daily teaching. At this step, the emphasis is usually on how to use what we commonly call office software. This initial step in applying these productivity tools for teaching and learning is linked to the emerging stage in ICT integration.

Enhancing traditional teaching

After introducing productivity tools for teaching, the next step generally is to use computer-assisted learning software as an adjunct to regular teaching in different subjects of the curriculum. This second step sees the gradual integration of computer-based learning into regular teaching, and is linked to the applying stage in ICT integration.

Facilitating learning using multi-modal instruction

The step that follows commonly involves teachers using a variety of multimedia tools to aid their students' learning. Teachers need to select what is the most appropriate tool for a given task, and to use these tools in combination to solve real-life problems. At the same time, teachers have to recognize situations where various multimedia and specialized software can be useful for teaching and learning. This third step in teaching with ICT is linked to the infusing stage in ICT integration.

Creating and managing innovative learning environments

The final step involves specializing in the use of ICT to create innovative learning environments that in time transform classroom learning. Heads of schools provide vision and leadership in curriculum planning for the whole institution; they innovate with delivery methods of learning content; they establish ICT coordinating teams and support teachers' innovative use of ICT to facilitate students' knowledge construction and higher-order thinking within and across subjects.

Specialized software including modelling and simulation, expert systems, semantic networking and other interactive learning tools, as well as learning management systems, are often employed to support pedagogical innovation. By using accepted learning principles and current trends in pedagogy, teachers are aided in developing, delivering and managing open and flexible learning programmes. This fourth step in teaching with and through ICT is linked to the transforming stage in the ICT integration model.

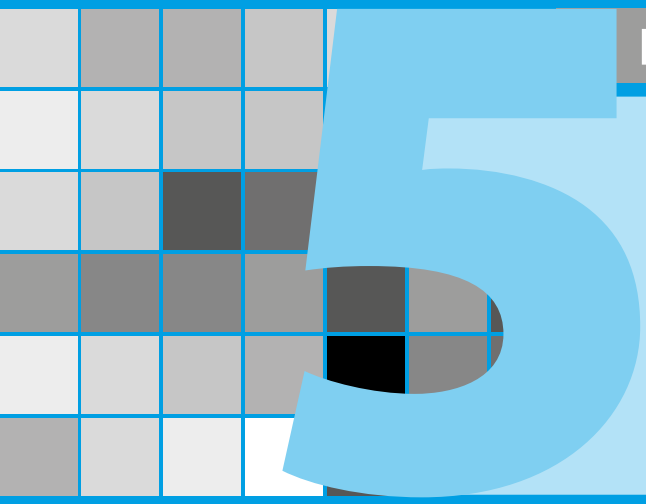
How to use the models

The model presented in the first section of this chapter shows the stages that schools, even education systems and countries, pass through when technology – ICT – is introduced in classrooms and brings about changes in pedagogy. Of course, in the real world, the situation is much more complex. But the model is proving useful in the Asia-Pacific region to track the stage a school is at.

As we see in Chapter 7, this model of stages of ICT adoption and use proves useful to policy and decision-makers in charting progress, not only of an organization but also of a system, in integrating ICT and in steering growth to higher stages of ICT integration.

The second model presented in this chapter shows the four stages of ICT integration mapped onto learning and teaching. Again, the real world is much more complex but the model shows four broad steps that learners and teachers typically pass through in learning about and teaching with ICT.

Models are most useful when, like the two above, they can be used to guide practice. Further, because models are visual representations of what are often complex interacting systems, they usually make it easier to see how different components relate to each other.



5 E-learning for Students and Teachers

You will find in this chapter:

- what e-learning for students and teachers comprises
- how e-learning is constructed as a model
- where e-resources and online courses fit in the model
- what blended learning and communities of practice are
- how the e-learning model can serve as a template for teacher education and be useful as a planning tool

5. E-learning for Students and Teachers

What is e-learning?

E-learning, or electronic learning, is a widely used term in business, industry and education. Google "e-learning" and you will get in excess of one hundred million hits. The term e-learning is apt for education because it combines in its name e (electronic) and learning, and thus puts an emphasis on learning in a way that the term ICT by itself does not.

Where ICT provide the vehicle, e-learning can be described as the journey, with increased knowledge, understanding and skills as the destination. In other words, we use ICT to participate in various electronic learning activities. Underlying these activities are all the electronic devices that enable learners to connect to networks – the World Wide Web or simply the web – and associated web technologies like browsers and search engines that allow learners to interact with content on the web (see clipped insert).

Two web tools

A browser is a web tool for retrieving and displaying information resources from the web such as web pages, images and videos. Each information resource or website has an address called a URL (short for Uniform Resource Locator). A common feature of web browsers are bookmarks or favorites that allow you to record the addresses of any website you want to revisit. Major web browsers are Internet Explorer, Mozilla Firefox, Google Chrome and Apple Safari.

A search engine is a web tool for searching for information on the web. The results of a web search are commonly called hits. A very popular search engine worldwide is Google that claims to index some billions of pages. In China, the search engine Baidu exceeds Google in daily number of users.

Elaborating on the scope of e-learning

There is no universally agreed upon definition of e-learning. One writer defines e-learning as "pedagogy empowered by digital technology" (Nichols, 2008). Others list variations of e-learning. The differences lie generally in what electronic devices for learning are included in the definition. Following Resta and Patru (2010) in the UNESCO publication, *Teacher Development in an E-learning Age: A Policy and Planning Guide*, the approach here is to start with the observation that e-learning is learning by communicating using the internet and interacting with content accessed on the internet, all within the context of sound pedagogy. This approach shows e-learning to have two dimensions:

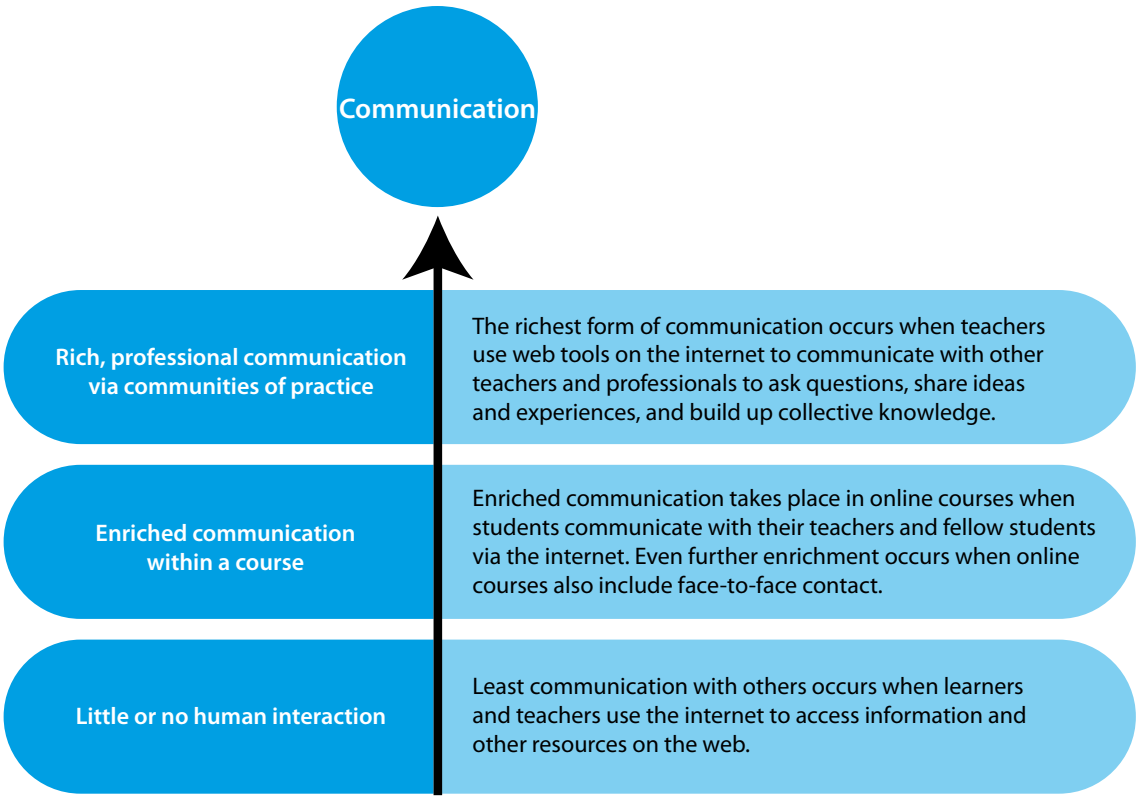
1. communication – communicating using the internet or web; and
2. content – content on the web.

A discussion of these two dimensions leads to the development of a model for e-learning within which we identify different categories of learning. This model is similar to that of Resta and Patru (2010).

Communication dimension

Communication via the internet in terms of communication with others can be conceived as a continuum. At one end of the continuum there is little or no human communication; at a midpoint position there is enriched communication within a course; while at the other end of the continuum there is very rich communication via what are called communities of practice. Figure 5.1 shows these points of reference along the communication dimension of e-learning, presented as a vertical axis. Each point of reference is accompanied by a brief explanation.

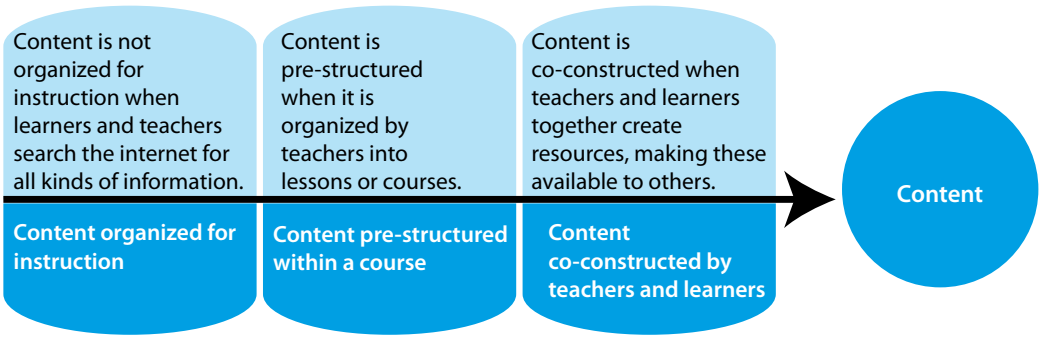
Figure 5.1: The communication dimension (one of two dimensions of e-learning) as a continuum with three points of reference



Content dimension

In a similar way to the communication dimension, organization of content for instruction on the internet may also be conceived as a continuum. At one end of the continuum, content is not organized for any particular instruction. This occurs when learners and teachers search the internet for all kinds of information and resources. At a mid-point position on the continuum, content is pre-structured by teachers for a particular course or programme. At the other end of the continuum, content is co-constructed by teachers and learners together as they create new resources, which they can make available to others on the web. Figure 5.2 shows these three points of reference along the content dimension of e-learning, constructed this time as a horizontal axis. For each point of reference along the continuum, there is an accompanying brief explanation.

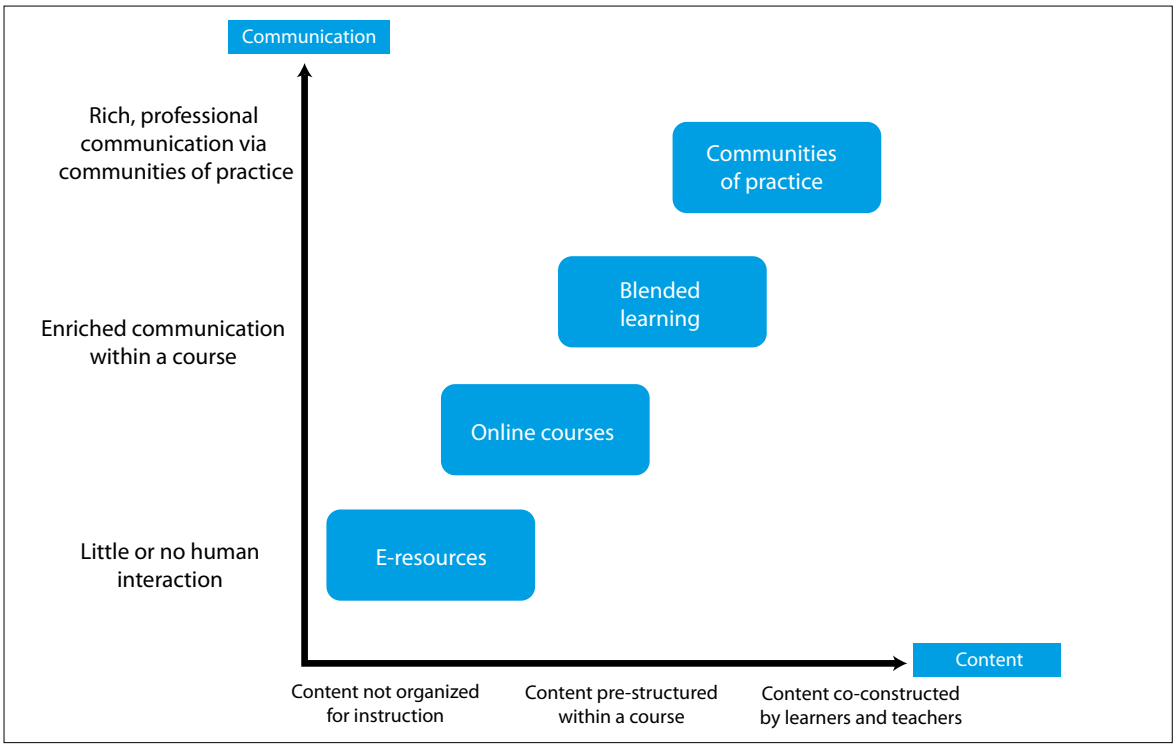
Figure 5.2: The content dimension (the second of two dimensions of e-learning) as a continuum with three points of reference



Categories of e-learning

The two dimensions of e-learning, communication and content, are described separately, above, as a matter of convenience. We now put them together to build a two-dimensional model of e-learning. In a way that is not possible when working with a single dimension, we can now position different categories of e-learning within the two axes as each varies along both communication and content dimensions. Figure 5.3 is the end result.

Figure 5.3: Four basic categories of e-learning



Source: Adapted from Resta and Patru (2010).

Figure 5.3 shows four basic categories of e-learning (see clipped insert for further detail). When learners and teachers search the internet for information and learning resources – e-resources – the content is not organized for instruction and there is little or no human interaction. Hence the position of e-resources in the bottom left corner of the model.

With online courses such as are offered in distance education programmes, the content has been pre-constructed by the instructor and there is a certain degree of communication with the instructor. Hence the position of online courses further along both dimensions in the model than e-resources. Blended learning courses, as the name implies, offer a blend of online content and face-to-face contact with the instructor. Because of the additional interaction with the instructor, blended courses are positioned further along the content dimension and further up the communication dimension than online courses.

Communities of practice occur when teachers and learners together co-construct courses, continually add to and comment on courses, and share these with others on the web. When teachers engage with other teachers using web tools to share their experiences, the richest form of communication takes place. Hence the position of communities of practice is at the top right corner of the model.

The four basic categories of e-learning are not completely separate and independent of each other as Figure 5.3 suggests. Some of the links and relationships between the categories

are detailed by Resta and Patru (2010) on which this section is based. Nor in real classrooms will categories of learning be as precisely differentiated as the model implies. As stated for the two models presented in the previous chapter, a model is a visual representation of a system in the real world and is useful if it helps clarify how the components within it relate to each other and if it helps our understanding of the complexity within a system. We turn next to see the potential usefulness for teachers and teacher educators of the model of categories of learning in e-learning.

Four basic categories of e-learning

E-resources refer here to information and learning resources on the web that are available for access by teachers and learners for instruction. Many collections of such instructional resources, sometimes called information repositories, are freely available, and these are discussed in more detail in Chapter 8. To access these e-resources, all you need is a search engine. With bookmarks you can return easily to a favourite resource.

Online courses are offered by many teaching institutions around the world, usually for a fee, and often as part of a diploma or degree. However, there are also many free online courses on a multitude of subjects offered by organizations and individuals. Commercial course management systems (CMS) provide for the presentation of course materials on the web, testing, feedback, plus other features. Details of a freely provided CMS called Moodle are given in Chapter 9.

Blended learning is a term to describe learning that combines different learning environments: typically the use of learning via the web and face-to-face teaching. Thus blended learning can combine the use of web instructional tools or online courses and traditional teaching methods such as teacher instruction, discussion, seminars and tutorials. In a blended learning approach, teachers may draw on web tools that enable students to communicate with each other, collaborate, and share resources (such tools are detailed in Chapters 9 and 10), as well as employ course management systems (CMS) as in online courses (see above).

Communities of practice are groups of people such as teachers or even students who share a common interest. Often such groups develop because of one member's special interest in a topic, or they can be set up specifically to share ideas and experiences. Communication between members may be by email, by videoconferencing, or increasingly by using social networking tools. Examples are given in Chapter 12.

Extended view of e-learning

The model of e-learning developed above with its four categories of learning allows us to extend the view of e-learning given at the start of this chapter. We can, therefore, be more specific and say that e-learning is using the internet for communicating and locating content, within the context of sound pedagogy, to:

- access e-resources for classroom instruction;
- participate in online courses;
- provide blended learning by combining online content with other teaching methods; and
- offer support for communities of practice to share ideas and experiences.

A template for teacher education

The approach to e-learning in this chapter offers a template for teacher educators with its four basic categories of learning. If based on sound pedagogy, e-learning provides a way forward in that it sets out a framework for training the next generation of teachers. As Resta and Patru (2010) state in the foreword, the purpose of UNESCO's guide to teacher development in an e-learning age is to:

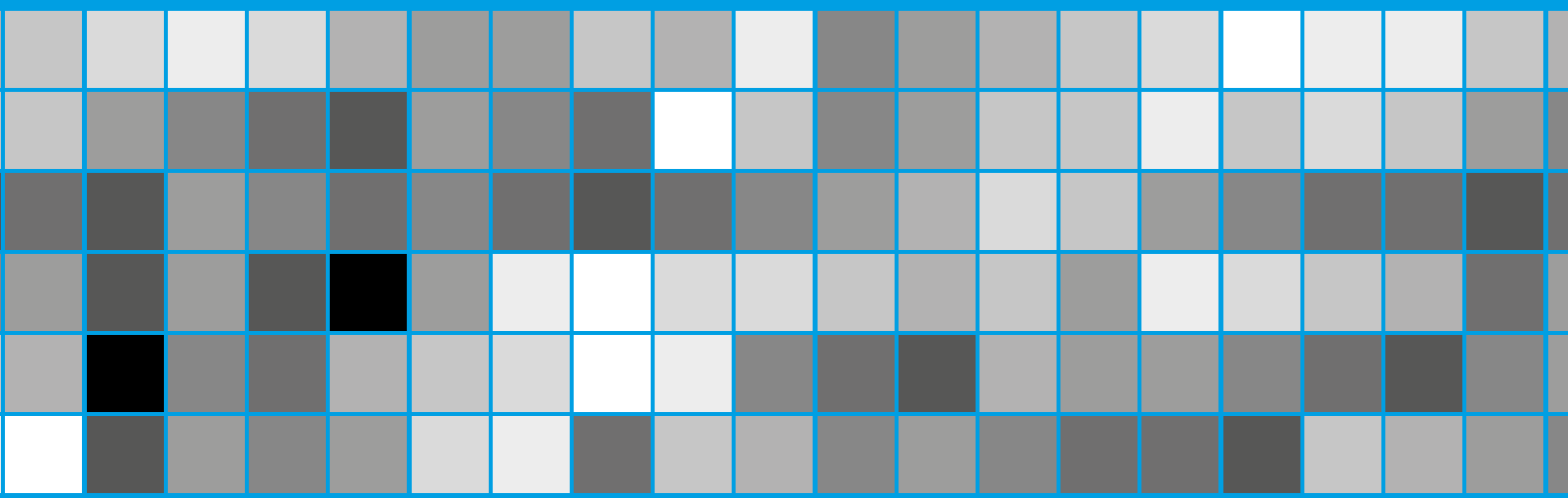
> assist decision-makers in ministries of education, faculties of education, and schools in understanding key issues, strategies, and new approaches in the use of e-learning for teacher development.

If you are a member of any of these groups – decision-makers in ministries of education, faculties of education, or schools – this UNESCO publication is recommended as a policy and planning guide for programmes in teacher education.

Besides providing a template for teacher education courses, the e-learning model is also useful in delineating different categories of learning with and through ICT. Subsequent chapters adopt the model's framework to:

- detail useful e-resources for learning and teaching (Chapter 8);
- describe how teachers can make use of web tools in their teaching in a blended approach (Chapters 9 and 10); and
- illustrate ways that communities of practice assist in the professional development of teachers (Chapter 12).

This e-learning model is a valuable planning tool.



6 Assessing Student E-learning

You will find in this chapter:

- why assessment needs to match 21st century learning
- how teachers can adopt a learner-centred approach
- how project-based learning is assessed
- what portfolios are and how they are used and assessed

6. Assessing Student E-learning

Assessment of 21st century learning

At the dawn of the microcomputer era – a year before IBM released its very first individual computer that it dubbed Personal Computer so giving rise to the term PC — a pioneering book titled *Mindstorms* (Papert, 1980) was published. Its author, Seymour Papert, had an important message for educators. There is a tendency, he said, for new tools to be used initially like the former tools they replace. He warned it would be the same with computers. He foresaw that even with the introduction of these devices – new tools for extending children's minds – schools would continue with their old forms of assessment. The full title of Papert's seminal work, as important today as it was three decades ago, is *Mindstorms: Children, Computers, and Powerful Ideas*.

The term "digital natives" was introduced in Chapter 3 to describe children born this century who are growing up in a digital world. New kinds of skills are required of these children in the 21st century, skills that include digital literacies. Modes of learning for them are changing, too, as students become active players in learning activities, rather than merely passive receivers of information. To solve real problems rather than artificial exercises, learning involves more working together with other students as members of teams rather than working alone, as it often used to be.

In the past, assessment was largely concerned with testing whether students could reproduce information and knowledge accurately. However, as we see in previous chapters, the sheer amount of information and knowledge is growing at such a rapid rate that it is no longer practical to regard certain prescribed information as sufficient to prepare students for the world of work and for life. In certain branches of science, for instance, and in the field of information technology itself, knowledge changes or is up-dated between the time students start their courses and when they graduate.

Educators are not always agreed as to how methods of assessment need to change for e-learning. Some argue that assessment of e-learning is no different from assessment of any other learning activity, and that both require valid and reliable instruments. This is partly true. But as Papert recognized more than thirty years ago, the real need for change is brought about by new ICT tools and the consequential changes in the nature and types of learning activities. Methods of assessment need to match these, otherwise they cannot be valid.

A learner-centred approach

Adopting a learner-centred approach or student-centred learning in the classroom places learners in the central position. This is in direct contrast to much traditional teaching where the teacher is the all-knowing authority. In student-centred learning, students are

given a voice. Their needs, abilities, interests and learning styles help determine classroom activities. The role of the teacher is in no way diminished as a result. Rather, teachers use their knowledge and resources to co-design learning activities and projects for and with their students, as the e-learning model presented in the last chapter shows.

In effect, teachers make their approach more learner-centred by giving students more responsibility for their own learning. This can mean, for instance, allowing students to choose their own projects. It can also mean letting students decide what their goals are and even giving them a say in how these are assessed. In learner-centred classroom activities, students often work together in small groups, and they decide between themselves what each member's respective role should be.

In classrooms like the ones we are describing, individual or group projects often focus on searching for answers to particular questions, with the teacher helping to identify suitable problems and questions. The problems for investigation arise from students' backgrounds and experiences, which make these more real and motivating – *authentic* is a word you sometimes hear. The data students collect in finding answers to problems they have chosen are not limited by a particular subject or discipline but usually cross subject boundaries. Because students commonly work in small groups, they learn from each other in planning how best to solve problems, and they learn to work in teams.

What marks a learner-centred approach as quite different from teacher-centred learning is in how learning is assessed. Typically, the end result of a group or individual project in learner-centred classrooms is that students demonstrate what they have learned by presenting some product or performance. Other students in the class usually form the audience. In other words, students choose how to demonstrate what they have learned, and other students react and provide feedback. For some teachers and administrators, it is this aspect of a learner-centred approach that is most questionable for it appears to usurp what is traditionally regarded as the teacher's role in safeguarding standards.

Project-based learning

The type of learning described above – seeking solutions to real-life problems, gathering information, analysing data – is commonly called project-based learning or PBL for short. There is nothing particularly new about this type of learning since good teachers have frequently incorporated project work, individual or group, into regular classroom activities. What currently gives rise to an increasing interest in PBL are ICT, particularly the research opportunities provided by the internet and the array of multimedia tools for assembling and presenting the results of projects. Indeed, Wikipedia (an e-resource detailed in Chapter 8) defines project-based learning as "the use of classroom projects, intended to bring about deep learning, where students use technology and inquiry to engage with issues and questions that are relevant to their lives" (http://en.wikipedia.org/wiki/Project-based_learning).

Besides student use of technology in project work, a key distinguishing feature of today's use of PBL is modes of assessment. Rather than assessment using traditional tests, students are typically assessed on the basis of the projects they present. To illustrate, we consider two forms of PBL assessment: formative and summative. To make the following assessment descriptions more concrete, let us imagine that students have been given the task of seeking a solution to a significant problem within a context that they are familiar with, that they work singly or in groups over a reasonable period of time, say half a term or more, and that they are asked to present their findings in the form of a few web pages.

Formative assessment

The purpose of formative assessment in PBL is to provide constructive feedback to students during the course of projects so that they can modify and improve them. Such feedback gives students an estimate of the value of their work as seen by others and it can motivate them to work further in reshaping their projects before finally submitting them.

One possibility is for students to invite fellow students and even parents and members of the community to review their draft web pages. In doing so, students tell their invited audience what the goals of their project are and perhaps even add a few questions about particular aspects of the project to focus on in giving feedback. The mere act of telling others about project goals and posing questions to focus on helps students note where their projects can be improved. Receiving feedback from others, however, is a powerful way of demonstrating that what they are doing is a worthwhile activity and, to utilize ICT further, students can issue invitations for feedback by email.

Summative assessment

Summative assessment is teachers' evaluation of students' work when the projects are submitted. The teacher's task here is similar to that used in traditional testing where judgments are made, for example, about a piece of written work or responses to open-ended test questions. With PBL, we see the emergence of more objective assessment tools in what are termed *rubrics* for evaluating projects.

Put simply, a rubric is a list of indicators or criteria for judging key components of projects to be evaluated. Each indicator is usually scored from low (indicating poor performance) through to high (indicating excellent performance). The final score given to a project is the average obtained by summing scores over the different project components. An example best illustrates how rubrics are used in summative assessment.

In the following generalized sample rubric, there are four indicators scored 1 to 4 where:

1. indicates incomplete
2. indicates partially proficient
3. indicates proficient
4. indicates excellent

Suppose the components of projects to be evaluated include Content, Writing, Presentation and Web Skills. The four indicators and four components are seen in the assessment rubric portrayed in Table 6.1.

Table 6.1: Sample rubric for assessing project-based learning

Indicators / Components	Incomplete	Partially Proficient	Proficient	Excellent
Content				
Writing				
Presentation				
Web Skills				

The assessment rubric depicted in Table 6.1 is really just a framework that helps teachers to assess student projects. To illustrate how it works, the project content may be evaluated as incomplete, partially proficient, proficient or excellent and, if the teacher wants a numerical score, it can be scored 1, 2, 3 or 4. Other aspects of the project like writing, presentation and web skills may be similarly assessed. With writing, for example, a grading of "incomplete" may be given if the project's description of purpose is unclear and it contains many spelling and grammatical errors; if the purpose is clearly stated but the writing is awkward and contains some errors, it may be judged "partially proficient"; if the purpose is clearly stated and the project is written reasonably concisely but still contains a few errors, it may be judged "proficient"; and if the project is written very well and free of major errors, it may be judged excellent.

If numerical scores are used, the final score for a project is obtained by summing the scores given for content, writing, presentation and web skills. The total score (with a maximum of 16) can be converted to a percentage.

E-portfolios

Another new approach to assessment is the use of e-portfolios. Portfolios have long been used by artists as a means of showing a sample of their work, whether these are paintings, drawings, or photographs. Similarly, some individuals maintain job portfolios to hold references, letters of commendation, and other samples from their work, organized in ways to demonstrate their competence and creativity. However, electronic portfolios, or e-portfolios as these are now universally called, have taken on wider significance as tools for learning, feedback, self-assessment and self-reflection (see clipped insert).

E-portfolios

An e-portfolio (short for electronic portfolio) is an electronic or digital record compiled by users and typically maintained on the internet to exhibit abilities, achievement and growth in one or more areas. The electronic record can contain a variety of artefacts such as audio, graphics, video, multimedia, and text.

Teachers and teacher educators are using e-portfolios with their students as a way of keeping learning records. Students under the guidance of their teachers select what samples of their work to include, the feedback received, and their reflections on what they have achieved. Maintained over a term or semester, e-portfolios motivate students by providing evidence of self-growth and achievement. Further, they allow students to share their work with fellow students, and this is motivating too. Indeed, they can share their work with an even wider audience on the internet if they wish, a far cry from the time when what they produced was seen only by their teacher.

When students compile e-portfolios, they practise and demonstrate their skills in using ICT in real and authentic situations. They demonstrate the extent to which they can use ICT to communicate effectively. And they integrate ICT naturally into regular classroom learning activities.

Because e-portfolios provide a convenient way of storing a variety of artefacts collected over time, and because they frequently include hard-to-measure aspects of learning, they are seen as more comprehensive measures of assessment than examination and other test scores. Because they also build in self-assessment and reflection, they provide the opportunity for students to set their own learning goals and assume responsibility for their learning. In short, e-portfolios encourage students to become self-motivated, lifelong learners.

On the other hand, e-portfolios are not without certain shortcomings. One is that e-portfolios are very time-consuming, both for students to compile and more particularly for instructors to navigate through and assess, as well as to give opportunities for display or presentation. Coupled with this shortcoming, according to some, is the difficulty in distinguishing what is a student's contribution.

Assessment of e-portfolios typically follows the approach illustrated in the previous section on project-based learning. That is, feedback and review may be given during the process of compiling an e-portfolio – formative assessment. And when e-portfolios are submitted at the end of a term or course, summative assessment utilizes assessment rubrics like that shown in Table 6.1.

The following snapshot contributed to this Guide describes a programme operating in Indonesia that uses e-portfolios as a means of assessment and the kinds of ICT employed.

E-portfolios

As part of an online course run by Education Development Centre in Indonesia through USAID DBE 2 Project, participants were assessed on the basis of e-portfolios they produced at the end of the course. These consisted of written and audio reflections, photos and videos, social bookmarking, and examples of teachers' works collected and stored online. Using various programs (e.g. Wordpress, Ning, and Blogger), participants defined the purpose of their e-portfolios, selected appropriate tools, designed and developed artefacts, and presented these as online resources.

Why e-portfolios? First, e-portfolios were used to assess participants' work and progress. But in addition, e-portfolios are a good means of storage and retrieval; they enhance technology skills; and, most importantly, they augment learning. Furthermore, e-portfolios prompt information sharing and generate online interactive discussions.

As an example of an e-portfolio, Fitria, an ICT assistant and former online participant from Central Java, collected her e-portfolio artefacts in Wordpress, which provides space for comments

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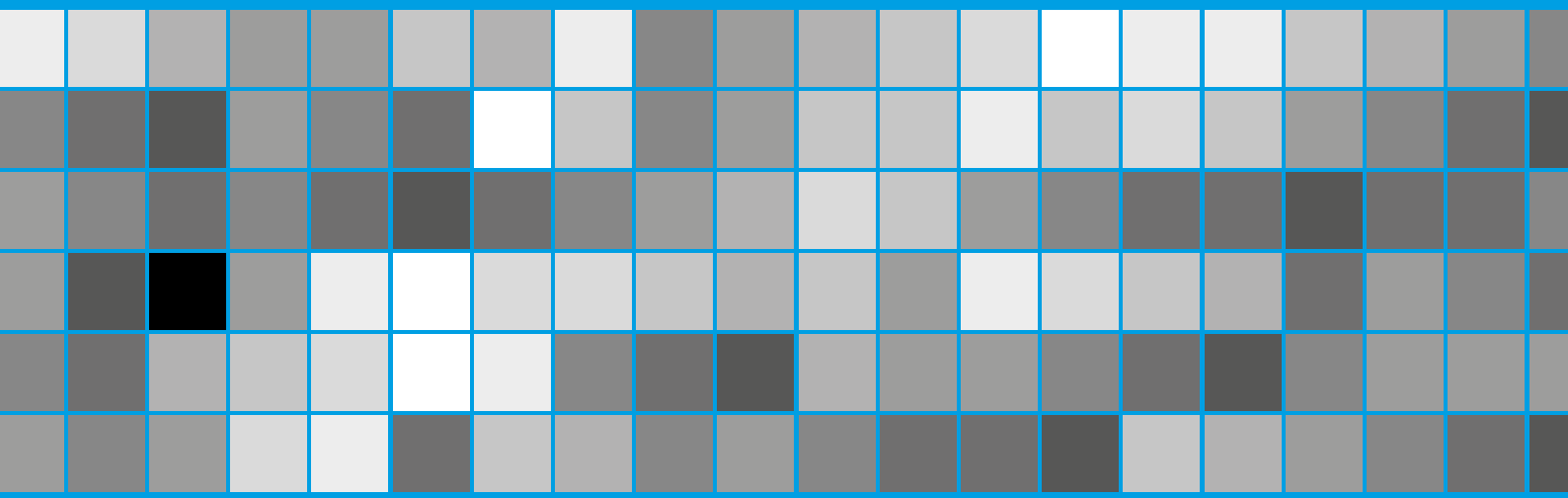
The focus in this chapter is on the individual student and assessment of new modes of learning. Project-based learning is reviewed and ways of assessing student projects are presented. The chapter concludes with an examination of how e-portfolios are used as tools for learning and gauging student growth, as well as for general measures of assessment including self-assessment and self-reflection. In the next chapter, the focus broadens from assessment of the individual to assessment at the institution and system level.



Gauging Organization Progress in Integrating ICT

You will find in this chapter:

- why decision-makers need information about progress in e-learning
- how performance indicators relate to competency standards
- how useful a matrix of indicators for ICT can be
- how to apply a matrix of ICT indicators to gauge an organization's or a system's progress in integrating ICT

7. Gauging Organization Progress in Integrating ICT

Need for information on effectiveness

In the previous chapter, we see how new learner-centred approaches to classroom teaching and the nature of e-learning bring with them new ways of assessing student growth and achievement. In this chapter, we move from the classroom to the organization (the school or teacher education institution) and the education system (of which schools and teacher education institutions are parts), and consider how to gauge progress in integrating ICT. In other words, the focus moves from the micro level to the meso and macro levels.

Suppose you work at the level of education policy planning and decision-making as a school head, dean of teacher education, or member of the ministry of education in your country. Your organization or the ministry may have a large investment in ICT, in preparing teachers for ICT, in maintenance of equipment and support for teachers. How effective is progress in the implementation of ICT? Unfortunately, education policy planners and decision-makers frequently have little or no information about effectiveness of ICT in schools or teacher education programmes. There are several reasons for this. First, evaluation studies are often overlooked in allocating resources for programmes and activities. Second, evaluation of effectiveness is difficult since account needs to be taken of complex and interrelated clusters of factors. And third, educators do not always have the necessary evaluation skills.

In the sections that follow, we develop a framework that points the way to how organizations and systems can gauge progress in ICT integration. This framework builds on the model of stages of ICT adoption and use put forward in Chapter 4. We start first with competency standards and performance indicators.

Competency standards and performance indicators

Competency standards are requirements that are generally agreed upon to perform a particular task, job or work role. As examples of competency standards, the Association of College and Research Libraries (2000) in the United States puts forward five information literacy competency standards for higher education. Here are the first three standards, which show how to rank students' information literacy in terms of three levels of competence from lowest (Standard 1) to highest (Standard 3):

Standard 1: The information literate student determines the nature and extent of the information needed.

Standard 2: The information literate student accesses needed information effectively and efficiently.

Standard 3: The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.

A number of countries, including several in the Asia-Pacific region, have developed national or regional ICT competency standards. Those that have include Australia, the People's Republic of China, India and New Zealand. ICT competency standards for teachers are presented in a UNESCO (2008) project.

Along with competency standards, it is necessary to establish what are called performance indicators to gauge, for example, each competency standard. According to Barsaga (2003), indicators are simply measuring devices. Performance indicators identify what is to be measured (that is, what data are required for measurement) and, sometimes as well, when the measurement is to be made. An example of a quite objective indicator is the number of student teachers per computer with an internet connection. The indicator here identifies what is to be measured – namely, the ratio of student teachers to internet-connected computers – and, implicitly, the time of measurement by collecting the information at a given point in time. The data required in this instance are the number of student teachers currently in a course or programme and the number of computers available with connections to the internet.

On occasion, the measurement of indicators is qualitative rather than quantitative. An example of a qualitative performance indicator might be whether students think they have improved over a course in the teacher education programme. Here the indicator is a student's judgement about competence at the end of a course compared to that at the beginning of the course. The data required in this instance might take the form of a self-rating scale administered to all student teachers at the end of the course.

Other indicators are more like test items but, rather than being scored right or wrong, they are noted as present or not present (1 or 0). Aston (2003, p. 70) gives examples of such indicators:

- Is ICT included in the curriculum? *(Yes or No)*
- Are objectives for the teaching or the use of ICT defined in the curriculum? *(Yes or No)*
- Are approaches to ICT defined in the curriculum? *(Yes or No)*

Generating appropriate indicators is quite a demanding task. For areas as complex as subjects in the curriculum, for instance, there need to be sufficient indicators to specify the domain adequately. Indicators need to be easily understood and able to be collected without undue difficulty. And, like all measures, indicators should desirably be objective and reliable.

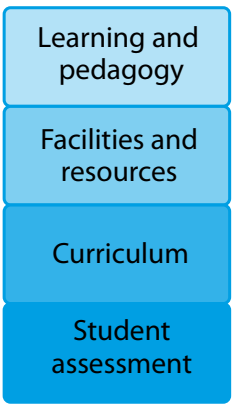
Matrix of ICT performance indicators

The next step to measuring organization progress in ICT integration is to develop a two-dimensional matrix of ICT performance indicators. The first dimension of this matrix is based on the model presented in Chapter 4 of stages of ICT adoption and use. Figure 7.1 shows the same model in matrix form with a single row. Here we see stages of ICT adoption and use as a continuum from emerging through to applying, infusing and transforming. The discussion that follows is based on the writer's chapter on assessment by Resta and Patru (2010).

Figure 7.1: Four stages of ICT adoption and use as a continuum from emerging through to applying, infusing and transforming

For the second dimension of the matrix we are developing, we use performance indicators that relate to aspects of ICT. To gauge progress of programmes in schools and teacher education faculties, appropriate clusters of indicators are likely to include learning and pedagogy, facilities and resources, curriculum and student assessment (see Figure 7.2).

Figure 7.2: Four clusters of performance indicators of ICT use



If we now combine the row consisting of stages reached in ICT adoption (from Figure 7.1) with the column of clusters of performance indicators of ICT use (from Figure 7.2), we arrive at the two-dimensional matrix shown in Table 7.1.

Table 7.1: Matrix of ICT performance indicators for gauging organization progress in ICT integration

Stages / Clusters	Emerging	Applying	Infusing	Transforming
Learning and pedagogy				
Facilities and resources				
Curriculum				
Student assessment				

In the next step, we apply the matrix in Figure 7.1 to gauging an organization's progress in implementing ICT.

Progress in implementing ICT

So far the matrix in Table 7.1 is just a shell. Appropriate performance indicators need to be generated for each of the 16 cells in the matrix formed by stages and clusters. In practice, additional clusters of variables might merit inclusion such as, for example, developing plans and policies, vision, and leadership.

A way of generating performance indicators for the cells is illustrated in a project described by Anderson and van Weert (2002). To give an idea of what these indicators look like, suppose we take one row of the matrix, the first on learning and pedagogy, to see the kinds of performance indicators for each of the four stages: Emerging, Applying, Infusing, and Transforming. The results are shown in Table 7.2.

Table 7.2: Matrix of ICT performance indicators for determining progress in ICT integration

Stages / Clusters	Emerging	Applying	Infusing	Transforming
• Learning and pedagogy	• Teaching centred • Didactic-style teaching	• Factual knowledge-based learning • Teacher-centred • Didactic-style teaching • E-learning a separate subject	• Learner-centred • Collaborative learning	• Critical thinking and informed decision-making • Whole-learner learning, multi-sensory, preferred learning styles • Collaborative learning • Collaborative knowledge

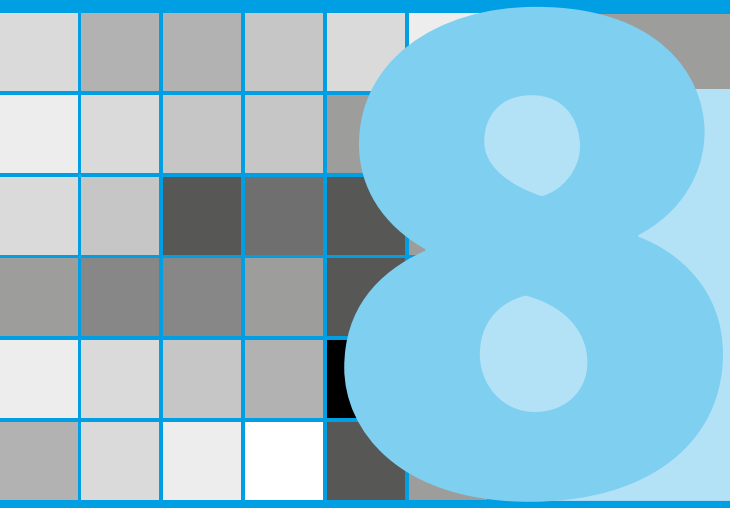
Source: Adapted from Anderson and van Weert, 2002.

The matrix of ICT performance indicators in Table 7.2 provides a framework for evaluation similar to the rubric described in the last chapter for assessing project-based learning (compare Table 6.1). If the focus is on a single school, we might observe the learning and pedagogy taking place in each classroom and in terms of the ICT performance indicators in the columns of Table 7.2 make a judgment about the stage reached for learning and pedagogy in that school. We would conduct a similar exercise for the other clusters (facilities and resources, curriculum and student assessment) and any further clusters that might be deemed appropriate like, for example, vision and leadership. ICT performance indicators for these and other clusters may be found in Anderson and van Weert (2002, Chapter III). Finally, we aggregate the judgments arrived at for each cluster in the matrix we are using to

determine the stage the school is at in terms of ICT development along a continuum from emerging through to transforming. The further along the continuum, the more effective is the school in integrating ICT into every facet of its operation.

If we wish to see how an organization such as a school or teacher education institution has progressed in implementing ICT across the curriculum, we apply the matrix of ICT performance indicators at two points in time. A comparison of the results over time shows the degree that an organization or institution has progressed along the continuum. The matrix can also help with formulating desired standards for an institution or region. Thus the matrix supports two aspects of assessment: describing what the current situation is and steering growth to higher stages of ICT integration.

This chapter describes the general procedures to follow in gauging an organization's progress in ICT integration. A much more detailed framework and specification for ICT performance indicators is developed by the UNESCO Institute for Statistics (UIS) for determining a country's progress in terms of ICT integration. This comprehensive guide (UIS, 2009) details a range of indicators on ICT in education, with information about how data may be collected, from what sources the data may be collected, and how to analyze and interpret each indicator. Collectively, these performance indicators provide a guide to aid the monitoring of a country's progress in the global drive to integrate ICT in education.



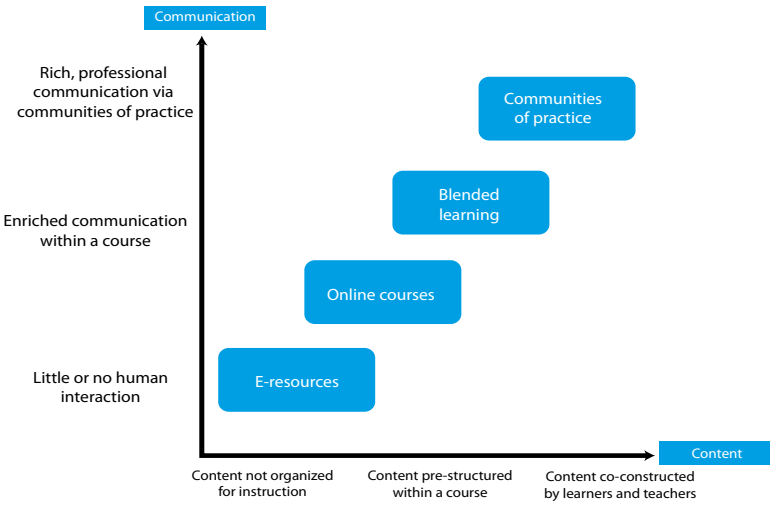
8 E-resources for Learning

You will find in this chapter:

- how to locate e-resources through web portals
- where rich reference materials are available
- what e-books are and where to locate them
- how valuable e-resources are to teachers and teacher educators

8. E-resources for Learning

In Chapter 5 a model of e-learning is developed, shown on the right, with four categories of e-learning. We examine three of these categories in detail, starting in this chapter with e-resources, blended learning in Chapters 9 and 10, and communities of practice in Chapter 12.



On the web is a vast amount of e-resources useful for instructional purposes. In this chapter, we review a small selection of these resources; we describe how they might be utilized and we tell you where to find them. With these starting points, teachers and teacher educators have at their fingertips a rich treasure of invaluable learning materials.

Web portals – a gateway to e-resources

Web portals

A web portal is a gateway to global sources of information in particular fields. Besides information, services like email and discussion forums may also be provided. The portal or gateway is essentially a website, the entry point to a range of information.

In a world where there is a super abundance of information on any topic you can think of, web portals provide an efficient way to find e-resources in fields that interest you. You can think of a web portal as a one-stop shop to extensive collections of information on particular topics gathered from worldwide sources that can be accessed easily at the one location. Because resources are collected by an organization, it means that the information has been through some form of quality control and thus is usually more reliable than much other information on the internet.

There are many web portals that contain teaching ideas, lessons and curriculum materials. In this section, we illustrate two particularly useful ones.

A portal for teachers

We are fortunate in the Asia-Pacific region that the UNESCO Regional Office for Education has the most comprehensive range of information on ICT in education of any of the

UNESCO regional offices around the world. Its portal for teachers (Figure 8.1) contains, among other resources, teaching guidelines, lesson plans, and links to online ICT teacher training courses.

Figure 8.1: UNESCO's web portal for teachers

Source: http://www.unescobkk.org/education/ict/online-resources/portal-for-teachers

If you copy the website address in Figure 8.1 into your browser, you are taken directly to the portal for teachers where you see a number of pathways or links to choose from, together with brief descriptions of each. To give a flavour of this portal, suppose you choose the link:

Teaching: Ideas, Lessons and Curriculum Materials

This pathway takes you to numerous further links that provide teachers and curriculum developers with ready-made lesson plans, activities and teaching materials covering all major curricular areas. Materials are organized into specific subjects, ranging from arts, languages, health and physical education, to mathematics, sciences (life, physical, and social), and information technology. Where applicable, the age group for which the materials are designed is indicated.

There are also sections containing resources for problem solving and teaching life skills, such as dealing with trauma, career guidance, and understanding consumer issues such as personal finance and investing.

Many of the resources make use of fully interactive media, some of which offer templates for making your own lesson plans. Each subject area is divided into recommended sites followed by other useful resources.

Instead of following the pathway to ideas, lessons and curriculum materials, you could select:

Choosing Internet Resources

(shows teachers how to assess the validity and authority of internet resources)

or

Teachers' Roles in ICT-enhanced Classrooms

(describes roles teachers play in the new knowledge societies)

or

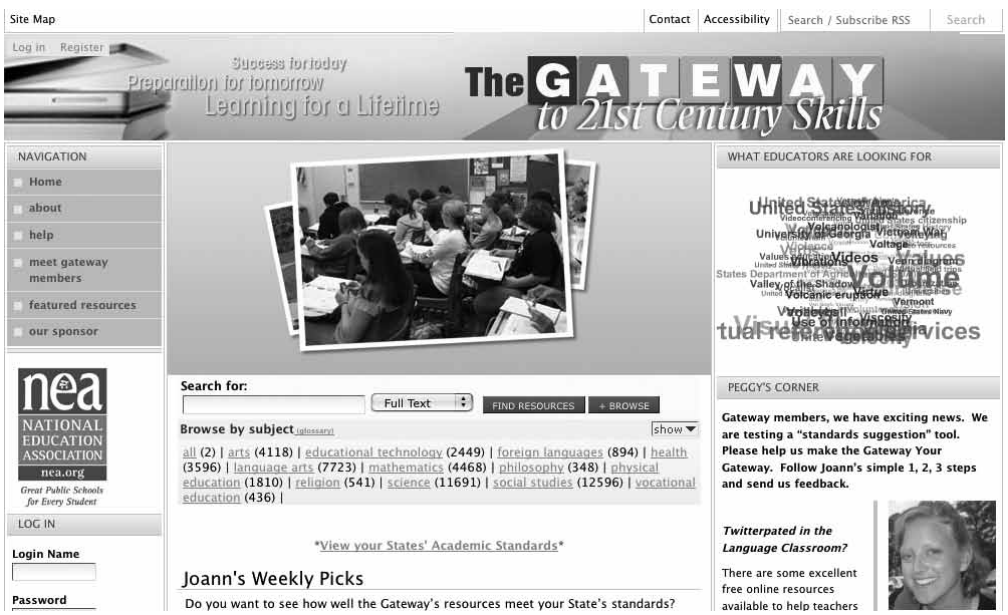
several further pathways.

We have explored only one small part of this amazingly rich set of classroom resources. Once you know the kind of content in this portal for teachers and its entry point (http://www.unescobkk.org/education/ict/online-resources/portal-for-teachers), you have at your fingertips a rich and diverse collection of e-resources for learning and teaching.

Gateway to 21st century skills

Another valuable portal to a large collection of quality classroom resources is The Gateway to 21st Century Skills (Figure 8.2). Like the UNESCO portal for teachers, copying the entry point (http://www.thegateway.org) into your browser leads to a treasure chest of e-resources for learning and teaching, a collection numbering more than 50,000, all freely accessible to users anywhere.

Figure 8.2: The gateway to 21st century skills



Source: http://www.thegateway.org

For a taste of this portal's contents, let us enter the Gateway. Once inside, you can choose to go in several different directions. There is a page for first time users to explain its powerful search engine. You can search by subject (mathematics, science, social studies ...), by grade level, by content type (lesson plan, activity, or project), or by keywords (e.g. Pythagoras theorem, Boyle's law, and so on).

Suppose you make a search for lesson plans on writing. One result is shown in Figure 8.3. This topic is aimed at students in the senior levels of secondary school, and illustrates ways of integrating ICT into regular classroom activities.

Figure 8.3: A lesson plan on "Blogging about Your Own Utopia"

Blogtopia: Blogging about Your Own Utopia

GEM Element	Element Value
title	Blogtopia: Blogging about Your Own Utopia
description	After studying the utopian literature, students design their own utopian society, publishing the explanation of their ideal world on a blog. As they blog about their utopia, students establish the habits, practices, and organizing social structures that citizens will follow in their utopian societies.
subject	writing (composition), integrating technology into the classroom,
type	Lesson plan
level	12, 11, 9, 10,
keywords	Literature, Internet, Blogs, Utopian societies,
mediator	Secondary school teachers
priceCode	
onlineprovider	ReadWriteThink
EssentialResources	Computers with Internet access; printer; paper
publisher	ReadWriteThink
isPartOf	
Identifier	

SHARE

Source: The Gateway to 21st Century Skills
(http://www.thegateway.org/browse/dcrecord.2009-09-10.6806146014)

Clicking on the lesson title, Blogtopia: Blogging about Your Own Utopia, takes you to a detailed plan of six lessons, complete with student objectives, instruction and activities, web resources and student assessment.

Rich source of reference materials

If you are connected to the internet, you have an online reference library at your fingertips, a vast library collection that includes encyclopedias, dictionaries, thesauri, maps, country profiles, biographies, quotations, even grammar and style checkers. We review below a few of the more useful.

A comprehensive online encyclopedia

Wikipedia is a publishing phenomenon. Launched in 2001, Wikipedia is already the largest encyclopedia in the English-speaking world with more than three million articles, a number that literally grows hourly. The encyclopedia comes in other languages too, 260 in fact, and the total number of articles exceeds 14 million. Millions of people throughout the world access Wikipedia regularly. Access to the encyclopedia is free.

The reason Wikipedia has grown so spectacularly is that it is written collaboratively by volunteer contributors around the globe. Anyone can contribute an article or add to an existing article. The name Wikipedia is formed from two words *wiki* and *encyclopedia*. Wiki, as we see in the next chapter, is a tool for creating websites collaboratively; *wiki* also happens to be a Hawaiian word meaning *quick*. That Wikipedia is written collaboratively is both one of its strengths and a serious weakness. The rapid growth of this online encyclopedia is because so many individuals willingly contribute entries for it and the ease with which this can be done usually ensures the information is kept up-to-date. The vision of Wikipedia's founder (Jimmy Wales) is "a world in which every single person on the planet has free access to the sum of all human knowledge". At the same time, sadly, there are a few individuals who contribute misinformation, deliberately or otherwise. These errors remain online until they are amended by one of the encyclopedia's administrators or by another contributor.

Already, Wikipedia has been compared with Encyclopedia Britannica for accuracy of information (for example, in a study reported in the reputable science journal *Nature*). In a comparison of a number of scientific topics, findings indicated that Wikipedia was nearly as accurate as Britannica. Where Wikipedia was shown to have an advantage, however, is that it is more dynamic: new information can be presented almost immediately, rather than waiting for a future release in the case of a paper-based publication, or as a supplement on disk that needs to be integrated with a previous issue.

Wikipedia is not the only encyclopedia you can access online but it is the most comprehensive. As a reference work, Wikipedia is particularly useful for finding general information about almost any topic quickly.

Dictionaries and thesauri

As with online encyclopedias, there are many dictionaries and thesauri online to choose from. An excellent dictionary is Dictionary.com (http://dictionary.reference.com).

Suppose you check the meaning of the word *portal* in Dictionary.com. Almost instantly, you are given its several meanings as a noun, which include the following:

1. A doorway, entrance, or gate, especially one that is large and imposing.
2. An entrance or a means of entrance: the local library, a portal of knowledge.
3. A website considered as an entry point to other websites, often by being or providing access to a search engine.

Since the word *portal* has further specialized meanings, the accompanying Financial, Medical, Cultural and Computing dictionaries add further meanings. You can also find out how to pronounce the word *portal*, as well as learn about its origin and history. You can even ask to see the word *portal* used in a sentence. Dictionary.com is a most comprehensive dictionary, and certainly quicker to use than a print-based equivalent dictionary.

A thesaurus is another handy reference tool for finding words with associated meanings or even opposite meanings. An excellent online thesaurus is Thesaurus.com (http://thesaurus.reference.com).

Suppose, again, you enter the word *portal* in this online thesaurus. Included in the comprehensive output you find:

Part of Speech: noun

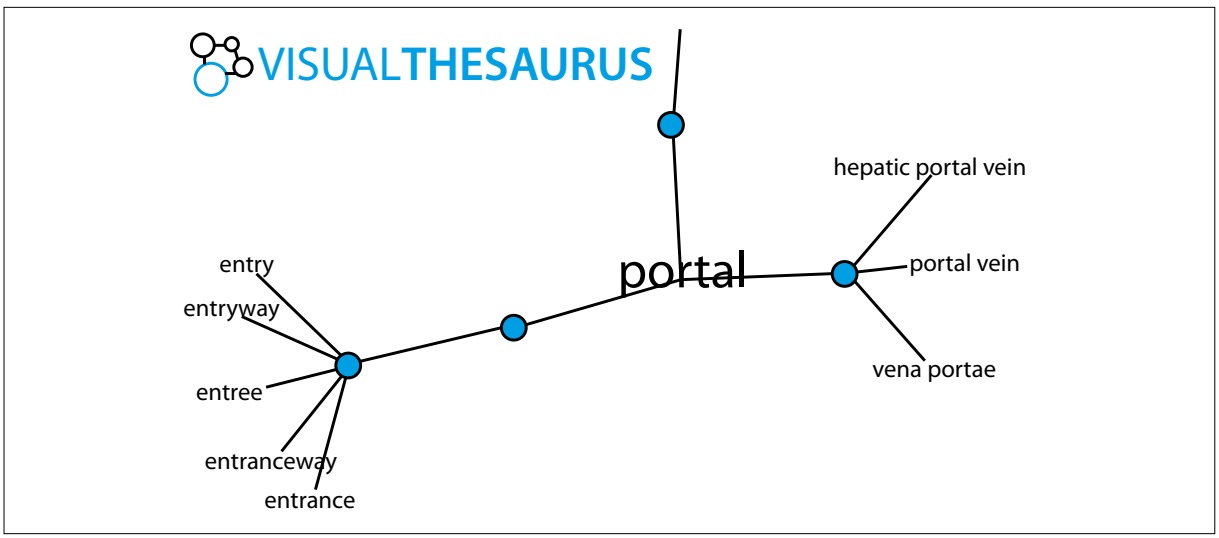
Definition: way in to a place

Synonyms: access, admit, approach, avenue, door, doorway, entrance, foyer, gate, hall, ingress, ingression, inlet, lobby, opening, passage, passageway, threshold, vestibule

Antonyms: egress, exit

An interesting feature in Thesaurus.com is a visual thesaurus, illustrated in Figure 8.4, which shows mapping of the word *portal*. In Chapter 10, we look at a similar concept in mind mapping tools.

Figure 8.4: Mapping of the word *portal* in the Visual Thesaurus



Source: http://thesaurus.reference.com

Countries of the world

The most comprehensive reference for information about all countries in the world is the CIA World Factbook (https://www.cia.gov/library/publications/the-world-factbook). Go to this website to find the most current information on the history, people, government, economy, geography, communications, transportation, military, and border issues of some 266 countries/states of the world. Included also for each country are its flag and a map.

The reference desk

The above are a just a few of the many reference resources that are freely available on the internet. You can find many others at the Reference Desk (http://www.refdesk.com).

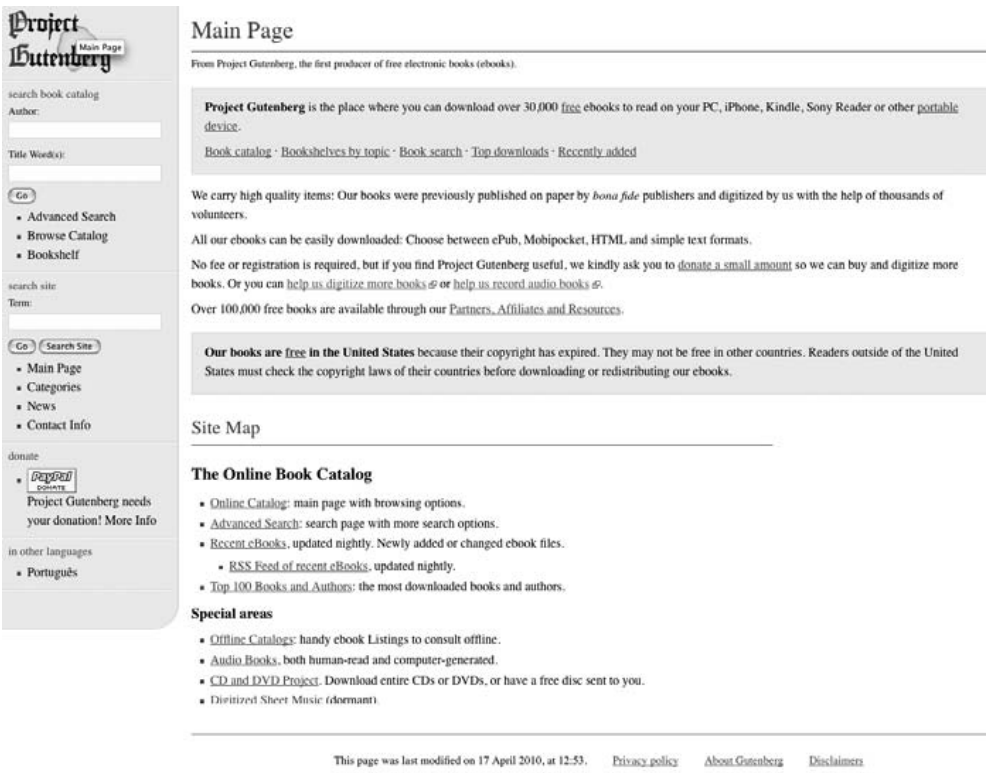
The world of e-books

The famous science fiction writer, Isaac Asimov, as long ago as 1951, wrote a short story predicting a device called a *telebook* for reading books on a television screen. His story was written in the same year that the world's first commercial computer was launched, and so the account of telebooks might have seemed a little far-fetched at the time. Today, however, similar electronic books or e-books are readily available. Let us look at some of these.

Project Gutenberg

The first digitized books on the internet came from the aptly named Project Gutenberg. This collection of e-books has steadily grown in size and now contains more than 30,000 titles whose copyright has expired. To read any of these books, you connect to the internet and enter the website for Project Gutenberg in your browser (see Figure 8.5). You can then download at no cost full text versions of any of the available titles onto your computer or onto certain smartphones, Kindle (see below), Sony Reader or other mobile-linked device.

Figure 8.5: Project Gutenberg offers a vast collection of e-books



Source: From the Public Domain for Free Downloading (http://www.gutenberg.org).

Here is a list of 10 popular downloads from Project Gutenberg:

1. *Jane Eyre* by Charlotte Bronte
2. *The Arabian Nights Entertainments* – Anonymous
3. *The Adventures of Sherlock Holmes* by Sir Arthur Conan Doyle
4. *The Outline of Science* by J. Arthur Thomson
5. *Manners, Customs and Dress During the Middle Ages and During the Renaissance Period* by P. L. Jacob
6. *Alice's Adventures in Wonderland* by Lewis Carol
7. *Pride and Prejudice* by Jane Austen
8. *Adventures of Huckleberry Finn* by Mark Twain
9. *A Tale of Two Cities* by Charles Dickens
10. *The Marvellous World of Oz* by L. Frank Baum

Kindle

Amazon's Kindle differs from Project Gutenberg in that it is a portable reader that uses high-speed mobile telephone networks rather than the internet, and therefore does not need to be used with a computer. But like Project Gutenberg, you download onto the Kindle, in this case from the Amazon.com website for a fee, books, magazines, newspapers, and other documents. More than 350,000 books, newspapers, magazines, and blogs too, are available to download. Kindle applications are available for downloading to smartphones.

Some publishers and other companies like Sony also market an e-Reader, similar to the Kindle, for reading books on an electronic paper display.

Google books

Yet another source of e-books is Google Books, which contains a vast collection of books on its website. You can access these from the Google browser page, or more directly (http://books.google.com/books). From Google Books you can select from fiction or non-fiction. Figure 8.6 shows a few of the hundreds of titles from one of the sub-categories in fiction (literature). Other sub-categories in fiction are science fiction, fantasy, romance, mystery, fairy tales, short stories, and poetry; while within non-fiction, thousands of titles are available from the sub-categories, philosophy, economics, political science, linguistics, mathematics, physics, chemistry and biology.

An e-library

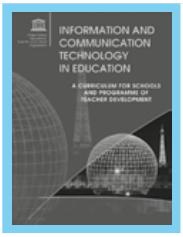
Particularly useful for teachers and teacher educators is UNESCO Bangkok's electronic library or e-library (http://www.unescobkk.org/information-resources/e-library/). This site serves as a gateway to a diverse source of information on education, social sciences, culture, communication/information, natural sciences, and to a number of cross-cutting themes and topics relevant to the Asia-Pacific region.

Figure 8.6: A small sample of books from google books (literature)

Source: http://books.google.com/books

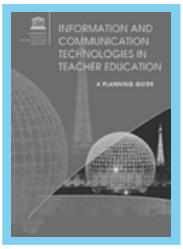
From within UNESCO's e-library you can navigate, for example, to all UNESCO publications on ICT in Education (http://www.unescobkk.org/index.php?id=799), some of which like those below are cited in this Guide:

ICT in Teacher Education: Case Studies from the Asia-Pacific Region



Information Communication in Technology in Education: A Curriculum for Schools and Programme of Teacher Development

Integrating ICTs into Education: Lessons Learned (Volume 1)



Information and Communication Technologies in Teacher Education: A Planning Guide

When you select more information about any of these books or about many others in the e-library, you can then download the complete publication as a PDF document (see clipped insert). Once you download the book of your choice, it is yours to keep and view on screen whenever you wish without the need to be connected to the internet. You can obtain a hard copy by printing it and adding it to your own professional library.

PDF

PDF, short for Portable Document Format, is a format created by Adobe Systems for saving files and allowing them to be read exactly as they are created. To view and print a PDF file, you need Adobe Reader, which you can download from Adobe (http://www.adobe.com/products/reader) free of cost.

The value of e-resources

This chapter touches on a small sample only of the vast store of e-resources on the web that may be freely accessed by teachers and teacher educators. The ready availability of the kinds of curriculum resources, lesson plans, reference materials, digitized books and e-libraries reviewed above is a rich treasure at your fingertips. All you need to make a start is access to the internet and a web address.

A note of caution is required, however, in accessing this vast storehouse of educational materials on the internet. There is an abundance of material and some of it is clearly better than others. Educators need to practise the same skills they try to impart to their students, which is to evaluate materials carefully before using them. In Chapter 12, we turn to the richest form of communication in our e-learning model with which this chapter begins – communities of practice – which can be extremely helpful in finding out about useful e-resources for classroom use.

To conclude on a note of optimism: the vast store of e-resources on the internet, once evaluated as they are in this chapter, enable classroom teachers, librarians, and teacher educators anywhere in the region to augment severely limited resources at minimum or no cost, and to keep current with the latest educational theories and practice.

9 Blended Learning with Web 2.0 Tools

You will find in this chapter:

- what blogs, wikis, Moodle and other Web 2.0 tools are
- how innovative teachers and teacher educators are using Web 2.0 tools in their classrooms
- how Web 2.0 led to social networking services and how widely these are used by students

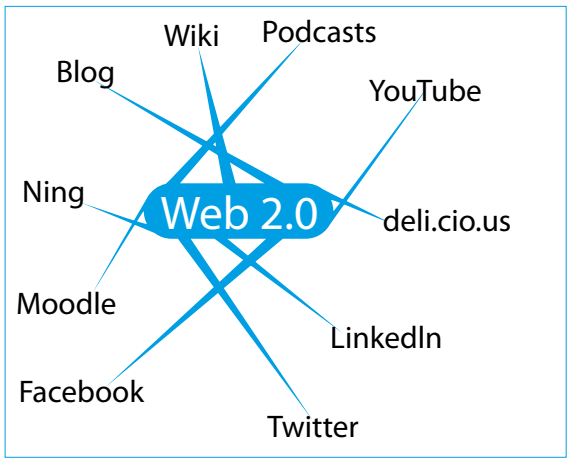
9. Blended Learning with Web 2.0 Tools

In the previous chapter, we look at one category of e-learning, namely, e-resources. In this chapter, we turn to a second category of learning identified in the e-learning model developed in Chapter 5 – blended learning – where teachers use web tools to augment classroom teaching. The new wave of Web 2.0 tools creates fresh opportunities for teachers to combine online materials and face-to-face teaching.

What is Web 2.0?

Web 2.0 is not a new version of the World Wide Web and it does not refer to any updated technical specifications. According to some (Tim Berners-Lee, inventor of the web), the term is a buzz word, merely "a piece of jargon".

Rather, Web 2.0 refers to a new wave of web applications that followed the dot.com bubble of 1997–2001. From the start it caused a wave of excitement around the world: Web 2.0 featured in *Time* magazine's Person of the Year award for 2006, and the BBC news service of June 2009 reported that the millionth English word was reached. It was *Web 2.0*.



A small sample of the large number of Web 2.0 applications

What is all the excitement about Web 2.0? A new wave of web applications began to appear in 2004 onwards. These allow users to create and share information on the web and to collaborate with others interactively. Users require no special skills to do this. With Web 2.0 tools, anyone can easily create their own materials and publish or communicate these to groups of friends and colleagues, or to a worldwide audience. Where previously online users were restricted to viewing web content passively, the new Web 2.0 applications allow users to change web content in some websites, while in other sites they can keep in touch with friends, organize meetings, exchange news and photos.

Different kinds of Web 2.0 applications include blogs, wikis, video-sharing, podcasting and social networking. Highly popular Web 2.0 tools or services are Wikipedia detailed in the last chapter; YouTube (see clipped insert in Chapter 2); and MySpace, Flickr, podcasting, Facebook and Twitter (see clipped insert in this chapter).

Popular Web 2.0 services

MySpace was one of the first social networking services to be set up on the web and it immediately enjoyed huge success. Like its subsequent competitors Facebook and Twitter, MySpace provides space for users to place personal profiles, upload photos and videos, and add friends.

Flickr is a service that allows users to store photos and videos, edit and organize them, and share them with others. The basic service, which has certain storage limits, is free.

Podcasting is the name given to distributing media files, either audio or video – referred to as podcasts – over the internet.

Facebook and Twitter are social networking Web 2.0 websites, which are described further in this chapter.

Blogs

In this Guide, we first meet blogs in Chapter 2 where they are described as personal electronic diaries or journals, but blogs can take many forms. Blogs are individuals' spaces on the web that give them a voice. They can be a soapbox, a commentary on current events, a collection of memos or thoughts, a place to post photos and comments – almost anything a user wishes. Other people on the internet can read these posts, as they are called, and leave comments if they wish, or comment on previous comments made. Each new blog post that people add is placed at the top so that visitors always see most recent posts first. Blogs, like social networking websites described later in this chapter, are a means of connecting with others and hearing from those readers who choose to react to what is written.

Blogs usually consist of text but they can also contain photos and multimedia files (video and audio). If they contain mostly photographs, they are termed *photoblogs*; if mostly video, they are called *vlogs*; and if mostly audio, *podcasts*.

If you want to be a blogger, that is a person who writes a blog (short for weblog), you need to find a website that provides a blogging publishing service. A good one is Blogger, a free blog publishing Web 2.0 tool from Google (https://www.blogger.com/start). First, you create a Google account (this is free). You give your blog a name and choose how you want it to look. Then you are ready to share your thoughts with the world or with selected friends since Blogger allows you to control who reads your blog.

If you simply want to read other people's blogs, rather than write them, you can use Blog Search (http://blogsearch.google.com.au) to locate bloggers. Suppose you have heard of someone who writes blogs, you can enter their name to locate their blog website.

Otherwise, you can enter the name of a topic you are interested in (say, *ICT, Avatar* or *noodles*). For all such blog searches, a number of hits is returned as in regular web searches.

Wikis

We encounter a wiki in Chapter 8 where we talk about the world's largest encyclopedia, Wikipedia. Like this online encyclopedia, wikis are websites that anyone within a community of users can either add content to or edit existing content. You can think of wikis as private (restricted to particular groups) or public (open to everyone) spaces, where individuals can collaboratively build up a body of content on particular topics of interest.

As with blogs, if teachers want to set up a wiki, the first step is to find a website that provides the necessary service, that is, contains wiki software to enable contributions and editing of content, and also permits storage space — to hold the content that a group collectively and interactively constructs. One such company that provides a free, easy-to-use, hosting service is Wetpaint (http://www.wetpaint.com). Here you can add video clips, photos, photo albums and text, as well as track threads of interest in discussion forums. Another company offering a similarly free service for educational institutions is Wikispaces (http://www.wikispaces.com).

Moodle

Moodle is a Web 2.0 tool developed in the Asia-Pacific region, in Perth, Australia. The application, designed specifically for educators, is a Course Management System (CMS), also called a Learning Management System (LMS) or a Virtual Learning Environment (VLE). The Moodle website (http://moodle.org) describes how it is primarily used:

- Many institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses (known as blended learning).
- Many of our users love to use the activity modules (such as forums, databases and wikis) to build richly collaborative communities of learning around their subject matter (in the social constructionist tradition), while others prefer to use Moodle as a way to deliver content to students and assess learning using assignments or quizzes.

Why the name Moodle? The name is an acronym formed from the initial letters: Modular Object-Oriented Dynamic Learning Environment. Because it is modular and because it uses open source software, users wherever they are based can write modules for it and develop it further (see clipped insert). As a result of global collaboration, Moodle has progressed quickly and is widely used in many educational institutions. Moodle is free to use. According to the company's statistics (http://moodle.org/stats), Moodle is used in more than 3 million courses, by more than 32 million users, spread over 209 countries that include many in the Asia-Pacific region.

Open source software

Open source software is computer software where the source code is open, allowing the public to use and modify it. With a wide user base, the software is thus developed cooperatively, which means that quick improvements often result.

The regional snapshot that follows reports a success story of a novel use of Moodle for professional development of science teachers in Brunei Darussalam.

Moodle and professional development

Moodle is a powerful and popular learning management system that is widely supported internationally. It is used in high schools, universities and many other educational/training settings to provide a digital dimension to teaching and learning. Moodle is regularly used to extend "traditional teaching" by providing online learning opportunities to learners both within and outside a classroom setting and for permitting learners the opportunity to learn at their own pace with a range of interesting material. However, the real power of Moodle may lie elsewhere, in the social learning facilities that it supports.

In a recent secondary science teacher workshop held in Brunei Darussalam, Moodle was used in a different way. It was used to support collaborative and cooperative learning in a teacher professional development setting. Participants used Moodle online chat facilities, online discussions and wiki facilities to share experiences about teaching and learning. These are the types of discussions that teachers need to engage in if they are to change beliefs that will lead to changes in their classroom practice. Participants, working in Moodle groups, were able to produce good answers to the questions that they themselves raised and in so doing added to knowledge about teaching and learning in Brunei.

Participants viewed Moodle as being a very helpful enabler for bringing teachers from separate schools into regular contact with each other, and they are keen to stay in contact with their newfound professional friends. Although none of the participants had previous knowledge of Moodle, all came away from the workshop believing that they would use Moodle in their own schools, perhaps at first to replicate traditional styles of teaching, but eventually to support the powerful collaborative learning approach they themselves experienced in this very successful workshop.

Michael Moroney, Educational technology lecturer, University of Brunei, Brunei Darussalam

Web 2.0 tools in the classroom

Web 2.0 tools are continually evolving. As in the early days of microcomputers, innovative teachers and teacher educators are exploring their use in the classroom. To find out how teachers are applying these new tools, a quick way is to point your browser to the UNESCO portal for teachers, described in the last chapter as a comprehensive source of information on ICT in education (http://www.unescobkk.org/education/ict/online-resources/portal-for-teachers).

After a little searching, you find an article, "Using Web 2.0 tools in everyday teaching and learning"(http://www2.unescobkk.org/education/ict/v2_2/detail.asp?id=56091), or another similar article. This particular article describes how teachers and school administrators use Web 2.0 tools to transform and expand the learning experiences of their students and of themselves. Some teachers portrayed in the article use blogs in their classrooms. When students write blogs, they obtain the satisfaction of receiving feedback from fellow students. This, in turn, encourages them to write more carefully about what they are learning, and often at greater length than they would do on paper.

You read also how another teacher uses wikis, which are sometimes more useful than blogs where a whole class is contributing information. This teacher's students formed teams and by means of wikis collaboratively constructed lists of resources for studying as they prepare for a test.

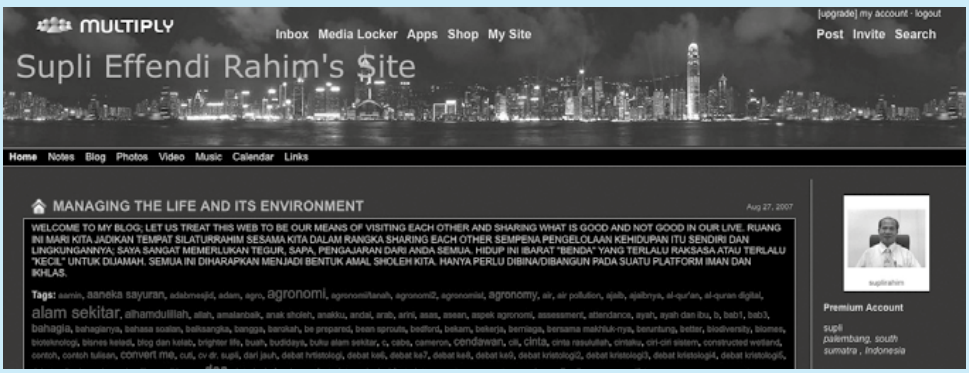
Yet other teachers depicted make use of podcasts. What makes this article additionally helpful is that its presentation in an interactive website illustrates how a blog works. In other words, following the article are comments made about it by other teachers.

The following regional snapshot from Malaysia exemplifies further how teachers in the region are exploring the potential of Web 2.0 tools in their teaching.

An amazing time teaching with Multiply blog

I faced a challenging time when I first gave lectures at two faculties at the University of Education Sultan Idris, Tanjung Malim, Perak, Malaysia. Subjects I teach are Agronomy, Society and Technology, Scientific Research, Environmental Management and Farm Mechanization. I decided to use blogs in my teaching, utilizing a free service called Multiply (http://multiply.com). Students taking the subject are instructed to make their own Multiply website. For example, if a student's name is Ahmad, the address www.ahmad.multiply.com becomes his personal website where he stores everything. Ahmad is then added to my Multiply site (www.suplirahim.multiply.com) and as his lecturer I am his contact. Within the blog, students need to join a particular group, for example, Mesraalamfst (for environmental management). As soon as I confirm Ahmad to be my contact, he has permission to join the group.

Each day I post a number of postings, such as lecture notes, announcements of lectures, assignments, videos, popular writing, songs, stories and relevant links. Each day students also reply, giving comments and making their own postings by themselves. Students report that they enjoy this kind of teaching. Above all, teaching in classrooms is improving for students know each other better. Using the blog service Multiply has been a wonderful and amazing experience for me as lecturer and for my students because interaction outside class is not limited by time and place. Many students boast that this use of blogs is a great idea in making their life as students cheerful and easier than ever before.



Professor Dr. Supli Effendi Rahim, UPSI, Tanjung Malim Perak, Malaysia

Social networking

Of all the new innovative Web 2.0 tools, runaway successes are social networking services that connect people who share personal or professional interests, or who go to the same school or college, or who otherwise wish to join friendship groups. In Chapter 1, we report that two of the most widely accessed internet sites currently are Facebook and Twitter. On these websites, users can freely avail themselves of services to place personal profiles of

themselves, share their profiles with others who have similar interests and thus create social networks, link with friends, and exchange news, photos and other information. To begin to use Facebook or Twitter, users must first create an account (http://www.facebook.com for Facebook and https://twitter.com/signup for Twitter), which requires having an email address and, additionally in the case of Facebook, noting one's age (for internal security reasons).

As an indication of how popular social networking has become, a Nielsen online survey in Australia (October 2009), reports that Facebook was the fourth most visited site in the preceding month (Google was the most popular). It is reported that "on average, one quarter of all internet use in Australia is on Facebook". This amounts to a staggering 6.5 hours of an average 26.5 hours spent online each week. Interest in Twitter is also experiencing remarkable growth. According to the same report, visits to it by Australians in the preceding 12 months grew almost 1,000 percent compared with the previous period. The number of people who visit social networking sites on their mobile phones is also rapidly increasing, according to the same online survey.

A book has been written about the exceptional rise of Facebook (Lacy, 2009), a relatively new web service that already boasts in excess of 400 million registered users worldwide. Sadly, however, there is a potentially ugly face to Facebook and other social networking sites that host user-generated content. As we note with the online encyclopedia, Wikipedia, in Chapter 8, such websites are open to misinformation or, in the case of social networking sites, abuse by individuals who post vulgar, racist, bullying or other offensive material. Although administrators remove such offending material when notified of its presence, by then the damage is often already done.

The growth of Facebook and Twitter in Australia is echoed in worldwide trends reported by Social Media Optimization (http://social-media-optimization.com). The three top ranked social networking sites in 2009 are Facebook, MySpace and Twitter. Further social networking services useful for educators, ranked in the top twenty, are LinkedIn and Ning (see clipped insert). Although these particular websites may in time be superseded by others, it is likely that their replacements will be of a similar kind. We say this because the popularity of social networking that Web 2.0 makes possible seems to reflect a deep, inner need to communicate with others, particularly to share information about what friends are doing, to organize events, and be connected.

Further social networking websites

LinkedIn is similar to Facebook but is used primarily by professional groups, like educators. It is a free service where users can place their work profiles and link with others who share similar professional interests.

Ning, like both Facebook and MySpace, is an online service for users to create their own social networks. Users do not need any technical skill to set up a Ning network and they can join any number of networks.

Although the data reported above on users' access to social networking sites do not provide any breakdown by age, observations suggest that Facebook, for instance, is most popular among students at schools, colleges and universities, that is, among teenagers and young adults. If these trends are not a passing fad, then educators cannot afford to ignore such significant internet use where users (likely to be students) spend up to a quarter of all their time online interacting with their friends, as they do on Facebook.

The following regional snapshot from Malaysia of the use of Facebook as a classroom tool illustrates how social networking sites are being applied when innovative teacher educators work with teachers in schools.

Facebook as a classroom tool

A group of teachers and students in a local secondary school in Penang, Malaysia, were first introduced to Facebook in late 2009. Everyone was a first time user and all attended a short workshop on how to use Facebook and its applications. After the initial stage of learning how to use Facebook and how to create a network, these students and their teachers started using it within their learning and teaching activities.

Teachers started providing notes and linkages on topics of interest within the school curriculum. A history teacher uploaded a video file on the history of Egypt for students to view in their own time. A math teacher uploaded examples of old exam questions for students to try out on their own. A number of interesting but related articles on social networking topics were also uploaded to give students and teachers a clearer picture and understanding of the capabilities of Facebook and other sites similar to it. There was even a competition to create online quizzes by the students using Facebook's Quiz application. Online discussion, notes and sharing of files are common activities among the teachers and students.

The Facebook site created for these groups of students has become an extended learning time for the students and their teachers. Students and teachers are both discovering together how social networking sites like Facebook can benefit their learning and teaching activities. The communication between members of the group is almost instantaneous and any information can be shared and made available to all members of the group.

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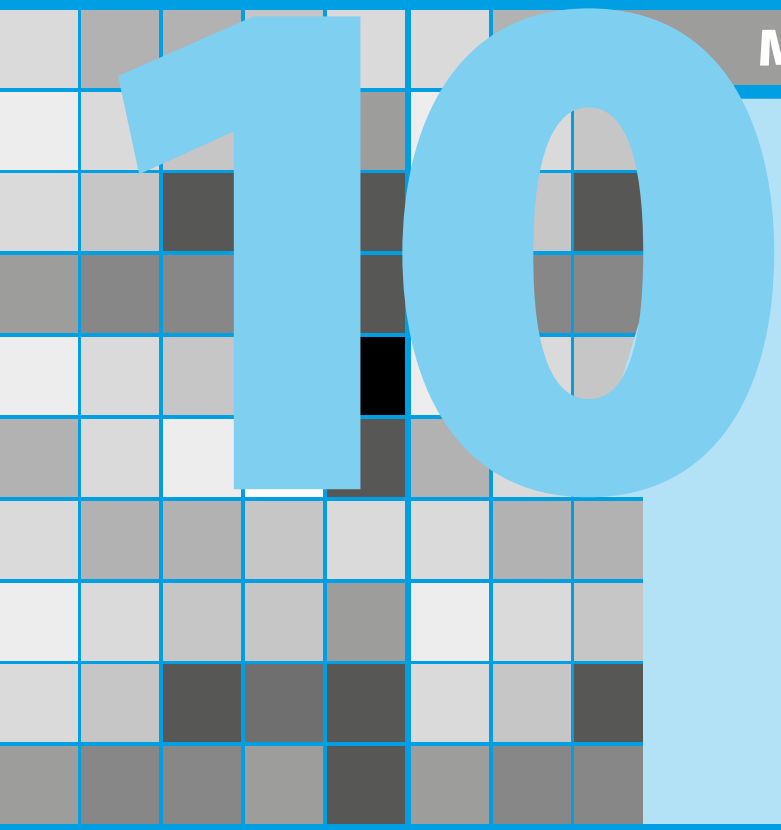
Social networking sites provide a tool for students within educational institutions to work together in conducting research on class projects. For educators, they provide opportunities to collaborate and network and we see a practical example of this in Chapter 12. The national agency in Australia set up to support the integration of ICT in teaching and learning (education.au) states that online social networking sites enable educators to:

- create and edit an online professional profile;
- connect with educators who have similar interests;
- share links, news, photos, ideas, opinions and blogs; and
- join or create their own communities of interest to share ideas about education practice, research or issues.

Universities and colleges in many countries establish Facebook and Twitter sites to showcase their activities and to connect with students and the wider community. Social networking on the web has quickly become a significant phenomenon at all education levels.



10 More Web Tools for Teachers

You will find in this chapter:

- what further kinds of web tools are available for the classroom
- how teachers use web tools combined with face-to-face teaching to provide blended learning for students
- what answer engines are and how these differ from search engines
- how teachers can create lesson materials with quiz and puzzle construction software
- what the benefits of online collaboration tools are
- where to obtain a collection of web tools compiled by UNESCO
- how blended learning works to promote higher-order thinking skills using webquests

10. More Web Tools for Teachers

Further classroom web tools

The focus in the previous chapter is on Web 2.0 tools: blogs, wikis, a course management system, and widely used social networking services. In this chapter, we turn to further web-based tools that teachers and teacher educators find useful with their students. Teachers use many of these web-based tools together with face-to-face teaching. As we note in the case of the Web 2.0 tools discussed earlier, this combination of web and classroom learning is called blended learning, one of the categories of e-learning discussed in Chapter 5.

According to Graham (2006), good use of online learning stimulates active learning in the classroom, which motivates students to continue learning activities beyond the lecture hall or classroom. Such online learning, then, in combination with sound face-to-face teaching, makes blended learning a powerful approach to learning.

The number of web tools available for teaching and learning is now so numerous that an initial question is where to start looking for these on the internet. Then, once you have located a web tool, you need to check carefully whether it is likely to be useful for your students in your particular situation. This chapter presents a small sample of free web tools for the classroom. To give a taste of what is available, we describe each tool briefly and where to find it. With this as a starting point, you will find countless more web tools for educators, and new ones are constantly appearing.

Answer engines

We start with what are called answer engines. Two widely-used search engines, Baidu and Google, are noted in Chapter 5. How do answer engines differ from these well-known search engines? One difference is that answer engines respond to questions posed in natural language in contrast to key word searches. Another difference is that certain answer engines compute answers to factual questions rather than search through enormous databases comprising pointers to websites trawled from the internet.

Answers.com

Go to Answers.com (http://www.answers.com) and you are invited to enter a question or phrase. Suppose in the dialog box you type: When was slavery abolished? See Figure 10.1. Click on "Go" and an answer is returned with dates when slavery was abolished in British and French colonies, and in the United States.

Figure 10.1: Asking a question in natural language from Answer.com

Source: http://www.answers.com

Sometimes no answer can be given since this website is a wiki and a particular question may not have been asked and answered yet. Like Wikipedia (see the discussion in Chapter 8), Answers.com is constantly being added to by contributors. Users are invited to browse through unanswered questions, new questions and new answers in order to contribute to the site's on-going development.

WolframAlpha

For factual questions that require computation, WolframAlpha can usually supply answers (http://www.wolframalpha.com/). Enter in the dialog box, for example, any date in the past or the future, and the result is returned along with other information for that day (see Figure 10.2). You can ask this question in natural language or simply type the date (January 1, 2011).

Figure 10.2: Asking factual and computational questions from WolframAlpha

Source: http://www.wolframalpha.com

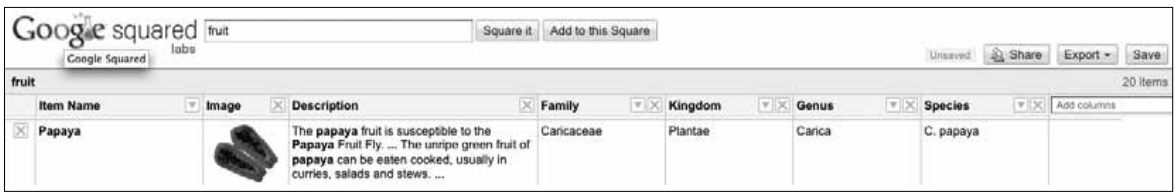
Of course, you can ask many other more useful kinds of questions for WolframAlpha is a powerful answer engine. As examples of the versatility of this answer engine, the left column below lists a few different kinds of questions that may be asked, while the right column indicates typical results:

Coordinates for Vientiane	returns latitude and longitude for Vientiane in Laos
Pythagoras theorem	returns equation and diagram
3a^2 = 27	returns plot and solution
Country with lowest GDP	returns five countries ranked lowest by GDP
Anagrams for *diet*	returns all anagrams for this word
Mekong and Amazon	returns various facts about both rivers

Google Squared

Still in its developmental stage, Google Squared (http://www.google.com/squared) returns yet other kinds of answers. You enter a category in the dialog box (say, tropical fruit) and Google Squared tries to build a square of information from this, something like a spreadsheet. One row of the resulting square is illustrated below for one tropical fruit, namely, papaya (see Figure 10.3). The columns of the square are characteristics of tropical fruit: for this example, its name, picture, description, family, genus and species. Within each cell are facts obtained from the web about the tropical fruit in each row: Clicking on any cell gives further information.

Figure 10.3: Finding information about tropical fruit from Google Squared



Source: http://www.google.com/squared

Mind mapping tools

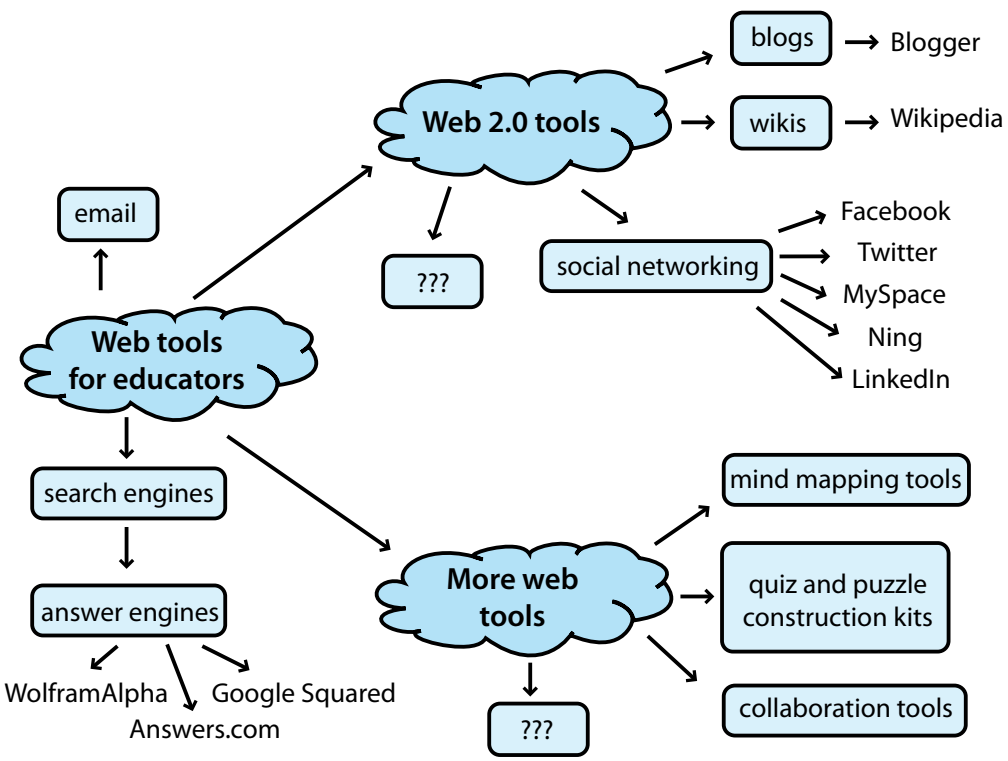
Mind maps, also called concept maps, are widely used by educators as tools to aid organizing, thinking and learning. They are used especially to develop study skills – writing essays, note-taking, summarizing, reading and studying. James Cook University in Australia suggests that mind maps are effective tools and strategies for improving organization. The university includes mind mapping in online workshops for students on learning skills. A useful tutorial on mind mapping is provided (http://www.jcu.edu.au/old_office/tld/learningskills/mindmap) showing how mind maps help in essay preparation, summarizing readings, and preparing for lectures, seminars, workshops and tutorials.

Mind maps have long been used by teachers to brainstorm for ideas as they record student comments on a blackboard or on large sheets of paper. Buzan (1991), who is widely credited with promoting mind mapping as a learning and thinking tool, comments in a video on YouTube that a mind map is "a thinking tool that reflects externally what goes on inside your head" (http://www.youtube.com/watch?v=MlabrWv25qQ&feature=player_embedded#). He concludes: "It is a genius tool".

You do not need a computer to draw a mind map since you can readily trace on paper or the blackboard the associations and connections between concepts. Buzan recommends curvy lines and the use of colour to connect concepts. These, together with images, he says, help to cement relationships more securely in our minds.

An example of a mind map is shown in Figure 10.4. This figure is a rather formalised representation of the content of both this and the previous chapter (it utilizes straight lines, for example, to show connections). This mind map, drawn originally with pencil and paper, was useful in organizing the content for both chapters. As the figure shows, the topic, web tools for educators, is subdivided into one chapter to discuss Web 2.0 tools and a second to present further useful web tools. The rounded rectangles with question marks represent further web tools not discussed in this Guide or tools yet to be invented.

Figure 10.4: A mind map for "Web Tools for Educators"



Although mind maps can be drawn by hand on the blackboard or on paper, there are many software mind mapping tools to make the task more versatile, easier to share and retain permanent copies. Online mind mapping tools also allow a number of users to develop a mind map collaboratively. Many online mind map tools are available commercially or on a trial basis. Of several that are freely available, one quite sophisticated software tool for mapping information, ideas and arguments is Compendium, developed by The Open University in the UK (http://compendium.open.ac.uk). Students at the university, the majority who study off campus, are encouraged to use this tool as an aid in their studies. Another useful and free brainstorming and mind mapping web tool is Bubbl.us (http://bubbl.us).

Quiz and puzzle construction kits

Other web tools that can be useful in the classroom are websites where you can construct quizzes and puzzles relating to content that you are currently teaching. Google the words *quiz maker* or *puzzle maker* to find a large number of software tools, many claiming to be free. A problem about much so-called free software is that in reality little is truly free since in many cases the price paid is the inconvenience of accompanying advertising. For some quiz software, every test item comes with highly distracting ads over which users have no control. Another problem with many free, online quiz and puzzle makers is the need to be online while you construct a quiz or puzzle, and this carries certain costs. Yet a further problem of such hosted services, as these are sometimes called, is the potential loss of one's data and, often even more crucial, the potential loss of privacy in the case of sensitive or confidential data.

In this section, we describe a web tool that you can freely download from the internet. It is developed by a respected educational institution, the Research and Development team at the University of Victoria, Humanities Computing and Media Centre in Canada. It carries no advertising. The software is quite versatile in that it allows users to create several different kinds of quizzes, with the facility to include hints to items if desired. As well as enabling different types of quizzes to be constructed, the software contains a component for creating crossword puzzles. The web tool has the somewhat curious name Hot Potatoes**.** You can download the latest version of Hot Potatoes from the website (http://hotpot.uvic.ca). Hot Potatoes is also included in the UNESCO (2006) *Directory of ICT Resources for Teaching and Learning of Science, Mathematics and Language*.

Hot Potatoes works as a tool for teachers enabling them to build a teaching website with a number of web pages. You do not need to know any HTML coding to do this because the software guides you through each step of construction and automatically creates web pages based on your input (e.g. entering questions and answers, preparing button captions, instructions for students and so on). The software comes with a tutorial and comprehensive help to assist in developing teaching materials for any project you wish. Once the website is created, students can access it from computers in class. Five different types of interactive quiz can be created:

1. traditional quizzes of different kinds – multiple choice, short-answer, or multi-select questions;
2. cloze-type exercises where students read a passage and complete the gaps, with the facility to include a *hint* button that gives students successive free letters of the answer required to complete any gap they are currently working on;
3. gap-filling exercises, a variant of cloze exercises, where students complete all the gaps in a passage before checking (after checking, correct answers are shown and students have further chances to complete gaps that are incorrect);
4. matching exercises where students need to match items in the left column with those in the right column; and
5. jumbled sentence or jumbled word exercises where the task is to rearrange words to make a sentence or rearrange letters to form a word.
6. A sixth application in Hot Potatoes is a tool to construct crossword puzzles of the usual kind with across and down clues. To show a clue, you click on a number.

Hot Potatoes is a powerful construction tool, but like any such tool, it requires time by teachers to learn how to use it to build teaching materials appropriate to their students' level and needs.

Online collaboration tools

With Web 2.0, the opportunity for users to collaborate expands considerably. As we review in the previous chapter, web tools like Flickr enable members of a group to work together on images while applications like Facebook and Twitter allow users to form networks and interact socially. Lomas et al. (2008) suggest that other web tools such as Skype (see clipped insert in Chapter 1) provide the opportunity for enhanced voice communication between users. These authors state that a further online activity that Web 2.0 makes possible is for users to construct documents collaboratively. We turn here to focus on one such collaboration tool – Google Docs.

Google Docs (http://docs.google.com/support/bin/topic.py?hl=en&topic=15114) is one of several online collaboration tools. It is useful because it enables users to work on documents and share these with colleagues or fellow students while online and in real time. Users can choose who may read and even who may edit documents. After documents are created, they may then be stored online, which means that users are able to edit them at any time wherever they happen to be located. Google Docs is a free service.

The Google Docs application exemplifies cloud computing (see clipped insert). The three-in-one application (word processor, spreadsheet and presentation tool) resides, not on a user's computer, but on a remote Google server, and the document that is constructed may also be stored securely on this same server. Users simply require an internet connection to access Google Docs together with a freely obtained Google account. As noted above with online quiz and puzzle construction kits, a potential problem with a hosted service like Google Docs is a perceived loss of confidence when sensitive materials are posted on remote servers.

Cloud computing

Cloud computing is the name given to a new style of computer use where applications are stored on remote servers that users access via the internet, and where they can store files. *Cloud* is a metaphor for computing services that are provided somewhere else, distant from a user's workstation.

The next regional snapshot comes from Brunei Darussalam. It describes what the benefits are for teachers and students who use Google Docs.

Benefits of Google Docs

The Google Docs platform is a set of tools that works pretty much like Microsoft Office. It allows the user to create and edit text documents, presentations and spreadsheets on the platform itself. Other than creation, files may also be uploaded from the desktop or a hard-drive. Any selected files may be shared with others by inviting any email address and giving it permission either to view or to edit the file. One of the best features of this platform is that it allows users with edit permissions to convert files into other popular formats such as html, rtf and pdf.

This platform is simply a virtual drive and file creator that can be very useful to anyone who is on the go. Teachers can improve student's learning outcomes by using this tool to provide educational resources and collaborative discussions interactively. Even more interesting is that teachers can easily organize student's individual and group assignments in any of the mentioned formats virtually. More importantly, teachers will be able to learn new ideas from students and improve teaching materials and resources.

One benefit for students who have difficulty in getting an internet connection is that they can always access their Google Docs platform in offline mode. Google Docs encourages students to use technology more often than before by sharing information and ideas with others faster and effectively. Students' learning will improve when they confidently share their thoughts interactively, especially weaker students.

Sharifah Nurol Diana Binti Shaikh Mahmud, Technical Instructor, Maktab Teknik Sultan Saiful Rijal, Brunei Darussalam

The benefits of Web 2.0 collaboration tools for teachers and students are recognised by the Ministry of Education (MOE) in Singapore. A press release (Ministry of Education, Singapore,

September 2009) states that MOE has moved to standardize all communications and collaboration tools for the nation's more than 30,000 teachers across all its 350 schools. An open standard cloud computing platform is adopted and the Google Apps for Education suite of tools (which includes instant messaging, blogs and wikis) is selected to enhance the teaching and learning environment in schools. The decision, according to the press release, makes Singapore the first country in Asia "to provide Web 2.0 communication and collaboration tools to all teachers in the public school system".

A collection of web tools from UNESCO

A highly useful collection of web tools for educators has been compiled by UNESCO funded by UNESCO G77 and China South-South Cooperation Fund in Education, which is available on request from the UNESCO Regional Office in Bangkok. When the CD-ROM opens, you choose from four icons the one that is closest to your job or area of interest – teacher, administrator, ICT technician or Ministry ICT coordinator – to see what web tools may help you (see Figure 10.5).

Figure 10.5: The UNESCO CD collection of "Web Tools for Educators"

Source: http://www.unescobkk.org/education/ict/online-resources/e-library/elibrary-themes/teaching-and-learning/web-tools-for-educators-cd-rom

Suppose you click on the Teacher icon. Among many categories of web tools that are shown next, suppose you select "Help students develop their teamwork skills". Four types of web tools are shown: Collaborative Management, Online Forum, Wiki and Webquest. Selecting one of these takes you to a further page describing the tool and showing how to use it in the classroom, together with links to online websites that contain sample lesson plans and other learning activities.

The snapshot that follows describes the kind of web tools contained on the CD (UNESCO, 2010), and details how to request copies for your use if you consider it useful.

Web tools for educators

This CD-ROM, Web Tools for Educators, contains free web-based tools (computer software that is accessible via the internet) that are useful for people working in the education field. In particular, this CD-ROM contains software that teachers can use to enhance teaching and learning, and software that education administrators can use to improve productivity and efficiency.

Each of the tools on this CD-ROM comes with a tutorial that explains what the tool can be used for and what its educational or efficiency advantages are. In addition, clear instructions are provided regarding how to download and install the tools.

UNESCO created this CD-ROM in recognition of the fact that many teachers and administrators are not yet aware of the educational applications of web-based tools, such as online forums and picture management software. This CD-ROM, by explaining how to operate web tools, makes these tools easily usable in educational and administrative settings. Providing the tools on a CD-ROM makes such tools easily accessible to teachers and administrators, particularly for those who do not have internet access.

You can obtain copies of the CDs (maximum of five CD-ROMs) by sending a request to: ict.bgk@unesco.org

Blended learning and higher-order thinking skills

We close this chapter with an example of how teachers can use blended learning with students to promote higher-order thinking skills utilizing what are called webquests.

As the name implies, webquests describe quests for knowledge about a topic using the web as a primary source of information. Webquests can be valuable exercises for students where teachers want to adopt a blended learning approach by combining a comprehensive use of varied web tools with face-to-face teaching. In addition to information from the internet, students utilize other sources of information as well, such as the library, news media, CDs and DVDs.

Students can do a webquest as an individual activity but more generally they work in small groups. As students research, analyze, synthezise and evaluate information they gather, the activities are very much learner-centred. Typically, students are set a task, for example, to investigate causes of soil erosion. Pointers are then given to students in the form of internet links to start them on their quest. Teachers guide students on how to organize information they obtain and how to present it in a coherent way, often in presentations

to the class at the end of a project. Research skills are developed as students use different sources of information to collect data, analyze these data, and present their results and reach conclusions.

Because learning is active, webquests are popular with students. Tasks to be investigated can be challenging because they cross over subject boundaries. Student interest is heightened. At the same time, webquests encourage higher-order thinking skills of analysis and synthesis. In contrast to using search and answer engines simply to find information, the focus in webquests is to apply the information obtained to arrive at answers to real-life problems.

UNESCO (2006) assembled a useful directory of ICT resources for teaching and learning that contains samples of webquests. On the CD that comes with this directory are lesson plans and multimedia activities for secondary-level students in science, mathematics and language. One inquiry-based webquest on the CD on global warming illustrates well how webquests can be used to promote learning. First, the task for students is presented. In this webquest, the teacher poses the problem as follows, in a way designed to catch the attention of students and motivate them:

> As part of a top secret research project on global warming, you and two other scientists have agreed to be transported 100 years into the future. You will be living in the year 2101 for two weeks. Your mission is to study the effects that global warming has had on the Earth in the future. At the end of two weeks, you will be transported back to present day Earth where you will report back to Central Command on what we can do today to make sure that future inhabitants of our planet are safe from the disastrous consequences of global warming.

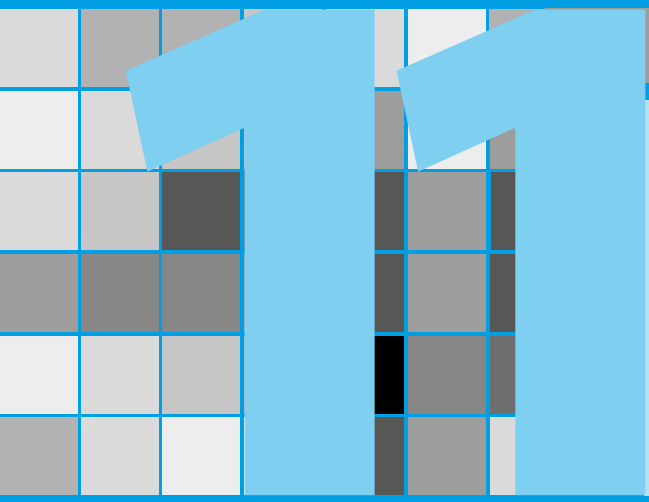
The procedures for students to follow are then detailed: first, to subdivide into small groups, then where to locate internet resources, how to use at least three different sources of information, and to meet regularly with their partners to share what they have discovered. The kinds of report students should write are described. The resources given to student working groups are links to more than a dozen sites on the internet that contain information on different aspects of climate change.

What makes this webquest particularly useful is the web page with study advice for students – ways to take notes, conventions to follow in citing sources, measures to avoid plagiarism and how to write a bibliography. Guidelines are given, too, on report writing.

Finally, this webquest contains highly useful web pages to assist students to evaluate their learning during this investigation. Two forms are presented. One is an evaluation rubric listing the objectives of the webquest and standards (beginning, developing, accomplished and exemplary) against which students' work will be assessed. You see a similar evaluation rubric in Chapter 6 in the section on project-based teaching. The second evaluation form is called a *Plus, Minus, Improvement Assessment* that allows students to assess their learning and enables the teacher to give feedback on how well they have met the objectives of the webquest.

Teachers can easily create their own webquests for whatever parts of the curriculum they are teaching using the one on global warming above as a practical template. A useful source of further information about webquests is a CD-ROM produced by UNESCO (2010), described above in this chapter.

Project-based learning or PBL for short is discussed in Chapter 6 on assessment of e-learning. A webquest is an example of PBL, where students engage in individual or group projects that further higher-order thinking skills.



Changing Learning Environments

You will find in this chapter:

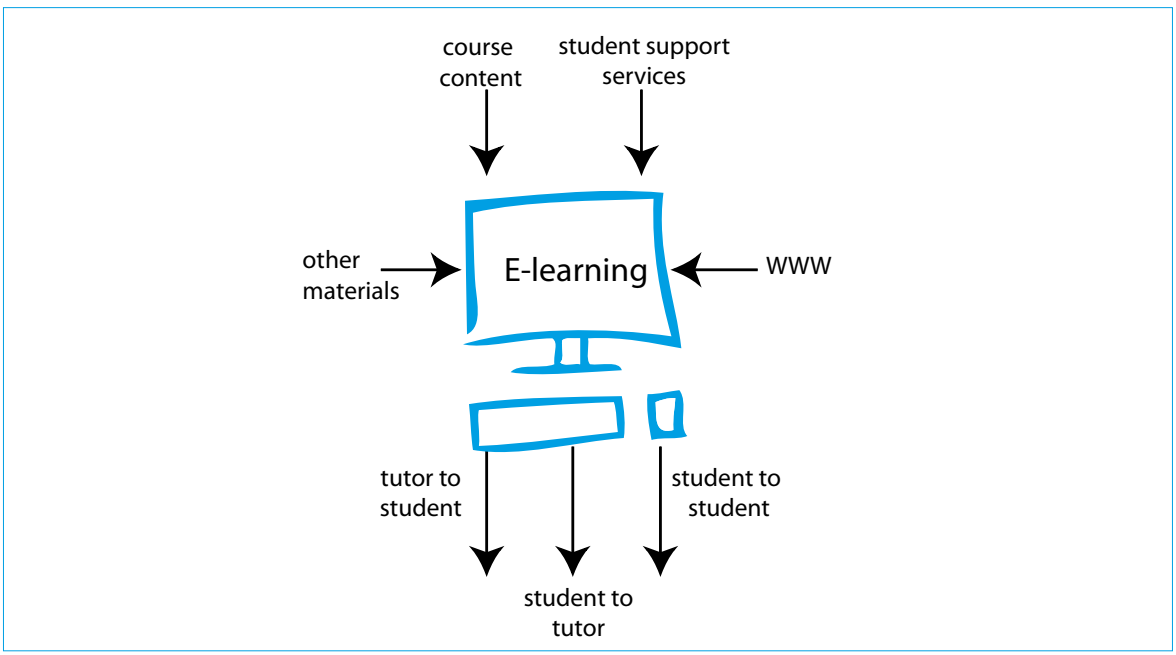
- how the learning environment continues to change
- how teachers use new whiteboards to foster interactive learning
- what virtual excursions and virtual field trips are and what the benefits of these are to students
- how e-learning is extending to m-learning and u-learning
- how touch-screen technology is changing the way we interact with new ICT tools
- what is required to transform classroom and school practice

11. Changing Learning Environments

Previous chapters touch on the changing needs of 21st century learners who are growing up in a digital world and the new skills they now need; the vast resources available on the internet for learning and the wave of new web tools that teachers are applying in the classroom. In this chapter, the focus is on the near future as ICT transforms classroom and school practice.

In those schools and teacher education institutions in the region that have fully embraced e-learning, continuing new developments in ICT are bringing about yet further changes in delivery of education, in pedagogy and student approaches to learning. Figure 11.1 attempts to encapsulate such an e-learning environment for these educational institutions as it is today.

Figure 11.1: Wired virtual learning environment of today

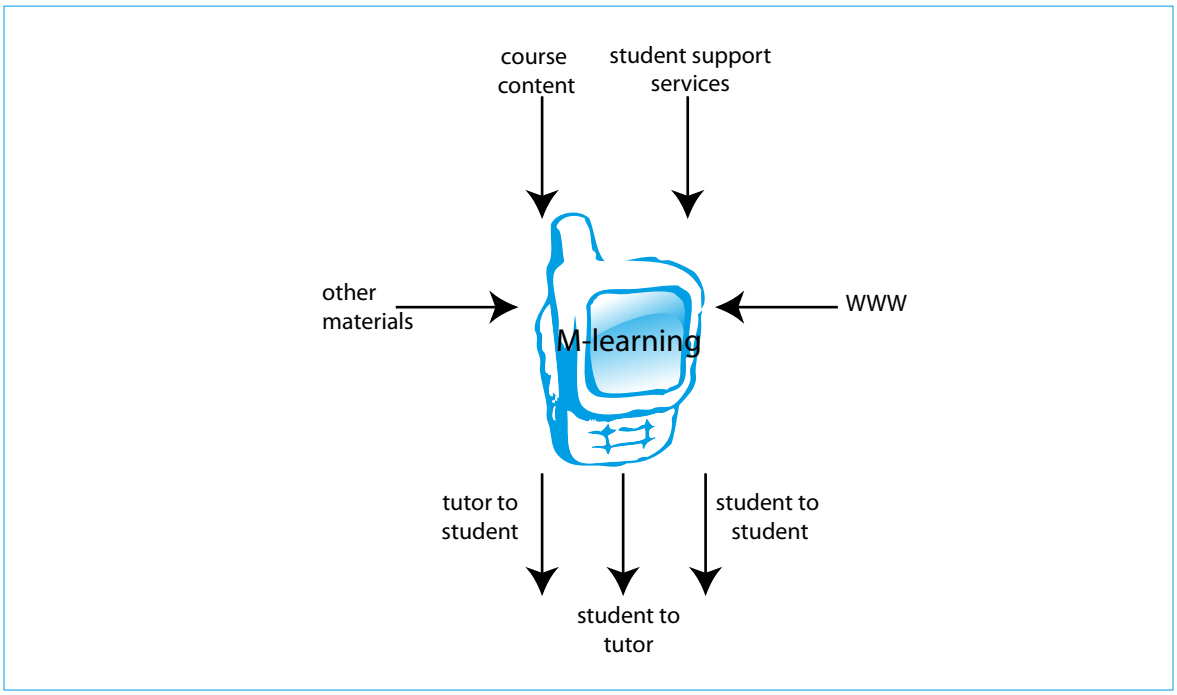


Source: Adapted from Keegan, 2002.

In the e-learning environment of today, blended learning is much in evidence. Teachers use a combination of online resources and guided instruction of the kinds described in Chapters 9 and 10. Communication between tutor and student, between student and tutor, and between student and student is a combination of online and face-to-face, whichever is the more appropriate for particular occasions. The learning environment is characterized as "wired" with students accessing workstations in generally fixed locations, within educational institutions and at home, in both cases with fixed links to internet service providers. Figure 11.1 depicts this learning environment of today in educational institutions that are well advanced along the pathway of ICT integration.

In contrast to the picture above, the learning environment of tomorrow, depicted in Figure 11.2, has a richer mix. Overlaid on all that is occurring today is a proliferation of mobile learning-enabled technologies. In some educational institutions in the Asia-Pacific region, the picture of tomorrow shown in Figure 11.2 is already happening. The learning environment here is characterized as wireless, as students access learning materials from the web and other sources, and communicate with tutors and fellow students from wherever they happen to be and at whatever times they wish.

Figure 11.2: Wireless virtual learning environment of tomorrow



Source: Adapted from Keegan, 2002.

In the sections below, we describe aspects of the continually changing learning environment brought about by new developments in ICT and changing pedagogical practices, concluding with our view of what is required to transform classroom and school practice.

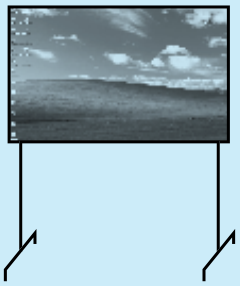
Interactive learning with whiteboards

Blackboards have been a standard feature in classrooms since they were invented in 1801. Then the whiteboard was introduced with its marker pens that eliminated messy chalk. Classrooms of tomorrow are installing interactive whiteboards, connected to a computer and projector (see clipped insert). These new ICT tools allow further kinds of interactive learning.

Interactive whiteboards

Connected to a computer and projector, interactive whiteboards allow students in classrooms to see displayed on a large board whatever is running on the connected computer. Boards are interactive since users can control the computer with their finger or electronic pen on the board's surface. By touch, students and teachers interact with the images displayed, write notes and highlight items. The whiteboard can be free standing like that shown in Figure 11.3, or mounted to a wall.

Figure 11.3: Free standing interactive whiteboard



As the adoption of interactive whiteboards increases, teachers are exploring imaginative ways to use them. For instance, they are used to teach vocabulary with students matching pictures and words; in language classes by showing news in the foreign language; to hold videoconferences with students in other countries; and in a multitude of other ways. A website called Interactive Whiteboard Sites contains links to many further sites with suggestions for using interactive whiteboards, complete with lesson plans, teacher activities, games and resources covering all curriculum areas and all school levels (http://www.avenelps.vic.edu.au/interactive_whiteboard_sites.htm).

The following regional snapshot from Hong Kong reports that a primary school uses interactive whiteboards to enhance interactive learning between students as well as between teachers and students.

Interactive whiteboards enhance interactive learning for Fanling primary students

For the pupils at Fanling Public School in Hong Kong, the improved learning environment made available through the use of Interactive Whiteboards (IWB) has been a boon. Students' motivation and concentration have obviously improved. Before using IWB there was usually very little in the way of interaction between teachers and students, and classes tended to be teacher-centric. One of the major benefits of using IWB is that it increases interaction throughout the class. We find that the IWB teaching style better enhances interactive learning between students, and between students and teachers.

Time management in class is much better, too, allowing more time for discussions and creative thinking. A visual demonstration of abstract concepts, for instance, helps students more quickly understand what's involved so they can more easily apply theory to a real example.

Also, the increased flexibility and convenience inherent in IWB make it easier for teachers to develop networks with other teachers. So, they can share ideas, swap resources and provide tips on new and creative ways to use IWB. This kind of teacher network helps teachers widen their horizons by giving them access to resources that simply weren't available before which, in turn, helps them with better lesson design and teaching strategies.

Chong Wu-lam, Learning Centre, Fanling Public School, Hong Kong

As this regional snapshot from Hong Kong shows, interactive whiteboards help make classrooms more connected and interactive.

Virtual excursions

Perhaps as a student you participated in school excursions. It is quite common for many schools, colleges and universities to organize excursions or field trips to visit national parks, factories, museums and other places of local and educational interest. Typically, a programme of learning activities is built around such visits. Now, with the aid of ICT, students can go on virtual excursions or virtual field trips to explore actual sites or those from the past, to investigate particular topics or view specimens and artefacts, all without leaving the classroom (see clipped insert).

Virtual excursions, virtual field trips, web tours

Virtual excursions, virtual field trips, and web tours are various terms used to describe organized student online learning experiences around visits to different places or different time periods. As part of a guided exploration activity, students commonly connect with other places and people, collect information and report their findings in electronic form using text and images. Sometimes such virtual learning explorations and investigations are conducted in real time with the aid of audioconferencing or videoconferencing facilities that allow students in one location to meet with and hold discussions with others in a remote location.

In Australia, virtual excursions are often used to overcome problems of distance and remoteness. Foley (2008) explains how his Rural and Distance Education Unit links "a school's videoconferencing facilities to equipment at the host location ... [providing] access to virtual excursions anywhere in the world where the technology is in place" (see clipped insert).

Videoconferencing

Videoconferencing is the use of computer hardware and software to enable individuals in separate locations to see and hear one another as in a conference setting. A form of videoconferencing, sometimes called desktop conferencing, can be carried out using a webcam and PC with software such as Skype (see clipped insert in Chapter 1).

For a further example of the ways that educators are bringing the world into their classrooms, the next regional snapshot takes us to a Sydney primary school. We find out how the school utilizes an internet videoconference link to go on a virtual excursion to the National Aeronautics and Space Administration (NASA) headquarters in Houston, Texas.

Videoconferencing and virtual excursions

As videoconferencing has entered schools and classrooms of the 21st century, a unique opportunity for new learning experiences, previously out of reach, has arrived. Students can now participate in field trips or excursions to the far corners of the world, experiencing real time interactions with groups of experts in areas of unique knowledge and interest. These experiences occur without students having to leave their home school or even their home classroom via "virtual excursions". Virtual excursions involve students visiting locations via an internet link using videoconferencing systems, and are becoming increasingly available in major locations of interest worldwide. Some aims of the use of this new technology in schools are to:

- assist geographically dispersed, and often isolated, schools and their teachers to offer students experiential education activities;
- facilitate the teaching of curriculum previously constrained by distance and time; and
- connect learning communities with events, activities and places of significance.

Students from Grade 4 at Randwick Public School in Sydney, New South Wales, went on a virtual excursion to NASA headquarters in Houston, Texas. Students were able to participate in a range of highly engaging activities including experiments simulating the effects of reduced gravity under the tutelage of a member of the space program via video link. This is one of a series of specific educational programs hosted by NASA and aimed at delivering experiential education for students of a wide age range.

The Great Barrier Reef Marine Park Authority in Queensland hosts another example of a virtual excursion where students are able to "dive" the reef and explore its sights live. This virtual excursion features direct audio and video links to a diver who can field questions and explain issues as he conducts a live underwater tour inside Townsville's reef HQ, the world's largest living coral reef aquarium.

David O'Connell, Deputy Principal, Randwick Public School, Sydney, Australia

Whereas interactive whiteboards enhance interactive learning in classrooms, videoconferencing and audioconferencing enable interactions with the outside world.

M-learning and u-learning

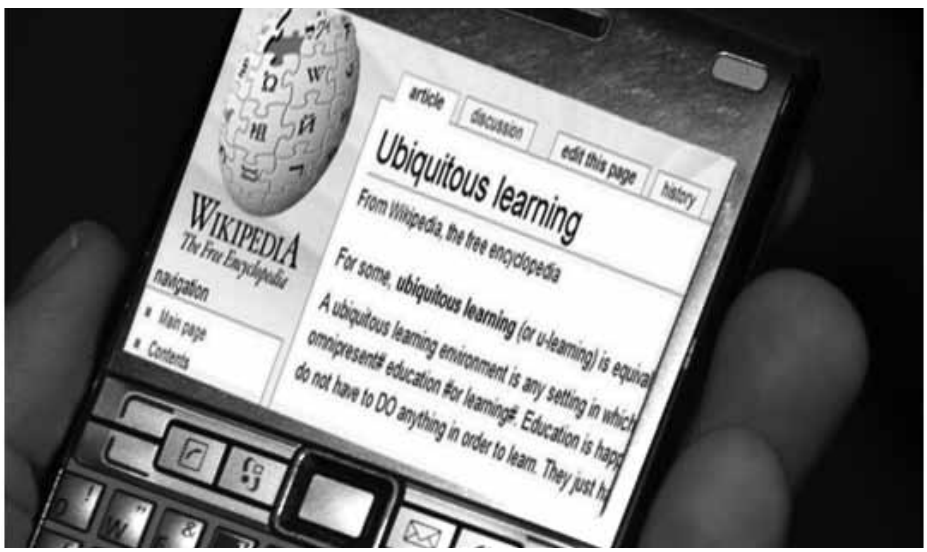
The mobile learning-enabled technologies depicted in Figure 11.2 that characterize wireless learning environments are brought about by a new communications device that is widely accepted and is being taken up at a faster rate than occurred with the PC. As users embrace this new, highly popular device, it appears to offer potential for education. The new portable tool is, of course, the mobile or cellular phone. Vinci and Cucchi (2007, p. 1) say that the mobile phone "represents a revolution in education as it gives the opportunity to learn 'in motion', making the learning process more appealing, interesting and motivating".

Mobile learning and its shortened form *m-learning* are terms increasingly encountered in educational circles. In an early working paper on learning/teaching/tutoring in a mobile environment, O'Malley and his co-workers (2003, p. 6) define m-learning as "learning that takes place via such wireless devices as mobile phones, personal digital assistants (PDAs), or laptop computers". New devices like the iPad and slates extend further the range of devices that enable e-learning. The expanded definition of mobile learning by O'Malley and his colleagues takes these and similar new devices into account:

> any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies (O'Malley et al., 2003, p. 6).

M-learning, then, widens the scope of e-learning. The mobility provided by hand-held, portable devices like smart mobile phones and other mobile technologies removes some of the limitations of learning in fixed locations. This increased mobility for learners gives rise to yet another term, *ubiquitous learning* or *u-learning*, where opportunities for learning are expanded even further (see Figure 11.4).

Figure 11.4: Accessing the internet from a mobile phone



© UNESCO/H. Schmid

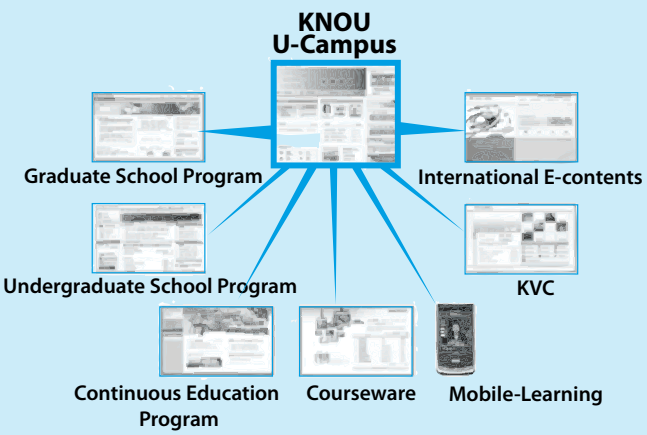
The following snapshot from the region describes how an educational institution at the forefront of educational innovation with ICT is exploring the use of mobile devices with its students. The snapshot comes from the Korea National Open University (KNOU) in the Republic of Korea.

M-learning for distance education

From December 2008 the Korea National Open University (KNOU) initiated a mobile learning system under a memorandum of understanding with the Korean Telephone Company, KT. Mobile learning, or m-learning, is novel in that it facilitates delivery of learning to the right person, at the right time, in the right place, using portable electronic devices. In the near future, m-learning could become a normal part of open and distance learning for lifelong education and self-directed learning.

M-learning is a ubiquitous learning system for distance education where anyone who wants to study can study anywhere, anytime, with the internet and multimedia. Mobile learning was introduced as a more advanced system of learning after several projects were undertaken to evaluate the efficiency of e-learning courses and to suggest a future of more ubiquitous learning. In future knowledge based societies where educational circumstances and paradigms change rapidly, distance education using ICT technology can satisfy the educational desires of various levels of learners.

In the past, KNOU provided students with distance education materials through broadcasting and other ICT. However, mobile technologies, like mobile devices and wireless internet services, have the potential to introduce new innovations into education. M-learning, a new form of education using mobile internet systems and handheld devices, offers students and teachers the opportunity to interact with and gain access to educational materials, independent of time and space. At KNOU, m-learning is expanding to almost every department in the university as this diagram shows.



Professor Dr. Tae Rim Lee, Korea National Open University, Seoul, Republic of Korea

It is not only universities that are exploring the use of mobile phones for education. The next regional snapshot comes from Singapore. Supported by researchers in the National Institute of Education, a primary school there reports that 9 and 10-year-olds are achieving better at school with the use of smartphones to create new learning spaces.

Creating new learning spaces with technology

Despite developments in learning sciences and educational technology, the image of students seated row by row facing a teacher still defines the learning spaces today. Nan Chiau Primary School in Singapore, together with researchers from the National Institute of Education, collaborated to map out a new landscape of students' learning. This new learning space is not defined by class hours or specific locations, but by learning opportunities across spaces as the students take ideas and learning resources gained in one location or context and apply or develop them in another.

As a result of the collaboration, Primary 3 and 4 students (9 and 10-year-olds) in the school are empowered to learn using smartphones as cognitive partners and tools for learning. The students' usage of smartphones is being closely observed to understand better the notion of seamless learning, where students leverage on new learning opportunities (or spaces) to engage in continuous and on-the-move learning. The smartphones represent a bridge between what students do in school (formal learning) and what they do outside of school (informal learning). This use of smartphones to create new learning spaces has resulted in better learning outcomes where students are more driven and take greater interest and responsibility for their own learning.

Gene Lim Yong Seng, Head of Department ICT, Nan Chiau Primary School, Singapore

The regional snapshots from Korea and Singapore are evidence that the wireless virtual learning environment of tomorrow imagined by Keegan in 2002 is now happening. As new learning spaces are created beyond the walls of the classroom and the school, e-learning is becoming m-learning and u-learning.

The way we interact with new ICT tools is changing

Proponents of touch-screen technologies claim that interacting with devices like mobile phones by holding them in our hands and operating them with our fingers is the more natural way of operating a tool. Already, owners of the new generation of smartphones point and touch icons on the screen and use fingers to scroll. Fingers are used also to resize pictures by pinching or stretching them.

Whereas currently most computers are operated indirectly using a mouse or a trackpad, the newer ICT devices with touch-screens allow you to read your email, search the internet and run mini-applications called Apps directly by touching the display (see clipped insert).

Apps

Previously app was an informal, colloquial expression, short for computer application, but the term has come into general use through devices like Google's mobile phone "where web meets phone", and Apple's iPhone and iPad. There are in excess of 140,000 Apps for both the iPhone and iPad across many fields – education, business, politics, travel, entertainment and music. A Google app named Google Docs is reviewed in Chapter 10.

The launch of an innovative ICT tool in 2010 called an iPad paved the way for a new range of devices. With a screen size larger than a mobile phone the devices are still held in the palm of the hand and are operated with one's fingers. What makes the iPad different is that it can be used to download books, magazines and newspapers as well as to roam the internet, send and receive email, share photos and videos, and social network with friends. The device has a virtual keypad and the display adjusts as you turn it on its side from vertical to horizontal orientation. The new range of ICT tools appears to have potential for schools for they enable all the kinds of learning activities discussed in preceding chapters.

Touch-screen technology is already changing how users interact with devices like mobile phones, certain netbooks and other mobile-linked devices. Once users adapt to this new way of interaction using one's fingers rather than a mouse, the new ICT tools are generally quicker to operate. Even more significant, the value-added component of the new technologies described here is that they enable instant communication, constant access to information and immediate use of a variety of tools through a range of Apps. What touch-screen technology clearly shows is that these kinds of devices, and others yet to be invented, become even more personal and are available wherever and whenever users need them.

Changes required in classroom and school practice

The kinds of newer ICT tools described in this chapter are not pre-requisites to transform classroom and school practice. Nor can any ICT by themselves do that. In Australia, for instance, when the federal government initiated a programme in 2009 to fund laptops for all secondary school students in the country, state governments on the advice of educators refused the initial offer unless it was accompanied by software, maintenance and teacher support. In response, the Government initiated a Digital Strategy for Teachers and School Leaders as part of its $2.2 billion AUD Digital Education Revolution to help teachers and school leaders achieve ICT proficiency and embed these skills across the curriculum and teaching practices. As Benderson in another context commented, "Teachers need to be trained. There needs to be appropriate content. We need to develop engaging activities that take real advantage of technological capabilities" (cited in Ng, 2009).

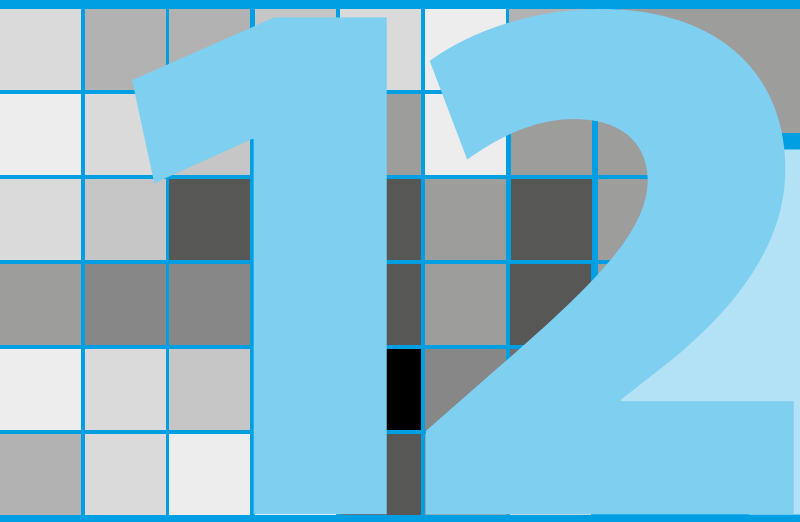
Research studies around the world show that ICT help to broaden access to education as well as improve learning outcomes. At the same time, research indicates that success in using ICT in education depends on teachers' skill in integrating ICT and pedagogy and in utilizing ICT to provide learner-centred interactive education (UNESCO, 2007). In what are described as snapshots taken from around the region and written specifically for this publication, this Guide contains numerous examples of how teachers and teacher educators are applying ICT in the classroom. Further examples of ICT in teacher education programmes from the Asia-Pacific region are available in a collection of case studies compiled by UNESCO (2007). These examples, both the regional snapshots and the case studies, are not necessarily put forward as exemplars of "best practice" but rather as offering:

> ... insights into the process of educating teachers to integrate ICT into education and the process of utilizing ICT tools for training teachers. In addition, these projects provide information about the issues and obstacles that are often faced in ICT-enhanced teacher education in the region. This information will be useful to education planners, teachers, educators and researchers, particularly those in the Asia-Pacific region. (UNESCO, 2007, p. 1)

The theme running through every chapter in this Guide is that schools (including those for training teachers) are transformed through the changes that take place in student learning enabled by the use of ICT under the guidance of good teachers. In Chapter 1, we note that good use of ICT helps bring about changes in teachers' roles, from one where the teacher controls and directs all aspects of learning to situations where students are given more options and responsibilities for their own learning. Similarly, we note in Chapter 1 that students' roles are facilitated by proper use of ICT, changing learners from mere reproducers of knowledge to producers of knowledge. Other chapters, specifically Chapters 6 and 10, suggest strategies for teachers to adopt in moving towards a learner-centred approach. It is through these kinds of changes that educational practice will be transformed. More powerful learning is the driving force.

Because ICT are instrumental in bringing about the changes we are discussing, projects such as UNESCO Bangkok's Next Generation of Teachers (2006-continuing) play a critical role. Another important on-going UNESCO project, Facilitating Effective ICT-pedagogy Integration (2010-12), aims to promote students' use of ICT for higher-order thinking by guiding teachers and students in using online collaboration tools. It is these kinds of projects and similar in-country programmes that will bring about a transformation of classroom and school practice.

In the next and final chapter, we focus on the most important element in the transformation of classroom and school practice – the teacher – and how teachers can continue their professional development.



12 Supporting Teachers in Transforming Education

You will find in this chapter:

- what the most important factor is in ICT as a transforming agent
- how learning networks can further teachers' professional development
- why professional communities of practice provide a rich form of communication to support teachers' continued growth

12. Supporting Teachers in Transforming Education

Key themes running through this Guide

One pervasive theme running through this Guide – it is part of the Guide's title – is that ICT have the potential to be the transforming agent in bringing about a shift towards a new learning paradigm for the education needs of the 21st century and thereby transform education. When we talk about transforming education, we mean radically changing the way teachers teach (described as the art or process of imparting skills, knowledge and values) and the way learners learn (that is, acquire skills, knowledge and values).

Another recurring theme in this Guide is that this potential for ICT can only be realized in the hands of good teachers. As elsewhere in this Guide, "teachers" refer to teachers in schools and teacher educators while "schools" include schools of teacher education as well as primary and secondary schools. From the first paragraph of Chapter 1, and continuing throughout this Guide, we emphasize that teachers through their use of ICT can effect profound changes in student learning.

Teachers are the key to transforming education.

Since teachers are so critical, it follows that their professional development is of prime importance in bringing about changes that will transform education, along with a clearly stated vision for ICT use in education and adequate ICT infrastructure and support. Through its Regional Office for Education in Asia and the Pacific, UNESCO has taken a lead in the region in conducting workshops, seminars and conferences on teacher training on ICT use and ICT-pedagogy integration (UNESCO, 2003, 2004, 2005b, 2006, 2007). Ongoing UNESCO programmes and projects on ICT include promoting North-South-South knowledge sharing, preparing the next generation of teachers through ICT (2006-continuing) and facilitating effective ICT-pedagogy integration (2010-2012). These constructive activities focus on preparing teachers to integrate ICT effectively into their teaching for the improvement of student learning.

Remaining sections in this chapter focus on ways teachers can further their own professional development.

Developing learning networks

The kind of continuing professional development we are talking about in this section is not through attending short courses or workshops on ICT, beneficial though these are, but rather through engaging with other teachers in the same school and with teachers in neighbouring schools and beyond. A valuable strategy is to develop what are called learning networks or personal learning networks.

A good starting point, according to Anderson and van Weert (2002), is to join with fellow enthusiasts at your school, to meet together informally to talk about ICT issues and share knowledge. This process where two or more teaching colleagues work together to discuss problems, share experiences and provide support for one another with a view to improving their teaching is often called peer coaching. Somewhat similar is peer review but here a more experienced teacher commonly pairs with another who needs guidance. By observing each other's teaching and discussing problems, the mentor in this relationship provides feedback and constructive suggestions for improving practice.

Where there is an ICT coordinator at the school, he or she can provide leadership and foster teamwork, which make this kind of teacher development particularly effective. Such meetings can be extended to involve teachers from nearby schools, and even teachers further afield. Although these kinds of personal learning networks, or PLNs, were available long before the appearance of ICT in schools, they require someone to take the initiative and provide leadership in bringing together colleagues to discuss common problems, a task not always easy when teachers lead such busy lives.

A frequently cited blog defines PLN as "the entire collection of people with whom you engage and exchange information, usually online" (Klingensmith, 2009). This is a simple yet sufficiently embracing definition that recognises the contribution of ICT. With the internet came email, which gives educators a quick way to engage and exchange information with others who share similar professional interests. Besides email, however, the ready availability of Web 2.0 tools like those highlighted in Chapters 9 and 10 – blogs, wikis, Facebook, Twitter, LinkedIn, online collaboration tools – provides many further possibilities for teachers to link with others and so further their professional development. Klingensmith describes several different ways that educators use PLNs:

- to learn from content-area specialists;
- to locate resources for your classroom, such as free websites and software;
- to get lesson plan ideas from master teachers;
- to learn about new technology and how to integrate it into your teaching;
- to find collaborative solutions; and
- to find interesting links to education news.

Teachers and teacher educators are in a similar position to other professional groups and constantly need to update their knowledge. Teachers need, therefore, to be supported or encouraged to take their own learning as conscientiously as that of their students. The use of PLNs is one way to achieve this.

The following snapshot from the region presents a picture of an application of ICT in Australia to engage primary-school teachers from remote locations in professional learning activities, which were often difficult previously because of remoteness and isolation.

The use of ICT in developing learning networks for professional development

Information sharing and professional collaboration for developing and fine-tuning teacher skills can benefit greatly through the use of ICT. Schools in remote locations can join with others to participate in professional learning activities for teachers, which previously may not have been possible due to distance and time constraints.

One such activity conducted in NSW departmental schools through the Australian government's Quality Teacher Program sought to develop teacher skills in assessing student work samples and develop consistency in teacher judgement. Schools participated from diverse areas including Norfolk Island (Pacific Ocean), Guyra (Northern NSW) and Randwick (Sydney), among others.

In a practical sense, the format of this series of workshops meant that teachers from a range of geographic locations, socio-economic communities and culturally diverse populations were able to work together. The workshops increased teacher understanding of the levels at which student work was comparable and able to be equated on graded marking scales.

Schools were invited to download via email specific assessment tasks created by the Curriculum Support directorate, at specified grade levels, in different Key Learning Areas (KLAs). These KLAs included mathematics, English, and human society and its environment (social studies).

The assessment tasks were then administered to students in the participating schools with the work produced being scanned and emailed back to the coordinator of the programme for dissemination to all participant schools. Teachers were also required to create and use a marking rubric that was shared between schools. A rubric is best described as a matrix containing descriptors of possible levels of achievement in a work sample, with each descriptor corresponding to a marking level. Once all work and rubrics were disseminated, schools "met" online via video-conference to grade and discuss the student work. This discussion was moderated by senior curriculum consultants and assessment advisors whose role was to facilitate the discussion through highlighting specific aspects of the work, guiding discussion through any areas of contention and assisting the group to reach a shared understanding of where they saw the individual samples sitting on a grading scale.

The whole exercise contributed greatly to the professional development of all participating teachers.

David O'Connell, Deputy Principal, Randwick Public School, Sydney, Australia

Professional communities of practice

The use of ICT to develop learning networks creates what have come to be known as communities of practice after the term was coined by the cognitive anthropologist, Etienne Wenger. According to Wenger (2006), communities of practice are "formed by people who engage in a process of collective learning in a shared domain of human endeavour ... who

share an interest, a craft, and/or a profession". Thus a network of educators who engage for the purpose of furthering their learning about integrating ICT in their teaching is aptly described as a community of practice or professional community of practice.

Communities of practice are first discussed in this Guide in Chapter 5 where a model of e-learning is presented. In that model, communities of practice are positioned along a continuum at a point where the richest form of communication takes place. This occurs when teachers use web tools to communicate with other teachers and professionals to ask questions, share ideas and experiences, and build up collective knowledge. Evidence that teachers find this process valuable in furthering their professional development is given in the next regional snapshot from an Australian primary school. Here, the school's learning technology coordinator shares her experiences of how social networking – Twitter, blogs and other web tools – helped her own professional development, making her more effective in promoting her students' learning experiences.

Twitter for professional development

Like many other teachers, I have attended a variety of professional development sessions, be they conferences, workshops, or more informal sessions. Some of these have been free, others pretty expensive – the cost definitely not commensurate with quality, in my opinion. This year I have accessed less formal professional development, but conversely feel as if my professional learning has increased. I have achieved this by becoming a regular user of Twitter, and through reading other educators' blogs using Feedly or Google Reader – making professional development available to me anywhere, anytime.

Initially, when introduced to Twitter, I seriously questioned the point of it. How could you possibly share much of value in 140 characters, and more to the point, why? However, persistence has certainly paid off.

I have learned so much from educators who so willingly share. I'm not even sure now where I started or whom I first followed, but my Professional Learning Network, or PLN, has grown immeasurably. Invariably those in my Twitter network write blogs that I read regularly too.

The great thing about Twitter and blog readers is that you pick up such useful information that you can immediately use in your classroom. I have used many new web tools this year, all thanks to my rapidly expanding PLN. Where else would I have found out about etherpad, glogster, wallwisher or wordle? Without Twitter, my class certainly wouldn't have collaborated with Mr Bob's class in Queensland.

In a world where there is so much negativity and bad news, it is so refreshing and affirming to know that there are people out there whom you have never met, but who are willing to share and help you out. I often point this out to my students to encourage them to help out whenever they can.

Educators often talk about the value of authentic audience. The network that I have built through using Twitter has contributed to the authentic, and global audience that enhances my students' learning experiences.

Pam Thompson, Learning Technologies Coordinator, Hawthorndene Primary School, Adelaide, Australia

Educators at all levels are finding communities of practice highly worthwhile as ways to continue their professional development, as both regional snapshots in this chapter affirm. The use of online communication and collaboration tools conquers problems of distance and isolation. Communities of practice promote a rich form of collective learning by bringing teachers together with other teachers as well as bringing teachers together with teacher educators, curriculum consultants and other experts.

Wegner (2006) makes the interesting observation that, in the world of business, communities of practice add a layer to the business but they do not fundamentally change what the business is about. However, in education, communities of practice contribute to changing the nature of learning in the institution and this leads, says Wegner, to "a much deeper transformation".

The use of ICT to create professional communities of practice and thus promote a richer understanding of the potential of ICT to advance learning is a powerful means of supporting teachers in transforming education.

References

Anderson, J. 1984. *Computing in Schools: An Australian Perspective*. Melbourne, Australian Council for Educational Research.

Anderson, J. and Glenn, A. 2003. *Building Capacity of Teachers/Facilitators in Technology-Pedagogy Integration for Improved Teaching and Learning*. Bangkok, UNESCO Regional Office for Education in Asia and the Pacific. http://www.unescobkk.org/fileadmin/user_upload/ict/e-books/ICTBuidling_Capacity/BuildingCapacity.pdf (Accessed 8 March, 2010)

Anderson, J. and van Weert, T. (Eds). 2002. *Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher Development*. Paris, UNESCO. http://unesdoc.unesco.org/images/0012/001295/129538e.pdf (Accessed 28 March, 2010)

Annan, K. 2003. *Address by UN Secretary-General to the World Summit on the Information Society*. http://www.itu.int/wsis/geneva/coverage/statements/opening/annan.html (Accessed 8 March, 2010)

Association of College and Research Libraries. 2000. *The Information Literacy Competency Standards for Higher Education*. http://www.ala.org/ala/mgrps/divs/acrl/standards/informationliteracycompetency.cfm (Accessed 8 March, 2010)

Aston, M. 2003. The development and use of indicators to measure the impact of ICT use in education in the United Kingdom and other European countries. In *Performance Indicators for ICT Use in Education*. Bangkok, UNESCO. http://unesdoc.unesco.org/images/0014/001446/144657eb.pdf (Accessed 18 March, 2010)

Barsaga, E.B. 2003. Situational analysis on developing and using ICT indicators in education. In *Performance Indicators for ICT Use in Education*. Bangkok, UNESCO. http://unesdoc.unesco.org/images/0014/001446/144657eb.pdf (Accessed 8 March, 2010)

Buzan, T. 1991. *The Mind Map Book*. New York, Penguin.

CIA World Factbook. 2010. *The World Factbook* (updated weekly). Washington, D.C., Central Intelligence Agency. https://www.cia.gov/library/publications/the-world-factbook (Accessed 24 March, 2010)

Downes, T, Khun, T, Scott, D, Leonard, R and Warhurst, J. 2003. *Preservice Teacher Training and Teacher Professional Development in the Use of ICTs in the Training of Mathematics and Science in Participating SEAMEO Countries* (a SEAMEO-Australia Project). Canberra, Department of Science, Education and Training.

Foley, D. 2008. *Space Odyssey 2008*. http://www.schools.nsw.edu.au/news/schoolstories/yr2008/jul/space.php (Accessed 8 March, 2010)

Graham, C. R. 2006. Blended learning systems: Definition, current trends, and future directions. In C. J. Bonk. and C. R. Graham (Eds), *The Handbook of Blended Learning: Global Perspectives, Local Designs* (pp. 3-21). San Francisco, Pfeiffer.

Ham, V., Gilmore, A., Kachelhoffer, A., Morrow, D., Moeau, P. and Wenmouth, D. 2002. *Evaluation of the New Initiatives in Interactive Education: An Information and Communication Technology (ICT) Strategy for Schools. What Makes for Effective Teacher Professional Development in ICT?* Wellington, New Zealand, Ministry of Education. http://www.educationcounts.govt.nz/publications/ict/5807 (Accessed 19 March, 2010)

ICT for Development. 2002. *Malaysia ICT4D National Education Policy*. http://www.comminit.com/en/node/148397/307 (Accessed 13 March, 2010)

IDC. 2008. *The Diverse and Exploding Digital Universe*. http://www.emc.com/collateral/analyst-reports/diverse-exploding-digital-universe.pdf (Accessed 16 March, 2010)

International Telecommunication Union (ITU). 2009. *Measuring the Information Society – The ICT Development Index*. http://www.itu.int/net/pressoffice/backgrounders/general/pdf/5.pdf (Accessed 12 March, 2010)

International Telecommunication Union (ITU). 2010. *Measuring the Information Society 2010.* http://www.itu.int/ITU-D/ict/publications/idi/2010/index.html (Accessed 12 March, 2010)

Keegan, D. 2002. *The Future of Learning: From eLearning to mLearning.* http://learning.ericsson.net/mlearning2/project_one/book.html (Accessed 8 March, 2010)

Kim, G.J. 2009. *ICT in education: Issues and questions. Opening address, 13th UNESCO-APEID International Conference, ICT Transforming Education,* Hangzhou, China, November 15-17, 2009. http://www.unescobkk.org/education/apeid/apeid-international-conference/13-th-apeid-international-conference/papers-and-presentations/ (Accessed 18 March, 2010)

Klingensmith, K. 2009. *PLN: Your Personal Learning Network Made Easy.* http://onceateacher.wordpress.com/2009/05/05/pln-your-personal-learning-network-made-easy/ (Accessed 17 March, 2010)

Lacy, S. 2009. *The Facebook Story.* Richmond, UK, Crimson,.

Ledesma, L. 2005. *Learning in a Digital World – Learning Through ICT in New Zealand.* https://www.det.nsw.edu.au/media/downloads/detawscholar/scholarships/2006/reports3/harvey_laar.doc (Accessed 8 March, 2010)

Li, J. 2010. Singapore accelerates digital inclusion for seniors. *futureGOV*. Singapore. http://www.futuregov.net/articles/2009/nov/23/singapore-accelerates-digital-inclusion-senior-cit/ (Accessed 18 March, 2010)

Lomas, C., Burke, M. and Page, C. L. 2008. *Collaboration Tools.* Educause Learning Initiative. (Paper 2: 2008.) http://net.educause.edu/ir/library/pdf/ELI3020.pdf (Accessed 8 March, 2010)

Majumdar, S. (Ed.). 2005. *Regional Guidelines on Teacher Development for Pedagogy-Technology Integration.* Bangkok, UNESCO Regional Office for Education in Asia and the Pacific. http://unesdoc.unesco.org/images/0014/001405/140577e.pdf (Accessed 28 March, 2010)

Ministry of Education, Singapore. 2009. *MOE Adopts Open Standard Internet Email and Collaboration Services for over 30,000 Teachers.* (Press Release, September 2009) http://www.moe.gov.sg/media/press/2009/09/moe-adopts-open-standard-inter.php (Accessed 8 March, 2010)

Nallaya, S. 2010. *The Impact of Multi-modal Texts on the Development of English Language Proficiency.* Unpublished doctoral thesis, The University of Adelaide, Australia.

Ng, K. 2009. Inside the Teachers' Lounge. *futureGOV*. Vol. 6, No. 6, p. 6 (December 2009).

Nichols, M. 2008. *E-learning in context.* Laidlaw College, Auckland, New Zealand. (E-Primer Series.) http://akoaotearoa.ac.nz/sites/default/files/ng/group-661/n877-1---e-learning-in-context.pdf (Accessed 8 March, 2010)

OECD. 2006. *Are Students Ready for a Technology-Rich World? What PISA Studies Tell Us.* http://www.oecd.org/document/31/0,3343,en_32252351_32236173_35995743_1_1_1_1,00.html (Accessed 11 March, 2010)

O'Malley, C., Vavoula, G., Glew, J.P., Taylor, J., Sharples, M. and Lefrere, P. 2003. *Guidelines for Learning/Teaching/Tutoring in a Mobile Environment.* MOBIlearn. http://www.mobilearn.org/download/results/guidelines.pdf (Accessed 18 March, 2010)

Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas.* Brighton, UK, Harvester Press.

Partnership for 21st Century Skills. 2010. *Framework for 21st Century Learning.* http://www.21stcenturyskills.org/index.php?Itemid=120&id=254&option=com_content&task=view (Accessed 8 March, 2010)

Prensky, M. 2001. Digital natives, digital immigrants. *On the Horizon*. Vol.9, No.5, pp. 1-6. http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf (Accessed 8 March, 2010)

Resta, P. and Patru, M. (Eds). 2010. *Teacher Development in an E-learning Age: A Policy and Planning Guide.* Paris, UNESCO.

UNESCO. 2003. *Teacher Training on ICT Use in Education in Asia and the Pacific: Overview from Selected Countries.* Bangkok, UNESCO. http://unesdoc.unesco.org/images/0013/001329/132979e.pdf (Accessed 8 March, 2010)

UNESCO. 2004. *Integrating ICTs into Education: Lessons Learned.* Bangkok, UNESCO. http://www.unescobkk.org/fileadmin/user_upload/ict/e-books/ICTLessonsLearned/ICT_integrating_education.pdf (Accessed 8 March, 2010)

UNESCO. 2005a. *Mobile Learning for Expanding Educational Opportunities.* Bangkok, UNESCO. http://unesdoc.unesco.org/images/0014/001436/143684e.pdf (Accessed 13 March, 2010)

UNESCO. 2005b. *Towards Knowledge Societies.* Paris, UNESCO. (UNESCO World Report). http://unesdoc.unesco.org/images/0014/001418/141843e.pdf (Accessed 8 March, 2010)

UNESCO. 2006. *Directory of ICT Resources for Teaching and Learning of Science, Mathematics and Language.* Bangkok, UNESCO. http://www.unescobkk.org/index.php?id=4086 (Accessed 18 March, 2010)

UNESCO. 2007. *ICT in Teacher Education: Case Studies from the Asia-Pacific Region.* Bangkok, UNESCO. http://unesdoc.unesco.org/images/0015/001567/156757e.pdf (Accessed 8 March, 2010)

UNESCO. 2008. *ICT Competency Standards for Teachers (Policy Framework, Competency Standards Modules, Implementation Guidelines).* Paris, UNESCO. http://cst.unesco-ci.org/sites/projects/cst/ (Accessed 18 March, 2010)

UNESCO. 2009. *ICT in Education* (December 4, 2009).

UNESCO. 2010. *Web Tools for Educators* [CD]. Bangkok, UNESCO.

UNESCO Institute for Statistics. 2009. *Guide to Measuring Information and Communication Technologies (ICT) in Education.* Montreal, Canada, UNESCO Institute for Statistics. (Technical Paper No. 2.) http://www.uis.unesco.org/template/pdf/cscl/ICT/ICT_Guide_EN.pdf (Accessed 8 March, 2010)

Vinci, M-L. and Cucchi, D. 2007. *Possibilities of Application of E-tools in Education: Mobile Learning.* http://www.leonardo-lets.net/ict/common/download/MariaLuisaVinci.pdf (Accessed 8 March, 2010)

Wenger, E. 2006. *Communities of Practice: A Brief Introduction.* http://www.ewenger.com/theory/communities_of_practice_intro.htm (Accessed 14 March, 2010)

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