Asia-Pacific Regional Bureau for Education
UNESCO Bangkok

ICT IN EDUCATION

Meta-survey on the Use of Technologies in EDUCATION

Edited by Glen Farrell, Ph.D and Cédric Wachholz

in Asia and the Pacific

2003–2004

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Contributing authors

Ms Lkhagvasuren **Ariunaa**, Civil Society Programs Director is affiliated with Mongolian Foundation for Open Society (Soros Foundation).

Ms Salanieta **Bakalevu** works as an Instructional Designer at the Distance & Flexible Learning Support Centre of the University of the South Pacific in Suva, Fiji.

Ms Tian **Belawati**, Ph.D., Vice Rector for Academic Affairs, is affiliated with Universitas Terbuka (Indonesia Open University).

Mr Sukhbaatar **Enkhjargal**, Executive Director is affiliated with MIDAS NGO (Mongolian Information Development Association). More information at web: *www.ict.mn/midas*.

Mr Glen **Farrell**, Ph.D., has had a long career in distance education and the management of innovative organizations. He is now involved in project management and international consultancies on change and reform in education systems and the use of technology. Dr. Farrell has worked with such organizations as The Commonwealth of Learning, where he is a Senior Consultant, the World Bank, Industry Canada, the World Health Organization, Schoolnet India, Technikon South Africa, and the Open University of Hong Kong.

Ms Lyndsay **Green** is a consultant in the application of learning technologies offering services through *www.traintec.com.*

Ms Jung Sun **Hahn**, Ph.D., Professor and Chairperson, is affiliated with Department of Educational Technology, College of Education, Ewha Womans University, Republic of Korea.

Ms Carol **Jasen** is a Ph.D. student at the University of Melbourne and a Research Assistant in the Department of Teaching, Learning and Research Support at the University of Melbourne, Australia.

Ms Chen **Li**, Ph.D., Professor, Deputy Dean of Information Sciences College and Research in Distance education, Beijing Normal University.

Mr Som **Naidu**, Ph.D., Professor is Head, Research and Evaluation in the Department of Teaching, Learning and Research Support at the University of Melbourne, Australia.

Mr Hilary **Perraton,** Ph.D., is an educational consultant. He was the founding director of the International Research Foundation for Open Learning and for ten years a member of the Commonwealth Secretariat.

Mr Tom **Prebble**, Ph.D., is a Professor of Higher Education, Massey University, New Zealand.

PREL – Pacific Resources for Education and Learning

- Mr Thomas **Barlow** is the President and CEO of PREL - Pacific Resources for Education and Learning.
- Mr Steve **Baxendale** is the Program Director of PRELStar.
- Mr Andrew **Kerr** is the Associate Director of the Pacific Regional Technology in Education Consortium (PR*TEC).
- Ms Kavita **Rao** is an Instructional Design Specialist for PR*TEC and for the Pacific Mathematics and Science Consortium.
- Ms Nicole **Sayres** is a Senior Affiliate of Pacific Resources for Education and Learning.

Ms Usha Vyasulu **Reddi**, Ph.D., is the Director of the Commonwealth Educational Media Centre for Asia (CEMCA), established by the Commonwealth of Learning to meet regional needs of Asia.

Mr Tohid **Sadeghnezhad**, is a researcher in the Islamic Republic of Iran.

Ms Vineeta **Sinha** is currently a free lance project consultant and was attached to CEMCA as a consultant with the COLLIT-India Pilot project.

Mr Anare **Tuitoga** is an Instructional Designer at the Distance & Flexible Learning Support Centre of the University of the South Pacific in Suva, Fiji.

Ms Ruby **Vaa**, Ph.D., is the Director of the University of the South Pacific Centre in Samoa.

Mr Cédric **Wachholz**, is a Programme Specialist and the Focal Point for ICT in Education in the UNESCO Asia and Pacific Regional Bureau for Education.

Ms Aya **Yoshida**, Ph.D., is a Professor affiliated with the National Institute of Multimedia Education, Chiba Japan.

Preface

This *Meta-survey of the Asia-Pacific Programme on Promoting the Effective Use of Information and Communication Technologies in Education* is part of the regional ICT in Education project coordinated by the UNESCO Asia and Pacific Regional Bureau for Education and financed by Japanese Funds-in-Trust.

The Meta-survey acts as a snapshot of the current state of ICT use in education throughout Asia and the Pacific. Surveys on the general ICT situation of countries in the region existed before, but not with this particular focus on education, describing and analysing the use of ICTs both in formal and non-formal learning environments.

The knowledge gained will guide UNESCO's project implementation and future project formulation. It will also contribute to a broader understanding of how ICTs can be harnessed to achieve Education for All (EFA) goals. The examples and insights gathered through the survey will help to avoid duplication of efforts and encourage the building of new partnerships.

The information collected is being widely shared through a number of formats: this publication; a CD-ROM that includes an additional analysis and database on educational software; and through a posting of the documents on the UNESCO Bangkok website at www.unescobkk.org/education/ict/metasurvey.

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Finally yet importantly, we would like to thank the Government of Japan, and particularly the Ministry of Education, Culture, Sports, Science and Technology (MEXT) for their generous financial contribution and continued support, without which this survey would not have been possible.

INTRODUCTION

"Information and communication technologies (ICTs) must be harnessed to support EFA goals at an affordable cost."

Dakar Framework for Action[1]

More of the same is just not going to work. Building more classrooms, and training more teachers to reach those currently unreached by education systems is unrealistic and will not be enough to meet the Education for All (EFA) challenge. Some countries are already spending considerable percentages of their Gross Domestic Product on education and have little room for manoeuvering. In addition, traditional education models will no doubt be unable to achieve educational empowerment effectively in the emerging Knowledge Societies.

UNESCO Bangkok launched this Meta-survey to obtain information on existing ICT applications and models that have proved to be efficient or hold promise of contributing substantially to achieving EFA goals. Particular attention was paid to models that could be adapted and improved for large-scale use.

The Meta-survey allowed UNESCO to obtain a more accurate picture of the current state of ICT use in education in the Asia and Pacific region. UNESCO uses a broad definition of Information and Communication Technologies (ICTs) for this study to include broadcast technologies, such as radio and television, as well as the use of computers, related peripherals, e-mail and the web. Both formal and non-formal learning environments are targeted, reaching from primary to secondary levels, technical and vocational education and teacher training, but generally not including the higher education level.

This study helped UNESCO to identify, analyse and summarise current applications and practices in the use of ICTs in formal and non-formal education. It has furthered the process of creating or strengthening regional networks on ICTs and education and provided valuable information to be used in UNESCO's programme formulation, activity prioritisation, and training strategy development.

The researchers were asked to map and analyse ICT initiatives in education, especially for disadvantaged groups and girls and women. In their analyses of UNESCO Member-states, special attention was paid to the following aspects:

- National policies, strategies and programmes, including policy goals, action plans, current implementation status, budgets allocated, sources of funding, gaps, limitations and needs perceived.
- Current levels of ICT access and use in education, spelling out which technologies are being used, for what purposes, and to what extent in basic education (primary/secondary), vocational education, teacher training, and non-formal education. This part includes "digital divide" issues, especially those relating to gender. Some instructive examples of partnership experiences between levels of governments, civil society, and the private sector were described as well.
- Illustrative examples of initiatives which may be major successes or failures with a focus on delivery models, the development of learning materials or resources related to ICT use, efforts to address issues of access to ICT, and any evidence on ICT use in education initiatives.

- Training being systematically implemented in the countries, especially that for teachers, educators in non-formal education settings, and learners. What are the strategies, and sources of expertise; is it compulsory or optional; is there evidence of effectiveness; and what are the needs?

- Constraints regarding the use of ICT in the country, particularly those involving gender, rural/urban divisions, ethnic minorities, learning software language, issues of ICT use and learning quality, resourcing and sustainability.

- Analyses focusing on actions/initiatives that the researcher felt might facilitate the increased use of ICT in the country to support educational goals.

The research method applied included a careful selection of organizations and individuals with knowledge and expertise in the use of ICTs in education in the Asia-Pacific region. They were invited to prepare the country and thematic reports and gathered the necessary information using publications, the web, e-mail and telephone interaction with individual contacts within the countries, personal information and other sources. The researchers therefore analysed and synthesized already existing information, but also integrated new knowledge gained. A much more comprehensive survey including detailed questionnaires to Ministries of Education for the thorough analysis of school and country situations is currently being undertaken by UNESCO's ICT in Education Indicator Project in selected Member States.

For this reason, the Meta-survey neither attempts nor pretends to reflect country situations in their diversity in the limited space we have here. This task was sometimes difficult because information was hard to obtain. At other times, because of our broad definition of the term "ICTs" and the coverage of formal and non-formal learning environments, there was a sheer information overflow. The criteria for selecting and synthesizing information have been mentioned before: lessons to be learnt in order to reach the Education for All (EFA) goals, better understanding the countries' key players, initiatives, constraints, and needs and opportunities for UNESCO to contribute to development.

When we received the first drafts of the country reports we noticed that the gender analysis component was generally incomplete, even though this is a major EFA priority. To make up for this lack, we contracted an ICT and gender specialist, Ms Lyndsay Green, to write a separate chapter on gender issues and trends in the use of ICT in education in this region. The report benefited directly from Ms Green's participation in the very timely Forum on ICTs & Gender: Optimizing Opportunities, organized by the Global Knowledge Partnership (GKP) in Kuala Lumpur from 20–23 August 2003.

The Meta-survey is composed of the following chapters:

The first chapter gives an overview of developments and trends in the application of ICTs in education. It provides an illustrative overview of applications and models of ICT use in education, looking more carefully at trends in content development and in applications for primary and secondary education and for non-formal education, and in research and evaluation, and at emerging infrastructure developments.

Gender-based issues and trends in ICT applications in education in Asia and the Pacific are the focus of the second chapter. It shows exciting examples of how ICTs can increase access to and improve the quality of learning experiences for girls and women, including in non-formal education. Trends in strategies, including gender mainstreaming and the engendering of ICT and education policies, are discussed.

The third chapter includes the collection of the ICT in education country papers, grouped by sub-regions.

The concluding section summarises the apparent principles of ICT applications in education and discusses different policy framework developments, constraints and challenges of successful ICT integration in the region and possible strategies and opportunities for UNESCO assistance.

We trust that initiatives beyond those launched by UNESCO will benefit from, and be inspired by, the knowledge shared and networks created through this survey.

Sheldon Shaeffer
Director
UNESCO Asia and Pacific Regional Bureau for Education

[1] World Education Forum (2000): The Dakar Framework for Action, Expanded Commentary, Paris p. 21

Regional Perspectives

An Overview of Developments and Trends in the Application of Information and Communication Technologies in Education

Mr Glen M. Farrell, Ph. D.
Senior Consultant
Commonwealth of Learning

October, 2003

glenf@col.org

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The context

Over the last few years the use of information and communication technologies (ICTs) in all sectors of education has increased dramatically – and continues to do so. While the writer is not aware of supporting research specific to education, it is probable that the diffusion and adoption of ICTs in that context is following a pattern similar to that which has characterized the adoption of any innovation in other fields such as agriculture and medicine.

The pattern in those contexts has been that adoption is typically led by a small group of "innovators" who are able to imagine applications for the innovation, in this case ICT, and are able to acquire the resources needed to test it. This influences a larger group of "early adopters" to try the technology, largely on the basis of the "visions" created by the work of the "innovators" coupled with the advocacy and incentives that policy makers and institutional leaders may provide. At this point the adoption of the innovation is shifting from the periphery to mainstream practice and is starting to receive a great deal of attention. Practitioners want to see evidence of the benefits of adoption and are less likely to be influenced by the rhetoric of the advocates. As more evidence supporting adoption becomes available, the large body of "late adopters" will decide to get involved – and following these, a smaller group of practitioners who generally find change of any kind difficult, decide to adopt the innovation. This group is referred to as the "laggards".

It is arguable that the adoption of ICTs in education has, in general terms, reached the stage of early adoption. Decision-makers and teachers want to know how this innovation will increase access to educational opportunities, what the costs will be, and what the impact will be on the quality of content and the learning experience. They need to be convinced by evidence before making wholesale changes to the way schools function and the way in which available resources are allocated. And their starting point, as it has been with farmers or physicians, is the question: "How will this help me improve what I am already doing?"

The need to encourage and facilitate the use of ICTs in education systems is urgent. The World Education Forum concluded at its Dakar conference in 2000 [1] that, while there had been progress since the Jomtien conference a decade earlier, large numbers of people were still without a basic education and that more effort was required to meet the Education For All (EFA) goals. More use of distance education, telematics and broadcasting was urged. And, as will be seen from the examples that follow, that is happening.

The intent of this chapter is to provide a global snapshot of trends in the adoption of ICTs into educational practice and, thereby, to provide a backdrop against which to view applications in countries of the Asia-Pacific region that are described in the following section of this report. As we shall see, there are many examples of "innovators" who are trying new things. There are also some very successful examples of applications on a mass scale, and many more initiatives that hold much promise. Some of these examples will be used to illustrate the various trends happening in the areas of ICT infrastructure development, ICT applications in primary and secondary school systems, curriculum materials content development, and non-formal education. There is also a trend towards more emphasis on research and evaluation on issues related to ICT use in education including not only those related to efficiency and effectiveness, but also to the matter of gender equity in terms of access and involvement – an issue that will be reviewed in a separate section of this report. The description of trends that follows is not intended to be a listing of "good practice" but rather as examples selected to illustrate that trend. Taken together, the trends illustrate the growing contribution ICT applications are making to the achievement of EFA goals.

Trends in emerging ICT infrastructure

There are many ways to look at the concept of infrastructure. A common framework is to think of infrastructure in terms of the following components: the hardware (the machines) that we use, watch or listen to such as computers, television sets, radios, etc.; the "libraries" where information is stored such as servers; the networks that enable information to move between and among machines and libraries such as satellites, wires and cables, and wireless networks; and the operating systems, such as Windows and Linux, that allow the interactions to take place. For the purposes of this discussion we shall include another component, the emergence of "management information" strategies that allow us to access information we want in an efficient manner.

It is also important to make clear that the definition of ICT used in the scope of this report is comprehensive. It includes not only the newer digital technologies of computers, Internet, e-mail, World Wide Web, wireless, etc, but also the older technologies of print, radio and television that have been used extensively in both distance education and classroom instruction. Indeed, as many of the examples illustrate, these "older" technologies are still the mainstay of educational outreach in many parts of the world because the state of infrastructure development has not allowed the same degree of adoption as has taken place in more developed countries. This is often referred to as the "digital divide".

Combined Use of "Old" and "New" Technologies

What follows illustrates ways that "old" and "new" ICTs are being used together to add value to educational endeavors around the world and, in the process, are providing bridges to the digital divide. The examples also illustrate the importance of not "throwing the baby out with the bath water" as is often the case when "old" ICTs are abandoned in the rush to incorporate the new.

1. One of the best school-based examples of this trend can be found in **Mexico's Telesecundaria**, which is described in detail later in this chapter. The school uses television, print, and, more recently, the Internet to support classroom-based learning.

2. Another, more recent, example is the Philippine government's **Integrated Distance Learning Programme (IDLP)**, which uses satellite, television, computers, the Internet, and solar power to target some 3,000 communities, or barangays, across the island of Mindinao. Enrollees in remote highlands and evacuation centres will take a qualifying exam to determine the programme most appropriate for them. The programme is designed to address the low quality of education among indigenous peoples. More information is available at www.digitalopportunity.org/article/country/970/

3. **Radio Sagarmatha** in Nepal is broadcasting the Internet over the radio – something that is in direct contrast to the more common practice of simulcasting radio over the Internet. www.digitaldividenetwork.org/content/stories/index.cfm?key=252. While this example relates to education in a general sense, it illustrates how community radio can be enriched as an information source through the use of the Internet. Listeners can learn about the Internet and its uses, and also phone in their queries for Internet searching and have the information broadcast for all to hear.

4. **Interactive Radio Instruction** [2] is not new. It has been used for nearly 30 years in over 20 countries around the world. However, it illustrates how the combination of "old" technologies, radio and print, can effectively improve the quality of education in remote schools. In many ways the model resembles the Farm Radio Forum started by the Canadian Broadcasting Corporation and replicated in India and other parts of the world. Modern

day versions now incorporate Internet-based interactivity as well.

5. The **Kothmale Internet Radio** project in Sri Lanka [3] is an add-on to a community radio that was set up 20 years ago by the Sri Lanka Broadcasting Corporation when the construction of the Kothmale dam displaced entire villages. Local radio was chosen as a strategy for helping to rebuild the social fabric for those displaced within this rural community and KIR became an important part of many people's lives.

Several community telecentre facilities were developed to enable Internet access for members of the communities so they could do "radio browsing" of websites. In this way community radio is used as a gateway for a poor community to actively participate in the global knowledge society. At present, the radio browsing formula is the only means to overcome the language barrier entirely, as information on English-language websites is explained and discussed directly in Sinhalese and Tamil. One advantage for Kothmale is the existence of many regionally based English-language sites carrying a vast range of information relevant for much of the Asian region. The number of students at KIR centres after school hours, surfing the web in English and using English for their e-mail exchanges, indicates that language is far less of a barrier for the younger generations than it is for adults.

Growing Interest in "Open Source" Operating Systems

Operating systems enable computers, and the networks that connect them, to function. They are comprised of two main types of software: those that control the workings of the computer, and those that allow computer users to undertake specific sorts of tasks such as word processing, using spreadsheets or developing and manipulating graphics.

Some of the most commonly used operating systems, such as Windows, are referred to as "proprietary" software. Use of this type of software usually requires the payment of a license fee and, even then, the user is not able to access the source code or inner workings.

Open source software on the other hand, refers to any software which may be copied and used freely. The software is often available free of charge on the Internet. And, unlike proprietary software, open source software can be copied, used, studied, modified, distributed, etc., with little or no copyright restrictions. It is royalty and license free, and is therefore substantially cheaper to acquire than branded alternatives. The reason for this is that open source software is developed by volunteer collectives who are not seeking to profit from its sale. In addition, just as the recipe for generic drugs is made public, so the source code of open source software is accessible to the user. Any qualified person can see exactly how the software works and can easily make changes to the functionality of it.

The reasons for the growing interest in open source software in the educational context are obvious. As Dr. Kathryn Moyle points out in her paper "Open Source Software and Australian School Education",[4] the use of ICT in schools is an added cost to the traditional infrastructure of buildings, teachers' salaries, books, etc. Therefore, anything that can potentially save money is attractive. Open source is attractive for other reasons as well. Governments and schools are interested in increasing the interoperability between software systems for teaching and learning and administrative purposes. The question of how to achieve interoperability hinges on the nature of the standards upon which the software is based. This is akin to determining the nature of the foundations upon which a house is to be built. Open standards that allow the code for the standard to be seen provide the capacity for interoperability between both open and proprietary software. Open source software provides a concrete way of developing open standards. Rather than making open standards theoretical exercises, open source software provides the practical means for determining these standards.

However, there are pros and cons as Martin Bruggink points out in his paper on "Open Source in Africa: Towards Informed Decision-Making".[5] He provides a comprehensive review of the realities involved in the use of open source software and gives a useful summary of the advantages and disadvantages.

Nevertheless, open source software is becoming increasingly attractive to educational leaders and practitioners. The Australian context described by Kathryn Moyle is illustrative. After a comprehensive review of the current state of open source software use in the country, she concluded that the management of software is emerging as an important part of the work of schools. She reviews a list of the software requirements that schools have, gives her assessment of the pros and cons of open source, and provides a review of the risks involved in using proprietary software.

Obviously the trend toward open source software will be of increasing significance to education leaders and the importance of making informed decisions before adopting it is important. Other sources that discuss this trend include:

- Fredrick Noronha's paper "Liberation Technology for the Lands of Diversity? Free Software in Asia." [6]
- Particular pieces of open source software are discussed at: www.unesco.org/webworld/portal_Software.

- http://fossfa.org/database/all_projects.html/ has a database of people, projects and organizations involved in open source software development.

- The Commonwealth of Learning completed an assessment of open source learning management systems in June 2003. A hard copy is available by sending a request to: (info@col.org).

Use of Mobile Technology

An article in the February 25, 2003 edition of the Guardian begins as follows:

> "Imagine all those times in the day when we see groups of young people hunched over mobile phones, thumbs straining repetitively. Now imagine they are not texting friends or passing the time with a game, but are actively engaged in learning. If you are finding this hard to imagine, the researchers running the "m-learning" project are not."

The aim of **m-Learning** [7] is to develop prototype products and services, which will deliver information and learning experiences via technologies that are inexpensive, portable and accessible to the majority of European Union citizens. The products and services in development are designed to capture the interest of young adults (16 to 24) who are not currently taking part in education or training and to assist them in the development of life long learning objectives. The learning themes focus on subjects of interest to young adults, e.g. football and music, and the modules include activities designed to develop aspects of literacy and numeracy. m-Learning's target audience includes young adults who are unemployed, under-employed or homeless. The m-learning infrastructure includes a Learning Management System which, when combined with the microportal interface layer under development, will facilitate access to m-learning materials and services from a variety of mobile devices as well as web and TV access. For interfacing with devices with minimum multimedia functionality, and for the benefit of learners with sensory difficulties, m-learning is developing speech-to-text, text-to-speech and SMS facilities. In addition, the following supports are also being developed: an intelligent tutor system to help identify needs and learning preferences, and a tutor agent to help personal learning planning. User trials involving young adults from the target audience will take place in the UK and Italy.

A somewhat similar project began in May, 2003 in the Philippines. Over the life of the project, more than 13,000 pupils in Grades 5 and 6, mostly 10 to 11-year-olds from selected public and private schools, will be able to view educational science videos downloaded to the classroom with the help of mobile phones and satellite communication systems.

Text2teach [8] is part of the global Bridgeit programme to deliver digital learning materials to teachers and students in even the most remote schools with the use of mobile and satellite technology. Bridgeit is a global programme developed jointly by Nokia, the international media company Pearson, the International Youth Foundation (IYF), and the United Nations Development Programme (UNDP). The four organizations combined their expertise in technology, content, training, and processes to create an impact on the learning of young people. In the Philippines, text2teach is spearheaded by the Ayala Foundation in cooperation with several partners. The Department of Education and the South East Asia Ministers of Education Organisation (SEAMEO-Innotech) were responsible for lesson development and the training of more than a hundred science teachers, supervisors and school heads. Mobile telephone operator Globe Telecom, PMSI-Dream Broadcasting and the Chikka Asia services, which offers short message service (SMS) on the Internet, provided the hardware, software and technical requirements for the project.

Under text2teach, each school is equipped with a satellite dish, a 29-inch television set with rack, a 40-gigabyte digital video server/recorder to record and store video clips and two to three mobile phones.

The technology is fairly basic. Following a lesson plan that incorporates text2teach lessons, science teachers just have to send an SMS request on mobile phones for specific videos from the more than 100 that Pearson has made available from its KnowledgeBox video library. These are then downloaded via satellite to a Nokia digital recorder connected to the school's television set.

The Emergence of Knowledge Management Systems

The increasing rate of ICT adoption in education is generating a huge amount of information and knowledge in areas such as technology applications, costs, learning materials, training, and organisational change – all of which people want access to. Fortunately there are a variety of knowledge/information management systems emerging that make the task easier.

1. **Portals** are one of these management systems. They are essentially sites on the Internet that serve as search engines to assist the user in finding the required information from the morass of sources. Nowlin and Bliss[9] have defined a portal as:

   > "a term, generally synonymous with *gateway*, for a World Wide Web site that is or proposes to be a major starting site for users when they get connected to the Web or that users tend to visit as an anchor site. There are general portals and specialized or niche portals. Some major general portals include Yahoo, Excite, Netscape, Lycos,

CNET, Microsoft Network, and America Online. Examples of niche portals include Garden.com (for gardeners), Fool.com (for investors), and SearchNetworking.com (for network administrators). A number of large access providers offer portals to the Web for their own users. Most portals have adopted the Yahoo style of content categories with a text-intensive, faster loading page that visitors will find easy to use and to return to. Companies with portal sites have attracted much stock market investor interest because portals are viewed as able to command large audiences and numbers of advertising viewers. Typical services offered by portal sites include a directory of Web sites, a facility to search for other sites, news, weather information, e-mail, stock quotes, phone and map information, and sometimes a community forum. Excite is among the first portals to offer users the ability to create a site that is personalized for individual interests."

Neil Butcher[10] has stated that: "In effect, a portal can contain *any* service available via the Internet. It is not limited to the World Wide Web, as it can be expanded to included e-mail services, chat rooms, and other Internet applications not dependent on the web." He describes three types of portals currently available, emphasising that, in many instances, these services are merged in a single portal:

a. ***Networking Portals*** are those that provide various individuals (educators, learners, managers and administrators) with a central point from which to access various educational tools and facilities (online and offline).

b. ***Organizational Portals*** are those constructed by a specific organization whose core business is to deliver educational material. Generally these types of portals contain search facilities, links to other relevant organizations or institutions, as well as subscription services, projects, publications and information about the organization itself.

c. ***Resource-based Portals*** provide access to various educational resources online. A feature of many resource-based portals is that they provide subscription services, thus requiring people to pay before being able to access resources. They may have a focus on generic resources, subject-specific resources such as math, or they may focus on links to other resource sites.

Butcher also provides a comprehensive analysis of the features and tasks required in the construction and maintenance of portals.

An example of a portal that has a different focus, and has direct relevance to this discussion, is the one developed by UNESCO (www.unesco.org/bangkok/education/ict). This is ***a comprehensive networking portal*** that has a focus on ICT use in education in the Asia-Pacific region.

Another is www.bized.ac.uk/, an example of a portal that is both ***resource-based and networking***, that provides service for students, teachers and lecturers of **business, economics, accounting, leisure and recreation,** and **travel and tourism,** with a searchable and browsable catalogue of over 4300 quality checked Internet resources.

The ***Digital Dividend Clearinghouse*** is an innovative online platform tracking social enterprises that use ICTs to deliver critical tools and services to underserved communities in developing countries. Its twin goals are 1) to serve as a knowledge base for those interested in developing sustainable business models to bridge the global digital divide, and 2) to facilitate networking among those stakeholders. http://wriws1.digitaldividend.org/wri/app/index.jsp

2. **AskERIC** (http://askeric.org/About/) is a personalized Internet-based service providing education information to teachers, librarians, counsellors, administrators, parents, and anyone interested in education throughout the United States and the world and it contains a database of lesson plans that cover most areas in any curriculum.

3. **Teachers Net** (http://teachers.net/gazette/AUG03/wong.html) is another example of a lesson plan and teaching resource database. While this and AskERIC are both US sites, they nonetheless offer a potentially useful resource, and provide an example of how such sites can be constructed.

4. **The Manhattan Virtual Classroom** (http://manhattan.sf.net) has been in use at Western New England College since 1997. It includes a variety of discussion groups, live chat, areas to post the syllabus, lectures, and other handouts/notices, a module for organizing online assignments and exams, and a self-contained module for private e-mail. However the point of including it in this illustrative list is that it was developed using open source software and is easy to install on a Linux/FreeBSD server.

5. **Eschoolnet**[11], a service of Schoolnet Europe, provides another form of knowledge management services that will be described in more detail in a later section of this chapter.

6. **Knowledge Finder** (http://colfinder.org/public), a service offered by the Commonwealth of Learning, was launched in July 2002. The Finder, an example of a knowledge management system, is designed to be useful to anyone involved with, or interested in, open anV distance learning, including government policy makers, educators, developers, trainers, researchers and learners. All content comes from online sources in the public

domain, filtered so that only the resources most relevant to educational development, curriculum content and learning are included in the Finder's current index of about one million reports, eBooks, documents and web pages. The type of information available also includes timely and critical development topics such as poverty alleviation, gender equity, food security and health. Open and distance learning (ODL) sites are indexed into regional interest libraries while other development topics are indexed globally. The COL Knowledge Finder is also linked to other key ODL information sources such as the Global Distance Education Network (GDENet, www.col.org/disted), and national and regional "SchoolNets". Users also have access to advanced tools for storing, cataloguing and disseminating their research.

Analysis

The rate of change in the nature of ICT infrastructure, combined with the stunning rate of global adoption, makes the development of policy frameworks very challenging. Historically and theoretically, the purpose of policy in educational environments has been to guide the adoption process; however, what we observe now is that innovation typically begins in the absence of any guiding policy, and policymakers find themselves in the position of scrambling to regain the leadership role. And they find that the policy development processes of the past, those based on careful, time consuming analysis, are a luxury that can no longer be afforded because the pace of change is so rapid. Policy makers need access to planning tools that enable them to assess needs, evaluate ICT infrastructure options, and make decisions within short timeframes. And they need to be able to continually evaluate the effects of policy and make adjustments as needed. Efforts to develop tools and training to assist policy makers to meet this challenge need to be "ramped up".

Trends in Content Development – Learning Objects and Repositories

The background for this trend is well stated on the website of the Centre for Educational Technology:[12]

> *"Learning Technologies have been evolving over the last two or three decades, and have gone through many phases and approaches, including early mainframe based programmed learning systems, microcomputer software packages written in native programming languages for specific machines, bulletin boards, CBT systems, authoring systems, and more recently after the internet explosion, web-based systems and Learning Management Systems. For much of this time, learning software development has often been the result of individual ideas and initiative, and little regard has been paid to ensuring that learning software can survive the rapid change in technology. Those who wrote high quality learning materials for BBC micros now find them trapped on floppy disks that cannot be read by modern PCs, and even if they could, the software on them would not run.*
>
> *Further, unlike the well elaborated ways we have for categorising and describing text that libraries have evolved, no such system exists for computer based learning materials. This has made the learning content world somewhat chaotic, and many excellent materials are underused for one or both of the above reasons."*

The need then is for standardised systems that can catalogue, store and retrieve content in ways that enable users to access and organize it for their particular purposes as well as sharing it institutionally, nationally, and internationally. There is a great deal of effort being expended around the world on the development of such systems – ones that will standardize the development of resources (learning objects), catalogue them (metadata) and store them (repositories).

A recent paper[13] from the Australian National Training Authority provides an excellent overview of Learning Object Repositories. While the paper acknowledges the lack of a generally accepted specific definition of a **learning object**, it suggests that one think about it as you would any educational resource. Learning objects are digital assets that can be as diverse as a chapter in a book, a piece of text, a video or audio clip, or visuals on an overhead transparency or PowerPoint slide. And they can be used in a variety of teaching settings, by course designers, managers, trainers, content writers and learners. The only constraint is that the asset meet the required level of educational integrity.

The educational integrity of learning objects means that they can be identified, tracked, referenced, used and reused for a variety of learning purposes. Learning objects are developed to function as discrete entities or to be linked in order to relate to explicit concepts or learning outcomes. Content requirements are determined through communication with educators across the target audience and then the learning object is developed by independent contractors.

Another way of thinking about learning objects comes from the Wisconsin Online Resource Center.[14] They define learning objects as:

- A new way of thinking about learning content. Traditionally, content comes in several hour chunks. Learning objects are much *smaller units of learning*, typically ranging from 2 minutes to 15 minutes.

- *Self-contained* – each learning object can be taken independently.
- *Reusable* – a single learning object may be used in multiple contexts for multiple purposes.
- *Capable of being aggregated* – learning objects can be grouped into larger collections of content, including traditional course structures.
- *Tagged with metadata* – every learning object has descriptive information allowing it to be easily found by a search.

As the authors of the Australian paper state, the smaller a learning object is, the higher the level of reusability, but the lower the level of instructional value. While this is true, if a learning object becomes too small, there is a danger that it may become meaningless with little chance for reuse. Conversely, the larger the learning object the greater the instructional content and context, but there will be fewer opportunities for its reuse.

Metadata is structured data that is used to "tag" information to learning objects that enable users to locate the information they are searching for. It is essentially descriptors for the learning object much like the card catalogue system of a library. Typically the metadata tagging would include information about the subject content (e.g.. math, science, etc.), the form of the object (such as a video clip, piece of text, slides, etc.), and the learners for whom it would be appropriate.

Repositories, the "libraries" where learning object databases are stored, differ from standard web materials in that they provide teachers, students and parents with information that is structured and organized to facilitate the finding and use of learning materials regardless of their source location. The Australian paper points out that:

> "Most learning object repositories are stand alone. That is, these repositories function a lot like portals in that they contain a web-based user interface, a search mechanism, and a means of retrieving a learning object. Within this stand-alone architecture, there is the potential for two major models or repository. The most common suggests a centralised model in which the learning object metadata is located on a single server or website. This website or portal then provides the interface with which to search the repository. This model is typical of the small intra-organisational repository. The alternative model is based on a distributed system, in which the learning object metadata is contained in a number of connected servers or websites. Distributed learning object repositories typically employ a peer-to-peer architecture in which a variety of repositories may be searched from a single portal".

While the initial leadership for learning object repositories has tended to come from the university sector, the interest and activity in the schools sector is increasing rapidly. For example, the Australian and New Zealand Governments have created an organization to develop a pool of educationally sound and quality assured content specifically for Australian and New Zealand schools. This initiative will support teachers in enhancing student learning, thereby greatly improving educational outcomes for students.

EdNA Online[15] is a repository that holds information in a range of formats: learning materials, networks, authorities, policy, industry information, traineeships, packages, support services, training providers and research. The EdNA VET Online project aims to develop the vocational education and training (VET) component, and, during 2003, EDNA will work collaboratively with the Australian Flexible Learning Framework (AFLF) to develop content guidelines and metadata standards to facilitate interoperability.

The eduSource project (www.edusource.ca/english/what_eng.html) is focused on the creation of a network of linked and interoperable learning object repositories across Canada. The initial part of this project will be an inventory of ongoing development of the tools, systems, protocols and practices. Consequent to this initial exercise the project will look at defining the components of an interoperable framework, the web services that will tie them all together, and the protocols necessary to allow institutions to enter into that framework.

The Campus Alberta Repository of Educational Objects (CAREO) http://careo.netera.ca) in Canada is a searchable, web-based collection of teaching material for educators. The CAREO project defines learning objects as including: simulations, tutorials, drill and practice modules, content databases, multi-media exercises. It also goes beyond the area of curriculum development to include administrative objects such as calendars and quiz programmes, research-related items such as discussion papers and research results, and also content creation tools such as map makers, database tools, graphics and animation tools. CAREO is a project supported by Alberta Learning and the Canadian Advanced Network for Research, Industry and Education (CANARIE) that has as its primary goal the creation of a searchable, web-based collection of multidisciplinary teaching materials for educators across the province and beyond.

Educational Software Components of Tomorrow (ESCOT-www.escot.org/) is a test bed project for the integration of innovative technology in middle school mathematics. The project investigates replicable practices that produce predictably high quality digital learning resources (learning objects).

There are a great many repositories that are focused on content development in the realm of higher education. One of the most well known is the Merlot project

(www.merlot.org/Home.po). Merlot is a free and open resource designed primarily for faculty and students of higher education. Links to online learning materials are collected here along with annotations such as peer reviews and assignments.

The Wisconsin Online Resource Center mentioned previously provides a comprehensive listing of repository sites, including Merlot, as well as a bibliography on learning objects.

Work on the development of international standards for building educational content repositories is well underway. The most well know project is The IMS Global Learning Consortium that develops and promotes the adoption of open technical specifications for interoperable learning technology. Several IMS specifications have become worldwide de facto standards for delivering learning products and services. IMS specifications and related publications are made available to the public at no charge from www.imsglobal.org. No fee is required to implement the specifications.

Analysis

As the work on learning repositories progresses, so must the development of international standards to ensure that there is interoperability among them. One of these standards development projects is the *ISO/IEC JTC 1/SC 36 project* on information technology for learning, education and training that is administered under the American National Standards Institute (ANSI). Its scope is**:** standardization in the field of information technologies for learning, education and training to support individuals, groups or organizations, and to enable interoperability and reusability of resources and tools.

The development of learning object repositories that are widely accessible and sharable is perhaps the most significant trend of all because of the potential it holds for reducing one of the largest single costs in the use of ICT in education – namely the cost of developing content. It is often said that "it is not the technology that's difficult – it is developing appropriate content". This development offers not only the economy and flexibility that comes with reusability, but also, for the first time, allows content to be developed independently from the form of its delivery. It offers benefits across the spectrum of learning venues – from the remote learner in some form of distance education, to the teacher and learners face-to-face in a classroom.

The potential is also there for much greater collaboration among educators in the developing world to develop content repositories that reflect both culture and content – while still being able to chose from databases internationally. The challenge will be to provide the training and core infrastructure needed to take advantage of it.

Trends in ICT applications in primary and secondary education

Three trends that are being enabled by the increasing rates of ICT adoption are: the growing use of distance education models; the growth of organizations that facilitate collaboration and sharing across schools and school systems; and the pedagogical changes occurring as a result of ICT applications. The first of these often uses the label Open School ; the second is typically called Schoolnets; and the third refers to the variety of ways that teachers are using ICTs to enhance teaching and learning processes in their classrooms.

The Growth of Open Schools

The models that have evolved in the primary and secondary education sectors as a result of the use of distance education methodologies often use the label "Open School". It is somewhat ironic that the development of distance education models, which began in many parts of the world for the purpose of increasing access to primary and secondary education, has been so dominated by the higher education sector for the past quarter century. That, however, is changing. "Open schools" are emerging to provide:

- Education opportunities in dispersed locations where conventional schools are not viable;
- A choice to students (and their parents) of what they want to learn;
- A safety net to school drop-outs so they do not lapse into illiteracy;
- An education to those who cannot attend conventional schools for a variety of social and economic reasons, as well as to those who missed out and are now "over age".

These developments are making important contributions to the achievement of EFA goals.

A report published by COL in 2000[16] described the ways in which this trend is being facilitated by the ever-increasing use of ICT in education:

- The Internet and worldwide web are enabling access to new and enlarged sources of information and knowledge that offer teachers and students opportunities for self-development as well as benefits from incorporation into classroom environments.

- Other Internet-related feedback mechanisms are providing greater opportunity to reduce the isolation and time delay associated with distance education.

- The extraordinary pace of software development is enriching teaching and learning with enhanced graphics, interaction, animation and visualization.

- Lower telecommunications bandwidth costs and the emergence of enhanced cable, wireless and satellite systems are facilitating greater opportunities for basic access, video-conferencing, on-line interactive learning, and real time interaction between the learner and the providing institution or teacher.

- Community access schemes are making it easier for lower income people and rural people to receive the benefits of distance education.

However, it is not just the newer digital technologies that are enabling this trend. The older ICTs such as radio and television have been, and continue to be, used widely because they have greater outreach, and are often cheaper than other technologies. And, as we shall see later, they are increasingly being used in combination with newer ICTs. The following examples will serve to illustrate how ICTs are being applied to make elementary and secondary education more accessible on a mass scale in different parts of the world:

1. **India's National Open School (NOS)** (www.nos.org) is the largest Open School in the world in terms of enrolment, programmes and courses offered and the geographical areas under its operations. It operates through a network of 10 regional centres and more than 1400 study centres spread all over India. It also has study centres in the Middle-East, Nepal and Canada. NOS offers Secondary and Senior Secondary courses, as well as various vocational and life enrichment courses, through an open and distance learning mode. More recently it also ventured into Open Basic and Elementary Education. At the Elementary Education Level and Adult Education sector, it has MOUs with more than 200 agencies that in turn have their own centres through which the NOS courses are offered. During the 2001-2002 admission year 213,660 students were admitted in the academic and vocational stream making the cumulative enrolment more than 725,000. During that year 329,136 students appeared in the NOS examinations and, of these, 25% were certified. Approximately 35% of NOS learners are female.

   NOS is a prime example of a distance teaching institution that is continually evolving in its use of ICT. It began, as have most such institutions, using print based materials that were distributed to learners through the post and regional centres. Today, it is equipped with the latest hardware and software. There is a Local Area Network with a centralised database system using Windows NT as the basic operating system and a Pentium III-based NT Server. All the Regional Centres of NOS have been provided with Internet access and an e-mail facility for transfer of data and smooth connectivity with headquarters in Delhi. In order to provide better and more efficient services, all major areas of applications have been computerized. For example, learners can now register entirely on-line.

   NOS has also established a partnership network of over 100 institutions, mostly in the private sector, to run its IT courses. These centres serve as training centres for NOS and in turn get the benefit of well-planned, well-structured courses, supported by self- study instructional and audio-video material.

   NOS also offers a wide range of vocational courses that are independent and modular and lead to various certificates in Agriculture, Secretarial Practice, Technology, etc.

   CD versions of all course materials have been produced and made available to students as priced publications. The course materials have also been placed onto the NOS website (*www.nos.org*). Other current and planned uses for this website include:

   - Direct Interaction with the students: once registration of a particular student is done on-line, each individual student account will be provided with a user-ID and password and a free e-mail account.

   - Tutorials: there will be a separate section for tutorials as part of the course itself. At the end of this section, on-line testing will be provided.

   - Assignments: students will be required to submit assignments via the Internet. They will be evaluated and feedback provided immediately.

   - On Demand Examinations: this is a revolutionary concept in the context of Indian education, but an important step to take from the standpoint of adding more flexibility to the distance learning process. Pilots are underway and systems are being put in place.

     NOS has also taken a lead role in establishing an electronic forum using the Internet. The forum, "Indian Open Schooling Network (IOSN)", enables member Internet-based schools (approximately 30) to communicate, share content, problem solve and generally enhance the teaching-learning process. IOSN has linkages with the Commonwealth Electronic Network for Schools and Education (CENSE), thereby expanding contacts within the international community.

2. **Mexico's Telesecundaria** was created over three decades ago in response to the needs of rural Mexican communities where a general secondary school (grades 7 to 9) was not feasible because the number of students was low and attracting teachers was difficult. Telesecundaria's primary feature is the use of television to enable one teacher to be responsible for all subjects, rather than having several subject matter specialists as is the case in general secondary schools. Enrolments are currently over 900,000 and expected to grow. Neighbouring countries are beginning to use it as well. Much of the following information on the Telesecundaria is derived from a paper by Castro, Wolff and Garc'a:[17]

   The pedagogical model is not distance education in any pure sense. It is not a conventional classroom model either. The programmes are aired from 8:00 a.m. to 2:00 p.m. and repeated from 2:00 p.m. to 8:00 p.m. for a second shift of students. Each subject is allocated 60 minutes in the school day. The students watch 15 minutes of television and at the end of the TV session, the set is turned off and the book, workbook and teacher take over, following detailed instructions on what to do in the remaining 45 minutes. At the end of the 60 minutes another subject begins following the same routine. Teachers follow a guide that contains instructional strategies and learning objectives. The guide also assists teachers in overcoming some of the limitations they may encounter due to unavailability of teaching materials or learning tools, and it provides strategies for adapting the lesson to local contexts and individual student needs. Telesecundaria teachers and supervisors also receive in-service training through televised programmes that are broadcast during the afternoons or on Saturdays.

   Each Telesecundaria school has at least three television sets, a decoder to decompress EDUSAT's digital signal, and a 1.9 minimum meter external satellite dish. About 10% of Telesecundaria schools use solar power. A majority (85%) of the Telesecundaria schools are located in purpose-built buildings constructed by the government, and have 3 to 9 classrooms, restrooms, a library, a science laboratory, playground, and often a piece of land for farming. The remaining 15% are often poor, ill-equipped facilities.

   Telesecundaria is both effective and cost efficient. Flow rates (a measure of dropouts) are slightly better than those of general secondary schools, and significantly better than technical schools – in spite of the fact that this is a school catering to the poor, predominantly located in rural areas, where one would expect high dropout rates. The explanation offered by Telesecundaria officials is that this is because: there is strong involvement of local communities; the use of a single teacher (instead of one teacher per discipline) means the teacher is closer to students; an, the high quality of the programmes. Almost 75% of the students who enter at grade 7 successfully complete grade 9.

   In terms of costs, the authors show that it would be three times more expensive to operate a conventional secondary school in the areas where Telesecundaria schools operate. In short, these schools are an example of one of the very few programmes in which the poor receive a better-conceived and better-managed programme than urban middle and upper socio-economic classes.

   That said, however, Telesecundaria is not perfect. Theft of TV sets occurs at some schools, sometimes antennas malfunction, and sometimes the books do not get out to rural areas in time. It is also recognized that the Telesecundaria model is very rigid because of TV scheduling. Experiments are underway with an Internet based system that would allow teachers and students to view programmes at different times and to view programme repeats. More than likely, the long-run future of Telesecundaria will be web-based to give it more flexibility.

3. **The New Zealand Correspondence School** (www.correspondence.school.nz/) was started by the Ministry of Education in the early part of the 20th century for the purpose of enabling access to primary and secondary education through the use of print materials distributed via the post. Today it is New Zealand's largest school serving over 31,000 students, nationally and internationally, with a wide range of programmes of study that lead to a variety of qualifications, including the National Certificates in: Educational Achievement, University Bursary (2003 only), Employment Skills, Computing, and Business and Computing. One may also choose to build a personal record of learning or simply take a subject for interest.

   According to the 2002 report from the CEO, the School embarked on a journey in 2000 that will enable it to reposition itself within New Zealand education.

   The new vision calls for a new pedagogy that is "learner centred-digitally minded". The pedagogy is based on research conducted through the school's two-year "eSection" pilot, which explored best teaching practice in an online environment. Systematic provision of intensive professional development for teachers is now a priority to ensure that they, and in turn their students, will gain maximum benefit from technology and from the new pedagogy. As part of implementing the vision, thirteen ICT projects were continued or completed in 2002. These ranged from the further development of the ICT infrastructure to the digitisation of resources and the development of new software. Work was also started on the development of a new Learning Management System, which is a key ICT project. Changes to

pedagogy, operational processes, and student preferences are driving the design of the new system, which, when complete, will enable teachers to personalise a programme of learning for each student and to tailor learning resources to each student's needs and interests.

The New Zealand Correspondence School was chosen as one of the current models that illustrate the trend towards "open schools" as part of national education systems, not because it is new, but because it is an organization that is essentially "re-inventing" itself in order to incorporate emerging ICTs into its operations. The process of this "re-invention" is described in the following comments taken from the 2002 Annual Report (www.correspondence.school.nz/about/publications/2002annual_report.pdf):

Then. Until relatively recently the practice within face-to-face classrooms could be characterised as teachers working on their own in a rectangular classroom with a group of 20+ students for fixed periods of time. Much of the theory and practice that has been developed about what happens in classrooms is based on these assumptions. Similarly, in the field of distance education there has been an emphasis on bridging the geographical separation of teacher and student, based on the notion of a guided didactic conversation being embedded within print-based materials. Each of these areas of education has developed quite separately, with their own bodies of knowledge, skills and experience, and their own theories and practices. The one thing that they did have in common was a focus on teaching, emphasizing instructional processes and asking, "How can we teach better?"

Now. We are witnessing a fundamental shift in the culture of pedagogic practice in our schools and distance education settings. As primarily face-to-face institutions strive to embrace ICT and attempt to address the demands of learner choice and autonomy, many classroom teachers are adopting practices that may previously have been considered the domain of distance educators, for example, establishing individualized learning programmes on school intranets. Similarly, as distance education providers adopt a range of online technologies as an alternative means of providing instruction, they too face the challenge of adopting what may have been regarded as face-to-face practices, for example, teaching via video conferencing. This is the era of eLearning where a gray area is forming between two previously discreet areas of educational endeavour, as each uses ICT as a means of meeting learner needs instead of emphasising the role of teaching.

Next. It may be only a relatively short time before we move to the next phase, where we see an almost complete merging of the two paradigms, and where a student's learning experience will not be dependent on attendance at a particular school or institution, or enrolment with a particular provider. Instead, a combination of online technologies will make it possible for students to complete a 'portfolio' of subjects through a range of institutions. In this scenario the role of schools, teachers and students will all change and the emphasis on the "e" in eLearning will no longer be necessary. Instead, the focus will be again on the whole sphere of education, addressing the issues of both teaching and learning, as well as taking into account the context of that learning.

Alternative Secondary Education is the core activity of the Namibian College for Open Learning (NAMCOL). (www.saide.org.za/worldbank/countries/namibia/namcol.htm) It began after independence when the government in Namibia was faced with the problem of providing secondary education for large numbers of learners who could not be accommodated in the formal school sector. More specifically, the objectives of NAMCOL are: upgrading the educational level of adults and out-of-school youths through programmes of open learning; establishment and maintenance of tutorial centres for those Namibians who are unable to engage in conventional school-based education; and provision of counselling services to those seeking admission into programmes of open learning.

The College currently offers courses at two levels: the Junior Secondary Certificate (Grade 10) and the International General Certificate of Secondary Education (Grade 12). In addition, NAMCOL offers the Certificate in Education for Development (CED), which is designed to meet the professional development needs of adult educators, extension agents and community development workers. This course is offered in collaboration with the University of South Africa (UNISA) Adult Basic Education and Training Institute. All courses are offered in English, with the exception of the indigenous language courses.

The College has used radio mainly for information campaigns. However, an instructional radio programme is now being developed in partnership with the Namibian Broadcasting Corporation which will be incorporated into the Business Management Course for Grade Ten.

The Emergence of SchoolNets

A recent study by the Commonwealth of Learning[18] defines Schoolnets as follows:

"Schoolnets can be defined as groupings of schools that use ICTs to support the education process, or agencies that facilitate and develop the use of ICTs in the education context. The word "school" refers to the participants, namely the schools in the primary and secondary education space. Schools generally consist of the teachers, students, families and the broader community,

all of who can benefit from the introduction of schoolnets. The word "net," a shortened form of "network," refers to the purpose of the initiatives. Most importantly, it is the network of people within the community of practitioners that collaborate for the purpose of enhancing teaching and learning. Secondly, it is the network or platform of ICT infrastructure that allows people to communicate, collaborate and share within restricted or larger groupings. Thirdly, it refers to the emphasis on the Internet and related technologies that enable the world at large to be accessible to the individual, no matter where in the world he or she may be. By definition, schoolnets encourage teaching and learning through a collaborative approach to the education process. Complementing this is the belief that the use of ICTs promotes a more individualised learning experience, with a broad range of educational resources and experiences available to both the teacher and learner, and that the use of ICTs throughout the world supports the trend towards outcomes-based and learner-focused education.

These movements have typically been organized within school districts, or within geographic or socio-economic boundaries and include the establishment of national and regional Schoolnets to promote and facilitate the use of ICTs in the education sector, in both the developed and developing world. Although the overarching theme among Schoolnets is similar, they range in their focus from policy formulation and advocacy, information dissemination, deployment and installation of technology, teacher training and facilitation of collaborative student projects."

The report also provides examples of these various types of schoolnet organizations:

1. SchoolNet Canada (www.schoolnet.ca) is an initiative led by Industry Canada in partnership with provincial and territorial governments, the education community and private sector. SchoolNet Canada carries out many initiatives to encourage the use of ICT in the classroom, including SchoolNet GrassRoots, SchoolNet's Network of Innovative Schools, First Nation's SchoolNet, LibraryNet and SchoolNet's Youth Employment Initiative. SchoolNet's services allow students, teachers and parents to learn about the world of ICTs and how they can be used to enhance education. Over the past two years it has also focused on creating e-learning content.

2. European SchoolNet (www.eun.org or www.eschoolnet.org) is an international partnership of 26 Ministries of Education developing learning for schools, teachers and pupils across Europe and beyond. It provides insight into the use of ICT in Europe for policy-makers and education professionals. The organization acts as a gateway to national and regional school networks and international partnerships for more than 20 European Ministries of Education, thus helping to develop learning for schools, teachers and pupils across Europe, and supporting school networks in individual European Union (EU) countries. It is primarily driven by individual governments and the EU, and is focused on the teaching and learning experience using ICTs.

3. SchoolNet South Africa (www.school.za) is a non-profit, independent organization with an emphasis on promoting the use of ICT for teaching and learning in South Africa, particularly in historically disadvantaged schools. The organization initially worked on many aspects of school networking including policy and advocacy, infrastructure provision, teacher development and content provision. As the use of ICTs in South African schools has proliferated, the organization has refocused to ensure that the educational value of ICTs is realised, largely through teacher development, conferencing and workshops.

4. Western Cape Schools Network (www.wcape.school.za) was established in 1994 and, together with other provincially based school networks in South Africa, assisted in the development of SchoolNet SA. It is largely a volunteer-based organization with a small staff and has extended its functions over time. It is soon to be merged into SchoolNet SA. The Western Cape office of SchoolNet SA will continue to manage the help desk and some other educational services on behalf of SchoolNet SA for the entire country, in addition to providing other services.

5. SchoolNet Africa (www.schoolnetafrica.net) emerged out of a need to promote and support the development of schoolnets throughout the African continent. The organization has been created as a support mechanism for national schoolnets, and thus works primarily in the areas of policy direction, information dissemination and support, and resource mobilisation while participating in various continent-wide initiatives.

6. World Links for Development (www.worldbank.org/worldlinks) started as an initiative of the World Bank Institute and has grown to become a separate non-profit entity. World Links is focused on the promotion of ICTs in the developing world, and as of October 2001, was active within 15 countries, reaching approximately 650 schools. It works in collaboration with Ministries of Education and supports the development of national schoolnets. Although involved in various aspects of ICT in education, it has had a particular focus on teacher development. The organization is currently developing a fee-for-service contracting component that will enable it to share its knowledge and expertise more broadly and will also assist in sustaining the organization.

7. SchoolNet India (www.schoolnetindia.com) was incorporated by Infrastructure Leasing & Financial Services Limited (of India) as part of a broader initiative

to meet the need for sustainable models of social infrastructure, specifically in the sectors of education and health. SchoolNet India is committed to enhancing the quality and delivery of education across the spectrum of schools and curricula in the country. Its focus is on the use of technology in the development of teaching materials as well as the learning process in the classroom. The areas of content include technology, curriculum subjects, teacher training and support services. It is operational in over 18 locations across India. In order to facilitate support for their programmes in less advantaged schools (over 750,000 schools), it has established the SchoolNet Foundation, which attracts financial and in-kind support from individuals, corporations and donor agencies. The SchoolNet India model is a standard corporation that performs the operations with the assistance of a special purpose charitable vehicle.

8. Pilippinas Schoolnet (www.world-links.org/english/html/philippines.html) is a partnership involving the Department of Education, the private sector, NGOs and local universities. Thirty geographically dispersed public high schools have been selected to participate in a pilot programme to animate ICT applications. Hardware, software, connectivity and basic computer literacy training are being provided by the Department of Education, NGOs and a variety of corporate donors.

9. The development of the Schoolnet in Thailand (www.nectec.or.th/it-projects/) in 1995 allowed schools all over Thailand to have dial-up access to the Internet. This goal was furthered in 1998 as a result of a Golden Jubilee initiative, which allowed schools to access the Internet without the need for a long distance phone call to Bangkok. This has enabled schools to use the Internet to access the libraries, classrooms and laboratories in the country. By April of 1999 there were more than 850 schools using SchoolNet services, with more than 200 schools running their own websites. More recently, a project has been initiated aimed at providing massive educational content in the Thai language on the web.

10. Another development is the ASEAN SchoolNet (www.unesco.org/bangkok/education/ict/unesco_projects/JFIT/ICT_Brochure.pdf), a UNESCO-led project co-funded by the Japanese Funds-In-Trust and the ASEAN Foundation to strengthen ICT use in schools. The project is designed to explore and demonstrate ICT applications; test innovative models; and improve connectivity and access to resources.

Changing Practice in the Classroom

Change in education involves much more than the provision of technological appliances. Not only do teachers need to develop the competencies for using the tools and developing instructional materials for them, but also the educational systems they are part of need to change in order to provide an environment that encourages and supports ICT-integrated pedagogy. Roy Singh[19] makes this point very well in a paper on 21st century education in the Asia-Pacific region. He describes challenges facing educational systems and makes the point that these need to have the capacity to nurture both individual and institutional creativity. The following case examples, reports and analyses describe various ways teachers are integrating ICT applications into their classrooms, and provide some insight into the processes they follow in making decisions to adopt particular ICT tools.

1. Lawrence Ssenkubuge, an information technology resource teacher at a school in Uganda, was faced with an overwhelming response to his efforts to get teachers and students to use the school computers.[20] He had to make changes to his classroom practices in order to accommodate the huge increase in the demand for training on the use of computers and how they could be used in teaching. His solution was to develop a system of peer-to-peer learning whereby some of the trained students became the trainer for other students and teachers. They set up a student-managed computer club as the forum for conducting training and maintaining the equipment – something, he states, that the students undertook with much enthusiasm. Ssenkubuge goes on to describe how he and his students, in collaboration with a neighboring school, created an award winning website on "wetlands" that became part of a world-wide project.

2. A comprehensive source of information regarding integration of ICTs in classrooms around the world is the report on the Second Information Technology in Education Module 2 (SITES M2), edited by Robert Kozma.[21] The qualitative study he describes was conducted by a team of international education experts in 28 countries studying 174 case studies of innovative pedagogical practices that used ICTs. In general, the findings of SITES M2 support those of an earlier study which found that: teachers and students are using ICTs as part of larger changes in the roles and activities of the classroom; teachers are engaged in advising and guiding students; students do collaborate with other students to search for information, design or create products, and publish or present their results; teachers do acquire new ICT and pedagogical skills, subject knowledge and collaborative skills.

The following examples, taken from an abstract[22] of the study, are illustrative of how ICTs are being integrated into classrooms:

- *Primary school children in a small rural school in Catalonia, Spain took digital photographs of their church and town square and digital recordings of their grandparents telling folktales and singing nearly forgotten folksongs. They collaborated with*

students in nearby villages to build a website on the history of their region.

- *Lower secondary school students in Norway used the e-mail to collaborate with students in the US as they followed two women who crossed Antarctica on cross-country skis. The students communicated with the women and with weather and research stations in the area to learn about the Antarctic continent.*

- *A technology-intensive upper secondary school in the US was redesigned from the ground up around technology and project-based learning. The school was organized like a high-tech start-up business in that students were given real world projects consisting of complex tasks with long-range due dates for which they had individual and shared responsibility.*

- *First and second grade students in Chile used low-cost Nintendo Gameboys to improve their reading and mathematics skills. The self-regulated educational games were developed by university engineers, psychologists, and educators in support of the country's curriculum objectives.*

- *A physics teacher in the Philippines wanted to enhance the development of her students' critical thinking skills through hands-on investigation, in-depth verification, exploration, and discovery of scientific concepts and processes. Teams of students used computers and probe ware to conduct experiments and solve a hypothetical murder case.*

3. England's contribution to the SITES M2 study was carried out by the National Foundation for Educational Research. The results were reported by Harris and Kington[23] as follows:

   The introduction of the innovative practices in these schools placed additional demands on teachers as they had to:

   - *develop their own ICT skills.*
   - *be willing to change their existing practices.*
   - *support students as their roles and activities changed.*
   - *monitor the implementation of the activities they introduced, and identify possible solutions to any problems that arose.*

   In addition, students' roles and activities also changed as they:

   - *had greater independence and responsibility for their own work.*
   - *worked towards targets/deadlines.*
   - *were more reflective about their work.*

   Several factors were important in contributing to the successful implementation of the innovations introduced within the schools:

   - *previous involvement in innovations (both involving ICT and unrelated to ICT).*
   - *support at senior management level, not only for implementing new practices, but also for addressing financial implications when appropriate.*
   - *the involvement of several members of staff: the prevailing culture within the schools was one of collaboration and mutual support.*
   - *willingness to take risks, accepting that some ventures would succeed but others would not.*

4. The lack of broadband connectivity in many parts of the world is a major constraint to the use of the web in classroom instruction; however, that is changing and it is useful to look at the ways the web can be used to facilitate learning. A recent paper[24] from TeleEducation New Brunswick provides a framework for this. Four examples are presented to illustrate increasing integration of web use:

   - *A website is developed as an information "container" to supplement classroom education with text (course notes, assignments, pointers to external websites), and other types of media (graphics, video clips etc.).*

   Currently this is by far the most common use of the web in the classroom supporting the presentation of information. The functions of learner guidance, practice and feedback, and student assessment are left to classroom interactions between the student and the teacher.

   - *A website is created to supplement classroom education similar to the previous example, but a news group and e-mail discussion list is established for the instructor to communicate asynchronously (not in real time) with students to help guide their understanding of content and exercises. The instructor has also developed an on-line student assessment application that allows students to take some tests on-line and submit them electronically to the instructor.*

   In this example, the instructor has shifted more of the functions of effective instruction to Internet support including elements of learner guidance and learner

assessment. The primary delivery vehicle is still the classroom, however.

- *An instructor with the support of an instructional designer and media developers prepares a series of Internet-based self-instructional tutorials or modules which present important concepts using simple simulations and video clips, provides interactive sequences of examples and non-examples to guide students through tough concepts, includes practice questions with computer generated corrective feedback, and finally presents on-line tests on the module concepts which are tracked and reported back to the instructor via an Internet application.*

Here most instructional functions have been shifted to the Internet environment. The modules are entirely self-instructional and no collaborative Internet tools like e-mail have been included. This approach is derived from the tradition of self-instructional, individualized computer-based training (CBT). Classroom sessions may still take place for other non-modularized segments of the course.

- *An instructor, with the support of an instructional designer and media developer, prepares an Internet-based "distance education" course for remote students or those who wish to study independently. Information is presented primarily using WWW pages, embedded media files like graphics, simple animations, video and sound clips, and a supporting textbook. Collaborative tools like e-mail, discussion lists, live chat and a shared work space are used for learner guidance, dialogue, and practice activities. The instructor also embeds a few multi-media self-instructional tutorials with computer generated practice and feedback as exercises within some course units. Finally, all testing and student assessment is completed using various Internet tools. An Internet application is used to track student activity and assessment.*

In this example, the Internet was again used to support all instructional functions; however, the entire course is delivered "virtually" via the Internet. This approach is based on a classroom model that fosters collaborative approaches to learning among students. The electronic environment attempts to mirror and enhance that model in a space that is totally virtual.

Analysis

A conclusion drawn from examination of these trends in the application of ICTs in schools is the fact that they are highly interrelated. For example, the use of ICTs to improve access to education requires that mechanisms be established to train teachers, develop materials and share experiences. Changes to pedagogical practice in classrooms require that teachers have access to infrastructure and are given the opportunity to develop the expertise to use the machines and software tools. The trends also demonstrate the variety of strategies that educational policy makers, administrators and teachers are pursuing in order to improve access to learning opportunities, enhance the quality of the learning experience for students, and, at the same time, make the most efficient use of limited resources. They also illustrate a number of other features about the adoption of ICTs into the schools and school systems. These include:

1. The adoption of ICTs that continues to enable the growth of "open school" institutions is not a "one-off" process. It is an on-going process incorporating new technologies as they are perceived to add value to those already deployed. Furthermore, the adoption process is facilitated when it is possible to try new initiatives on a small scale and then make decisions regarding larger scale adoption on the basis of evidence that doing so will add value to current practice. The development of "readiness indicators" that help decision makers understand the circumstances under which a given technology innovation will add value and be sustainable will be of growing importance.

2. The examples of the National Open School in India and Telesecundaria in Mexico, both highly successful in terms of fulfilling their respective mandates, begs the question of the conditions that need to be met in order for these models to be replicated elsewhere. Clearly, one is that there be a national need for delivery systems capable of reaching mass numbers – as there was in India and Mexico. Also, there were successful precedents for the models that emerged in each of the countries. In the case of India there was the highly successful Indira Ghandi National Open University; Mexico had a national television network and experience in using it for education purposes; and the Namibian College of Open Learning had experience using radio. It would seem, therefore, that adoption occurs more readily when there are existing models that can be used to help educators "imagine what could be", and when there is some level of existing infrastructure to use as a "launch pad".

3. The increasing use of ICTs creates needs that are systemic in nature. For example. teachers want to share experience and learn from that of others. Collaboration becomes an obvious way of achieving economies both in the technologies and development of learning materials. And partnerships, consortia and joint ventures become useful ways to share risk and costs. The growth of SchoolNets is, in part, a response to these needs – one that has become a truly global phenomenon in both developed and developing countries. The interesting point is that it is the increasing adoption of ICTs that creates the needs and facilitates the solution strategies!

4. The growing array of partnership arrangements deserves a special focus. The examples demonstrate a growing

comfort with partnerships, not only among institutions and different levels of government, but more importantly with the private sector. The role the private sector plays in the provision of infrastructure and software makes such partnerships an inevitable component of the adoption process.

5. There are several additional conclusions that can be reached about the impact of ICT use on classroom practices. First, the evidence clearly indicates that ICT use requires a change in pedagogical practice. Teachers need training, ongoing support, and a work environment that supports change if they are to make appropriate adaptations. Secondly, the evidence suggests that changing classroom practice is an evolutionary process involving small increments of change rather than large ones. Teachers need to be able to see how a change in practice will enable them to improve on the way they currently do their job. Using peers as a way of coaching and supporting change in schools appears to be effective.

Trends in ICT applications in non-formal education

Non-formal education (NFE) is an integral part of a lifelong learning concept that allows young people and adults to acquire and maintain the skills and abilities needed to adapt to a continuously changing environment. Much, perhaps most, of non-formal learning is organized by the individual learner and occurs through self study outside the formal educational system. The content of this type of NFE is as eclectic as the needs and interests of the learners, reflecting the diversity of their demographic and socio-economic circumstances. And there is no doubt that as more individuals have access to the web, and as the amount of information on the web continues to grow, individual self study will increase.

There is a very substantial portion of NFE that is organized by some type of "provider". One part of this activity is reflected in what is frequently termed the "continuing education market" by both public and private institutions and organizations. Here one finds formally organized courses and workshops on almost every subject imaginable. The use of ICTs to provide access to this type of learning activity is increasing; however, some research has shown that one of the powerful motivators that drives participation in these programmes is the social contact. Therefore, one would not expect the use of ICTs to replace face-to-face contact.

Another part of this "organized" NFE activity are the programmes that are more targeted to both content and learner groups. Whereas the "continuing education" activity described above is typically market responsive and sustained by fees, this type of activity is usually sponsored and designed to achieve particular ends such as professional up-grading, religious education, corporate in-house training, literacy development, or community development more generally. The use of ICT in this sector of NFE has historically been much higher than in the other sectors. The use of radio and television has been, and continues to be, quite extensive. And the use of the newer digital technologies is increasing rapidly – often in a "mix and match" fashion as described previously. The use of the web tends to be the medium of choice in corporate training initiatives.

This latter sector of NFE activity (organized) is the one that is of particular interest to this study because it is here that we find NFE programmes focusing on issues related to poverty reduction and capacity building in the developing nations of the world. It is in this type of NFE activity that we see donor organizations, non-governmental organizations (NGOs), governments, and increasingly the private sector, focusing their efforts on increasing literacy levels and enhancing the capacities of developing nations to improve socio-economic conditions. And it is also in this sector of NFE that we find a concerted effort to up-grade the skills of specialised workers such as teachers and health care personnel. For purposes of examining the use of ICTs in this branch of NFE activity, the examples are grouped into three categories: literacy programmes, specialised up-grading and community development – by far the most eclectic grouping of activities!

Applications in Literacy

Literacy programmes have historically involved face-to-face interactions between and among learners and tutors. Other than radio, ICT has not had much applicability because of the lack of resources and infrastructure in the communities where literacy programmes have typically been offered. However, as the following examples indicate, that is starting to change:

1. **The Tata Group.** "40 hours is all it takes to teach an Indian to read" is a claim being made on the basis of the results from an initiative[25] of the Tata Group in India. The initiative is a computer-based functional literacy (CBFL) programme that used a "new-age solution" to an age-old problem, and one that has the potential to lift India's literacy rate in record time.

   The programme uses animated graphics and a voiceover to explain how individual alphabets combine to give structure and meaning to various words. It was designed from education material developed by the National Literacy Mission and uses puppets as the motif in the teaching process. The lessons are tailored to fit different languages and even dialects, to focus on reading, and are based on theories of cognition, language and communication. With the emphasis on learning words rather than alphabets, the project stimulates thought

processes. The objective is to teach the reading of words in as short a time as possible.

The initial experiment for the CBFL programme was conducted in Beeramguda village in the Medak district of Andhra Pradesh in February 2000. This was followed by an extended trial run in 80 centres spread across the districts of Medak, Guntur, Vijayawada and Visakhapatnam. The initial experiment and trial run highlighted the following advantages of the project:

- Acceleration in the pace of 'learning to read' (it takes about one-third of the time that writing-oriented methods require).
- Flexibility in adjusting to individual learning rates.
- Lower dropout rates in comparison with other adult literacy programmes.
- Trained teachers or large-scale infrastructure not required.
- Programs can run on low-end computers (these are the kind of machines that many organizations can afford to give away).
- Enhanced existing adult-literacy programmes.
- Multimedia format ensured that the pronunciation of the words/letters is taught accurately through the system, rather than being left to individual teachers. This is particularly useful for languages like Tamil, where the same letter can be pronounced differently depending on the context.

2. **The Commonwealth of Learning.** Another example is a project that has just recently been completed by the Commonwealth of Learning.[26] The purpose of the project was to explore ways in which literacy programmes might be enhanced through the use of appropriate technologies. The project outcomes were defined and approved as follows:

   - Enhanced knowledge of what constitutes appropriate and sustainable use of ICTs in literacy education.
   - Development of a cadre of tutors who are knowledgeable in terms of using ICT in literacy education and are aware of media-based instructional resources on a global basis.
   - Significantly improved knowledge and skills in reading, numeracy and the use of ICT appliances for learners who participated in the project.
   - Objective data regarding the role of ICT-based community learning centres (CLC) in the education delivery model for the country.
   - Development of materials for training literacy workers.
   - Development of literacy teaching materials.

   The issues associated with providing access for literacy workers and learners to technology appliances such as computers, audio and video equipment, as well as on-line connectivity, had to be resolved in order for the project to proceed. Therefore, the delivery model selected was that of a "technology-based community learning centre" that would give learners access to the technological appliances as well as a place to gather and interact with others. As a result, these centres were at the core of the implementation of the project. An important aspect of the project evaluation was an assessment of their effectiveness in enabling literacy workers to develop instructional materials and deliver literacy training programmes. The use of these centres for other purposes by members of the community was encouraged as a way of increasing both sustainability and relevance in the community.

   Each centre was equipped with two or three computers, a printer, TV, VCR, digital camera, handicam and an audiocassette recorder. Internet connectivity was to be provided along with regional language software where available. Staff were selected and trained to operate and support the equipment and tutors were taught how to use the technology to design and produce instructional material locally.

   Following the completion of the project, workshops were held in each of the countries to disseminate information gleaned from the project. The evaluation report, written and carried out by an independent team, is available from COL.

3. **The Solomon Islands.** A project in the Solomon Islands[27] is another illustration of the application of ICT in developing literacy skills, but in the context of a more specific national development goal. The need was to find ways to provide services more equitably to remote communities and to enable a greater degree of information exchange among citizens. Obviously, both access to infrastructure and the literacy skills to use it are necessary prerequisites.

   The purpose of the project was to explore the feasibility of using an existing communications network (Pfnet) to provide educational opportunities to remote communities. The courses selected were Pre-tertiary English and English for all academic purposes. They were provided by the University of the South Pacific

(USP). A Pfnet Internet gateway base station was established in the rural community of Sasamungga, Choiseul along with a solar powered computer centre at the community school. Part of the evaluation of the project was to assess impact of this on the wider community – particularly the impact on vulnerable groups such as women and young people. In doing so, it was hoped that this study would provide useful baseline data for further expansion of Pfnet to all rural areas of the country, and provide a prototype example of how it can be used for distance learning.

Participants rated the project as very successful. The achievement of the distance learners was high, village leaders came to realize the importance of good leadership in their communities, and, staff and administrators at Sasamunga Community High and Primary School now have access to computers.

Action Aid

The International Education Unit of ActionAid[28] has set up three pilot projects in Burundi, India and Uganda to introduce ICTs through existent Reflect structures. The central assumptions of the project are:

- It is the process by which technology and its management are chosen - not the choice of technology itself - which has the greatest impact on the lives and livelihoods of poor and marginalized people and on the sustainability of the technology.
- Existing Reflect structures and methods are an ideal bridge to provide poor people with access to ICTs in accordance with their needs and objectives as they define them.
- Communities already possess the knowledge that is most valuable to them and their development, but need additional information in order to make meaningful choices, particularly when making links with processes and actors beyond their local level.

The overall objective of the project is to strengthen the capacity of poor people to communicate by providing ICTs they themselves have chosen as valuable and appropriate for their specific context. Clearly this involves building the capacity of those people to make that choice. In particular, the project aims to:

- Develop a pro-poor model for ICTs in development.
- Draw and disseminate lessons from the experiences of integrating ICTs into Reflect programmes and processes.

In all three pilot communities, facilitators will assist members of the communities to identify and analyse their information gaps and communication needs. The facilitators will then act as intermediaries, introducing Reflect circles to ICTs and describing their potential uses. Where other ICT initiatives exist within easy distance, groups can make contact with them and find out about their experiences.

On the basis of this participatory process, groups will come to a point where they will be able to choose the equipment they would like to have, where it should be, and how it should be managed, sustained and monitored. According to these requirements, a communication centre will be planned and set up in each pilot location.

Applications in Specialised Up-Grading of Education

The need to enable a variety of workers to up-grade and maintain their skill level and competencies is of utmost importance all over the world, particularly in developing countries where the need for competent teachers, health care workers and policy makers is especially acute. The use of various combinations of ICT is becoming an important strategy for addressing this challenge.

1. **The Global Development Learning Network** (GDLN) (www.gdln.org/about.html) is a worldwide partnership of distance learning centres and other public, private, and non-governmental organizations committed to development learning and development dialogue for lasting poverty reduction. Offering a unique combination of distance learning technologies and methods, GDLN facilitates timely and cost-effective knowledge sharing, consultation, coordination, and training. Through GDLN, individuals, groups, and organizations design and deliver courses, seminars, and other activities that cover the full range of development issues. GDLN Centres around the world have facilities for videoconferencing, web-based learning, and face-to-face interaction as well as offering logistical support and facilitation services. These provide cost-effective, fast, and high-impact alternatives to traditional meetings and courses, enabling people around the world to connect with each other without having to travel.

2. The **Distance Learning Project of the World Bank** in Sri Lanka[29] is an example of a project designed to strengthen the environment for policy reforms and to build capacity in the public and private sectors. Distance learning will be used to disseminate the latest technical information and cross-country experience in support of market reforms. Senior public and private sector decision-makers will access interactive multi-media and Internet-based training programmes developed by the World Bank Institute, major universities, private corporations, and technical organizations around the world. This exposure to global knowledge will enhance the capacity of Sri Lankan decision-makers to conceptualise and implement reforms. Better policies

will, in turn, lead to improved governance, poverty reduction, and economic growth. The activities include: the establishment of video conferencing capacity; access to distance learning course materials; financing of operating costs over the first 4 years of operation; technical assistance for staff training; a market survey; development of a business plan; a marketing campaign and periodic evaluation of centre operation/management effectiveness; and the purchasing, installing, and maintaining of distance learning technology.

3. The **e-learning for life** initiative[30] is a partnership involving the Coca-Cola Company, the United Nations Development Programme (UNDP) and the Ministry of Education in Malaysia. It provides Internet access, educational software and ICT training for students, teachers and local community members in peri-urban and rural areas. The project supports the Malaysian government's vision of building a knowledge-based economy and the Ministry of Education's drive to bridge the digital divide by bringing Internet access and e-learning resources to Malaysian classrooms and communities.

   Six ICT "hubs," equipped with state-of-the-art infrastructure, multimedia resources and software, have been set up in secondary schools across Peninsular Malaysia. Under the leadership of the Ministry of Education, the ICT "hub" schools are integrating computer lab-based training into existing curricula. A core group of teachers and students are being trained so they can then transfer their ICT skills to others in the hub area.

4. **Healthworks**[31] is a new radio program series for health professionals who want to improve living conditions in their communities. It consists of thirteen (13) programmes of information and ideas to help health and social development workers. The Healthworks episodes plus theme music and promo are available to radio stations for download from OneWorld Radio. The series is accompanied by a workbook with spaces for responding to learning activities in the Healthworks programmes. Listeners who complete the workbook can receive a Certificate of Participation. Radio stations interested in re-broadcasting Healthworks, can download an Info Pack and a script for a sample Healthworks programme.

5. The **Aravind Eye Hospital** in India is helping to eradicate blindness by using Internet-connected kiosks to provide video consultations and diagnosis, as well as providing extensive education and training to local healthcare providers (www.digitaldividend.org/pubs/pubs_04_overview.htm).

6. **TelMedPak** (www.telmedpak.com) is a team of health professionals in Pakistan working to: create awareness of the educational and reference opportunities available on the Internet amongst health professionals and medical students; facilitate electronic access to medical information for the public; facilitate the use of information technology at medical colleges and institutions in Pakistan; and explore modalities for provision of telemedicine to the rural areas of Pakistan.

7. **MEdRC EduTech** (www.medrcedutech.com/) is an Indian company that has core competencies in learning technologies, multimedia programming, television production and development of interactive software. MEdRC has developed a unique process through which media can be distributed through personal computers at networked e-Learning Centres and emerging channels such as broadband Internet, interactive TV and mobile technologies. MedRC's mission is to:

   - Provide the opportunity for medical teachers to deliver education using digital channels.
   - Forge collaborative relationships to promote lifelong learning in medical and health education, particularly in the form of continuing professional development at all levels.
   - Innovate and imaginatively utilize emerging technologies to make learning interactive, flexible and exciting.
   - Set up a network of 200 e-Learning centres, one each at every medical college location in India - on a build, own and operate model.

8. **Teachers Without Borders**[32] is a website that connects a global community of teachers with each other in order to share ideas, work collaboratively, and make change. One of its services is a programme that leads to a Certificate of Teaching Mastery. The programme is a professional development course of study that focuses on preparing teachers for the 21st century.

9. China is trying to improve the quality and technical competence of primary school teachers through a project[33] that will use two ICT approaches: the **electronic classroom** model, already in use elsewhere in China, and **online learning resources for self-study**. There will be a learning centre in three counties of each province, linked to a common network, with multi-media classrooms at each site. For primary schools in central townships, satellite technology will provide digital data, including text, video, audio and graphics, which they can download and store. Teachers in the townships will use these materials for their own learning, which will include how to make use of ICT in their classrooms. The project will also test models for financing distance teacher education and produce policy recommendations on cost-efficiency and cost-recovery strategies.

Community use of the ICT infrastructure can be a source of income to offset costs, including fee-for-service ICT and agricultural training, cyber weather services, and dial-up Internet.

10. **Straight Talk** (www.straight-talk.or.ug) and **SchoolNet Uganda** (www.schoolnetuganda.sc.ug) have collaborated to launch an online counseling service that provides training for teacher and student-peer counsellors. The objectives of the project include: demonstrating the integration of ICTs in HIV/AIDS prevention and caring services; expanding and diversifying opportunities for access to Adolescent Sexual Reproductive Health (ASRH); information and services for young people in and out of school; and promoting the creation of HIV/AIDS information and educational communication initiatives by and for young people, to enhance behaviour change.

11. **The Virtual Colombo Plan**[34] was launched by the Australian Government and the World Bank in August 2001. Its major focus is to improve education and access to knowledge in developing countries through distance education and to support policy development using ICTs. It is designed to:

- Enhance the quality of basic teacher education and school management in Papua New Guinea, Indonesia and a number of other developing countries.
- Expand physical infrastructure to improve access to and the cost-effectiveness of ICTs for distance learning and knowledge dissemination. This will be achieved by providing support for the World Bank's Global Development Learning Network in selected countries in Asia and the Pacific.
- Use courses and material developed by Australian universities to improve the capacity of the African Virtual University to deliver quality, relevant courses that address Africa's development needs.
- Deliver ICT-based training through some 200 virtual scholarships.
- Develop activities in basic education, public policy, and higher education, in consultation with Australian universities and other key institutions.

Applications in Community Development

The range of examples that could be used to illustrate this trend is almost limitless. Those that follow will demonstrate the range of contexts in which ICTs are being applied.

1. **The Asian Women's Exchange** (www.panasia.org.sg/grants/awards/99221a.htm) is an Internet-based women's information service and network in Asia. It is an initiative geared towards developing cooperative approaches and partnerships in increasing access and exploring applications of ICTs for women's empowerment. This network aims to help expand existing regional networks in the women's movement, promote electronic resource sharing and build a regional information service that will support various women's advocacies, specifically those that are critical for the women in the region.

2. **Catalysing Access to ICTs** is a three-year project in Africa[35] to enable poor people to gain maximum benefit from the opportunities offered by ICT. It is hoped it will also act as a strong catalyst for reform. It will provide a package of strategic activities to improve affordable access to the full range of ICTs, from Internet to community radio.

3. The **Learning Center Program** in Vietnam (www2.coca-cola.com/citizenship/education_asia_digital_divid.html) is part of a pan-Asian programme in which the Coca Cola Company is partnering with governments, multilateral organizations, non-government organizations and educators to help and empower a new generation of teachers and students through the innovative and locally relevant use of ICTs. The goal is to help communities throughout the region bridge the growing "digital divide" between ICT "haves" and ICT "have-nots".

4. **Deepalaya schools** (www.digitalopportunity.org/article/view/64866/1) have started 337 educational centres and 7 formal schools that offer education from Kindergarten to 12th grade. Computer lessons are a compulsory part of the curriculum from 6th to 12th grade; however, after 8th grade the children also learn how to use DOS and Windows operating systems, MS Office, the Internet, and e-mail. Apart from the computer lessons that are in the students' timetable, there is also a vocational training programme on computer hardware and software for school drop-outs or students that have passed grade 10 or 12.

5. Pedagogical techniques that allow communities to become owners of the technology as they learn to use ICTs were demonstrated in the **Lighthouse Project** in Thailand (www.panasia.org.sg/news/rnd_st/ict_rnd06s.htm). The goals of this pilot project were to help villagers master technology, cultivate a sense of ownership in the use of technology, and foster cultural pride. Additionally, the project intended to create a learner-centred constructivist educational experience using desktop publishing software. A community computer centre was constructed and equipped and training was provided. Many of the goals of the project were accomplished, as villagers became owners of the technology they learned to use, and became information-producers rather than information-receivers.

6. **The Gobi Women's Project**, launched in 1996, provides non-formal distance education to some 15,000 nomadic women. (www.unesco.org/education/educnews/96_12_12/gobi.htm) The aim is to provide useful instruction on health, commercial skills, family planning, traditional crafts and environmental issues. The project has re-equipped four radio stations (one in the capital and three in the Gobi) to produce three weekly series reinforcing the books' lessons. While the Ulaanbaator station takes the lead in introducing new subjects, the regional stations take a local look at the curriculum. Radio producers, teachers and communicators have been trained by the project, which has also provided some 30 jeeps. An achievement of the project is that women are becoming self-sufficient: they can now make clothes for their children and families.

7. One of the most intensive applications of ICTs anywhere in the world can be found in the Pondicherry region of south India. The **M.S. Swaminathan Foundation** (www.mssrf.org/) has provided leadership in an experiment in electronic knowledge delivery to the poor. Ten villages near Pondicherry have been connected by a hybrid wired and wireless network - consisting of PCs, telephones, VHF duplex radio devices and e-mail connectivity through dial-up telephone lines - that facilitates both voice and data transfer. This has enabled the villagers to get information that they need and can use to improve their agricultural and fishing practices. The vision for the project is based on the holistic philosophy of Swaminathan, which emphasizes an integrated pro-poor, pro-women, pro-nature orientation to development and community ownership of technological tools and encourages collective action for the spread of technology. The process involves local volunteers gathering information and feeding it into an intranet that people access through nodes in different villages in their local language. Most of the operators and volunteers providing primary information are women, thus giving them status and influence. All centres evolved to meet the information demands made by the community. More recently, the project has been replicated in other regions of southern India and has incorporated literacy training into the activities.

Analysis

The three categories of NFE show quite different patterns of ICT use. For example, while literacy programmes have not historically incorporated much use of ICT, mostly because of the environments of the learners, one gets the sense that this is changing rapidly. The Tata project demonstrates that large numbers of literacy learners can learn quickly with relatively low cost infrastructure requirements. The Commonwealth of Learning project demonstrated that ICTs can be used very effectively by tutors to develop locally relevant teaching materials. The Solomon Islands example is encouraging so far as the use of distance education is concerned. And the Action Aid initiative, similar in many ways to the model developed by the M.S.Swaminathan Foundation, promises, with its "bottom up" development model, to make a unique addition to the growing experience of ICT use in literacy education programmes.

However, unlike the adoption of ICT in primary and secondary education, ICT use in literacy has not yet captured the imagination and commitment of policy makers needed to move adoption to a mass level. A more comprehensive review of the use of ICT in literacy education needs to be undertaken that compiles a body of evidence, describes policy options, and defines mechanisms for sharing resources, materials and experience in the same way that SchoolNets are doing in formal primary and secondary education.

The use of ICT to facilitate skills up-grading for professionals and para-professionals is well underway – often because of the advocacy and initiative of the workers themselves. Access to these types of programmes is typically through the use of distance education models that are enhanced by ICT applications. Of particular note is the increasing use of ICT - supported distance education strategies for up-grading the skills of teachers.

As indicated earlier, the number of examples using ICT in education for development – community education - is huge. It is in this sector that we see the most use of older broadcast technologies as well as the most creative examples of ways they can be combined with the use of e-mail and the Internet. The Swaminathan example also demonstrates how we can develop both community "ownership" and the direction in which ICT use should be heading – an important point from a sustainability perspective!

The examples of ICT use in NFE have been selected only to illustrate some of the many applications that are underway around the world. Many more are identified on a website developed by UNESCO Bangkok which is undoubtedly the most comprehensive source of information on ICT applications in non-formal education in the Asia Pacific region. The website can be found at: www.unesco.org/bangkok/education/ict/teaching_learning/nonformal_edu/projects.htm.

Trends in research and evaluation

The amount of research and evaluation regarding ICT applications in education is limited. And the majority of what has been done has occurred in the higher education sector. Most of what has been written about ICT in education has been either of a visionary nature describing what "might be" or advocating increased use. However, this situation is

changing as use of ICT in the other sectors of education increases. As the rate of ICT use increases, there are more projects to evaluate. The following studies and reports of project evaluations illustrate this growing emphasis on the gathering and documentation of evidence concerning the use of ICT in education:

1. At all levels there are questions as to whether, in the rush to embrace e-learning, enough research is being done into the benefits for students and staff in different disciplines. For example, **Oxford University's Learning Technologies Group**[36] has questioned whether the choice of technology will shape the way subjects are taught or researched. It said that in trying to make a "tool-kit" for all, staff might be deterred from experimenting by imposing the teaching methods of one discipline onto another. Their view is that there has been an absence of debate about how information technology can be used effectively to complement face-to-face teaching.

2. The **Flexible Learning Framework in Australia** has just completed a project called *"Access & Equity in Online Learning"*.[37] The purpose of the project was to establish the needs of learners in the following groups: those with literacy needs, indigenous learners and learners with disability. Three additional groups were subsequently added: women e-learners, rural and remote rural e-learners and isolated metropolitan e-learners. The project produced guidelines, literature reviews and research reports, 17 of which are listed on their website.

3. Another contribution to the body of evidence about ICT applications is the work that the **UNESCO office in Bangkok** is conducting on performance indicators regarding the use of ICTs in education.[38] This work is part of the "ICT in Education in Asia and the Pacific Programme", an international undertaking funded by the Japanese Funds-in-Trust.

4. A project of the **Flexible Learning Framework in Australia** (http://learnscope.flexiblelearning.net.au/LearnScope/golearn.asp?Category=11&DocumentId=4379) attempted to enhance the learning outcomes of students by using ICTs to provide direct instruction. This involved a trial of real time teaching via the Internet, using Microsoft Netmeeting. The conclusion was that real time teaching via the Internet appears to enhance the cognitive functioning of children in the five-to-eight-year age groups and demonstrated that teaching via the Internet using a direct instruction model with children in the five-to-eight-year age groups is a pedagogically sound and cost effective way to support young learners.

5. A research project[39] carried out by the **Institute of Education, University of London** from April 2000 to March 2001 provided some data regarding the use of ICT in literacy. The study report focused on the following topics:

   - The use of ICT to provide effective learning for people with literacy and numeracy needs.
   - The use of ICT in helping people with literacy and numeracy needs to achieve satisfactory learning outcomes in non-basic skills learning.

   The study concluded that the use of ICT did have beneficial effects. A full description of the results is provided on the website.

6. A study[40] by **SchoolNet Canada** to assess the impact of its "Grassroots Programme" provides some insights into the adoption of ICT by teachers. The study report provides an overview of innovation and a background to some of the challenges associated with large-scale innovation in the Canadian K-12 school system. It describes the factors contributing to the success of the programme and also the challenges that are faced.

7. Another **SchoolNet Canada** report[41] from 1998 titled "The Emerging Contribution of Online Resources and Tools to Classroom Learning and Teaching" concluded that the use of technology in the classroom has already been demonstrated to have a significant impact on teaching and learning. It concluded that the way new technology is adopted is related to l) the users' interest in improving on what they now do well, and 2) the users' interest in doing things that are different from the ones they are used to doing. It also identified several trends with respect to the K/12-13 sector:

   - Trend 1: Higher levels of control by learners are called for as classrooms are getting more online.
   - Trend 2: Learning situations become more realistic and authentic as classrooms are getting online.
   - Trend 3: Online resources boost student interest and motivation in the classroom through a greater diversity of learning goals, projects, and outcomes.
   - Trend 4: The successful online classroom combines information technology with appropriate pedagogy.
   - Trend 5: The classroom is extended to online learning communities with the potential to support or even challenge the locally established curriculum.
   - Trend 6: The education of educators is broadened to include just-in-time and/or collaborative learning.
   - Trend 7: Educators use online technology as a driving element of an educational reform.

   The report goes on to describe a number of gaps in current knowledge about online use of technology in the classroom such as:

- More information is needed on the nature and extent of teachers' experience with information technologies, how teachers view these resources, how they understand their impact on society as a whole, and how they alter their instructional practices in order to use them effectively.

- The content of what will be taught using online resources is becoming more diverse and shifting towards more construction and input by the learner. More information is required on whether this more dynamic content conflicts with traditional curriculum content and goals.

- As the presence and use of information technologies becomes increasingly widespread, schools and universities will need to develop performance indicators to monitor the use and outcomes of the technologies, and to demonstrate accountability to funding sources and the public.

8. A recent study[42] in the **UK** identified a range of factors that teachers need to take into account when using ICTs. These include:

   - Clear identification of how ICT will be used to improve pupils' attainment and meet specific objectives within subjects of the curriculum.

   - Ensuring that pupils have adequate ICT skills to achieve those subject specific objectives.

   - A planned match of pedagogy with the identified purpose of ICT activities and learning outcomes.

   - Finding appropriate starting points for development for particular teachers in accordance with their teaching styles and approaches.

   - Adequate access to, and intensity of use of, the necessary equipment by pupils and teachers.

   - Effective technical back-up and support to overcome any difficulties encountered.

9. The British Educational Communications and Technology Agency (BECTA) is an organization set up to support the transformation of education through the integration of ICT into learning and teaching, educational institutions and systems. It provides a variety of services, one of which is an educational research portal[43] that contains links to other websites, documents and sources of information in the field of ICT research and educational research generally. Study reports are listed in categories such as "ICT and Effective Pedagogy"; "ICT and School Improvement"; and "Management Information Systems".

   An example, one of the many reports contained in the "ICT and Pedagogy" section of this portal, is a study focusing on how teachers make effective choices about when, when not, and how to use ICT in teaching literacy and numeracy in primary schools.

Analysis

These examples of research and evaluation, while providing some very useful evidence, also underscore the point that there is still a paucity of "hard data" on which to base policy and investment decisions. As was pointed out in the opening paragraphs of this chapter, the adoption of ICT in education is still in its early stages. However, it has seemingly reached a "take-off" point which increases the pressure on educational leaders to be, and be seen to be, doing something about the adoption of ICTs. Networks that facilitate sharing experience and information among policy makers and institutional leaders seem to be lacking. Initiatives that would address this need would make a significant contribution as the more formal research activities proceed.

Summary

The adoption of ICTs into the practice of education is not something that began with the emergence of the new digital technologies. It has been on going for decades in very successful programmes that have utilised radio, television and print. What is new are the many ways that these "older technologies" are being combined with the use of e-mail and the Internet, particularly in the arena of non-formal education.

ICT infrastructure is evolving in other ways as well. The use of wireless technologies, often referred to as "m-learning", is a relatively new trend that may help overcome the lack of ICT infrastructure in remote communities. Open source system software holds some promise for cost saving, and more importantly, for the development of standards that facilitate interoperability among systems. And, with the burgeoning amount of information, it is not surprising that management systems are being developed to allow for efficient cataloguing, searching and retrieval of information. One of the more important trends is the rapidly expanding development of online learning object content repositories. The ability to be able to reuse content in different contexts and deliver it in different formats for learners at different levels of the system is promising, and will lead to greater convergence between the historically separate worlds of the distance educator and the classroom teacher. But it is in an early stage of development and there are issues that need to be resolved.

A trend that will surely grow is the use of distance learning models to create mass access to primary and secondary education. The very successful examples of the National Open School in India and Telesecundaria in Mexico

demonstrate how the goals of increasing access and enhancing the quality of curriculum content can be achieved. However, the increased use of ICT in schools has created new needs for both teachers and school systems. For example, the benefits of sharing information and teaching materials becomes more obvious. Teachers need to acquire new skills. And managers want to collaborate to share costs. In response, we are seeing the emergence of new organizational models called schoolnets with mandates to address these and other needs.

While the "tried and true" older technologies continue to play an important role in non-formal education, the use of newer ICTs is proving useful here as well. There are emerging applications in literacy training and certainly in continuing professional education. In the community development area the applications demonstrate appropriate use as well as showing models of local control and relevance to community needs.

The final comment is about evidence. Is this increased use of ICT in education contributing to the goals of more access to learning opportunities; enhanced quality of content and pedagogy; and greater efficiencies? While there remains a paucity of data to answer these questions, it is clear that the emphasis on research and evaluation is increasing. And a notable feature of this increasing effort is a shift from the arguments of being "for" or "against" ICTs, to questions related to the conditions that need to be met in order to ensure that adoption adds value to current practice.

NOTES

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•Low-cost satellite Internet access widely available across Africa (Component 1a)
•Robust African Internet backbone with exchange points at the core and strong African ISP Associations (Component 1b)
•Well-informed, lively and inclusive policy debates across Africa, shaping the local policy environment (Component 1c)
•Positive policy environments for radio broadcasting across Africa (led by Panos Institute) (Component 1d)
•An African-led network of institutions, actively strengthening the African expertise involved in setting ICT related policy (Component 1e)
•Increased capacity for African developing countries to participate in international ICT decision making (Component 1f)
•Low-cost computers and open source software being developed and tailored to the African market (Component 2a)
•Stronger network of community radio, FM and public service radio stations across Africa, offering good pro-poor radio programmes (led by Amarc) (Component 2b)
•A thriving African-based Open Knowledge Network, catalysing the creation and exchange of local content (led by OneWorld) (Component 2c)

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Gender-based Issues and Trends in ICT Applications in Education in Asia and the Pacific

Ms Lyndsay Green

Introduction

Gender is a factor in every aspect of formal, non-formal and informal education, and has an impact on all participants: learners, teachers and administrators. The issues examined here are drawn from all facets of the educational system, and the strategies have relevance across sectors. In particular, formal education has a great deal to learn from strategies being used in the non-formal sector, and some of the initiatives being undertaken in the Asia-Pacific region, as described below, are leading the way in putting information and communication technologies (ICTs) to work for gender equality.

The emphasis is on ICT applications and models that hold promise in assisting with the achievement of Education for All (EFA) goals, specifically Goal 3, to "promote gender equality and empower women." The focus is on Asia and the Pacific; however, examples are included from other regions where they suggest models that lend themselves to broader application.

One of the strongest messages that emerges from research on the effective use of ICTs in the education of women is the need to use appropriate technology. The examples below look at the newer ICTs, computers and related services such as e-mail and the web, and also include the use of broadcast technologies, such as radio and television, as well as audio and videotapes.

Along with an endorsement for the more traditional ICTs, there is an equally strong message that women and girls must not be left behind in the digital revolution. The digital divide includes a gender divide, especially for rural and marginalised women, and the newer ICTs have the capacity to allow us to benefit from the full contribution of women.

Gender issues

Can ICTs Improve Access to Education for Girls and Women?

Conditions that prevent girls and women from accessing educational opportunities include illiteracy, poverty, time famine, socio-cultural factors, mobility and relevancy. ICTs have the potential to ease or remove some of these barriers, but they may also create additional barriers including restricted access to the technology, and factors inhibiting usage such as high costs and lack of skills and information.[1]

Interactive radio instruction (IRI) has been used successfully to improve access to primary education, and in the case of an IRI project run by the Zambian Ministry of Education, analysis of enrolment figures demonstrates that girls have a high participation rate. Children from eight to 10 years of age are organised into listening groups at IRI centres and follow lessons broadcast over the radio under the guidance of a mentor. For 2001, girls comprised 48.68 per cent of the total IRI enrolment, while in the same year in the other primary education programmes girls represented 45.2 per cent of the total. This is deemed to be a significant achievement for a programme that was only fully implemented two years ago. One of the incentives for parents to enrol their children in IRI is that, unlike in the formal education system, there is no requirement to pay user fees or buy uniforms.[2]

ICTs also have the potential to mediate some of the problems currently facing women who wish to further their education through open and distance learning (ODL). Dr. Edith Mhehe, who has researched difficulties faced by Tanzanian women considering or participating in higher education through the Open University of Tanzania (OUT), argues that ICTs could alleviate the constraints that women currently face. The barriers are operational (including physical and social isolation) and personal (relating to juggling of social demands and lack of support). They include lack of time, cultural expectations that are incompatible with education and inadequate financial resources.[3]

However, if the benefits of ICTs to ODL are to be realised, careful attention needs to be paid to student support. Research conducted on the impact of ICTs on ODL in the South Pacific concluded that because ODL courses require a high degree of organisation and commitment, support services in the Pacific need to be improved, especially in the regional centres. It was determined that the use of ICTs allowed Samoan women studying at the master's level at Australian universities to continue to fulfil vital family and community obligations; however, the burden was heavy. Research done at Indira Gandhi National Open University (IGNOU) also found the need for more support for female students. Researchers concluded that many problems experienced by ODL students are common to both genders, but they become more acute in the case of women. The most severe problems were irregular and unsystematic tutorial help, inadequate supply of reading material and lack of study centres.[4]

An interesting finding is that access to the newer ICTs may have a role to play in encouraging participation in the formal educational system. This was the conclusion from the Information Village project in Pondicherry. It found that parents and students accessed databases at the "knowledge centres" to choose courses from information about what was available in the educational institutions. And the school dropout rate declined considerably after children started using the computers and CD-ROM educational materials. "There is a greater awareness among the community of the value of education."[5]

Can ICTs Improve the Learning Experience for Girls and Women?

There is evidence that under the proper conditions ICTs may increase the quality of basic and secondary education for women and girls. An example is provided by World Links (*www.world-links.org*), which links students and teachers around the world via the Internet for collaborative projects and integration of technology into learning. World Links commissioned a gender assessment study in 2001 to determine whether girls and boys are being impacted differently by their educational programmes in Senegal, Mauritania, Uganda and Ghana. They concluded that the learning outcomes seem to be greater for girls because when girls connect to the Internet, they focus more on academic-related issues than on leisure. The findings suggest that there was more impact on girls' communication and reasoning skills than boys', and that female students also expressed increased self-esteem. The students felt that the quality of teaching improved because they became more knowledgeable and active learners.[6]

There are also successful examples of using interactive radio to enhance the quality of the educational experience. Papua New Guinea gained an enthusiastic response from teachers and headmasters because of the difference it was able to make in the classroom. Improvements in exam results were attributed to the radio science methodology, which resulted in more active teachers and students, better linkages between follow-up exercises and local knowledge and improvements in thinking rather than rote knowledge.[7]

Also, when ICTs use local languages and incorporate a strong visual component, they have the potential to be an effective educational tool to reach women with limited literacy. The International Women's Tribunal Centre worked with the International Development Research Centre (IDRC) to develop a CD-ROM for poor rural women farmers in Uganda with little or no reading ability. The tool addressed their needs as farmers and small businesswomen

to earn more money.[8] SEWA (Self-Employed Women's Association) uses video to support their goals of organising women workers for full employment and self-reliance. They have conducted educational programmes on themes such as organising, leadership building, forestry, water conservation, health education and financial services, and they estimate they have reached 20,000 women viewers. "When literacy became a hindrance, SEWA members found a solution. They learnt video vocabulary. To be functionally literate they had to master fewer than 20 Western words."[9]

However there is ample evidence that without gender-sensitive programme design, ICT-enabled education is unlikely to result in an equitable learning environment. Research conducted on students attending a US-based higher education distance organisation using primarily online instruction compared differences in male and female preferred learning styles, communication patterns and participation barriers. The conclusion was that the women experienced a less equitable environment because the medium requires some technical skills and a degree of confidence about distance education, and because the learning environment supported a male domination in online communication patterns that effectively silenced female students.[10]

Lack of computer skills is a severe barrier for women and girls in accessing the new ICTs.[11] In the classroom, unless fair use policies are put in place, girls are likely to receive less hands-on computer experience. The World Links gender research found that girls had inequitable access to the computer labs in some schools as a result of several conditions: high student-to-computer ratios and first-come, first-served policies did not favour the girls; girls' access time was limited by earlier curfew hours and domestic chore responsibilities; and local patriarchal beliefs allowed boys to dominate the computer lab environment.[12]

The role of women as role models is extremely important in improving the quality of the educational experience for girls and women,[13] and women educators need to have a degree of comfort with ICTs if they are to be effective role models for their female students. This is not always the situation, as Dr. Suri found when she measured the attitudes to computers of teachers in distance teaching institutions in India. The female teachers were less positive regarding interest in and personal importance attached to computers, they were less secure about their computer skills, and they knew less about computers. They also viewed computing as an abstract science. The male teachers, in contrast, were more interested in computing, had higher self-confidence in their ability to use computers, and viewed the computer as a masculine technology. The female teachers said that it was hard for them to learn how to programme a computer, or they expressed a fear of using computers.[14]

Can ICTs Help Women and Girls Access Non-formal Education?

The most compelling case for the potential for ICTs to improve access to education for girls and women is found in cases of formal and informal learning. Here are some examples:

- **Mothers4Mothers** (*www.mom4mom.com*), based in Malaysia, uses ICTs to build cyber communities and networking opportunities for homemakers, homeworkers and teleworkers. One of their projects, eHomemakers, provides resources on how to get started on work at home projects and advice on how to become a successful "homepreneur." Homebased Xchange allows people to post their products and services online, and share their opinions on a forum. Other projects include an online grief support group and an online breastfeeding support group. Mothers4Mothers also provides computer training to women.[15]

- **The Information Village project in Pondicherry** cites significant educational results from their project including support to women's small business development. Women's self-help groups use the system to contact other women's groups with which to share their experiences. One innovative use of ICTs is the development of a multimedia presentation and multimedia flash cards to provide gynecological information to reach women who are prevented by cultural attitudes from discussing their health problems with male doctors and younger females.[16]

- **Horn of Africa Regional Women's Knowledge Network (HAWKNet)** is a regional network of women and women's organisations in the East and Horn of Africa regions with a web portal that provides a forum for women and girls. The website contains information on key issues affecting women in the region including conflict and peace-building processes, food insecurity, HIV/AIDS and other health-related issues, poverty, education, and ICT policies. The website includes an events calendar, bulletin/advertisement boards, chat rooms, and online meeting and working spaces. An e-commerce portal provides an opportunity for women in the region to access distant markets for their goods and products.[17]

- **Women of Uganda Network (WOUGNET)** uses ICTs as tools among women's organisations to share information and address issues collectively. Their emphasis is on the use of e-mail and the web and how these technologies can be integrated with traditional communications tools. Their website, *www.wougnet.org*, profiles the work of 41 Ugandan women's organisations. They administer an

electronic mailing list, produce a monthly electronic newsletter and host online discussions. They also offer a web design programme to develop websites for WOUGNET members.[18]

- The **Japanese Government** is launching a number of online initiatives to support women's networking including e-business support for women entrepreneurs with an "upward mobile site" providing information for women who want to find jobs, start a business, enter an international field or participate in community-building. Regional centres provide access to the network for rural women and serve as counselling centres for women faced with problems such as domestic violence. Since May 2003, there has been a site providing information for women in agricultural and fishing communities who want to start fishery, farming or forestry businesses. The site includes information on starting a business and borrowing money, and links to a simulated farming experience. Part of the long-term strategy is to establish distribution systems for the products through the use of ICTs.[19]

- In **China**, a substantial number of websites have been uploaded by women's organisations to disseminate information.[20]

Women as ICT Professionals

One of the major concerns regarding women, ICTs and education is that women are not equitably participating as professionals in the ICT sector. Women are not pursuing the field of computer science in adequate numbers, and when they enter the profession they are more likely to be employed in word processing and data entry positions, rather than in programming and decision-making. There is concern that if women are not active participants in the field of ICTs, they will not be in a position to ensure gender-sensitive design and implementation. Also, the potential for establishing women as role models will be lost.

The research conducted by Asian Pacific Women's Information Network Center (APWINC) found gender differences in enrolment in ICT in universities and colleges in the Pacific region. The closest to parity in enrolment was found in the Philippines, whereas there was a marked gender difference in enrolment in the other five countries (ranging from 20 per cent female enrolment in Korea to 33 per cent in Sri Lanka). A similar gender gap is seen in graduates. In the Philippines, despite near parity enrolment at university and college levels, the gender gap widens with each higher level of qualification.[21]

The representation of women in ICT faculties mirrors the marked gender differences in graduate and postgraduate output, with the exception of the Philippines where there are more women than men. In the other two countries for which data were available, women did not exceed 25 per cent of the faculty.[22] The importance of female ICT faculty in attracting women to the field has been well documented. For example, one research project found that the major reason for girls' lack of interest in ICT at a higher education stage was the male-orientated atmosphere of computer science courses.[23]

It is interesting to note that ICTs themselves may assist in encouraging women to pursue ICT professions. The Institute for Distance Education (IDEAL) at Universiti Putra Malaysia offers a Bachelor of Computer Science via distance learning. This was the first programme in the country to be delivered entirely via the Internet and, according to 1998 research, 37 per cent of the students were female.[24]

Trends in strategies

Much of the analysis about the impact of the trends in strategies being undertaken to address the issues highlighted above is still at the anecdotal stage, but some research findings are available. Since the potential for crossover application appears to be high, each strategy discussion below includes examples from all facets of the educational system: formal, non-formal and informal. The importance of gender-focused ICT research is beginning to be recognised and hopefully the results will be available to inform future work.

Gender Mainstreaming

The accepted wisdom for ensuring gender equity is referred to as "mainstreaming."[25] Gender mainstreaming ensures that an organisation's programmes and policies include gender analysis from inception, and that strategies to ensure gender equity are implemented in all facets of the organization's operations. Gender mainstreaming acknowledges that there are no "gender neutral" decisions.[26]

SchoolNet Africa, a network of schoolnet organisations and practitioners promoting ICTs and education in 31 African countries, has a policy of gender mainstreaming. Implementation strategies include the placement of gender on agendas, encouraging website content that is gender responsive, encouraging gender balance in learner teams, and providing an award for gender responsiveness. For example, a recent workshop held in Botswana incorporated gender in all speakers' notes and, in addition, a dedicated session was held on the topic.[27]

Research has found that the closer the responsibilities for addressing gender issues to daily operations are brought, the greater the chances of success. The Open University of Tanzania (OUT) is considering initiating a gender unit at their headquarters to be responsible for finding effective

and sustainable solutions to the barriers facing women students.[28]

Gender mainstreaming is an all-encompassing matter for Sookmyung Women's University, Republic of Korea's first private college for women. Sookmyung has been offering computer education to undergraduates since 1987 and, in an effort to bolster computer knowledge, is increasing the supply of PCs to the student body and providing both students and teachers with Internet IDs. The university's experience with women's use of ICTs has led Sookmyung to establish the Asia-Pacific Women's Information and Communication Center (APWINC), which has been involved in many pioneering projects on ICTs and gender in the region including research, training and information dissemination.[29]

Gender-sensitive Programme Design

Gender mainstreaming leads to gender-sensitive programme design, which takes deliberate steps to remove barriers to women's participation and actively encourages women's involvement. The requirement for gender-sensitive programme design applies to all facets of the educational system: in the case of the formal system from curriculum to admissions to student-support strategies, and in the case of the non-formal and informal systems, from access to training to relevant content.[30]

- **World Links** responded to their gender assessment study by introducing special action to encourage women and girls to apply and participate in their programme. They offer awareness sessions on gender and development and have developed new policies including one to relieve girls from household chores that they perform during evenings in boarding schools while male students are enjoying more lab time. They also encourage schools to develop fair-use policies for their computer labs to ensure girls' access is proportional to their representation in the overall student body.[31]

- **The Open University of Sri Lanka** trains primary and secondary school teachers in the use of gender-sensitive materials in the school and teacher education curricula, and offers a number of computer programmes and courses that use gender-sensitive language.[32]

- In the **Information Village** project in Pondicherry, because of a deliberate decision to give priority to women, more than half the volunteers operating the knowledge centres are female. A 2001–02 survey of users and non-users in five villages found that the use of women operators was linked to an increase in the number of women users.[33]

Other examples of gender-sensitive programme design include female-focused programmes and programmes with a financial incentive to encourage women's participation. In Bangladesh, Lever Brothers Bangladesh Limited is sponsoring computer courses for 1,500 female students who wrote secondary school exams and are awaiting their results.[34] In Cambodia, female students are being offered a 50 per cent discounted fee to attend Cisco system training. The e-learning programme is being offered through the Royal University of Phnom Penh, and the National Information Communications Technology Development Authority (NiDa) is offering the financial incentive to encourage women to join the IT field.[35]

Engendering ICT and Education Policies

Research on how to ensure that women and girls benefit from ICTs in education emphasises the importance of engendering policies at all levels – regional, national, local and sectoral. Policy initiatives range from the global level (e.g., efforts to include gender equity in the World Summit on the Information Society (WSIS) process) to the classroom level (e.g., fair-use policies to ensure equal time on the computers for girls). Research has found that developing policy at one level only is not effective. If initiatives are to be successful, multilevel policies need to be developed in tandem.[36]

- The **South Pacific** provides a case study of developing an ICT policy and action plan that makes explicit reference to women, ensuring that there will be a systematic effort to develop strategies and activities that focus on the needs of women. Evaluation activities, including data collection, will also be mandated to have a deliberate focus on the impact on women.[37]

- **APWINC** examined the national policies for the advancement of women's "informatisation" in six countries. Republic of Korea was the only country to have formulated a plan and a budget for this purpose. China approaches women's informatisation through the overall development of women. Indonesia has mainstreamed the use of ICT by women in its overall development plan for women. The Philippines and Sri Lanka have no specific plans or programmes for women's informatisation, while India has some programmes to encourage women to use ICT in different sectors.[38]

- To encourage the development of gender-equal ICT policies, **APWINC** held a two-week programme in July 2003 for 22 government women from 14 countries. The goal of the Asia Pacific Latin America Government Women's ICT Training (APLAW-IT) is to activate partnerships in network building so that more women can benefit through ICT capacity-building and to promote gender equality in ICT

policies. APLAW-IT shared information through country reports on gender and ICT, conducted e-business training and carried out ICT field trips.

Providing Girls and Women with Access to Equipment

Strategies for enabling girls and women to use ICTs for education emphasise the need for access to equipment in welcoming and supportive environments. The use of telecentres is one model that is finding support.[39] However, research on the effectiveness of telecentres in reaching women and girls shows mixed results, and great care must be taken to ensure gender-sensitive programme design.

- Research conducted by the **Acacia project**, which has been involved with 35 telecentres in six African countries, concluded that most groups, other than young males, will not use telecentre services optimally unless they are assisted or supported by a range of sensitive strategies. Women are particularly disfavoured because of cultural norms, costs and other administrative and structural characteristics associated with telecentre use. Also, most information products currently available in the telecentres are not made for or attractive to women.[40]

- In **Sri Lanka**, teacher education programmes used regional study centres equipped with audiocassettes, videocassettes and computers. Surveys found that use of the technology by the women students was poor for a variety of reasons: non-availability of transport facilities, the nature of the terrain which made even walking difficult, and cultural inhibitions and household chores that prohibited long hours away from home. Researchers felt that mindset and gender-based socialisation may also have been contributing factors.[41]

- Research into barriers to the use of ICTs faced by women students of the **University of the South Pacific** found the major barrier to be equipment access at study centres. The small number of computers was aggravated by staff use of the computers for their own work, the centres' restricted hours and a lack of maintenance skills. As well, costs of transport to the centres were prohibitive.[42]

- The **Malaysian government** has opened 15 telecentres, with another 119 in the implementation stage. One of the aims of the Community Communications Development Program (CCDP) is to enable rural communities to acquire skills, knowledge and experience through the use of communication and multimedia facilities. Four groups are being targeted for training: operator, village committee, teachers and youth. To ensure the involvement of girls and women they are partnering with the Foundation for Women's Education and Vocational Training.[43]

- The **Government of Bangladesh** aims to ensure that high school girls are provided with computer access in an ICTs and Education programme announced in July 2002. Girls' schools are to be given priority in a programme that will provide 10,000 computers, along with Internet connections, to schools at the secondary level.[44]

- Placing equipment in women's homes has the potential to remove their access problem. This approach is being tried in New Zealand where **Computers in Homes (CIH)** is providing all socially and economically disadvantaged families with a computer, an Internet connection, training and technical support. Tutoring has been offered in one-on-one learning at home. The project is new and research results are preliminary, but it has been noted that mothers are the most reliable attendees at the training and the family meetings at the school. They are using the PC during the day while the children are at school.[45]

- The **University of the South Pacific** has recognised that lack of computers at home also acts as a barrier to the teachers' acceptance of distance learning programmes. To encourage computer ownership, the university allows staff to purchase computers on time payment at the university book centre, and many have taken advantage of the programme.[46]

Providing Gender-sensitive Training

Training is an essential component of any effort to support the education of girls and women through ICTs, and to be effective the training must be gender-sensitive and provide ongoing support.[47] The requirement for gender-sensitive training applies to all facets of the educational system: from educators to curriculum developers, from administrators to admissions officers. Arguably the most effective strategy is to have training begin in the early school years with teachers actively encouraging girls to become computer literate.[48]

Dr. Suri of the University of Delhi examined the attitudinal barriers of women teachers towards ICTs (as discussed above), and has a number of recommendations to increase the skill and confidence level of both teachers and students. She proposes computer skill training workshops provided in single-sex settings, with female instructors.[49] This should be coupled with supportive policies and programmes such as educational leave, scholarships and preferential access to equipment. She also recommends recruiting computer professionals to help teachers prepare material for courses

and tutorial support. The training should be conducted as part of a collaborative task.[50]

This technique of "learning through doing" has found success with female learners. Research recommends imbedding ICTs in the curriculum, rather than teaching computers as a separate subject. When Carnegie Mellon University changed its approach to teaching computer science from one of conveying abstract technical knowledge to demonstrating applied computer applications, they increased the number of females enrolled in the programme from 8 per cent in 1995 to 37 per cent in 1999.[51]

An effective way to offer relevant and applied ICT training is to focus on skill development for a specific professional or occupational group. An example is the seven-day workshop held in Kathmandu, Nepal, in August 2003, to train women development journalists in South Asia in new media. The workshop aimed to familiarise women journalists with the use of Internet-based technologies in order to improve their skills. The focus was "learning through content production." Topics included website creation, writing for the Internet, discussion forums and mailing lists, Internet radio and TV, online journalism issues and using the Internet effectively as a research tool. The Centre for Women's Research (Cenwor), based in Sri Lanka, facilitated the hands-on training.[52]

All-female training sessions that place girls and women in the role of teachers have proven to be effective. In pilot projects in two telecentres in Mozambique, when it was determined that men were significantly greater users of the telecentre computer services, including e-mail, Internet and CD-ROM, a training programme called Skills for Women was launched. There were no dropouts from the programme, the trainees formed the nucleus of regular users of the telecentres and some became trainers themselves. Research emphasised the importance of all-female classes and the value of peer assistance.[53]

Peer training is also being used effectively by Marathmoli, the Internet-based information network and support service for women and other marginalised peoples of Maharashtra. Marathmoli conducted ICT training and leadership training for young girls, and these same girls are now assisting as trainers in the ongoing training camps.[54]

One of the critical strategies in the non-formal sector has been capacity-building in women's organisations to enhance their capability to transfer knowledge to their target groups.[55] WENT (Asia-Pacific Women's Electronic Networking Training) has been held annually since 1999. The training is organised by APWINC and the Association for Progressive Communications Women's Networking Support Program (APC WNSP) with the goal of promoting the use of ICT among women and enhancing women's roles in social and policy advocacy.[56] To date 116 women from 18 countries have been trained in basic website development and networking, web-based information management using ICT and local area networking.[57]

Women's organisations are well positioned to develop gender-sensitive training for their clients:

- **Women's Aid Organization (WAO)** is a Malaysian organisation that provides shelter and counselling to survivors of violence against women. WAO has been experimenting with a variety of techniques to provide computer training to residents and ex-residents, including pre-packaged training programmes. They have found customised training by volunteers to be most effective, especially when linked to employment prospects and daily concerns, local language instruction, child care provision, computer access and technical support.[58]

- **Women'sNet,** which provides a website relevant to South African women, girls and women's organizations, has developed a number of effective strategies to provide gender-sensitive ICT training. They work in small groups to facilitate participants' engagement with the technology, and demonstrate applied uses of ICTs. They combine content development with technical training, either in the form of content that can be posted in the Women'sNet site, or radio-ready audio spots. They design campaigns for the learner's organisation and demonstrate how the technology can facilitate their activities. Their trainers speak multiple languages. One technique that has worked particularly well for girls is to have them document the training through audio or videotaping.[59]

- Large-scale government initiatives to target women for ICT training are underway in both The Republic of Korea and China, and in both cases organizations with a mandate for women are partners in the project. **The e-Korean Project** launched in March 2001 by the Ministry of Information and Communication has a goal of providing two million "housewives" with Internet training. The number of housewives who have used the Internet increased from 1.8 per cent in 1999 to 45 per cent in 2002. The Korean Ministry of Gender Equality is providing ICT training for women in specialised areas including e-business courses, web-design courses and onsite job training. In addition, 1,000 female ICT professionals are being trained by Sookmyung Women's University, Samsung Mulitcampus and the Korea Women Development Institute.[60] The **All China Women's Federation**, the Ministry of Education and the Ministry of Science and Technology have trained nearly three million women who had been laid off from work to re-skill them to find employment in the emerging economy.[61]

Ensuring Relevancy

Research findings emphasise the tendency for girls and women to treat ICTs as utilitarian tools and as means to an end. The strategies that have been successful in engaging girls and women in the use of ICT for education have emphasised relevant content that matters to their lives.

An example of the power of relevant content is found in a pilot project using ICTs in literacy that is being carried out in Zambia and India in selected learning centres, supported by the Commonwealth of Learning (COL). The project started its operation in Kabwe in August 2000, with five literacy classes, now increased to seven. One of the most startling results of the pilot is that the number of female learners far outnumbers that of the male learners (nearly 100 per cent female). One of the conclusions for the programme's attractiveness to females is the content of the literacy training materials which are often interwoven with or based on topics that are viewed as "female," such as health, nutrition and child care.[62]

Another example is the Women Empowerment through ICT project in Nepal, which has emphasised practical outputs in its programme to train 10,000 computer literate women. Computer training is being linked with the potential to engage in income-generating activities, and the focus is on ICT skills for front office management, for designing instructional materials or to set up their own businesses.

Organisers of the Information Village project in Pondicherry emphasise that the success of their project rests on the fact that much of the content, including close to 100 databases, has been developed in collaboration with the local people. "We do not download the information and then look for users. Through surveys and continuous dialogue with village communities, we study what information is needed and what will be useful to the community...We maintain ledgers in each centre and all queries are recorded and analysed."[63]

Some significant efforts are being made to develop ICT content of relevance to rural women. Maharashtra Women's Net will be participating in the Virtual University initiative with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The organisation has already developed content on health issues targeted at rural women.[64] In China, Agricultural Broadcasting and TV School uses radio, TV, tapes, videos and written material to provide agricultural open and distance education to rural labourers, especially rural women and girls. Estimates are that nearly 10 million rural women have been trained through tele-education to enable them to use information for farming and daily life.[65] The FAO Regional Office for Asia and the Pacific supports various open universities in India, Sri Lanka and the Philippines to explore the educational and learning needs of rural women in their curriculum content. They are also working with three agriculture universities in northern India to improve their multimedia teaching strategies in working with rural women. In 2004, FAO will support a subregional workshop on Gender Responsive Community Education Programme in Distance Education to make the linkages between the Open University and community-based organisations.[66]

Conducting Gender-focused Research

Research reports decry the lack of hard data around the issues of gender, ICTs and education and recommend a commitment to ongoing research and gender-disaggregated data. When APWINC conducted their research on the ICT status of six Asian countries, the authors of the country reports drew attention to the paucity of data that were available, and especially to the lack of gender-disaggregated data.[67] This same situation was encountered by the researchers participating in COL's project on women and ICTs for open and distance learning.[68] The commitment to gender research needs to be an institutional imperative. As an example, one of the research priorities of the Open University of Sri Lanka is to address the role of gender in student enrolment and performance.[69]

A valuable new tool for gender analysis has been developed by APC WNSP. Gender Evaluation Methodology (GEM) is a guide to integrating a gender analysis into evaluations of initiatives that use ICTs for social change. As well as serving in evaluation, the tool is designed to be used in the project planning process to ensure the integration of gender concerns. (See *www.apcwomen.org/gem/index.htm.*)

Promotion and Information Sharing

One of the problems confronting those who wish to engage girls and women in the use of ICTs for education is the lack of awareness of the potential of ICTs. This problem is well illustrated in the telecentre project in Mozambique where women were interested in the idea of using ICTs, but mainly used the telecentre services to meet their immediate and obvious needs such as telephone use. "Demonstration, training and practice is needed before the benefits of ICTs are recognised, but women are not prepared to give the time or spend the money until benefits are proven."[70]

One strategy is to use the media as a transmission vehicle to raise awareness and knowledge about how ICT can empower women.[71] The Information Village project in Pondicherry has been providing content to All-India Radio (AIR) including a series called Silicon Valley in which people are interviewed who benefit from the knowledge centres.[72] In Sri Lanka the goal is to produce live radio programmes on the subject of the Internet and use the Mobile Computer Laboratory of CINTECH to encourage women to increase their use of new technologies.[73] SchoolNet Africa carried out a Global Campaign for Education using celebrities to teach on gender issues for one hour. The programme reached 50 countries at the same time and involved 1.8 million learners worldwide. They

also use media campaigns to create awareness and increase gender sensitivity among educators.[74]

Another promotional technique is the use of awards, both to give an increased profile to the sector and to share best practices. SchoolNet Africa provides an award for gender responsiveness. Global Knowledge Partnership (GKP) and APC WNSP organise the Gender and ICT Awards to recognise gender and ICT initiatives globally and provide further impetus for others to mainstream gender in the field of ICT for women's empowerment. Best practices and lessons learned will be showcased on a special website during the four-year run of the awards.

Using Blended Media

The use of blended media is a consistent theme in the use of ICTs for educating girls and women. The objective is to use a variety of technological tools within an educational experience, selecting what works best to meet the needs of the learner and the pedagogical objectives.

- Research on the ODL activities of the University of the South Pacific concluded that a combination of delivery methods would provide the best educational experience for their female students. Women preferred a mixed mode of learning, which included face-to-face and online delivery and communication. For people in rural areas, print packages were still the best mode for learning, and radio provided a viable alternative. However, in the future, it is anticipated that telecentres may provide isolated populations with access to ICTs.[75]

- Women's Aid Organization (WAO) uses a website to provide information to survivors of violence against women and their support networks. They have concluded that although there have been major successes, the medium remains largely inaccessible to most Malaysian women due to a lack of infrastructure and skills, as well as a lack of culture that encourages women to use the technology to their advantage. WAO has found that public education through the radio and other forms of traditional media is more effective in reaching out to the public, especially to their clients. They have partnered with several national radio stations to produce regular programmes on women's issues, including some in soap opera format.[76] HAWKNet has decided that since radio and TV are the most commonly used forms of ICT in Africa, they will be promoting the integration of radio and television with the Internet.[77]

- The Information Village project in Pondicherry has emphasised the use of multiple media. Knowledge centres in 10 villages are connected by a hybrid wired and wireless network consisting of PCs, telephones, VHF duplex radio devices, as well as spread spectrum and e-mail connectivity through dial-up telephone lines. A fortnightly Tamil newsletter, *Our Village News,* is also part of the project. Multimedia and loud speakers are used to reach out to illiterate clients. "Currently we are testing the possibility of using World Space radio to network the rural poor of the world."[78]

Conclusion

There is a legitimate fear that the advance in ICT development and use may increase the "structured illiteracy" of those who do not have access, and may reduce the status of women as bearers of "indigenous knowledge."[79] However it is equally possible for ICTs to give a voice to the voiceless and empower women to use their knowledge for global benefit.

The strategies discussed in are pointing the way forward. The non-formal sector in particular is learning the importance of engendering programmes and projects at every stage and ensuring that gender-specific policies are enacted at all levels. Access to equipment is critical, but true access requires addressing and overcoming the barriers of poverty, geography, time famine and socio-cultural constraints. Gender-sensitive training is essential and works best if it is applied, practical and provided in all-female sessions. And the role of computer-savy women as teachers, mentors and role models cannot be overestimated. Capacity-building in women's institutions and organisations is a very effective method for expanding multifold the benefits of ICT training programmes.

The mandatory ingredient is *relevancy*. Women and girls need to understand the ways in which ICTs can benefit them and their community, and improve their world. They need to see how ICTs can help them do their work better or faster, keep themselves and their family fed, healthy and safe, and expand their horizons. Organisations that already have a valid and respected role with women and girls need to take the lead in ICT implementation, training and capacity-building. Organisations that are custodians of knowledge that is critical to women's lives, whether it be information about health, agriculture, business development or domestic violence, need to use ICTs in gender-appropriate ways to maximise the impact of their own programmes. We have learned a great deal about what needs to be done. We now need the collective will to apply these lessons learned.

NOTES

1 Lyndsay Green and Lawry Trevor-Deutsch, *Women and ICTs for Open and Distance Learning: Some Experiences and Strategies from the Commonwealth* (Vancouver: Commonwealth of Learning, 2002). Hilton cites the most important factors as geography, poverty, culture and health in Eliza Hilton, "KnowledgeBank paper 2 – Girl Issues"(2002), *http://imfundo.digitalbrain.com/imfundo/web/learn/kb2/?verb=view.*.

2 Mildred M. Wakumelo Nkolola, "Interactive Radio Instruction in Zambia," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
3 Edith Mhehe, "Overcoming Gender Barriers When Using ICTs for Formal and Non-Formal Education," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003. Some of the benefits Dr. Mhehe envisions for women students: "They could more easily communicate with the world around them and open up their minds to the world beyond their home base and outside their culturally defined roles. They could discuss issues with both male and female peers and tutors anywhere in the country without having to travel or meet physically. They could spend less time, money and effort searching for library based study material, particularly important since their lives are already overloaded. They would be less isolated which is a significant dropout factor. They could assist their children and others in the community to learn how to use ICTs."
4 See note 1 above.
5 Subbiah Aruchalam, "Reaching the Unreached", How Can We Use ICTs to Empower the Rural Poor in the Developing World Through Enhanced Access to Relevant Information? presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
6 See note 1 above. A sample quote from a female student: "We are no longer dependent on boys. We feel capable of solving our problems with great autonomy...that is powerful. It makes us very proud."
7 Michael Olsson, "Institutionalizing Radio Science in Papua New Guinea: A Response to Teacher Demand for Interactive Radio Instruction," *Learntech Case Study Series* 2 (1994).
8 For an online version of the CD-ROM entitled *Rural Women in Africa: Ideas for Earning Money* go to *www.iwtc.org/files/!start.html*. See Green and Trevor-Deutsch, note 1 above.
9 Namrata Bali Chandramohan, "SEWA Experiences on ICT," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
10 Kimberly Dawn Blum, "Gender Differences in Asynchronous Learning in Higher Education: Learning Styles, Participation Barriers and Communication Patterns," *JALN* 3 (1999).
11 Eighty per cent of the women students of the University of the South Pacific (USP) indicated a lack of computer literacy and appropriate training to be a barrier to their use of ICTs for ODL. A Bangladesh survey of women professionals found that 60 per cent had no exposure at all to computers, and the computer knowledge of the remaining 40 per cent was limited to word processing. See Green and Trevor-Deutsch, note 1 above.
12 Hilton, cited in note 1 above, notes the importance of "hands-on" experience, and that boys often dominate classroom interaction around ICTs and act as "experts" for the teacher, thereby reinforcing a gender stereotype.
13 The importance of the role women teachers can play in balancing gender disparities is acknowledged in government education policies in some regions. For example, the Ministry of Education in Zambia has committed itself to ensuring that every school employs some female teachers to provide appropriate role models for girls. See Green and Trevor-Deutsch in note 1 above.
14 Seema Suri, "Attitudinal Barriers Amongst Teachers in Distance Teaching Institutions of India," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
15 Dato' Zawiyah Baba, "Women on the Web: An Evaluative Survey of Websites on Women with Special Reference to Malaysian Websites," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003. There are more than 50 Malaysian websites concerning women covering the following topics: women and family, violence against women, women in business, women professional, religion, gender equality and politics.
16 See note 5 above.
17 Constantine Obuya, "Bringing African Women's Voices 'On-line," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
18 Angela Nakafeero, "Experience of Women of Uganda Network (WOUGNET)" presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
19 Yumie Nishimori, "Japanese Efforts for Disadvantaged Women and Women in Rural Areas," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
20 Kio Chung Kim, Leelangi Wansundera, and YongJa Kim, "ICT related Human Capital & Women's Informatization of Asian Countries: China, India, Indonesia, Korea, Philippines, Sri Lanka," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
21 See note 20 above.
22 See note 20 above.
23 See Hilton in note 1 above.
24 Gan Siowk Lee and Rinalia Abdul Rahim, "Barriers to Information and Communication Technologies Encountered by Women: Country Presentations – Malaysia" (Vancouver: Commonwealth of Learning, 1998).
25 For example, see UNDP's Guidance Note on Gender Mainstreaming at *www.sdnp.undp.org/gender/policies/guidance.html*.
26 For example, Grameen Telecom's Village Phone programme in Rural Bangladesh found that the concept of "universal access" is not gender neutral. The gender of the Village Phone operator and the physical placement of the phone can either inhibit or improve women's access to phones. A woman's home provides a space that is acceptable for other village women to access. See Green and Trevor-Deutsch in note 1 above.
27 Sara Kyofuna, "It is HOT for African Girls," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
28 Andrea Rugh, "Lessons Learned From the USAID Girls' Education Activity in Guatemala, Morocco, and Peru," (American Institute for Research, 2002). The Girls' Education Activity project ran from 1996 to 2001 with the goal of improving the overall school participation rates of girls in primary school in Guatemala, Morocco, and Peru. One of the lessons learned was the importance of supporting a group or individuals within (instead of outside) local institutional structures to pursue the goals of girls' education.
29 Examples include the research project on the ICT status of six Asian countries, WENT and GEM.
30 For an example of guidelines, see "Gender Guidelines for ICT and Education Policy Making and Planning" in the report *Gender Issues in the Use of Computers in Education in Africa* by Helen Derbyshire, January 2003. *http://imfundo.digitalbrain.com/imfundo/web/learn/genderissues/*
31 See Green and Trevor-Deutsch in note 1 above.
32 Uma Coomaraswamy, "Barriers to Information and Communication Technologies Encountered by Women: Country Presentations – Sri Lanka," (Vancouver: Commonwealth of Learning, 1998).
33 See note 5 above.
34 Ashabunnaher Beauty, "Bangladesh Country Report," presentation to Asia Pacific Latin America Government Women's ICT Training (APLAW-IT), Seoul, Republic of Korea, July 2003.
35 Phon Puthavika and Prak Sophear, "Royal Kingdom of Cambodia Country Report," presentation to Asia Pacific Latin America Government Women's ICT Training (APLAW-IT), Seoul, Republic of Korea, July 2003.
36 See note 28 above. Another lesson learned from the USAID Girls' Education Activity is that effecting changes in the school participation of girls requires attention both to the national policy level and to the organisations that can affect the local community level where impacts occur. One without the other dilutes the impact.
37 The current policy groups women with "the disadvantaged, the disabled, under-represented minorities, and those in rural and remote communities." They recommend that future policy give women a separate category of their own. See Green and Trevor-Deutsch in note 1 above.
38 See note 20 above.

39 Research carried out on the Information Village project in Pondicherry found that offering computer training for women and children in the knowledge centre at the local village meant that more women and children were able to avail themselves of the training. Local access ensures the safety of the learners because it was not necessary to travel to distant towns, as well as saving time and money. See note 5 above.
40 See Green and Trevor-Deutsch in note 1 above.
41 See Green and Trevor-Deutsch in note 1 above.
42 See Green and Trevor-Deutsch in note 1 above.
43 Nasaruddin Che Abu, "Empowerment Through Community Development," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
44 See note 34 above.
45 Di Das, "Computers in Homes in New Zealand: Addressing gender and culture issues through ICT," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003. Cultural prohibitions make it unacceptable to attend night classes and women are caring for children during the day, but it is acceptable to visit their children's school for evening meetings. The schools run videos in the library to keep the children occupied.
46 Esther Batiri Williams, "Crossing Borders: Women and Information and Communications Technologies in Open and Distance Learning in the South Pacific," (Vancouver: Commonwealth of Learning, 2001).
47 For a discussion of the shortcoming of mainstream training methods for women, see *Gender & information & communication technology: Towards an analytical framework. www.apcwomen.org/work/research/analytical-framework.html.* See Green and Trevor-Deutsch (note 1 above) for more suggestions about gender-sensitive training for ICTs for ODL.
48 One of the recommendations from the Kuala Lumpur Declaration August 2003 is to "introduce ICT into the school curriculum at the earliest possible opportunity, ensuring equal access to all." Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
49 Professor Uma Coomaraswamy of the Open University of Sri Lanka also recommends "girl-friendly" computer labs and finds that "when interacting with technology, girls tend to work better in pairs or small groups." In addition, she has found that the visibility of women graduates has been one of the most positive impacts on women. See note 32 above.
50 See note 14 above.
51 Nancy Taggart and Chloe O'Gara, "Training Women for Leadership and Success in I.T," *TechKnowLogia*, September/October (2000). *www.TechKnowLogia.org*.
52 The workshop was organised by Global Knowledge Partnership (GKP), OneWorld South Asia and Panos South Asia (Nepal). There were 12 participants from Pakistan, Bangladesh, Bhutan and Nepal. Another workshop targeted at participants from India, Sri Lanka and Maldives will be held in November 2003 in Bangalore. *www.globalknowledge.org/gkps_portal/index.cfm?menuid=338*.
53 Polly Gaster, "Promoting ICT Use by Women: Some Experiences from Two Districts of Mozambique," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
54 M.J. Asmita, "Marathmoli, Maharashtra Women's Net," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August, 2003.
55 The recommendation is made to train women leaders because they are catalysts and agents of change. They may include local leaders, extension workers, community development workers, NGOs, and media practitioners. See Green and Trevor-Deutsch in note 1 above.
56 WENT Africa 2003 was held in Cape Town, South Africa in March and was directly modelled on the Asian women's training, providing an excellent example of South-South collaboration.
57 Kio Chung Kim, "ICT For Women: Opportunities and Challenges," presentation on behalf of Dr. Kyungsook Lee at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
58 Jaclyn Kee, "Overcoming Gender Barriers When Using ICTs for Non-Formal Education," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
59 Natasha Primo, "Overcoming Gender Barriers When Using ICTs for Non-Formal Education – The Women's Net Experience," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
60 Online Learning Center (OLC) for Women at *www.apolc.org* has created an online community for ICT Trainers. See note 20 above.
61 See note 59 above.
62 See Green and Trevor-Deutsch in note 1 above.
63 See note 5 above.
64 See note 54 above.
65 See note 20 above.
66 Revathi Balakrishnan, "Rural Women's Equal Participation in Information Society," presentation at the Forum on ICTs & Gender: Optimizing Opportunities, Kuala Lumpur, 20–23 August 2003.
67 See note 20 above.
68 See Green and Trevor-Deutsch in note 1 above.
69 See note 32 above.
70 See note 53 above. HAWKNet also reports that one of their major challenges is lack of awareness of the benefits that come with ICTs. See note 17 above.
71 Another lesson learned from the USAID Girls' Education Activity is that the media need to be full partners to ensure extensive coverage. See note 28 above.
72 See note 5 above.
73 See note 32 above.
74 See note 27 above.
75 See Green and Trevor-Deutsch in note 1 above.
76 See note 58 above.
77 See note 17 above.
78 See note 5 above.
79 For example, see Hilton referenced in note 1 above.

map of Central and South West Asia

Central and South West Asia

Afghanistan • Islamic Republic of Iran • Kazakhstan • Kyrgyzstan • Pakistan • Tajikistan • Turkmenistan • Uzbekistan

Afghanistan

ICT USE IN EDUCATION

Mr Hilary Perraton, Ph.D

INTRODUCTION

Two decades of war have left Afghanistan battered and impoverished, facing major problems of reconstruction. Among these is the scale of the country's educational needs where even to restore the education service to the state it was a decade ago would leave it miserably inadequate. Planning is also hampered by the shortage of information. Basic data are scarce; there are, for example, no recent figures for primary and secondary enrolment ratios, but 10 years ago Afghanistan's figures were among the lowest in the world. Figures are also not available for telephone, Internet and PC users. (Table 1 illustrates how limited are the data on Afghanistan usually available from international sources.)

Table 1: Basic data on Afghanistan

Indicator	Date	Value
Population [millions]	1999	25.9
GNP per capita [USD]	1999	thought to be low income, $755 or below
Area [thousands km^2]	1999	652
Gross enrollment primary education ratio	1990-91	27.0
Gross enrollment secondary education ratio	1990-1	8.9

Source: World Bank; EFA Global monitoring report.

National policies, strategies and programmes

Afghanistan's recent history means that there has been a flurry of policy-making, much of it co-ordinated and possibly dominated by external agencies with key planning documents being developed outside the country. At this point it is impossible to forecast how far the Afghan government will have the capacity to implement plans that are being developed or how far the international community will fund either the capital or the recurrent expenditure needed to make them a reality.

Early steps towards an Afghan education policy were taken at a meeting of Afghan educators in Peshawar in 2001 with support from UNICEF in "An Afghan Perspective on Education."[1] It set out a series of goals including the development of a national vision for education, the broadening of educational opportunities for all children, especially for girls, recognition of the importance of teachers and the improvement of educational policy-making and management.

Thinking of this kind fed into the substantial "Afghanistan Comprehensive Needs Assessment in Education"[2] developed in 2002 by a team of agencies. It estimated primary gross enrolment ratios of 38 per cent for boys and three per cent for girls, and secondary enrolment between five per cent and 11 per cent. It noted that there were 3.5 million refugees outside Afghanistan and one million internally displaced people within the country. Some 80 per cent of school buildings had been destroyed in the war and Afghanistan needed an extra 43,500 teachers and 13,851 schools. The refurbishment and expansion of schools, measures to encourage children back to school and the expansion of teacher training were seen as priorities. The Assessment makes little reference to information and communication technologies (ICTs) beyond proposals to use radio in a back-to-school campaign and in a child development communication strategy for preschool children.

Policies have been developed for telecommunications. Indeed policy may be ahead of practicality as "Afghanistan has a barely functioning, very limited telecommunications sector" with little capacity outside the main towns of Kabul, Herat, Mazar and Kandehar.[3] With support from the United Nations Development Programme (UNDP), a seminar in Kuala Lumpur in 2002 developed an ICT policy which drew on existing national telecommunications strategy and telecommunications strategy issued by the government earlier in the same year. The seminar identified three objectives to be pursued: the development of ICT networks that would be accessible and affordable to all Afghans, policies for universal access to information and knowledge and improved government use of ICTs. It recognised that attainment of these goals was far off and, among other strategies, proposed arrangements for a national ICT council and arrangements to strengthen training in information technology. Among the groups it identified as priorities were teachers. It also recommended that "government emphasis on IT education in primary and secondary schools should be elaborated."[4]

The national policy documents do not discuss their educational implications in detail. They assume that the private sector will play a major role in the expansion of telecommunications, but require that as a condition of their licence telecommunications operators should contribute to "the achievement of national universal access objectives"[5] while the regulatory commission will identify targets for universal access and encourage the development of multipurpose community telecentres.[6]

Current level of ICT use

Afghanistan has an established educational radio and television service, although these are now reduced to two hours and one hour 10 minutes per week respectively. The government of Italy, with UNESCO, has funded a two-year programme to restore the former educational television headquarters in Kabul and provide new studio equipment (see *www.learningchannel.org/article/archive/1740*).

A seminar, involving both national and international participants and organised by the Ministry of Information and Culture, agreed in September 2002 both that Radio-Television Afghanistan should be transformed into a public service broadcaster and that arrangements should be put in place to license independent broadcasters (*www.unama-afg.org/docs/media/declaration2.htm*). These decisions, coupled with the existing experience of educational broadcasting, mean that Radio-Television Afghanistan may have a significant role to play in education during and following reconstruction. The Afghan delegation reported to a UNESCO meeting in Bangkok in 2003 that its priorities in educational radio and television were to provide teacher training programmes for primary school teachers by radio, with a half-hour programme every day together with a repeat, and to produce a daily half-hour basic literacy course by television. It is not clear from the report how far these proposals fit with Ministry of Education priorities or how they might relate to the work of the British Broadcasting Corporation (BBC). The same report also shows that 1,450 radio receivers are needed for each primary school – a figure that suggests there are no working radios in school at present.

External players are also important in relation to broadcasting. During the Taliban period, the BBC World Service launched an educational radio soap opera which still continues and attracts large audiences (see below). In higher education, international operators including Purdue University in the United States, the Technical University of Berlin and the software company CISCO have announced plans to expand work in computer-based systems in co-operation with Afghan higher-education partners. The CISCO Networking Academy – apparently funded by the European Commission and with UNDP support – is designed to teach computer skills to civil servants, civil society organisations and the general public.[7]

Computer-based work in classrooms is thought to be minimal. There is, however, interest by the international agencies in what might be needed if computers began to be used for education in any significant way. UNDP, for example, with funds from the European Union, has carried out a review of the problems of displaying text in Pashto and Dari on a computer screen, while noting that less than three per cent of the population of Kabul know how to use a computer, with lower figures from other parts of the country.[8]

Major initiatives

"New Home, New Life"

The BBC World Service launched a Pashto service for Afghanistan at the time of the Soviet invasion in 1981. Since then it has developed a series of educational broadcasting activities, calling on the skills of the Afghan refugee population, which are now run through a separate agency, the BBC Afghan Education Projects (BBC-AEP). An educational radio soap opera, "New Home, New Life" (NHNL) was launched in 1994 during the Taliban regime. It continues today and has now been repatriated from Peshawar to Afghanistan.

NHNL was designed to meet educational needs of both refugees and those in Afghanistan. It drew on the understanding of the BBC-AEP Afghan staff and on the specialist knowledge of donor agencies in order to develop educational messages across a range of topics, including repatriation, reintegration of returnees, mines awareness, health, hygiene and sanitation, and conflict resolution. These messages were incorporated into a storyline about the lives of villagers in three fictional villages in Afghanistan.

The soap opera format has proved powerful in allowing the same theme to be repeated in different contexts without boring the audience. People identify with the characters and the storylines, so much so that, for example, BBC-AEP has received many messages from listeners offering to find a bride for the character Nazir, the night watchman. And when listeners gossip about NHNL, they also repeat and reinforce the educational messages in the stories.

NHNL very quickly gained a mass following, mainly because it provided entertainment as well as information and advice. As the crisis in the country deepened, the show became the only source of entertainment for many Afghans – and the only thing that Afghans inside and outside Afghanistan had in common. And it was successful: a survey of 60,000 households undertaken in 1997 found that a dramatic fall in the number of mine accidents after 1994 was due to the impact of mines awareness messages in the soap opera. Around 50 per cent of people interviewed listened daily to the programme. The number of listeners has now risen since 1997, with the overwhelming majority of the Afghan population (including refugees in neighbouring countries) listening in one or both languages.

The success of the soap opera owes much to its use of needs analysis, based on techniques of participatory rural appraisal, which keeps it close to the everyday problems of its listeners' lives. Needs analysis also reveals the kinds of misinformation and dangerous practices, which can be countered through the radio programmes.

Unlike many soap operas in the world, NHNL began to reflect the changing world situation in its output within two weeks of the events of 11 September 2001. As political events developed, it quickly became clear that there was a huge humanitarian crisis in the making in Afghanistan, and that the audience's need for help and advice from a trusted source was greater than ever before.

The programme staff in Peshawar could draw on their personal experiences to anticipate the mass population

movements, which began even before the American bombing campaign in Afghanistan. They were, therefore, well placed to develop practical messages to support and help their audience, such as the importance of taking all documents with them if they fled their homes, the need to keep families together, mines awareness for people moving into foreign terrain, and conservation of food and water supplies. Most importantly AEP also encouraged debate about whether leaving homes and land could be more dangerous than staying behind.

All of these messages began to be incorporated into the soap opera by the beginning of October. Scenes in the programme involved families who arrived in both villages of NHNL, having fled their homes in panic from fear of bombing. These scenes became the vehicle for putting over the kind of practical humanitarian advice needed by Afghan audiences. Initial features developed in response to these contacts included mental health issues, post-traumatic shock syndrome (especially in children), practical information about mines and the need to behave safely, what is needed in an emergency kit, how to build a latrine and sanitation advice.

The overthrow of the Taliban regime made it possible for BBC-AEP to be repatriated to Kabul in October 2002. With its huge following, proven audience impact, use of accessible language and experience of working very closely with its audiences, NHNL remains as a powerful tool for the grassroots reconstruction of Afghanistan.

The original impetus for the soap opera was to help with repatriation of refugees, but the political situation in Afghanistan during the 1990s meant that large-scale repatriation never really got underway. Amongst the kinds of things which it is ideally placed to handle are the reintegration of returning communities, conflict resolution, income generation, and promoting learning and education among adults and children.

The impact of returning refugees on their communities is huge. There are strains on sanitation, water supplies, the supply of necessary commodities and the size of local markets. The radio team is working on programmes that respond to the changed political situation in Afghanistan including a new series on the process of developing the country's new constitution to help ordinary people make informed choices and air their views and concerns about the development of good government. It will also continue to cover critical areas such as mines awareness, health education, vaccination campaigns, veterinary issues and farming advice, as it has always done.

REACH

When the Taliban came into power in 1996, the prohibited education for girls and closed down many boys' schools as well. The BBC responded by planning freestanding radio educational programmes for Afghan children (REACH – Radio Education for Afghan Children). The programmes are designed to encourage active learning in the local environment by suggesting simple activities that children can carry out without help from adults.

The experience gained by BBC-AEP in running its REACH programme for school-age children provides the basis on which the team can plan further educational broadcasts both to support schools and for the large numbers of children outside formal education. The team has identified four audiences as priorities: teachers, medical personnel, farmers and women. They also have a role in capacity-building in radio techniques where they have unparalleled experience in successfully training teams of Afghan broadcasters to a very high standard, including training people with no previous broadcasting or journalistic experience.[9]

Constraints on ICT use

The constraints on ICT use are obvious and severe: a poor, mountainous country with a low density of population and a limited, partly destroyed, communications infrastructure. Along with these practical constraints are educational and linguistic ones. Afghanistan is short of schools and its workforce has a limited background education. If it is proposed to make materials available in the two most common mother tongues, then they will need to be developed or translated, once problems of presenting the script on a screen have been overcome.

Analysis

Afghanistan presents in a severe form the questions facing any of the least-developed countries in implementing a policy for the use of communications to support education and training. It will need to decide at what level in the education and training system any teaching about the technologies themselves should take place. Then, insofar as computer technologies are concerned, it will have to develop a linguistic policy and the emphasis to be placed on local versus international languages.

In broadcasting, experience elsewhere has shown how powerful radio can be in both formal and non-formal education. Given the shortage of trained teachers, radio and print-based distance education may be of particular value for teacher training in Afghanistan; its effectiveness for this purpose has been widely demonstrated elsewhere. The respect in which the BBC's work is held is a major asset on which to build.

NOTES

1 "An Afghan Perspective on Education: Building on the past for the future" (personal communication, 2001).
2 "Afghanistan Comprehensive Needs Assessment in Education: Draft report" (2002), *www.adb.org/Afghanistan/can_educn.pdf.*
3 "National Telecommunications Policy Paper" (Afghanistan Ministry of Communications, n.d.), *www.af-com-ministry.org/policy.asp.*
4 "Information and Communications Technology Policy for Afghanistan: Final Report," developed at ICT Policy Development and Implementation seminar for Afghanistan, Kuala Lumpur, 2002, *www.unesco.org/bangkok/education/act/ict_enabling/main.htm*.
5 See note 3 above.
6 See note 3 above.
7 See "ICT Announcement" on UNESCO-Bangkok website (16 April 2003), *www.unesco.org/bangkok/education/ict/board/news_list.php*
8 See "ICT Announcement" on UNESCO-Bangkok website (11 June 2003), *www.unesco.org/bangkok/education/ict/board/news_list.php*
9 Shirazuddin Siddiqi, "The role of the BBC in the reconstruction of Afghanistan" (unpublished paper, 2003). This section is closely based on Siddiqi

Central Asia:

Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan

ICT USE IN EDUCATION

Mr Hilary Perraton, Ph.D

INTRODUCTION

The five central Asian republics of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan share a common history and face similar problems in developing and reforming their educational systems. All were formerly within the Soviet Union, attained their independence suddenly in 1991 as a result of the breakup of the Union and are now members of the Commonwealth of Independent States (CIS). Despite many differences between them, it is convenient to look at them as a group. Basic data are set out in Table 1.

Table 1: Basic data on on the five republics

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Population (millions) 2002	14.9	5.0	6.4	5.8	24.4
GNI per capita (USD) 2001	$1,350	$280	$180	$950	$550
Area (thousands km2)	2,717	199	143	488	447
Population density: people per km2	6	25	44	10	59
Net enrolment ratio - primary education 2000	88.7	82.5	102.6	n/a	99.6
Gross enrolment ratio – primary education 1999-2000	96.2	101.6	104.6	n/a	n/a
Gross enrolment ratio – secondary education 1999– 2000	87.0	83.0	76.0	n/a	n/a
Phone subscriber per 100 people 2002	15.7	8.8	3.9	8.2	6.9
Internet hosts 2002	16,562	5,930	302	2,020	213
Internet users per 10,000 people 2002	93	298	5	17	109
PCs per 100 people 2002	n/a	1.3	n/a	n/a	n/a

Source: World Bank; EFA Global monitoring report; ITU statistics; ADB statistics.

These are landlocked countries, dominated by deserts and mountains, and with low densities of population. Economically, the five countries were part of the single Soviet system so that economic planning and decision-making was based on their role within that system. The resulting economic policy might just be defended within a command economy of a colossal state like the Soviet Union, but it was quite unfit to the needs of newly emerging states. Just one illustration is the over-emphasis placed on cotton cultivation, which had a severe environmental impact. There were some bizarre results of the state economy as well: Kazakhstan, for example, was left with a cosmodrome from the heyday of the Soviet space programme.

The development of new economic policies, with implications for education, was complicated by tensions within the region, reaching the level of civil war in Tajikistan, and by the high levels of emigration, especially of middle-class, well-educated Russians, the so-called *pieds rouges*.

In working through the period of post-Soviet transition, all five countries have had to respond to similar pressures. As one Russian commentator argues:

> The all-union "mechanism" was fundamentally different from a self-regulated market economic system, which in this context may be described as an "organism." The naively criminal attempt to transform the "mechanism" into an "organism" in one stroke by the universal total implantation of a totally new economic system made the destruction of the [former Soviet] united space unavoidable, resulting in economic catastrophe in the CIS countries. The most serious effects were felt not in Russia but in the weaker parts of the "mechanism," the Central Asian states.[1]

Independence thus meant that the new countries had to establish new economic structures and look for new economic links and trading partners, while at the same time seeking to establish their national identity and culture. Economics, culture, history and religion all had potential roles to play in transformation. For practical reasons, Central Asia soon began again to look to Russia; for reasons of history, language and culture countries they looked to Iran and Turkey; for religious reasons they looked to the rich Islamic states to the south; and as part of the move away from communism they looked to the West. Uzbekistan, for example, established new links with Turkey, Vietnam, India, France and the United States and succeeded in establishing

joint economic projects with China and, in principle, with Pakistan. Perhaps as significant, after earlier disputes, it re-established economic links with Russia.[2]

This reaching out may have begun a process of economic change to match the political transformation, but it has had limited short-term success. The CIS has proved a weak organisation and does not have the capacity to promote major economic change or co-operation. "The cousins of the Central Asian people in Turkey and Iran proved too weak economically to serve as locomotives of development, the brethren-in-faith in the rich Arab countries were in no hurry to share their wealth with remote northern relatives, and the West and the Asian tigers preferred to invest only in lucrative enterprises such as mining, metallurgy, telecommunications and car assembly plants."[3]

One part of the solution to the region's economic problems may lie in co-operation within the region, leaving politicians with the demanding task of promoting at one and the same time regional co-operation and a new national identity. But there are no simple answers to questions about the culture, the politics and the economics which the education system should serve, or about the framework within which educational decisions are to be taken. Decisions about language, for example, are fundamental to education and reflect the complexities of the region. Kazakh, as one illustration, was originally written in Arabic script which was replaced by a modified form of the Roman alphabet in 1930, only to switch to Cyrillic 10 years later. Kazakhstan is reported to have switched again, back to the Latin alphabet, but has applied this policy unevenly. "The difficulties experienced in establishing new alphabets may be seen as metaphors for the obstacles that pave the way for Central Asia as it attempts to define its new position, resolutely modern and freed from the constraints of the old Russian tutelage."[4]

It is not surprising that poverty dominates. The *Economist* reports how the whole region got poorer after the collapse of the Soviet Union. More than 80 per cent of the population fall below the official poverty line in Tajikistan and 17 per cent live on less than US$ 1 a day. The proportion of poor people in Kyrgyzstan hovers around 50 per cent. In Kazakhstan as a whole, nearly 25 per cent of the population are below the poverty line, while on the shores of the Caspian Sea the figure rises to 95 per cent.[5]

Despite all that they have in common, the differences between the countries are striking. Kazakhstan, the richest country in the region, is huge, the fourth-largest country within Eurasia, exceeded in area only by Russia, China and India. Much of it is semi-arid steppe but with important industrial areas in the northeast, where industry was most easily integrated with the rest of the Soviet Union. It has reserves of oil and natural gas, which made up over a quarter of GDP in 2001. Kazakhstan is described as multi-ethnic, with Kazakhs forming a plurality but not a majority of the population.

Kyrgyzstan and Tajikistan are smaller and poorer mountainous countries with limited mineral resources. Agriculture is still a dominant feature of the economy in Kyrgyzstan while Tajikistan was the least industrialised of the Soviet republics. Both countries export labour to Russia and Kazakhstan. They have high levels of debt and dependence on foreign aid. Tajikistan is still recovering from its civil war with a reported 100,000 dead and 700,000 homeless.

Turkmenistan is dominated by desert, with a small population and a low density of population. Its oil and gas reserves make it relatively wealthy within the region. Like Kazakhstan it has a relatively high rate of urbanisation. In Uzbekistan, in contrast, the primary sector is dominated by the rural population and only 38 per cent of the population is urbanised. It is self-sufficient in natural gas, has some mineral reserves and a significant industrial sector.

The five countries' Soviet inheritance means that all have a well-established educational system with high levels of literacy and high enrolment ratios at all levels. Central Asian education benefited both from an ideological commitment to raise the standard of education and from the relatively high proportion of GNP spent on education in the Soviet period.

Upon independence, the countries responded in a similar way in restructuring education. All of them reduced the length of compulsory education from 11 to nine years, allowed private education, sought to use local languages as the medium of instruction and began introducing fees, particularly for higher education. All also tried, with varying success, to decentralise educational decision-making, although in some cases this policy was rapidly reversed.[6] The countries now share a similar educational structure with 10 years of schooling organised in a 3 + 5 + 2 structure with a three-year primary cycle, followed by a five-year junior-secondary cycle and a two-year upper-secondary cycle, sometimes provided in a number of different types of school. Uzbekistan is now moving to 12 years of compulsory education, with the final three years either academic or professional.

The figures show that there have been declines in enrolment at most levels of education since transition. UNICEF comments, for example, that the situation in Kyrgyzstan "appears particularly alarming, with significant falls apparently taking place in enrolment rates at the primary level, as well as at lower-secondary level. Taking both levels together, the data appear to show that about one in seven children of compulsory age are not enrolled in school in several countries in Central Asia."[7] And a conclusion drawn by International Institute for Educational Planning (IIEP) eight years ago still seems to hold true: "Social demand for education, which was previously guaranteed by the state and satisfied at all levels of education except higher, but including continuing and non-formal education, can no

longer be met due to the economic and financial stringency of the transition period."[8]

National policies, strategies and programmes

Strategies can be distinguished at two levels: for the CIS as a whole, of which these states are members, and for the five separate countries. It is useful to examine how far policies have been adopted for the communications sector generally, and for information and communication technologies (ICTs) within education.

On the dissolution of the Soviet Union, the CIS countries agreed to share information technology resources relevant to research and education developed within the Union or among the member countries. Agreement was reached in 1992 between Azerbaijan, Russia, Armenia, Belarus, Ukraine, Moldova and the five central Asian republics. However, despite all good intentions, 90 per cent of the formal agreements made by the CIS have not been implemented.[9]

A review undertaken by the UNESCO Institute for Information Technologies in Education (IITE) provides some data on policies in four of the countries. (Their review did not include Turkmenistan.) Table 2 reproduces their data.

The IITE review did not consider the content of this documentation and it is not possible, therefore, to say how far these policies reflect, and are taken account of within, national policies in relation to ICTs. The picture they give, which is consistent with other information, is of Kazakhstan and Uzbekistan, the richest countries in the group, having gone further than the others in the development of policy. The general emphasis seems to be on secondary (and probably senior secondary) education. Development of curricula has gone ahead. Only in Uzbekistan is there a particular reference to the use of the Internet.

Alongside national policies there have been individual initiatives, many of them launched from outside the region, to promote or support the use of ICTs especially in higher education and for training. In all five countries, for example, an American Internet Access and Training Program (IATP) is aimed at people who have studied in the United States and returned home; it also aims to provide training in ICTs to professional groups that include educators. It runs some training programmes as well as providing access to the Internet (*www.iatp.uz/about.htm*).

In terms of national policies on broadcasting, the region gives a consistent picture of radio and television remaining dominated by state broadcasting corporations. With the exceptions of external broadcasters, such as the BBC and Voice of America which both have transmitters in Kazakhstan, the radio stations listed in the *World Radio TV*

Table 2: Government documents on ICTs in education

	Policies up to 2002	Policies from 2002
Kazakhstan	• Education Law No. 3904 adopted 7 June 1999. • The government programme of the President of the Republic of Kazakhstan, ICT Application in Secondary Education Systems, approved by Presidential order no. 3645 on 22 September 1997. • The government standard of information education (grades 7-11). Curriculum on Informatics (7-11 grades).	• The government programme for secondary education in the Republic of Kazakhstan (2002-4). • The information integration programme for elementary and secondary vocational institutions in the Republic of Kazakhstan. Approved by RK government resolution No. 616 on 10 May 2001.
Kyrgyzstan	• Curricula, syllabi and a draft of government educational standards for Informatics. • Curriculum approved by Kyrgyzstan' s Education Ministry.	• KR Government resolution No. 697 titled Approval of the Information and Communication Technologies Development Programme in the Kyrgyz Republic (8 November 2001).
Tajikistan	• Development and incorporation of new ICT into the education system. Computerisation of information processes in education management.	• A co-ordinated plan on complex education issues (2001– 10). • Official statement ordering the analysis of ICT efficiency in education, approved by the Education Ministry and the Academy of Sciences.
Uzbekistan	• Education Ministry Resolution No. 230 (2 May 2001). • The Computer and Information Technologies Programme for 2001– 05, aiming to provide extensive access to the Internet.	• Education Ministry Order No. 237 (29 June 2001) to create the New Information Technologies Centre.

Source: UNESCO-IITE 2002, Appendix 8.

Table 3: ICT school use in Central Asia

	Kazakhstan	Kyrgyzstan	Tajikistan	Uzbekistan
Percentage of schools with computer classrooms	100	66	11	46
Percentage of computers which are IBM or Apple compatible	95	4	4	8
Students per computer	62	57	48	100
Percentage of schools with Internet access	0	0	2	0

Source: UNESCO-IITE 2002 diagrams 2,3,4,7

Handbook 2002 appear to be entirely state broadcasters, although this may conceal a measure of privatisation. The same picture emerges in relation to television, although in much of the region there are also relays from Russia, Turkey and Iran. Post-Soviet transformation appears to have produced only partial shifts away from government control. Internews, an Internet news service funded by USAID, reports that in Kyrgyzstan a widening of ownership of stations in the 1990s was followed by a narrowing and a concentration in the hands of those close to government.[10]

There have, however, been some moves towards using television for informal education about the values of the new society. Building on the strengths of Kazakh cinema, a Kazakh-British co-production *Crossroads* (*Kavusahi* in Kazak) has attracted large audiences for programmes that look at the problems of working in the new style economy, and successfully fought the competition from Russian and American sitcoms.[11]

In Uzbekistan plans are underway for a series of radio dramas, the Silk-Road Radio Soap, which will address issues of health, agriculture and contemporary national issues. (UNESCO, in reporting on it, carefully avoids saying whether it will address trickier issues including AIDS and politics.) The programmes are apparently made in both Uzbek and Tajik and for use in Uzbekistan and Tajikistan (*www.unesco.org/bangkok/education/ict*).

The continuing public control of broadcasting gives countries the means, if they have the will and can find the finances, to use broadcasting for education.

Current level of ICT access and use

The IITE survey referred to above makes it possible to summarise the extent to which four countries of the region are using ICTs in the classroom. Although the title of the survey refers to secondary education, the text refers to computer use in schools at all three levels. It is, however, possible that the survey respondents treated the IITE questionnaire inconsistently. With those cautions, the survey gives the picture set out in Table 3.

It seems reasonable to assume that Kazakhstan interpreted the enquiry as referring to one group of its schools (possibly those with senior secondary classes only) as the logistics of equipping all its rural schools with computers would be forbidding. The study did not make it possible to distinguish between the use of a single computer for management purposes, and it is possible that some of the computers revealed by this survey were used in the office rather than in the classroom. The survey reports that the majority of Uzbekistan computer classes have programmes for elementary classes and that, where information was supplied, most of the software was developed by domestic specialists.

Reflecting the low densities of population and restricted national telephone systems, the Internet is irrelevant to basic education in Central Asia. Indeed, Kyrgyzstan notes that Internet access has become more difficult than it was since the winding down of a Soros Foundation project which was exploring the potential for the use of the Internet in the region.[12]

There may be potential to use a range of technologies for the updating or retraining of the teaching force. Distance education techniques have been widely used for this purpose, sometimes in countries in transition like Mongolia and South Africa, though more rarely in the former Soviet bloc. Uzbekistan is developing a distance education programme for secondary teachers within the context of its reform of secondary education. The UNESCO Institute for Information Technologies in Education is reported to be holding a workshop on this topic in Tajikistan in October 2003, which may shed light on the opportunities and constraints.

The picture that emerges is one in which governments, moved perhaps by a quest for post-Soviet modernisation, perhaps by middle-class pressure, perhaps by international enthusiasms for ICTs in education, have been compelled to frame policies and to begin bringing computers or informatics into the curriculum. With the exception of Uzbekistan, and like most of the other CIS states, computers are not expected to be a support for other subjects in the curriculum.[13] Rather, they seem to have been used for teaching *about* ICTs. But they are being used on a very modest scale, probably with cottage-industry software, and often with obsolete hardware. With all the other pressures

on the educational system this is hardly surprising. The relative insignificance of ICTs within the context of educational transformation is symbolised by the fact that the two country papers from Central Asia produced for the International Bureau of Education 2001 biennial conference barely mentioned the technologies in their analysis of the educational problems.[14]

Major initiatives

Computers in Schools in Kyrgyzstan

Kyrgyzstan's exploration of the use of computer-based technologies in schools probably reflects experience more generally. As already noted, Kyrgyzstan inherited a sound educational system from the Soviet Union and sees itself as the leading CIS state in the reform of education. As far back as 1995 it developed a national ICT programme which included an educational element, but this was only partially implemented because of shortage of funds. In 1996 the mass computerisation of schools began with funding from the Asian Development Bank with some 100 kits, each with 12 work stations in a local network being provided to schools. Over the next three years, the number of computers in schools expanded as with donations either by foundations or by the private sector. Active steps were taken to expand this process in 2000 with a further 1,450 computers provided with Ministry of Education and foundation funding. It seems, however, that expansion was more rapid between 1996 and 2000 than in the period 2000–2003. The result of this apparently piecemeal development is that in middle and senior secondary schools there is now one computer for every 240 students, but that ratio worsens to only 1:971 if you remove from the equation all the outdated, incompatible Soviet-era computers.

Originally, there were attempts to distribute computers evenly throughout the country, but because of donations and one-off initiatives, distribution has become more random and uneven. Only about 21 schools had Internet connection in April 2003, and the use of the Internet has declined since the end of a Soros Foundation programme that was exploring the use of the Internet for communication and development in the region. There are four main reasons for the restricted development of Internet use: the telecommunications infrastructure is limited, ISPs are not available in rural areas, costs are high and senior staff in schools are not persuaded of its value.

The expansion of computer use in the classroom generally is constrained by a number of factors. First, there is a shortage of teachers with an appropriate specialty. Nor are there technical and support services for schools. There is also a lack of an appropriate qualification structure for these teachers; a training system was included within the ADB project but not funded. In fact, in 2002–03, there were only 1,345 teachers of informatics in 2,029 schools which included 1,694 middle schools. Meanwhile few teaching materials are available in Kyrgyz and available software, for example about programming and algorithms, does not match the demand.

The Kyrgyz government now does have programmes which it would like to see developed in 2003-07 but these are dependent on funding. It would like to put 7,000 computers into schools, but at US$ 500 per computer this would require US$ 3.5 million for the computer hardware alone. Access to the Internet would require considerable recurrent expenditure, on top of that required for other uses of computers, estimated at US$ 1.2 million per annum if 1,700 schools were connected.

A project for an educational management information system appears to be making only slow progress.[15] A review, conducted under the auspices of UNDP, sets out priorities for developing the country's information technology outside the schools. In considering human resource development it argues for the need of the systematic education of senior government officials, improving educational management systems and the development of an Internet educational portal. By implication these moves are needed earlier in developing national readiness for the wider use of the technologies than school-based programmes.[16]

Two general conclusions follow from Kyrgyzstan's experience and appear to be reflected elsewhere in the region. First, the use of computers in schools has been heavily dependent on external funding so that the pace of change has in part been a function of aid policies of agencies like the Soros Foundation and the Asia Development Bank. (This may well be a contrast with the educational use of older media such as radio.) Second, some early developments relied on hardware and software that were incompatible with the international standards which market forces have more recently been imposing. Old Soviet computers and software to teach programming skills do not fit with demands from learners or employers today.

Distance Education in Kazakhstan

The government of Kazakhstan, in co-operation with the UNESCO Institute for Information Technologies in Education, has set up a pilot project of distance education for middle schools. The project was launched in 2001 with six schools in two districts of the country. It is now reported to involve 68 schools in the western district, 43 schools in the eastern district and 326 schools in the Pavlodar district in the more industrialised northeast of the country. The project has required the installation of some five to 10 computers in each school together with lecture rooms equipped with television. It appears to be designed, at least in part, for real-time interaction with specialist teachers, although it also looks ahead to tapping resources from Moscow through the Internet.[17]

Backwards and Forwards with the Internet in Uzbekistan

The UNDP began supporting Internet development in Uzbekistan in 1996 and continued to do so for some years, alongside other donors. The Internet was, however, seen by some politicians as a potential threat. This led the government in 1999 to make the state-owned operator of the national data communication network the sole operator of the national network with a monopoly on access to the Internet backbone. Funding agencies, including the Soros Foundation and USAID, withdrew their support. UNDP has, however, continued to work and has work in hand which includes training about ICTs for those working in small and medium enterprises.[18]

But politics changes priorities and USAID has come back into Uzbekistan with a set of projects which includes the Internet Access and Training Programme (IATP) referred to above and a "computers for schools" project. This project is run by an American non-governmental organisation (NGO) IREX (International Research and Exchanges Board) and has installed an average of 10 personal computers in each of about 100 primary and secondary schools throughout Uzbekistan, with funding from USAID which has a new priority "on education and youth in Central Asia." IREX reports that when the computers are fully deployed, 10,000 students a day will have access to the Internet (*www.irex.org/programs/uxc.index.asp*). While their website reports do not discuss the aims of the project beyond a general concern with fostering democracy and internationalising education, the reference to the Internet suggests that connectivity, probably alongside teaching of informatics rather than the use of computers within the curriculum, is central to the project.

Public Education and Information through the Internet in Tajikistan

Despite the technical constraints, agencies are beginning to use the Internet for public education in Central Asia. In Tajikistan, for example, IATP has put on its server a website about tuberculosis, which is a major health problem in the country. The site was created by five medical professionals in Dushanbe and was initially designed to provide information to the medical profession (*http://irex-tj.org/~dots*). IATP report that, "The participants initially created a Russian-language version of the website because Russian is universally understood by doctors in Tajikistan and the Eurasian medical community at large. Plans are underway to translate the website into Tajik, a difficult task given the lack of medical terms in the Tajik language, but an important one for making the information more accessible to patients. The committed group of participants continues to work on the project, planning to add information about the treatment facilities of various hospitals and links to relevant web resources. As treatment methods advance, so will the website." (*www.irex.org/programs/iatp/news/2003/01003-ca.asp#web*).

The University of Central Asia

The university has been established by the Aga Khan Foundation and has its first campus at Khorog in Tajikistan. It plans to open campuses in Kyrgyzstan and Kazakhstan. The university's main purpose is to provide education relevant to the needs of mountain people so that the theme of development in high mountain areas is central to its work. Alongside its degree-level work the university has, from its initial planning, also been interested in the development of community education. Taking account of the scattered nature of its audience it is also committed to the use of appropriate distance education technologies and has been exploring what these should be. While the university is only in its early days, it could become of major significance not only for the courses it is running but also for its exploration of their methodologies.

Soap Opera in Tajikistan and Uzbekistan

As noted briefly above, a Silk-Road Radio Soap builds on regional traditions of storytelling to discuss current issues in a twice-weekly radio drama series, produced and transmitted in Uzbeki and Tajik. The programmes are externally funded and have had support from UNFPA, UNESCO, UNODCCP and UNHCR together with the British government. Some 200 episodes have been completed and a comic-strip version is published in Tajikistan and Uzbekistan. Studio and airtime are provided free by Tajikistan and Uzbekistan.

Evaluation reports on the series have not been located, but UNESCO notes that:

> The themes dealt with in the radio dramas can be grouped in three categories, in accordance with the priority areas of the main funding agencies: family and reproductive health, agricultural themes and contemporary national issues such as humane and considerate treatment of displaced and underprivileged groups in society, ethnic harmony and tolerance in society and trafficking of women. New themes are constantly surfacing, in the light of ongoing needs assessment, consultation with stakeholders and audience research. These are incorporated in the radio drama storylines and scripts, through existing and developing characters and scenarios. In this way, the Silk-Road Radio Soap continues to be a medium for effective contemporary education, while also drawing attention to current, topical issues (*www.unescobkk.org/education/ict/v2/info.asp?id=14355*).

Constraints on ICT use

The major constraints on ICT use in these countries follow from their economics, their geography and their history, discussed briefly above. Assessments of e-readiness make it clear that the countries face major difficulties which need to be overcome in hardware, software and training in seeking to expand the information technology sector in the economy.[19] Constraints on educational use inevitably follow.

There are also potential constraints arising from questions of language and of alphabet. These are not likely to be serious at the higher levels of education, provided Russian or English is used. These remain the dominant languages of international trade and are apparently widely used in the government and private sector within the region, so language may not be a constraint on the use of the technologies in training and in relation to employment. Any proposals to use computer-based ICTs with small children or for non-formal education – which might well fall on other grounds – would need to take this into account. But any move to the increased use of national and local languages, rather than Russian or English, adds another layer of problems to computer-based activities.

Analysis

The development of the use of the technologies in education needs to be seen in the context of the process of transition which has dominated Central Asia over the last decade. The reduction in funding for education, which followed the collapse of the Soviet Union, has meant that educational innovations of many kinds have depended on external funding. A partial dependence on Moscow and on the richer parts of the former Union has been replaced by a reliance on the shifting policies of the aid agencies. External funding is, for example, a dominant theme in each of the illustrative projects discussed above. The evidence also suggests that a number of the agencies have moved away from an earlier interest in the use of computer-based technologies in school. The Asian Development Bank and the Soros Foundation, for example, have previously funded work in these areas but are no longer doing so. The Aga Khan Foundation, which funded early work on the use of computers in schools, in Kenya for example, does not appear to have this as a priority today. With the exception of the Silk-Road radio project, there does not seem to have been external support, or dramatic endogenous interest, in the use of radio despite its technical advantages for a region. With GNP per capita of less than US$ 1000 in four of these countries, the expansion of the use of ICTs in education looks as if it will remain dependent on external support.

That support in turn will depend on achieving clarity of purpose which does not seem to be present in much of the reported thinking and discussion from the region. Accounts of the use of computers in school, for example, do not specify why this is seen as desirable. Insofar as one can infer from the documentation, computers are seen as desirable in some cases in order to teach informatics, in others to allow access to the Internet. In contrast, there is little discussion of their use within the curriculum more generally, or within the process of educational reform, or simply for children to acquire basic skills in word processing or the use of spreadsheets. One consequence is that the shortage of specialist teachers of informatics is seen as a major constraint on development. A further consequence is that there seems to have been little informed discussion about the level in the educational system at which it makes sense to invest in the technologies or the extent to which vocationally oriented education in this area belongs properly to the publicly funded sector of education, or the publicly or privately funded training sectors.

Generally, Central Asia gives the understandable impression of being outside the mainstream of thinking about the roles of the technologies in education and distance education. The CIS republics, including Russia itself, rejected the Soviet Union traditions of distance education, which were overly dependent on print but had solid achievements to their credit and had worked out firm links between education or training and employment. But, having abandoned those approaches, at least some of the new thinking about distance education, as in the schools project in Kazakhstan, seems to be based on assumptions about the value of real-time, technology-based teaching at school level and of the use of master teachers in the television or computer classroom – a model which has been severely criticised and often failed to survive where it has been tried elsewhere. Other plans, including those for higher education in the region, are dominated by discussion about high-technology approaches in contrast to those widely used in, for example, the major Asian open universities. For poor and remote countries which have abandoned the educational traditions and practices of over half a century, there is a real danger of adopting currently fashionable approaches in a hurry.

What is needed is hard-headed analysis of the case for and against using the technologies in education backed by a critical analysis of successful and unsuccessful experience elsewhere. The encouraging feature of the literature from Ministries of Education in these countries is their apparent scepticism about the technologies and their proper concentration on the important jobs of improving and expanding education.

Two gaps: First, there is little here about the use of computers to help in the management of schools or of educational systems, and of their significance in any decentralisation of education. Second, again, radio seems a medium which was seen as powerful in the Soviet period, but which would seem from the literature to be suffering comparative neglect today.

NOTES

1 A.M. Vassiliev, *Central Asia: Political and economic challenges in the post-Soviet era* (London: Saqi, 2001), 16.
2 G.R. Capisani, *The Handbook of Central Asia* (London: Tauris, 2000), 85-6.
3 See note 1 above, p. 271.
4. Jean Radvani in Capisani. See note 2 above, pp. xi-xii.
5 "At the Crossroads: A survey of Central Asia," *Economist* 26 July 2003.
6 I. Kitaev, ed., *Assessment of Training Needs in Educational Planning and Managements (with special reference to Central Asia* (Paris: UNESCO/IIEP, 1995), 8,15.
7 UNICEF, "Education for all? (The MONEE Project, CEE/CIS/ Baltics – Regional monitoring Report 5)" (Florence: UNICEF International Child Development Centre,1998), 23).
8 See note 6 above, p. 9.
9 See note 1 above, p. 26.
10 "Television and Radio Companies, Operating in the Republic of Kazakhstan," *Internews* March 2003, *www.internews.kz/eng/ stations.*
11 See note 2 above, p. 68.
12 National Commission for UNESCO, Kyrgyzstan 2003, unpublished report.
13 "Basic ICT usage indicators in the Baltic and CIS states" (Moscow: UNESCO Institute for Information Technologies in Education, 2002), 14.
14 N. Bekturganov, "On the Development of the System of Education in the Republic of Kazakhstan, IBE conference paper (Ministry of Education and Culture of the Kyrgyz Republic, 2001), *www.ibe.org.*
15 This account is based on National Commission for UNESCO, Kyrgyzstan 2003. See note 12 above.
16 F. Nam, "Monitoring of ICT Development in the Kyrgyz Republic – ICT Strategy, Methodology, E-readiness Assessment, General Approach for Assessment of Developing Countries" (Bishkek: UNDP, n.d.), 38.
17 National Commission for UNESCO, Kazakhstan 2003, unpublished report. See note 12 above.
18 "Information and Communication Technology," UNDP Uzbekistan, 2002, *www.undp.uz/focus/information.cfm.*
19 See note 16 above.

Iran

ICT USE IN EDUCATION

Mr Tohid Sadeghnezhad

INTRODUCTION

Iran has a population of 64 million with a growth rate of 1.7 per cent. Its people represent a variety of ethnic origins including Par, Turk (Azerbaijani), Kurd, Lore, Armani (protestants), Arab, Baluch and Turkmen. Forty-one million live in urban areas and 23 million in rural areas.

The literacy rate is more than 96 per cent and education is mandatory through high school. There are currently approximately18 million students in the school system, which includes both public and private schools.

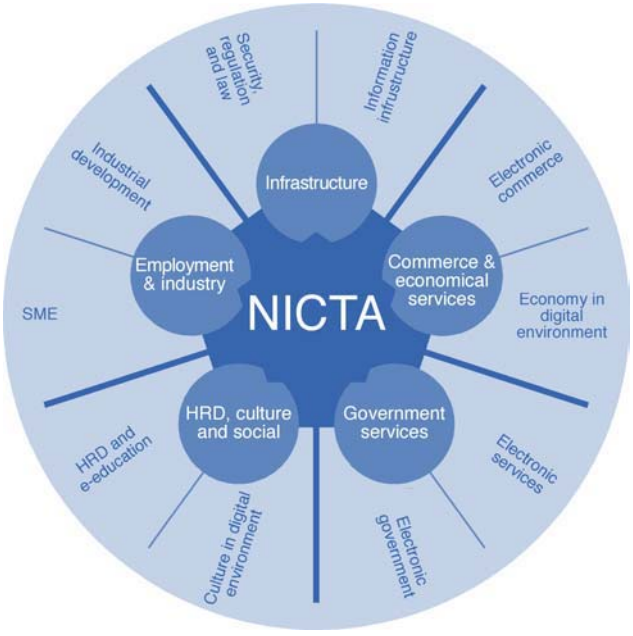
The government controls over 80 per cent of the economy and has a gross domestic product (GDP) of more than US$ 120 billion. Exports of raw oil, petrochemicals and carpets amount to about US$ 20 billion.

National policies, strategies and programmes

No clear national information and communication technologies (ICTs) strategy has been developed, although many governmental entities are responsible for developing policies and strategies. The oldest of these entities is the High Council of Informatics, established after the Iran Revolution to systemise information technologies (IT) and ICT activities. Its primary role is to assess and classify IT enterprises and supervise software development activities.

Another entity is the National ICT Agency (NICTA), which is led by the President of Iran, H.E. Khatami. It has the overall responsibility for ICT initiatives in the country. The structure and sectors of focus for NICTA are illustrated in Figure 1. NICTA is responsible for designing and managing the Application Plan of Information and Communication Technology (TAKFA), which is the overarching ICT development plan for Iran.

Figure 1: Structure and areas of focus for NICTA



Although NICTA is very important to the support of ICT, it has not established policies and strategies for using ICT in Iran. This task will fall to the High Council of IT, a Board of the Post, Telephone and Telegraph Ministry (PTT – see *www.iranict.org*).

Further, the Iran Informatics Companies Association (IRICA) was formed in 1944 with the primary objective of being a catalyst for the growth of the ICT industry. IRICA is a non-governmental, not-for-profit organisation, financed mainly by the annual payments of its 600 members.

While Iran has not yet developed policy and strategies, over the past two years there has been a big increase in activities and initiatives for decreasing the ICT gap. For example, the following laws and regulations have been put in place:

- A copyright law (although it does not yet protect foreign intellectual property, but this is to change soon).
- Protections and guarantees regarding foreign investment.
- Easier and more suitable methods for awarding contracts.
- A regulation that states that all national projects must be awarded to consortiums of Iranian and foreign companies.

The Information and Communication Technology Application programme (TAKFA) is, at this point, the most important policy initiative for Iran. Its mission is to foster the development of a knowledge-based economy by achieving the following objectives:

- Creating infrastructure (network, law and security) for Iran's information and communications development.
- Compiling and applying a comprehensive system of communications and information.
- Developing productive employment.
- Promoting the development of ICT skills at both individual and institutional levels.
- Implementing flagship projects.

A number of plans are to be developed to guide the pursuit of these objectives:

- A plan for electronic government (system, virtual network, law and security).
- A plan for promoting ICT application in education and expanding digital skills in Iran's manpower.
- A plan for expanding ICT in higher education.
- A plan for expanding ICT in health, treatment and medical education.

- A plan for expanding ICT in economy, commerce and trade.
- A plan for expanding the culture and knowledge of ICT, and for strengthening the Persian script and language in the computer environment.
- A plan for expanding active SME in ICT by creating growth centres and ICT parks.

A number of initiatives will be undertaken to execute these plans. Those most relevant to the education sector are the following:

- Developing a science network (universities and research institutes).
- Developing a growth network (Ministry of Education's schools).
- Creating a national information portal (i.e., creation of a web for all executive bodies and dissemination of relevant information through such a web).
- Developing ICT in schools.
- Creating digital libraries.
- Developing remote control medical services.

The main activities of TAKFA that will affect education are:

- The application of ICT in schools and workforce development (at primary and secondary schools as well as vocational training institutes).
- The application of ICT in higher education (Medicine, Engineering, Social Sciences, Arts, etc.).
- The development of ICT in cultural issues (Farsi writing and usage, art, culture, etc.).

In all, a total of 1,650 projects have been officially submitted to the SCICT with a total value of over US$ 2.7 billion. Most of them are for consultancy, concept development and feasibility studies, creating infrastructures in organisations, completion of projects defined in the past and human resource development.

Current level of ICT access and use

The governmental partners in Iranian education include the following:

- Ministry of Education
- Vocational Training Institute
- Tehran Technical Training Institute
- Electronic Education Committee of TAKFA
- Iran National Radio and TV
- Private sector organisations offering computer training

The most widely used ICTs are multimedia CD-Roms, web portals, electronic support of traditional curricula (PowerPoint presentations, etc.) and online newsgroups.

- **The Ministry of Education** has plans to develop ICT applications in primary and secondary education. Currently, 6,500 of Iran's 15,000 secondary schools have computer sites, and by 2006 all of the rest will as well. The Growth Network is the ministry's plan for establishing ICT facilities in schools. Guidelines for the Growth Network include research and development, putting hardware and Internet connectivity in place, developing educational materials and providing training for people in the education sector.
- **The Vocational Training Institute** has a few courses on IT and ICT; however, its equipment is not adequate.
- **The Tehran Technical Training Institute** provides training leading to the Microsoft Certificate of System Engineering (MCSE).
- **The Electronic Education Committee of TAKFA** is responsible for expanding the use of ICT in education by continuing to manage the progress of projects, conducting seminars to develop ICT expertise, identifying appropriate educational models and establishing a digital education database. They continue to develop education software products (all CD-Roms), with 25 products in 2000 increasing to 100 in 2002.
- **The Iran National Radio and TV** offers the Education Channel, which offers many programmes in the realm of IT-related subjects ranging from how to use various software to scientific shows and documentaries. There is also a radio station, the Education Station, which offers similar programmes. The other effective public broadcasting medium is the teletext provided by TV channels 2 (Farsi version) and 3 (English version). It offers a wide variety of information that is periodically updated, as well as daily information on topical matters.
- **The private sector** offers computer training in labs certified by the Ministry of Jobs and Social Insurance. These are the centre of IT-related training. They have formed their own association, the Computer Lab Heads.

Based on the latest statistics available, 1,100 computer labs are currently active in the region (see *www.isaci.com*).

Because of the widespread disregard of copyright, there has not been much motivation for the production of educational software; however, it appears this may change. In recent years, the High Council of Informatics has defined copyright for Iranian software products; the challenge now is to apply the law.

In computer literacy and use of computers there is no difference between genders. However, Islamic rules for boys and girls still apply to some extent. Also in rural areas and small cities there are doubts and worries about using computers, especially regarding the World Wide Web and the concern that it may be used to access materials that are inappropriate in terms of Islamic rules.

Major initiatives

- **The Ministry of Education** has initiated an Electronic School Plan in 10 schools that facilitates the use of computers and provides training for teachers and learners.

- **Pardis Technology Park** is located in Pardis area in the northeast of the capital city of Tehran. It plans to provide a range of services including ICT services; training and education; consulting, investing and marketing; banking, financing and insurance; and laboratory and workshop facilities.

- **SchoolNet** was established with the support of the Science and Arts Foundation (SAF) and Sharif University of Technology. SchoolNet makes it possible for schools and cultural institutions to connect to the Internet. Moreover the central intranet at SchoolNet facilitates access to the educational resources on the web and provides a portal to interact with the users.

- **The Vocational Training Institute** has established seven centres for ICT education. This number will be increased to 30 by 2004. In March 2003, departments of this institute were equipped with a computer site.

- **The Electronic Education Committee of TAKFA** recently held an electronic education seminar in Tehran that brought together experienced specialists and technologists to brainstorm about both the literature and the perspective of e-learning. A number of papers were presented and some workshops were held.

- **The website *www.irankids.com*** provides services to children that include training in areas such as science arithmetic, safety, art and music; entertainment such as proverbs, comics, jokes, picture galleries and computer games; parental training such as nutrition for kids, how to "tech" your kid and how to behave towards your kids; an Internet school for Iranian children; and a news board for kids.

- **The first virtual class** is an online teacher training class promoted by the Research and Programming Organization. It provides an opportunity for a number of experts of the Educational Department to take part in the class as students and experience a virtual class. The project was suggested by Parviz Dullayee, President of EDTLab and the staff of Electronics, Computer and Telecommunication Department of Wollongong University. The content of the eight-week course focuses on computer hardware and software, connection to the Internet and web-based applications.

Examples of training

- The Vocational Training Institute has established ICT courses for 3,000 teachers.

- All governmental staff must take a 130-hour course on MS Office and ICT concepts.

- Seventy thousand teachers of the Ministry of Education have passed ICDL courses. The content of these courses includes general IT information, introduction to OS and working with files, word processing, electronic presentation, spreadsheets, databases, Internet and mail and using search engines.

Constraints on the use of ICT

Ministry of Education constraints

The current constraints on the use of ICT in education are as follows:

- The private sector computer training institutes that provide ICT training do not meet any standards.

- There is little emphasis on ICT skill development strategy in vocational and educational departments.

- There is no distinct national standard for e-learning.

- There is a lack of knowledge of copyright law, and its application, which creates an insecure environment for those in charge of e-learning.

- There are no standards among the large number of unauthorised computer training labs. There is a need to establish a centre to observe and evaluate the function of computer training labs.

- There is a lack of evaluation of the efficiency and effectiveness of current e-learning activities.
- There is no distinct programme to develop ICT at the primary and secondary levels.
- Strategies from other countries have been copied with no cultural adaptation.
- ICT has been used in teaching without changing previous traditional infrastructure and practices.
- There is a lack of information for parents about the use of ICT in teaching.

Governmental Constraints

- The lack of a national e-learning strategy has led to isolated projects and variance in quality.
- Students have little access to computers and TV.
- Low bandwidth leads to a sharp decrease of data transfer in Internet services.
- Telecommunication infrastructure for connecting schools to the national intranet is not satisfactory.
- There is a lack of experienced trainers in ICT.
- There is an unsatisfactory level of expertise in Farsi among students in regions that have certain dialects and/or different languages (e.g., W. Azerbaijan, E. Azerbaijan, Zanjan, Ardabil, Kermanshah, Kordestan, Sistan and Balouchestan).
- Schools do not have lines that enable Internet connectivity.
- There is a lack of Farsi applications and script problems.
- There is a lack of strong and integrated management for the development of ICT for the country.
- ICT projects are granted to governmental corporations.
- There are a number of different decision-making bodies without distinguishing role descriptions.
- There is a lack of IT infrastructure in the society generally and especially in primary and secondary schools. The lack of computer labs and local network access plus poor Internet connectivity are the basic difficulties.

Analysis

The following are proposed strategies to improve and develop the use of ICT in the educational system:

- Develop and promulgate a national strategic plan for e-learning that is appropriate for primary, secondary and high schools, as well as vocational training centres. (This item is on the duty list of the High Council of Informatics – e-learning committee.)
- Train specialist teachers to develop ICT teaching in schools.
- Train ICT specialists in the Education Department.
- Introduce school principals to the use of ICT and help them develop a supporting school culture.
- Develop a vision for education that is based on lifelong learning.
- Hold training seminars to introduce families to the use of ICT in teaching.
- Activate parent-teacher associations to support the use of ICT in teaching.
- Activate city councils to act like a facilitator to develop the use of ICT in teaching.

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Pakistan

ICT USE IN EDUCATION

Mr Hilary Perraton, Ph.D

INTRODUCTION

As a large country, with GDP per capita below US$ *400 and a limited telecommunications infrastructure, Pakistan is severely constrained in developing the use of the new technologies in education. It is clear from the data in Table 1 that Pakistan is far from achieving basic education for all; the need to expand primary and secondary education, and raise its quality, are priorities which take precedence over proposals to expand the use of information and communication technology in education.*

Table 1: Basic data on Pakistan

Indicator	Date	Value
Population (millions)	1999	137.6
GDP per capita (US$)	2001	$387
Area (thousands km^2)	1999	796
Gross enrolment primary education ratio	1999– 2000	96
Gross enrolment secondary education ratio	1999– 2000	39
Phone subscriber per 100 people	2002	2.9
Internet hosts	2002	11,319
Internet hosts per 10,000 people	2002	34
PCs per 100 people	2002	0.4

Source: World Bank; EFA Global monitoring report; ITU statistics

National policies, strategies and programmes

Pakistan has recently adopted an Education Sector Reforms Action Plan[1] which proposes to increase the level of public expenditure on education and, along with other reform measures, to decentralise and to encourage public-private partnership in education. This follows a recognition that nearly 27 per cent of all school enrolment is through private-sector institutions of which there are some 36,000.[2]

Like other large, poor countries, Pakistan has an advanced industrial sector alongside its large rural and agrarian sector. As a result, while on a smaller scale than India, Pakistan has a computer software industry and has attracted work from major international companies in this area. It has launched a communications satellite and with it public discussion of its use for education. As well, alongside its well-established open university it has now set up a virtual university. At the same time, it is reported to be hampered in some computer uses by the lack of an agreed typographical style for Urdu and to benefit from the widespread use of English in government and business. These contrasts provide the backdrop for its policy development.

Pakistan has developed a formal policy and action plan for information and communication technologies (ICTs). Reflecting the country's adoption of neoliberal policies, the guiding theme is stated to be that government shall be the facilitator and enabler to encourage the private sector to drive the development in ICT and telecommunications. This is in line with earlier decisions to privatise telecommunications even though they proved problematic (e.g., a decision to privatise Pakistan Telecommunication in 1994 had still not been implemented five years later).[3] The major features of the policy are to encourage the development of a workforce with information technology skills, to provide a simple regulatory and enabling legal framework and to promote the use of information technology within both the private and public sectors. (A summary of the policy and accompanying action plan is available at *www.unescobkk.org*.)

The national policy and action plan argues for the development of a separate and more fully developed plan for the educational use of the technologies, but itself includes proposals for human resource development, information technology education and information technology training, emphasising the need to develop a skilled workforce. To this end it is proposed to expand training and education at postsecondary and higher education levels. At school level it is recommended that information technology literacy should be included in the curriculum of high schools, but the policy makes no recommendation about its role at other levels of the school system or in teacher training. It recommends that all graduates should become computer literate.

In relation to broadcasting, one recent survey reports that Pakistan has no national media policy with television programming governed by directives from the relevant ministry from time to time.[4] At the same time, in contrast with its liberalisation of the economy, the government of Nawaz Sharif in 1997 increased its control over and restrictions on television programming in order to bring it closer in line with Islamic values and to impose a strict dress code on presenters.[5]

Current level of ICT use

As one might expect, the role of the technologies appears to be low in priority for national educational policies at either school or the higher-education level. The Pakistan country paper for the 2001 International Bureau of Education biennial conference made only passing reference to the technologies, and did so mainly in relation to

management and in the context of decentralisation. Similarly, the 2002 "Report of the Taskforce on the Improvement of Higher Education" made little reference to the technologies and clearly did not see them as being the vehicle for university reform or expansion.

In sympathy with – indeed antedating – the ICT national policy and action plan, some provincial Ministries of Education have introduced computer studies into the high school curriculum, though with limited success: only eight per cent of college students in Karachi chose information technology as a subject for higher school certificate in 2003. An estimate in May 2003 put the number of computers in schools within the range 50,000 to 200,000; the same report referred to plans for a Pakistan Education Network which would provide connectivity to 60 universities initially and eventually to some thousands of primary and secondary schools.[6]

Similarly, over the years, there have been a number of experimental projects to encourage computer education in schools. The Pakistan Association for Computer Education in Schools, for example, reports on a computer literacy project in schools in 1985 and on "running programmes to spread computer literacy to the younger generation" with 100 computers in 50 schools from 1985–1990.[7] A Computer Literacy in Pakistan Schools (CLIPS) project covered 150 schools from 1991–1995, while a follow-up project recommended to the Sindh Ministry of Education in 1997 was not funded.

Other modest one-off developments are reported such as discovery centres, including computers for school children, set up in Karachi and Lahore. In 2000, following its support for private-public partnerships, the government began an information technology programme to encourage private companies to put computer equipment into public schools, provide students with access to computer classes at a fee, and/or provide information technology classes to the community. The programme is intended to be self-supporting and over 4,000 schools have been equipped with computer labs.[8]

There is a history of expectation of the use of public-service broadcasting on a significant scale in education, including non-formal education, because of its power and its national coverage.

> In a country where the literacy rate is only 37 per cent and where only 30 per cent of the total population are urban dwellers, the role of national television as a public service is immensely important. Islam is not the only driving force behind television programming in Pakistan; the preservation and promotion of eastern culture, with its traditional family system, the battle against crime, drugs and child abuse, together with the creation of awareness in health, family planning, environmental issues, are all important...Radio and television reach people in larger numbers than all newspapers and magazines combined [whose readership]...is less than 10 per cent of the population, while television is viewed by about 35 million people on about four million sets.[9]

Achievement has not always matched promise. The Pakistan Government established an educational channel some 10 years ago, influenced by this kind of consideration as well as by the needs of the formal education sector, with reported funding of US$ 100 million from the Japanese government.[10] Earlier this year there was a press announcement that Pakistan was to launch a 24-hour ETV channel in association with an institution based in Manila (*www.oneworld.net/article/search*). But the quality of the existing educational programmes, whether from the educational channel or from Allama Iqbal Open University, attracts criticism. Hoodbhoy argues that the educational programmes of both institutions are few in number and unacceptable in quality.[11]

In assessing the significance of the national television networks in Pakistan, it is necessary to note that a growing number of viewers now have access to satellite programmes including those of Star which was launched in 1991. So far, and with the partial exception of the BBC, there has been limited activity by the major international broadcasters in education.

Major initiatives

Pakistan has long experience of using information technologies, especially broadcasting, to support the work of what are described as "nation-building agencies." Education and extension broadcasting is well established. The technologies have, too, been part of the armoury of the Allama Iqbal Open University, established in 1974, which from its foundation has had a responsibility for public education at various levels and not simply for providing degree courses. Over the years it has, for example, used radio along with its other teaching methods in teacher education where its Primary Teachers' Orientation Course, followed by its Primary Teachers' Course, have been important mechanisms for the inservice education and professional development of the teaching force. The university has also used distance teaching methods for functional education, offering programmes from basic literacy to electrical wiring. Much of this work has been on an experimental and pilot basis, so that while it has valuably developed and tested methodologies for rural non-formal education, it has not had the mechanisms to tie its work with that of field extension agencies in a way that would allow national replication.[12]

Constraints on ICT use

The major constraints on ICT use are economic and geographical. Pakistan is a large country with a low GNP

Table 2: Levels of development of Internet use

Level	Pervasiveness of the Internet	Geographical dispersal	Connectivity infrastructure	Organisational infrastructure
0	**Non-existent**: Internet does not exist in viable form in country. Any users obtain connection by international telephone call.	**Non-existent**: The Internet is not present in this country.	**Non-existent**: The Internet is not present in this country.	**Non-existent**: The Internet is not present in this country.
1	**Embryonic**: Ratio of Internet users per capita < 1 in 1,000.	**Single location**: Internet points of presence in one major population centre only.	**Thin**: Domestic backbone <3 Mbps, international links <129 Kbps, no Internet exchanges.	**Single**: A single ISP has monopoly.
2	**Nascent**: Ratio of Internet users per capita at least 1 in 1,000.	**Moderately dispersed**: Internet points of presence located in multiple first-level political subdivisions in country.	**Expanded**: Domestic backbone 3– 200 Mbps, International links 129 Kbps– 45 Mbps, One Internet exchanges	**Controlled**: Only a few ISPs with high barriers to entrance to market. All ISPs connect to Internet internationally through monopoly telecoms provider.
3	**Established**: Ratio of Internet users per capita at least 1 in 100.	**Highly dispersed**: Internet points of presence located in at least 50% first-level political subdivisions.	**Broad**: Domestic backbone 201 Mbps – 100 Gbps, international links 46 Mbps– 10 Gbps, more than one Internet exchange, bilateral or open.	**Competitive**: Many ISPs with low barriers to market entry. Some competition in international links or domestic infrastructure.
4	**Common** Ratio of Internet users per capita at least 1 in 10.	**Nationwide**: Internet points of presence located in all first-level political subdivisions and rural access widely available.	**Extensive**: Domestic backbone > 100 Gbps, international links > 10 Gbps, Many Internet exchange both bilateral and open.	**Robust**: Many ISPs with both international links and domestic infrastructure open to competition.

Note: The column for Internet connectivity combines several measures used by Wolcott and Goodman. Despite the overall rating shown here, international links did operate in the range 129 Kbps– 45 Mbps.

Source: Based on Wolcott and Goodman (2000): 67-81.

and modestly developed communications infrastructure. At the same time it contains elements of an advanced industrialised economy and a consequent demand for a flow of people able to work with computers in that sector, which certainly places demands on the training sector and could be seen as doing so on the education sector.

There are particular constraints on the use of the Internet in Pakistan reported in a comparative study of Pakistan and Turkey. As shown in Table 2, Wolcott and Goodman[13] identified a number of different dimensions of Internet development and went on to assess Pakistan's status on each of these. In their assessment they reported that by late 2000 there had been rapid growth of users of the Internet in the late 1990s so that, while they showed Pakistan as being level 2, or "nascent," in its pervasiveness, it might around that time be moving to level 3, or "established." Geographical dispersion was quite limited with rural access in particular being difficult. As there was Internet activity in all provinces and in many parts of the country, they rated Pakistan as highly dispersed.

In a detailed study of interconnectivity they found that Pakistan lacked a domestic Internet backbone with no Internet exchange points within the country. Access was normally by means of dial-up connection. In terms of organisational infrastructure, the monopoly control of telecommunications put Pakistan in their level 2 of

controlled infrastructure. If it is assumed that education should follow rather than lead technological development in other sectors, then the current state of Internet use argues against extensive use in education, at least below tertiary level.

There are also linguistic constraints where it is proposed to use computers in a language other than English. Inevitably software is more limited in Urdu and likely to be extremely limited in the other languages spoken as mother tongue by many within the country.

Analysis

Pakistan seems to have followed an admirably cautious policy in its embrace of the technologies in education with their use in schools limited to the upper level of the relatively small secondary system. There is a potential contradiction in its policy on training which follows from its faith in the private sector. National policy is both to promote the use of the technologies to the extent, for example, of funding 75 per cent of the costs of training, while letting the private sector remain the main driver. The contradiction would be uncomfortable to resolve if, say, the private sector decided to concentrate international investment and development in India and South Africa and withdraw it from Pakistan.

There is one potential educational growth point: alongside many other countries Pakistan has recognised that there could be an increased role for the use of computer-based systems in the decentralised management of education, although this is not highlighted in its recent action plan.[14] As its open university has experience of teaching educational management, it might well consider investigating this and developing appropriate systems and software.

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map of East and South-East Asia

East and South-East Asia

Cambodia • China • Democratic People's Republic of Korea • Indonesia • Japan • Lao People's Democratic Republic • Malaysia • Mongolia • Myanmar • Philippines • Republic of Korea • Thailand • Viet Nam

Cambodia

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

At present, Cambodia has no specific policy regarding information and communication technologies (ICTs) in education. The Ministry of Education, Youth, and Sports (MOEYS) focuses its educational resources on basic education, with pre-primary and primary education accounting for nearly 70% of public expenditure on education.[1] In recent years, MOEYS has undertaken a reform process focused on developing a sector-wide approach to education. Part

of this process includes the revision of primary and secondary school curricula. There is little mention of ICTs in this process and no particular ICT subject in the curriculum.

Since 2000, however, the Government of Cambodia has taken several steps towards the development of a national ICT policy. On 23 August 2000, the government established the National Information Communications Technology Development Authority (NIDA), with Prime Minister Samdech Hun Sen as chairman. The main responsibilities of NIDA are (1) to formulate policies on information technology (IT) promotion and development, (2) to oversee implementation of IT policies to ensure economic growth, and (3) to monitor and evaluate all IT-related projects in the country.[2]

NIDA, in partnership with the United Nations Development Programme (UNDP) and UNESCO, organised the first national Information Technology Awareness Seminar in September 2001, which was attended by representatives from the national government, private sector, non-governmental organisations (NGOs), and international institutions. The prime minister opened the seminar by presenting the six elements critical to a long-term vision for IT in Cambodia:

- Developing telecommunication infrastructures through liberalisation, strengthening the regulatory framework and competition;
- Expanding Internet coverage by attracting private investment;
- Standardising the Khmer language for computer use and improving English language abilities;
- Increasing computer literacy by for example including it in the curriculum of every secondary school and university;
- Ensuring the private sector participates in IT development for the purpose of transferring technology and technical skills;
- Protecting intellectual capital and prevention of computer crimes.[3]

In February 2003, the MOEYS, with support of the UNESCO office in Cambodia, held a roundtable to formulate policies and strategies on ICT use in education. The following four policy approaches to ICTs resulted:

- ICTs as a need for all teachers and students;
- ICTs as a teaching and learning tool and as a subject itself;
- ICTs as a means to improve productivity, efficiency and effectiveness of education management;
- ICTs for the promotion of Education for All through distance education and self-learning.[4]

On 3 July 2003, the government held the National Meeting on the Formulation of National ICT Policies and Strategies to continue its work in this area.[5]

Current level of ICT access and use

According to an e-ASEAN (Association of Southeast Asian Nations) Readiness Assessment conducted in 2001, Cambodia ranked eighth out of the 10 ASEAN countries in terms of e-infrastructure, e-society, e-commerce and e-government. As such, it was classified as an "emerging" readiness country, characterised by the need to build basic ICT infrastructure.[6]

There is relatively little ICT use inside and outside of schools. Public access to computers and the Internet remain limited, despite various efforts to establish Internet cafes and centres. Urban dwellers fare much better in this regard, however, with approximately 100 Internet cafes in Phnom Penh and several in the Siem Reap tourist area.[7] But with more than 80 per cent of the population living in rural areas, the majority has little or no access to the Internet.[8]

Although the Government of Cambodia partners with non-governmental and international organisations on the promotion of ICT use in education, it has no specific policies or major programmes of its own regarding ICT use in basic, vocational, non-formal or special needs education.

Major initiatives

While the Government of Cambodia has made progress towards the development of an ICT framework in recent years, the international community has been responsible for the key initiatives that introduced and expanded ICT into the country. The Open Forum of Cambodia, a non-governmental organisation (NGO), provided the first e-mail connectivity in 1994. Since then, it has provided e-mail access to individuals, government agencies and NGOs, with currently about 500 subscribers, and it has opened an Internet cafe.[9] The International Development Research Centre (IDRC) of Canada helped Cambodia achieve full connectivity to the Internet in 1997 via a link to Singapore.[10]

Several more recent initiatives by the international community highlight various approaches to bringing ICTs to Cambodia:

- **VillageLeap.com:** This project established three computer-equipped schools in Robib, a remote and inaccessible area of Cambodia, in 1999. Under the project, one of the schools received a permanent Internet connection, which is now being used to bring local silk handicraft products to the global market (see *www.villageleap.com*).[11]

- **CambodiaSchools.com:** This adopt-a-school project solicits donations to build schools in Cambodia through the CambodiaSchools.com website. Donated funds are matched by a World Bank credit through the Social Fund of Cambodia and go towards construction of the schools as well as supplementary salaries for teachers. Donors can also support the installation of solar panels so that these schools can generate energy for electricity and Internet connectivity. More than 200 schools have been built under this programme, several of which have solar panels and Internet connections.[12]

- **Digital Divide Data (DDD):** This company began operations in Cambodia in 2001 with the dual objectives of providing digitalisation services to international customers and providing IT training and well-paying jobs to Cambodian workers. Part business, part philanthropy, DDD works with local NGOs and the Asia Foundation to recruit and train disadvantaged Cambodians, such as landmine survivors, former victims of sexual trafficking, and those too poor to afford technical education. The DDD model has been so successful that the number of Cambodian staff has grown from 20 to more than 100, with a second office opened in Battambang. Plans for a third office to be based in Vientiane, Laos, are underway.[13]

- **Community Information Centers (CICs):** The Asia Foundation, through a grant from the U.S. Agency for International Development, and in partnership with Microsoft Corporation and 11 Cambodian NGOs, undertook a project in spring 2003 to establish 22 CICs around the country. The CICs, which are based in offices of local NGOs, provide local communities with access to e-mail, the Internet, a new Khmer web portal and other computer-based services. The purpose of the CIC network is to increase access to news and information for Cambodians outside of Phnom Penh and to create a network for information-sharing across the country.[14]

- **Women's Media Centre Radio:** This non-formal education initiative aims to improve the participation and portrayal of women in the media. Through developing and running a daily radio broadcast, the primarily female staff receive practical experience in radio journalism and feature production, as well as in the use of radio, computer, and Internet technologies.[15]

- **Cisco Networking Academies:** The UNDP Asia Pacific Development Information Program (APDIP) and Cisco Systems, Inc., in partnership with NIDA, have established three Networking Academies in Cambodia. The Networking Academy Program teaches students to design and maintain computer networks.[16]

ASEAN and UNESCO have also launched regional ICT in education projects that include programmes in Cambodia. UNESCO and ASEAN, along with several development partners, have launched a regional project on strengthening ICT in schools and establishing a schoolnet. The general objectives of the project are to share practices on using ICTs in schools, to test various models of ICT-based teaching and to improve access to educational resources through the establishment of a schoolnet in ASEAN countries. Through its e-ASEAN initiative, ASEAN has also held a number of ICT programmes, workshops and seminars for representatives from member countries.[17]

UNESCO has also been increasingly active in supporting ICT use for education in Cambodia. Through a project titled "Promoting the Effective Use of Information and Communication Technologies for Education," it has been working with the Cambodian government to develop a national policy on ICT for education, to train teachers on skills and the use of ICTs to improve teaching and to establish a national ICT-based clearing-house. UNESCO has also contributed through pilot projects and computer donations. In 2002, UNESCO and the Open University of Hong Kong donated 350 phased-out personal computers to NIDA, MOEYS and the Cambodia Institute of Engineering. As part of a pilot project, MOEYS distributed 150 of the computers to five pedagogical institutions located around the country and held training for lecturers of these institutions on basic computer skills. Recently, UNESCO announced a new project on improving the management and delivery of technical and vocational education through the application of ICTs. UNESCO has also initiated an effort to create a non-formal education monitoring information system.

Examples of training

Several small-scale training efforts are being undertaken by the Cambodian government and the international community. Most of these efforts focus on teacher training, with a few examples in the areas of non-formal education and distance learning. Training in ICT at the primary and secondary school levels is negligible.

Under the "Promoting the Effective Use of ICT in Education for All in Cambodia" project, UNESCO and the Teacher

Training Department of MOEYS have begun training teachers, both at the pre-service and inservice stages, in ICT skills and the use of ICT to improve teaching and learning. In May 2003, training was provided to teacher trainers who already had basic ICT skills. In August, those trainers trained 400 additional teacher trainers in the use of ICTs for education.[18] To support increased teacher training, MOEYS now requires all students in teacher training colleges to attend at least two hours per week of ICT courses. MOEYS continues to supply the necessary hardware to support this training.

Another objective of the UNESCO project is to provide ICT access to 1,000 primary and secondary school teachers through teaching colleges and to at least 5,000 children and youth enrolled in formal and non-formal education programmes. The project will address geographical and gender-related digital divide issues by targeting teachers and students in deprived areas and by establishing a minimum percentage of female trainees. According to the project guidelines, 35 per cent of the teacher trainers, 40 per cent of the trained primary and secondary school teachers and 45 per cent of the trained children and youth must be female.[19]

In 2000, the Sasakawa Peace Foundation of Japan funded two training programmes on distance education management and technology for educators and technicians from several Southeast Asian countries, including Cambodia. Thailand donated six sets of distance learning equipment to Cambodia following these two training programmes.[20]

Training has also been provided to Cambodian representatives under the Southeast Asian Ministers of Education Organization (SEAMEO) INNOTECH programme. In 2002, for example, a course was held in the Philippines titled "Technology Applications in Education: Teachers and Teacher Trainers."[21]

Constraints on the use of ICTs

There are numerous constraints on the use of ICT both within Cambodia in general and within the education sector specifically:

- **Lack of financial resources:** Cambodia is one of the least-developed countries in the world, ranking 130th out of 175 countries in the UNDP 2003 Human Development Index. Gross domestic product (GDP) per capita in Cambodia is roughly US$ 1,860.[22] Relatively high Internet prices – the highest in Southeast Asia in fact – limit the average Cambodian's ability to access the Internet and ICT training opportunities.[23] Likewise, the government faces numerous development priorities with limited financial resources.

- **Weak telecommunications policies and infrastructure:** Restrictions, ambiguity and lack of transparency in telecommunications policies, laws and implementing regulations constrain the development of the telecommunications industry.[24] In addition, since only 26 per cent of the population has a fixed telephone line, the potential for dial-up Internet access is limited.[25] The use of ICT in Cambodia has also been affected by the country's relatively late entry (1997) onto the Information Superhighway. According to the International Telecommunications Union, as of 2002 Cambodia had the lowest Internet penetration in Southeast Asia and the highest Internet prices.[26]

- **Lack of basic education infrastructure:** In the education sector, the basic needs are substantial. Schools lack trained teachers, equipment, textbooks, electricity and water. Teachers are undereducated, underpaid and often have to wait months for their salaries. Many rural areas do not even have local schools. Faced with these challenges in improving the quality of and access to education, MOEYS may not have the necessary resources to venture into the relatively costly realm of ICTs. Even if they received donations of computer equipment, most public schools in Cambodia could not afford the electricity and telephone lines to use them. Universities and pedagogical schools also lack ICT equipment and access.

- **Lack of ICT human capital:** The brutal Khmer Rouge regime and decades of internal conflict have decimated the human resource base of Cambodia. Under the Khmer Rouge, an estimated 1 to 3 million lives were lost, including more than 75 per cent of the teaching force. The legacy is a Cambodian population both young and uneducated, without a vibrant academic community to support ICT development. The adult literacy rate is 68.7 per cent with combined primary, secondary and tertiary gross enrolment of only 55 per cent.[27] The quality of education is also affected by the lack of trained teachers and their regular absence in school due to income-generating activities outside the classroom. The government itself does not use ICT extensively and its personnel lack training on the skills and benefits of ICT.

- **Difficulty of computerising the Khmer script:** The Khmer script is highly complex, with 150 letters in the alphabet, no spaces between words, and consonants that have multiple forms depending on their position within a word. This makes text entry in Khmer extremely difficult. Moreover, though different Khmer font systems for computing have been developed, they are not compatible with each other. To solve this dilemma, several Khmer-to-Khmer translation systems have been developed, and the

UNICODE consortium is working on developing a uniform code for entering Khmer script on computers. Even with this problem solved, however, the low number of Cambodian Internet users and the lack of ICT training constrain the development of Khmer web content.[28]

Analysis

With a lack of trained teachers and limited resources to improve educational quality and access to schooling, Cambodia's challenges in the education sector are numerous. It may be argued, therefore, that the immediate needs of the education system render an ICT programme to be a low priority for the near future. On the other hand, it may be imperative that Cambodia takes additional measures now to bring ICTs into education so that the country does not fall further behind in the digital age. As a new member to ASEAN, and with its entry into the World Trade Organization, Cambodia can benefit from, and has a greater need to promote, its connectivity to the international community.

To reap those benefits, Cambodia must bring clarity and direction to its telecommunications policies and develop a co-ordinated national ICT plan. The government should also seek to foster a supportive climate for private sector ICT ventures such as the DDD company. In considering how best to integrate ICT into education, it will be important to find the appropriate balance between interventions at the basic education level and those in the area of continuing or non-formal education. Cambodia needs to develop an ICT human resource base both now and for the long term, so the government should support initiatives like the CambodiaSchools.com model as well as adult skills training programmes. One possible initiative may be to build upon the network of CICs located around the country. In addition to offering continuing education, these centres could be adapted to provide distance education, including teacher training materials, perhaps through a link with MOEYS or institutions of higher learning.

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China

ICT USE IN EDUCATION

Ms Chen Li, Ph.D

Policy goals and Implementations

The Chinese government believes that modernisation of education by applying information technology is essential in order to produce students who can be competitive in the information era. The process of introducing and integrating information and communication technology (ICT) application into the education system is referred to as educational "informationisation" – something the Chinese government is giving a great deal of attention to.

The actions being undertaken by the government and schools include the following:

- Constructing infrastructure needed for an information environment;
- Developing educational resources;
- Encouraging computer education;
- Supporting teacher professional development;
- Integrating ICT into traditional classrooms;
- Delivering good educational resources into rural areas using ICT-assisted distance education methods;
- Changing administration systems through ICT applications.

Long-term Goals for Chinese Educational Informationisation[1]

The aim is to meet the following goals by 2010:

- ICT-based infrastructure which covers the whole country will be set up;
- ICT education will be popularised in the most places;
- The competence of ICT application for all Chinese citizens will be improved;
- There will be enough ICT specialists to meet social development needs;
- A lifelong education system will be in place;
- Software producing centres and ICT corporations will be operational;
- The general level of infrastructure development and ICT application in education will rank at the top level among developing countries;
- For universities, and for 85 per cent of the technical/vocational schools and primary and secondary schools in the developed area of China, the level of infrastructure development and ICT application will match that of developed countries.

Main Tasks and Relative Policies[2]

To realise these goals, the Chinese government has developed policies and plans as follows:

- Increase the bandwidth of the main lines of China Education and Research Network (CERNET), extend coverage towards the West and include small cities;
- Enhance the province and city networks of CERNET in order to supply good quality service to all kinds of education institutes with 2.5 Gbps bandwidth;
- Construct a wide band satellite-based network (CEBsat) and combine that with Internet (CERNET) in order to supply multiple information transmission services for the entire country, particularly remote and rural areas;
- Enhance university campus network construction, particularly in the western part of China, and develop a digital information platform to support an e-library, an information management system and a distance education system;
- Enhance campus network construction in primary and secondary schools, particularly in village areas, launch the course ICT Education in most of schools and integrate ICT into the curriculum of middle technical/vocational schools;
- Improve education administration informationisation by constructing platforms for officials, resources and public information;
- Increase the number and quality of ICT specialists to spread ICT education in primary and secondary schools, to train teachers in information literacy and to provide inservice training about information literacy for adult and vocational students;
- Facilitate sharing of teaching resources in order to improve the quality of education by developing a distributed education resource platform;
- Launch research on second generation networks and conduct trials in selected central cities;
- Develop policies regarding education enterprises that will encourage more financial investment and support development of ICT corporations;
- Develop quality standards for education informationisation and use them to develop evaluation systems.

In 2000, the Teacher Education Department of the Ministry of Education published a very important document, "Training Guidance for Teacher Training about Information School," which requested that all the teachers in primary and secondary schools learn how to use information technology by engaging in professional development activities.

In summary, the central government is attempting to enhance the application of ICT in different aspects of education in China through its national plan, by launching national-level projects and by encouraging local governments and local schools to be involved in and to invest in education informationisation.

Current level of ICT access and use

Main Achievements to Date[2]

- The development of infrastructure for educational informationisation is proceeding. The CERNET and CEBsat system provides basic support for scientific research and modern distance education. CERNET covers 30 cities and has become the second largest network.
- Application of ICT in education is developing swiftly. About 70 per cent of all colleges have established campus networks. Good progress is being made in secondary vocational education and in primary and secondary schools. Support for education from social enterprises and the development of educational resources are assisting this process.
- Education resource development and the modern distance education experiment have made some progress. Recently, many education administration departments and schools have developed an educational resource warehouse for materials such as web-based courses and other courseware, grouped according to the subject specialties and instructional characteristics of the institutions.

The Main Forms by Which ICT Is Applied into Education

- The satellite network system with two digital channels provides the main method of delivering courses to rural areas.
- More schools have access to the CERNET system as bandwidth improves. CERNET is used to obtain learning resources and for distance education.
- Computers are being connected to form network classrooms that can be connected to CERNET or the Internet.
- Multimedia classrooms are being developed to enable the exchange of instructional information (audio, video, Word, etc.) between teachers and students for use in conventional classrooms.
- Teachers and students use personal computers at home or schools.
- Instructional platforms are becoming available to provide support to schools for networked learning based on local and wide area networks (LANs and WANs).
- Resource warehouses are being established to share learning resources among teachers and students in all subjects.

Classifying Access and Use in Education[4]

Because of gaps in the economy, there are different levels of ICT access in education. These can be classified as follows:

- **Top level:** Some schools in central cities have very good ICT infrastructure. Teachers and students have access to the CERNET and all staff and students have a high level of ICT literacy. They understand how to change the teaching and learning model, how to develop curriculum content using ICT and how to improve the effectiveness and efficiency of administration through ICT applications.
- **Middle level:** Most schools at this level are trying to integrate ICT into courses and administration with a middle-level ICT environment. Only some of the staff are skilled in the use of ICT, but even though they are far from the top level, they are making a start at using ICT in the classroom.
- **Lower level:** Most schools in rural areas have no money to invest in ICT. Even with sponsorships from donors or governments, they cannot use ICT in effective ways. Few staff have received any training. They need more money, training and resources.

Major initiatives

National Government Projects

- **School Connection Project:**[5] The purpose is to enable all primary and secondary schools to have access to the Internet and to encourage the application of ICT. The goal of the project set by the national government is for over 90 per cent of elementary schools to be connected to the Internet by 2010.
- **Modern Distance Education Project:**[6] The purposes of this project are to increase the bandwidth of the China Education and Research Network, to convert two satellite TV channels from analogue to digital, to develop web-based teaching resources and

to support some universities to deliver distance courses by ICT on an experimental basis. The national government is providing the funding and the necessary authorisations.

- **Computer Network Construction Project for Western University Campus:**[7] In 2002, the national government invested CNY 900 million (US$ 108 million) to support 152 western universities to establish campus networks and have access to the China Education and Research Network (CERNET). The project improved the infrastructure for the rural areas of China, which may be useful for other levels of education in the future.

- **Popularisation of ICT Education in Primary and Secondary Schools:**[8] In 2000, the Ministry of Education launched a plan called Popularising ICT Education in Primary and Secondary Schools, and requested all primary and secondary schools to offer a course on ICT education during the following five to 10 years, The intent is to have all K-12 students learn to use a computer.

- **Administration Informationisation Project:**[9] This project aims at establishing a web-based support environment for educational administration to enhance the quality of public service education administration, to improve the efficiency of educational administration and to facilitate monitoring by the society.

- **Distance Education Project for Communist Party Members Training in the Countryside:**[10] The government plans to build a distance education network, which will reach the Communist Party member learning centres in the countryside. This project will use distance education to facilitate the provision of education for country Communist Party members, schools and the general community to improve the cultural condition in the countryside.

- **Modern Distance Education of Primary and Secondary Schools in the Countryside:**[11] This project started in 2003 with CNY 10 billion (US$ 100 million) invested by the central government. The money was used to buy infrastructure equipment. The aim was to enable primary and secondary schools in the countryside to make use of distance education in order to share good educational resources with the schools in developed areas.

Joint Projects Between Enterprises and The Education System

- **The Rural Area Distance Education Demonstration Project:**[12] The Li Jiacheng Fund and the Ministry of Education will provide 5,000 sets of receiving equipment to primary and secondary schools in 12 provinces in rural areas, and set up 10,000 learning centres which can receive China satellite and broadband learning programmes. The aim of the project is to improve education quality by supplying good teaching and learning resources.

- **China–U.S. e-Language Project:**[13] This is by far the biggest educational co-operation project. Through the co-operation of experts in China and the United States, it uses advanced technologies such as multimedia and simulation, together with advanced educational ideas, to develop web-based learning courseware for English and Chinese instruction. The learning modes are portable media such as CD-Rom/DVD, web-based learning and combinations of the two. It is mainly aimed at high school students from 12 to 18 years who study English in China and Chinese in America.

- **Wireless Network Instructional Demonstration Project Sponsored by Lenovo, Intel and the Affiliate School of Remin University:**[14] The aim of this project is to use the Lenovo E360 notebook together with the campus wireless LAN to apply different kinds of instructional resources for daily learning, to enhance interactions among teachers and students and among students themselves, and to improve the learning efficiency of students.

- **China-Europe Basic Education Project in Ganshu:**[15] This project is the biggest of all the European Union–sponsored Ganshu projects. The fund is EUR 15 million. Begun at the end of 2001, it has provided tuition assistance to students, equipped sets of desks and tables and provided computers. It has helped 439 primary school teachers to take degree programmes, provided training for 1,200 junior school teachers and set up 86 teacher learning centres. The project has now spread to 41 rural villages in Ganshu province.

Examples of training

- **Demonstrated Software College:**[16] In 2002, the Ministry of Education and the Committee of Country Development authorised 35 universities to set up demonstration software colleges. The aim is to train information technology personnel to meet market demand.

- **Training for Educational Technology Specialists:** About 150 universities provide training at the bachelor's degree level in educational technology. Approximately 20 other universities have the right to award master's degrees in educational technology and, among those, three universities (Beijing Normal

University, East China Normal University and South China Normal University), have the right to award a doctoral degree in educational technology, thus providing a multilevel system of professional training in educational technology.

- **Intel Future Education Project:**[17] In 2000, the Normal Department of the Ministry of Education and Intel Company set up the Intel Future Education project on an experimental basis in 10 provinces and central cities. The project delivers teacher professional development on how to integrate ICT and new teaching methodology in teaching and learning.

- **Teacher Training for The New Century:** The aims of this project are to improve the quality of teachers in primary and secondary schools, strengthen professional development opportunities for key teachers, improve the structure of teacher teams and increase the numbers of teachers in rural areas.

- **The Teacher Education Network Union:** In 2003 several universities, such as Beijing Normal University, Central Radio and TV University, and the China education TV station set up the Teacher Education Network Union. The union will work on supplying teacher professional development by distance education using ICT.

Constraints on the use of ICT

- **The lack of a clear and shared understanding of informationisation:** The different levels of government and administrators, as well as students, teachers and parents, often lack a full understanding of educational informationisation. Thus local governments often fail in their efforts to direct and promote educational informationisation because of impracticable plans and measures.

- **The deficiency of the investment in educational informationisation and the imbalance of the development in different areas:** The eastern part of the country invests more money and manpower in infrastructure than the west does. The provision of ICT equipment in elementary schools in the middle west and the poor villages is falling behind and the computers and networks they do have are not satisfactory. According to 2001statistics, in Shanghai the ratio of students owning computers is 16.7:1, but in Yunnan it is 186:1. It is not unusual for there to be no computers at all in the schools of the western villages.

- **The difficulty in integration of ICT into education:** The integration of ICT into traditional classrooms is a practical difficulty in Chinese schools because of the lack of education resources and sound application methodology. Research should be carried out to develop suitable models for China that embody best practices of ICT in daily instruction and administration.

- **The demand for the people who are skilled in ICT:** In order to integrate ICT into education, there needs to be many more people with specialised knowledge of educational technology – particularly on the part of the teachers and the administrators. Moreover, the insufficiency of the teachers and the resources in the west increases the gap between the western and the eastern parts of the country.

- **The constraints of the education informationisation facilities in elementary schools:** It is common for elementary schools to pay much more attention to the hardware than to its application and to teaching and software development. They also don't have sufficient budgets for daily maintenance, which limits the efficiency of ICT application. It is also worth noting that the schools seldom have an overall plan when using ICT in teaching and administration.

- **The immaturity of the educational ICT industry:** There are many factors creating obstacles to the development of the educational ICT industry. These include the lack of ICT products in terms of both quantity and quality, which are needed to support the development of informationisation; the shortage of talented people; the lack of co-ordinating policies, competitive mechanisms, and evaluation of results; and the immature stage of the development of information criteria and success indicators.

Analysis

Generally, China has made great progress in the application of ICT in education as a result of the sustaining effort of the national government. Most people in education realise that meeting the challenges of ICT is an important condition for moving forward. However, there is much to be done if the education system is to produce an information society with competitive citizens.

Educational informationisation can be classified into three steps for any country. The first is information infrastructure construction. The second is applying ICT into all aspects of education. The third and last is to change all aspects of the education system, particularly the education environment, educational content, pedagogy and administration methods. At this point, China has almost finished part of step one in

the central cities, but not in the villages. There are still two kinds of effort necessary for China: one is to support village schools to complete step one; the other is to push other schools to pass the second and third steps as soon as possible.

The following initiatives are suggested as ways of promoting the application of ICT in education:

- **Invest money on village information infrastructure and staff training.** Village information infrastructure level in China is very low. There are two problems: there are not enough facilities and few people can provide technical support.

- **Develop resources that are relevant to the application of ICT in education.** First, a national resource platform is needed to support the sharing of learning materials among regions and schools. Second, it is important to identify and spread ICT application models suitable to Chinese education. Last but not least, greater effort is needed to identify appropriate management and resource criteria to use as a basis for future development.

- **Supply staff training on ICT and new education philosophy.** In order to increase the application of ICT in education, it is necessary to help staff develop the requisite skills. Additionally, the ideas of relevant persons should be renewed to improve the efficiency and quality of ICT applications. The training of administration and decision-making staff is the most important task. So far there is no plan for this.

- **Promote development of modern e-government.** It is necessary to push forward the informationisation of educational government affairs and to build the perfect e-government system in order to improve the educational public services and administration. This will require the development of a wholesome e-government system and management mechanism, as well as e-government criteria.

Many domestic and overseas organisations and enterprises, such as UNESCO, Apple, IBM, Lenovo, TCL, overseas institutions and non-governmental organisations provide products, technology support, teacher training programmes and funding to enhance the development of ICT educational application in China. These joint projects have contributed a great deal to the application of ICT in education in China in terms of funds, new education philosophy and methodology, and administration system methods. Chinese education has benefited much from these collaborations and joint projects.

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Democratic People's Republic of

Korea

ICT USE IN EDUCATION

Ms Jung Sun Hahn, Ph.D

National policies, strategies and programmes

Introduction

The Democratic People's Republic of Korea is one of the world's most closed and isolated countries. It faces desperate economic conditions and is in its ninth year of food and energy shortages. Massive international food aid deliveries have allowed the regime to escape mass starvation since 1995, but the population remains vulnerable to prolonged malnutrition and deteriorating living conditions.

Reporting on information and communication technology (ICT) use in education appears to be an odd assignment when students at primary schools need food and basic necessities such as books, pencils and notebooks. The government of Democratic People's Republic of Korea does not reveal any official statistics about ICT, not even the number of people using computers. Thus this report is made with the absence of detailed information and statistics.

Policy Goals and Action Plans

The Democratic People's Republic of Korea is led by a national founder, a person with overwhelming power and the only one who can decide almost everything. In 1988 a three-year plan for the promotion of science and technology began, and the government started massive funding for information science and industry. However, the amount of funding was not known. The second three-year plan (1991-1994) aimed to computerise all sectors of the nation by the year 2000 and to industrialise the production of IC chips.[1]

Current Implementation Status

ICT is used by a limited number of organisations. State organisations, factories, companies, colleges, computer research and development institutions, and some senior middle schools have access to computers. While the Internet is not used, the intranet is installed and used by those limited number of organisations and institutions.

Budget and Sources of Funding

Information about budget and sources of funding is not available. It is known, however, that Democratic People's Republic of Korea is eager to develop the ICT industry, and will jointly venture with the Republic of Korea and the Hana Program Center (HPC) in Dandong, China.[2] The initial capital is US$ 300,000. The South will own 60 per cent of the HPC and the Pyongyang Information Center (PIC) in Democratic People's Republic of Korea will own the other 40 per cent. PIC is dispatching 40 of its top engineers to Dandong for three months of training from the Republic of Korean engineers.

Gaps, limitations and needs

Exposure to computers and ICT is limited to those students who excel in the class. This select group of students is given access to computers and the intranet.[3] This situation widens the already existing gap between the outstanding academic students and the average and below-average students.

Current level of ICT access and use

Summary of Technologies Being Used

In Democratic People's Republic of Korea, there are 16 AM radio stations, 14 FM radio stations and 38 TV stations.[4] The four major TV stations are Korea Central TV, Mansoodae TV, Pyongyang TV and Science & Education TV.[5] These stations air from 5:10 p.m. to 10:00 p.m. during the weekdays and from 9:00 a.m. to 10:30 p.m. on Sundays (Science & Education TV airs from noon to 10:30 p.m. on Sundays).

Korea Central TV airs a children's programme for 30 minutes per day,[6] but as most families do not own a TV receiver, most children cannot watch this programme. Children can watch television at school, but it is not generally used in the teaching-learning process.

Since 1998, Democratic People's Republic of Korea has conducted compulsory computer education two hours per week from the fourth grade to the sixth grade of senior middle schools.[7] Recently, the hours and the target students of the computer education have been extended to the study of mathematics. Some schools have specially designed programmes for gifted and talented students to train them as computer programmers or software engineers, but mainly the focus of computer education has been on teaching computer literacy to all students. Recently, the importance of ICT use has been realised and has started to be taught.

Digital Divide Issues

Computer hardware and computer education are provided to a limited number of schools and students. Schools in the major cities and students who are identified as talented and gifted are given priority. This causes a digital divide between the city and the rural dwellers and between the gifted and average students.

Nature and Roles of Partnerships

Due to the devastating economic situation in the country, the partnerships involved in the development of ICT are characterised not with the industries in Democratic People's Republic of Korea, but rather with corporations in the Republic of Korea and organisations in the US. For example, Democratic People's Republic of Korea has requested the Institute for Strategic Reconciliation (ISR, *www.isr2020.org*) to conduct computer education for students as well as teachers.[8] (ISR is a non-profit organisation whose members are Koreans residing in the United States.) In the first stage ISR installed two computer classrooms with 25 PCs at Morhanbong high middle school

and Osan high middle school. In the second stage ISR will install computer classrooms in 15 different cities. By 2004 ISR will open a computer education research centre and will conduct systematic training and research on computer use and its application in education.

Other examples are partnerships with corporations in the Republic of Korea such as the Hana Program Center (HPC), a new South-North joint venture established in Dandong, China, and the Korea Computer - Samsung Software Joint Co-operative Development Center between Samsung Electronics and the KCC, which opened in Beijing in March 2000.

Major initiatives

The leader of the country, Jong-il Kim realised that to build an infrastructure and to develop hardware would require a huge amount of capital. He knew his country could not afford it and he also realised that building the necessary infrastructure could not be accomplished in the current situation. Therefore, the leader changed his plan and shifted the emphasis from the development of hardware to software, which requires only knowledge workers who share intellectual and scientific minds, and creativity. The major organisations in software development are KCC (Korea Computer Center), PIC (Pyongyang Information Center) and the Department of Computer Science under the Academy of Science.

Kim started computer education for talented and gifted students beginning in high middle school. He also restructured several universities to put more emphasis on computer science and opened new science and technology universities in several cities. As well, he opened a research centre to educate more engineers and scientists. The specially trained graduates from high middle schools attend the best universities, such as Kim Il Sung University, Pyongyang Computer University, Pyongyang Program Center, Korea Computer Center and Chosun Computer Center.[9]

Annual software competitions have been held since 1990 to encourage interest in ICT and to promote the software industry. The participants who enter these competitions are scientists, engineers, teachers and students. The award winners receive various benefits such as being able to enter the college of their choice.

Democratic People's Republic of Korea has already reached the top level of software techniques in several fields.[10] Various research and development institutions are developing computer software ranging from computer games, character and voice recognition programmes, translation software and fingerprint recognition systems. Computer games developed by Democratic People's Republic of Koreans are exported and used in the Republic of Korea. The country is gradually shifting its focus from computer software to programmes necessary for each industry.

Recently Jong-il Kim re-emphasised the importance of science and technology and announced a road map to adapt the educational system and educational contents to the information age. He also announced that a plan to produce computer engineers and programmers had been very successful due to the curriculum revision introducing ICT.[11]

Examples of training

There is no evidence of training in ICT use in education. Any training that does occur is focused on achieving specific goals. For example, Democratic People's Republic of Korean military authorities are especially interested in computer security technology that protects against the destruction of computer hardware and software, physical loss of data or the invasion of databases by unauthorised individuals. The College of Automation University, a military academy for information, selects the 100 most talented students per year, trains them in intensive courses for five years, and then appoints all of them as officers. Ten out of 100 talented students take charge of only searching and hacking matters.

There are two training centres: the Computer Training Center at Kim Chaek Engineering University and the National Training School for Programming in Pyongyang.[12]

Constraints on the use of ICT

There are many constraints pertaining to the use of ICT in the country. In Democratic People's Republic of Korea, the most obvious constraint is the economic situation. Another constraint is the inability to access the Internet directly or surf and search for external information freely. Although the Internet country code "kp" has been assigned to Democratic People's Republic of Korea, no one has yet registered a domain. Instead of using the "kp" domain, Democratic People's Republic of Korea operates some Internet sites indirectly for the purpose of self-advertising.[13] Democratic People's Republic of Korea Infobank (*www.dprkorea.com*) opened in 1999 and is operated by the Hong Kong-based Pan Pacific Economic Development Association of Korean Nationals and is said to be sponsored by the Democratic People's Republic of Korea.

As of August 2003, there was just one Internet service provider (ISP).[14] Democratic People's Republic of Korea has just started to use the Internet to announce its policies and Kim's instructions via the website at *www.uriminjokkiri.com*. Democratic People's Republic of Korea, however, still connects to the Internet via Chinese or Japanese networks;

it is through these networks that the Democratic People's Republic of Korea receive external information and post information outside the nation.

The Kwangmyung intranet was installed in 2002 and is being used by major organisations and institutions.[15]

Analysis

Jong-il Kim uses India and Ireland as his models and attributes their success to their reliance on the many well-trained people they can draw on from the pool of human resources. Democratic People's Republic of Korea has a well-organised educational system, and Kim relies on it heavily to accomplish his goals. Through the education system for very gifted children, Democratic People's Republic of Korea is actively cultivating talent in computer-related fields. Programmers who are in their twenties and thirties are playing leading roles in software development, and the majority of them have come from the gifted student programmes. Kim is successful in educating talented young people to be outstanding programmers; however, the knowledge-based society does not rely on a handful of intelligent citizens.

The Democratic People's Republic of Korean ICT model could be characterised as intranet-oriented with a national innovation system under government initiative. In the Democratic People's Republic of Korea, people cannot access the Internet to get information freely. The information gathered through the Internet is filtered and is circulated among the people. This is due to the *juche* (the theory of self-reliance) – an ideology that dominates all the fields in the Democratic People's Republic of Korea.TheDemocratic People's Republic of Korea may need to choose between ideology and technology in order to achieve prosperity.

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Indonesia

ICT USE IN EDUCATION

Ms Tian Belawati, Ph.D

National policy

As other countries, Indonesia is determined to harness the use of information and communication technologies (ICTs) for increasing the country's national competitiveness. The initial step in doing so was the establishment of the Indonesian Telematics Coordinating Team (known as TKTI) in 2000, consisting of all cabinet ministers and chaired by Vice President Megawati Soekarnoputri, who is now the president of Indonesia. In 2001, the ICT national plan was formulated by Presidential Decree No. 6/2001 ('Guidelines for the Development and Implementation of ICT in Indonesia'), which states the government's general policy towards ICT and calls on TKTI to take an active role to drive ICT implementation in Indonesia.[1]

The decree is supplemented by a detailed five-year action plan, which specifically sets out an ICT plan for education that includes the following areas as priorities:[2]

- Collaboration between the ICT industry and ICT educational institutions (2001-2005);
- Development and implementation of ICT curricula (2001-2004;
- Use of ICT as an essential part of the curricula and learning tools in schools, universities and training centres (2001-2005);
- Establishment of distance education programmes. Facilitation of the use of Internet for more efficient teaching and learning (e.g. School 2000 or SMU 2000, which started in 1999).

Unfortunately, those priorities have not yet been fully implemented because of unrest in the country.

Current level of ICT access and use in education

Indonesia is one the largest of the ASEAN countries with a population of over 210 million. The area of the country is mostly water (81 per cent with the land divided into 33 provinces, 268 regencies, 73 municipalities, 2,004 subdistricts and 69,065 villages).[3] Despite the economic crisis which started in 1997, Indonesia has progressively increased its telecommunication network over the last decade.

Indonesia ranks number 21 within the top 25 countries of Internet users.[4] However, the percentage of Internet users to the total population is less than two per cent, which is much lower than the Internet penetration in other ASEAN countries such as Malaysia.[5]

The growth of ICT users in Indonesia within the last two years has been phenomenal, increasing from around two million in 2000 to over four million in 2002. The Indonesia Internet Service Provider Association (APJII) expects this number to increase up to 7,550,000 by the end of 2003 due to the expansion of Internet access points provided by Internet kiosks (known as WARNET), which are mostly owned by private business enterprises. A survey conducted by APJII showed that about 43 per cent of users access Internet from WARNET (APJII cited in International Telecommunication Union, 2002). The rest access the Internet from offices (41 per cent), homes (12 per cent), and schools/universities (four per cent).

The cost of Internet access varies depending on the type of connection. Subscription to ISP ranges from IDR 45,000 (US$ 5) to IDR 500,000 (US$ 60) per month depending on the options (number of hours, application, etc.) and connection lines (telephone, cable, fibre optic, etc.). Internet access from homes and offices can also be accomplished through the nationwide telecommunication corporations (Telkoms) direct Internet line (known as Telkomnet Instant), which costs around IDR 160 (US$ 0.02) per minute. Due to high competition among WARNET access sites, the cost of Internet access is relatively affordable, ranging from a low of IDR 5,000 (US$ 0.05) to IDR 9,000 (US$ 0.09) per hour.

In educational practice, ICT use in Indonesia is still in the initial stages. It is estimated that in 2002, about 2,500 educational institutions were Internet users of some kind, 80 per cent of which were secondary schools and the other 20 per cent higher education institutions.[6]

Although data on the actual use of ICT in schools have never been comprehensively surveyed, the use of computers (i.e., PCs) is primarily for administrative purposes. Several schools, especially private ones and those in large cities, have developed school websites that are used for promotion and communication between students, teachers and parents. However, the application of ICT to teaching-learning activities is prevalent in few schools, usually only international schools or franchised branches of foreign school systems.

A survey conducted by the Centre for Information and Communication Technology in Education (PUSTEKKOM) of 10 senior secondary schools in Jakarta found that all the schools had a policy to add computer studies to the curriculum. The main purpose was to encourage students to use computers and the Internet to search, gather and process information to support their learning. The content of the course included MS Word, MS Excel and MS PowerPoint, Photoshop, Coreldraw Office, and Internet (search engines, e-mail and mailing-lists).

In the non-formal education sector, ICT as a subject is very popular. Anywhere in the country, it is easy to find private training centres that offer short courses in various ICT-related subjects. These training centres, however, are usually not accredited nationally or internationally. Subjects taught include basic computer operation such as MS Office, programming, web-designing, graphics design, animation, etc.

As is the case in most ASEAN countries, statistics on gender use of ICTs in Indonesia are sparse. In the few studies reported, the number of women users is much smaller than that of men.[7] A survey on the use of ICTs by women's organizations in select countries of Asia and the Pacific, including Indonesia,[8] found that women and men have not benefited equally. Women in particular have to contend with ideological, systemic and institutional barriers to accessing ICTs.

Highlights of the survey findings include the following:

Women's groups that have been able to tap into the potential of ICTs have experienced benefits and increased opportunities to conduct research and gain access to news and information; improve organization, knowledge, and skills; monitor and participate in global women's initiatives; disseminate information and publicise materials; lobby development causes at local and regional levels; exchange information and experience; co-ordinate activities both in country and abroad; contribute to civil society and local communities; identify new contacts and development partners; and apply for donor funding and other forms of technical support.

The dominant use of ICTs is for e-mail, which is primarily used for administrative purposes and for correspondence with donors and regional and international partners. The Internet, on the other hand, was found to be useful for networking, information access and advocacy.

Major initiatives

The Ministry of National Education (MONE) has conducted several initiatives and programmes to enhance the use of ICT in primary and secondary education, including the following:

- **Education Radio Broadcast for Primary School Students** (Siaran Radio Pendidikan untuk Murid Sekolah Dasar or SRPM-SD): One of the first projects to utilise ICT was radio broadcasting for primary education; it was started in 1991/1992. The radio programmes were based on the national curriculum by PUSTEKKOM and were intended to enrich the learning-teaching process. By 2003, about 508 radio programmes (in Science, Social Science, Mathematics, Bahasa Indonesia and Civics) had been produced and used in about 20 provinces by 170 primary schools.[9] The schools that participated in this project were also equipped with a radio/audio cassette player, teacher manuals, and workbooks for the students.

- **IT programme:** The Directorate of Technical and Vocational Education (DTVE) and the MONE launched this programme in vocational secondary schools (VSSs) in 1999. It introduced information technology as a compulsory subject across all skill competency programmes. VSS students are taught basic knowledge on computers, as well as web designing. This project has led to the establishment of a communication forum known as School Information Network or Jaringan Informasi Sekolah (SIN or JIS) among VSSs in every region utilising a mailing-list application. It has been reported that more than 500 VSSs and about 800 individual members subscribe to the mailing list. The forum also conducts regular face-to-face meetings, which attract memberships from general secondary schools, junior secondary schools, primary schools and local representatives of APJII.[10]

- **WANKota** (Wide Area Network - CITY): This was initiated by members of SIN10 with the objective of connecting school LANs within and between cities, using a wireless connection. The project, which included eight cities (Malang, Surakarta, Yogyakarta, Wonosari, Bandung, Cibinong, Tangerang and Makasar), is predominately funded and supported by participating schools and local district governments. The pilot project for 2003 plans to include another 30 cities. The DTVE injected a small incentive for schools (through a school/VSS block grant of US$ 10,000 per city) to leverage-related parties to contribute either financially and/or conceptually through regulations. Among other things, WANKota serves as a distance-library, a medium for teleconferencing and as an access to the Internet through which all the schools will have a space for developing and hosting their own websites.

- **ICT block grants for secondary schools:** The Directorate of General Secondary Education (DGSE) and MONE initiated a system of block grants of abouUS$D 4,179 per school to procure computer facilities. The project, during 2002 and 2003, has allocated grants to about 174 schools throughout the country.[11]

- **"SMU2000" or School 2000:** This project was initiated through collaboration between the Directorate General of Primary and Secondary Education, MONE and APJII, and was intended to connect 2000 high schools to the Internet by the year 2000 through the development of an educational portal. However, although APJII has brought various partners to the project, it was only able to connect about 1,180 schools by the end of 2000.[12] Later data show that by March 2002, about 1,800 high schools had been provided with Internet connection. No further data are available on the progress of this project.

- **"E-dukasi" or E-ducation project of PUSTEKKOM:** In co-operation with the Directorate of Vocational Education, this project was started in 2002.[13] The objective is to improve the quality of education in high and vocational schools through the use of Internet-based learning materials (termed e-learning). The first subjects developed were Mathematics, Physics, Chemistry, Biology, Electronics, and Information Technology. They are now available for use by teachers (see www.e-dukasi.net/).

ICT-related activities are also being conducted by various institutions, and these are mostly intended to raise greater awareness of ICT and its advantages, encourage a larger community to use ICT for their benefit, develop content

through ICT, enhance collaboration among different agencies on ICT-related educational programmes and activities and provide training on ICT-related skills. APJII and The Southeast Asian Ministers of Education Organization for Open and Distance Learning (SEAMOLEC) are among the organizations that have been intensively conducting ICT-related programmes.

APJII has developed a website to raise awareness of the benefits of ICT (see http://ti.apjii.or.id/), which contains general information on ICT and how to use it for various purposes. It is easy to understand and is designed using simple technologies to allow maximum access. Information contained in the website is also available in CD format for wider dissemination.[14]

Examples of training

In addition to the various and sporadic teacher training provided by individual schools, there are several national efforts:

The Directorate General of Primary and Secondary Education (DGPSE), in collaboration with MONE's PUSTEKKOM, MONE, has trained some 800 high school teachers on computer-assisted learning.[15]

As part of the information technology programme for VSSs, the DTVE has provided training to teachers and students since 2001. Both groups are trained in using ICT (i.e., Internet) and teachers receive training in graphic design, sound, video, storyboard and the tools and peripherals for multimedia acquisition, presentation and production. Internet equipment has been supplied and connections made in over 550 locations.[16] It was expected that after the training, teachers would have the competencies to produce multimedia-learning packages on CD-ROM. However, it seems that this goal has not been realised yet. Servers of WANKota are still filled with materials produced by PUSTEKKOM rather than by those created by the trained teachers.[17]

Basic computer training for about 98 teachers from 49 schools (including JSSs, GSSs, and VSSs, both public and private) was provided by the APEC Cyber Education Network (ACEN) in 2001. This programme was followed in 2002 by the National Office for Educational Research and Development (known as Balitbang) providing other training related to web design, home page development, web database and e-learning application.

SEAMOLEC (www.seamolec.or.id/) has conducted many non-formal ICT-related training programmes such as Production of Web and CD-based Interactive Multimedia Learning Programs for Online Access, Utilization of Internet for Instruction and Training Purposes, Virtual Library to Support Distance Learning, and The Utilization of Internet in Teaching and Training Instruction.[18] SEAMOLEC training programmes are attended by participants from Southeast Asian countries, and are conducted through regional face-to-face workshops.

Unfortunately, there are no further data available on the impact of these initiatives in terms of the number of teachers trained or on the actual application of the skills in instructional practice in school classrooms.

Constraints on the use of ICT

The initiatives undertaken have significantly increased awareness of the potential use of ICT for education among both the general public and school communities. However, the use of ICT as an integral part of the teaching-learning process in schools, as well as a subject matter in primary and secondary schools, has not yet been widely implemented. The most common use of ICT is limited to the use of stand-alone PCs for administration purposes, even in the more advantaged schools. The use of ICT to facilitate learning and e-learning at basic education levels remains more as a seminar topic rather than an implemented programme.

This situation is due to multiple factors:

There is no national strategic plan for implementing ICT in education. All the initiatives have been conducted as project-based activities, which tend to be ad hoc, unsustainable and without long-term goals.

Since the multidimensional crisis, which was started with economic events in mid-1997, the Indonesian government has pushed its priorities to more fundamental issues such as political stabilisation and basic welfare for the people. This has caused delays in the development of ICT infrastructure. As a result, Internet access through Internet kiosks is limited to urban areas, especially in Java and Bali. Furthermore, the locations of the Internet kiosks are not associated with school locations; they are usually located in the business areas, while most primary and secondary schools are located in rural and residential areas.

Due to financial difficulties, government priority in basic education has been put on the rehabilitation of school buildings, teacher training on the pedagogical aspects of teaching and on teachers' welfare. ICT for education has, therefore, not yet been considered a priority. Hence, even though some teachers have been trained to use ICT in their teaching activities, they cannot use their new skills because of the lack of facilities (hardware). Moreover, the number of teachers who have been trained is very small in relation to the total number of primary and secondary school teachers in the country.

The availability of relevant content in the national language (Bahasa Indonesia) is limited. So far, the only development of

ICT-based learning materials has been done by PUSTEKKOM, and then only for five subjects. Individual private schools have developed their own web-based materials, but they are not available for external users.

Analysis

The use of ICT in basic education in Indonesia is still far from a reality. It can only be improved by providing access to hardware, developing instructional content and using the local language. Future initiatives should emphasise the following:

Providing access through the expansion of ICT infrastructure. This would include re-evaluation of telecommunication policy to decrease the domination of the two largest telecommunication operators (PT TELKOM and INDOSAT) and allow more opportunity to private players.[19]

Providing access through the use of existing community meeting centres (e.g., schools, mosques, post offices). These are the places where people usually gather. Government policies on telecommunication should encourage individual private entrepreneurs to establish Internet access points. Establishing Internet access points at schools especially would significantly accelerate the number of Internet users by enabling the teachers to use the technology in their instructional activities.

Providing incentives for content development. The government should encourage all segments of the educational community to participate in content development. International funding agencies should be invited to collaboratively enhance the identification and development of relevant content that is in line with the national vision for the educational sector. Furthermore, repackaging of Internet-accessed information and combining Internet technology with "traditional" or more established tools of communication like radio and print is also essential to enhance access to information.

Even the fulfillment of the above three aspects (higher access, local content and local language) will not be sufficient unless they are wrapped in a systematically and comprehensively designed national strategic plan for the use of ICT in education. Therefore, it is essential for the Indonesian government to immediately develop a national policy and strategic plan for harnessing the use of ICT in education.

The government should also address the matter of unequal access to ICT between men and women as it develops policies and plans. Specifically, it should implement the recommendations put forward by Cabrera-Balleza:[20]

Ensure that gender is mainstreamed in ICT policies and programmes and that women are represented in the bodies that make decisions and policies.

Make the technology accessible, relevant and useful to Asia-Pacific women by developing holistic state policies on ICT that take women's needs and gender issues into consideration as well as address related issues such as the urban-rural bias.

Promote the enrolment of girls in ICT programmes by providing incentives such as scholarships and awareness-raising activities.

Provide additional funding support to promote ICT use among women's groups in the Asia-Pacific region.

Conduct continuing training on the potential and use of ICT which should also include the basic technical aspects such as simple data exchange, searching, processing and storage.

Conduct awareness-raising workshops on the benefits of ICTs particularly as an effective means of communication.

Disseminate, in both print and electronic formats, results of research on women and ICT, especially those that provide examples of successful use of ICTs by women's organizations.

NOTES

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3 Daftar Wilayah Pemerintahan: (Ministry of Home Affairs, 2003), *www.depdagri.go.id.*
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6 Nugroho, 'Pengguna Internet Di Indonesia Meningkat Dua Kali Lipat' (2002), *www.ristek.go.id/berita/news/news_156.htm.*
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11 H. Yuhetty, ICT and Education in Indonesia, presentation at the UNESCO High Level Policy-Makers Workshop, Bangkok, 18-21 February 2003.
12 See note 1 above.
13 See e-dukasi website, *www.e-dukasi.net.*
14 See APJII website, www.apjii.or.id.
15 See note 11 above.
16 See note 11 above.
17 See note 10 above.
18 SEAMOLEC, *www.seamolec.or.id.*
19 'Status of Information and Communication Technology (ICT) Development in Indonesia' (in English) (GIPI (Global Internet Policy Initiative), 2003), *www.gipi.or.id/page.php/.*
20 See note 8 above.

Japan

ICT USE IN EDUCATION

Ms Aya Yoshida

National policies, strategies and programmes

It was 1994 when Japan took serious steps to promote a national ICT policy. The first step was the formation of the Advanced Information and Telecommunications Society Promotion Headquarters, headed by the prime minister and composed of the full cabinet. In 2001, this Headquarters was reformed as the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society, followed by the announcement

of the e-Japan Strategy.[1] Now, in 2003, the creation of basic ICT infrastructure that was the goal of e-Japan is almost complete and the e-Japan Priority Policy Program–2003 based on the second phase of the e-Japan Strategy has been decided. In this second phase, "human resources development and education/promotion of training" is identified as one of five key areas.[2]

The involvement of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in ICT promotion began with the (100) Hundred Schools Project in 1994[3] in co-operation with what was then still the Ministry of Trade and Industry. Approximately 100 schools from all over Japan were selected for assistance in using networks that would enable classroom teachers to provide variety in instruction. In 1999, this project was followed by implementation of the Information Technology in Education Project (ITEP),[4] the goal of which was to use computers in teaching in all elementary and secondary schools by 2005. Specifics of the plan included:

- Installation of computers with Internet access in all ordinary classrooms by 2005;
- Creation of training opportunities for teachers to improve their computer skills and enable them to use computers in teaching their subjects;
- Development of visual and video contents appropriate for teaching the use of computers;
- R&D on teaching methods that use high-speed networks;
- Creation of a teaching materials portal site at the National Institute for Educational Policy Research.

Current level of ICT access and use

Table 1: Computer installations and Internet access

Type of school	Students per educational computer (individuals)	Internet access rate (%)	High-speed (400 kbps or faster) Internet access rate (%)	Ordinary classrooms with LAN connections (%)
Elementary	12.6 (22.2)	99.4 (48.7)	52.8 (11.7)	23.2 (6.5)
Junior high	8.4 (11.2)	99.8 (67.8)	57.9 (15.9)	24.3 (7.1)
High school	7.4 (10.3)	99.9 (80.1)	75.7 (11.5)	51.8 (14.6)
Schools for the disabled	4.0 (7.7)	99.8 (59.9)	70.2 (10.4)	45.6 (12.0)

Note: Figures in parentheses are 1999 data, except for those on high-speed Internet access, which are 2000 data.

Source: MEXT (2001), " Survey of Information Education in Schools," www.mext.go.jp/a_menu/shotou/zyouhou/index.html

The degree to which ITEP has been implemented in education is shown in Table 1. The table presents computer installation and Internet access data as of fiscal 2002. There are on average approximately ten students per educational computer over all schools, except for schools for the disabled, where the ratio is lower. Virtually all schools have Internet access; however, high-speed Internet access, although increased over 1999 figures, remains lower in elementary and junior high schools than in high schools. Only 20 per cent of ordinary classrooms have LAN connections in elementary and junior high schools: that figure rises to around 50 per cent for high schools and schools for the disabled. Compared, however, to 1999 (or 2000), Internet access has become much more common, and the last couple of years have seen high-speed Internet access spreading at an accelerating rate.

Table 2 indicates the level of ICT skills in the teacher population. While 90 per cent of teachers know how to

Table 2: Teacher ICT skills

Type of school	Can operate a computer (%)	Can use computers in teaching
Elementary	88.0 (63.0)	66.3 (36.5)
Junior high	87.1 (67.2)	46.1 (29.7)
High school	89.0 (73.8)	38.1 (28.1)
Schools for the disabled	82.3 (54.2)	37.4 (20.5)

Note: Figures in parentheses are 2000 data.

Source: MEXT (2001), " Survey of Information Education in Schools," www.mext.go.jp/a_menu/shotou/zyouhou/index.html

Table 3: Teacher ICT use

Type of school	3-plus time/ week (%)	1-plus time/ week (%)	1-plus time/ month (%)	1-plus time/ semester (%)	Less than 1 time/ semster (%)	Virtually never (%)
Elementary	24.3	30.3	19.3	6.3	3.8	16.0
Junior high	35.4	24.3	10.7	3.8	2.5	23.3
High school	43.0	22.9	9.2	2.1	1.6	21.3
Schools for the disabled	35.4	25.8	10.2	3.1	2.4	23.1

Source: Committee to Promote IT Use in Primary and Secondary Education (2002), " IT Contributions to Learning Ability: Realities and Perspectives," www.mext.go.jp/b_menu/shingi/chousa/shotou21/

operate a computer, the proportion of teachers able to use computers in teaching falls to 66 per cent for elementary schools, and much lower for other types of schools. In elementary schools, the same teacher teaches almost all subjects, but in secondary schools, different teachers teach different subjects. In junior high schools, those who use computers are concentrated in the sciences. In high schools and schools for the disabled, teachers using computers are concentrated in vocational training classes. Relatively few teachers in other areas have the skills required to use computers in teaching and, thus, the proportion of all teachers using computers in teaching is relatively low.

Table 3 shows the frequency with which teachers use ICT. At all levels, around 60 per cent of teachers use ICT one or more times per week. Around 20 per cent virtually never use it.

Table 4 shows that elementary school students are most likely to be the most frequent users. Compared to elementary school students, those in other schools do not often use computers. This result appears to be related to data on teachers reported in Table 2, with teachers in secondary schools lacking the ICT skills for teaching purposes.

Data are available on the use of broadcast (TV and radio) technologies in education. Nippon Hoso Kyokai, Japan Broadcasting Corporation (NHK) has radio and TV channels that are used for education. Educational radio started in 1931 with programmes specifically for schools begun in 1935. Educational TV was initiated in 1959 and there is now a variety of school education programmes, such as national language, foreign languages, math, science, social sciences and so on.

All schools, from elementary to high school, have 15 TV monitors on average. Table 5 shows the use of broadcasting technology in schools. TV is pre-eminent over radio, particularly in elementary schools. An interesting statistic is that the use of these media has declined year by year since the 1980s. Broadcasting is being replaced by the new ICTs such as recorded videos and computers.

School completion from elementary to junior high is almost 100 per cent and 97 per cent by the end of high school. There seems to be, then, no niche for non-formal education in the system. Cram schools, however, might be regarded as a kind of non-formal education. However, there are no data on ICT use in these schools. Some university

Table 3: Student ICT use

Type of school	3-plus time/ week (%)	1-plus time/ week (%)	1-plus time/ month (%)	1-plus time/ semester (%)	Less than 1 time/ semster (%)	Virtually never (%)
Elementary	11.6	20.9	16.7	22.6	4.6	23.6
Junior high	6.5	4.5	3.7	10.6	7.9	66.9
High school	13.2	2.4	2.0	3.6	3.8	75.0
Schools for the disabled	13.5	6.4	6.1	9.7	4.0	60.3

Source: Committee to Promote IT Use in Primary and Secondary Education (2002), " IT Contributions to Learning Ability: Realities and Perspectives," www.mext.go.jp/b_menu/shingi/chousa/shotou21/

Table 5: The use of broadcast technologies

Type of school	TV (%)			Radio (%)		
	1992	1996	1998	1992	1996	1998
Elementary	95.2	94.9	97.1	4.6	4.0	7.1
Junior high	39.2	31.7	58.4	5.6	n/a	6.0
High school	50.9	45.5	62.1	2.8	7.6	2.0

Source: H. Sano, K. Saito, and Y. Itani (1997) " The Use of Broadcasting in School Education, compared with other media," The NHK Monthly Report on Broadcasting Research, p.12-29.

preparatory schools use satellite to deliver classes taught by prominent lecturers, and some of these schools use personal computers with cameras for question-and-answer sessions between students at home and the lecturers. Other language schools employ web-based training.

In Japan, there is no digital divide in ICT infrastructure or in access. Differences due to gender, cultural background or place of residence are not an issue either in accessing ICTs.

Major initiatives

Important examples of initiatives to promote use of ICT in education include the Japan Association for Promotion of Educational Technology's Computer Education Practical Idea Award,[5] started in 1997, and the MEXT Internet Utilization Concours (NETCON),[6] started in 1999. The former aims to broaden the use of computers, while the latter is more narrowly focused on the use of the Internet in education.[7]

Awards vary widely depending on the level of the schools and the particular classes involved, but they can be roughly divided into five patterns:

- The first pattern uses the Internet as a source of information. When investigating a particular topic, an Internet search engine can lead to unexpected discoveries and acquisition of information not found in textbooks. One elementary school used the Internet to investigate local history, with a focus on historical figures that played important roles in constructing local levees. Information posted on the web was gathered and organised via the Internet and then information from other sources, including interviews with local people, was added. Use of the Internet for gaining information or as a learning tool is by far the most common. This approach is called "learning through investigation."[8] In cases where students do not know where to begin, the web is an especially effective way for them to get started.

- The second pattern creates multimedia presentations combining text, still images, video and audio, and posts them on the web. One elementary school used its period for integrated study for a project that added environmental sounds in the school's neighbourhood. Sounds were recorded and digital photographs were taken of the sites where the sounds were located. Presentation tools were used to combine sounds and images and add observations to them. The finished project was then uploaded on to the web. The project took advantage of the computer's ability to combine different media and, in addition, it used the Internet to communicate the information created. This proved to be an effective way to promote a deeper understanding than is possible by orally describing the images and sounds. It showed how environmental experiences could be recorded and shared with others via the Internet.

- The third pattern uses the Internet to exchange information. For example, in one experiment, around 200 schools planted seeds from the same plants at the same time on the same day. E-mail and a web-based bulletin board were used to post information about the plants' growth and student activities. Data were collected, organised and distributed to everyone. The experiment's objective was to test the effectiveness of the Internet as a means of stimulating exchange concerning a shared topic. One of the outcomes was spreading awareness of the regional variation in Japan's climate and topography.

- The fourth pattern uses the Internet for distance learning. With assistance from participating companies, some industrial high schools used an Internet-based video conferencing system for an internship programme in which students received remote instruction on how to build simple equipment. Web-based groupware was used to assemble reports on each day's progress. Equipment manufacturing internships had not been easy for companies because it was difficult to put students on their regular assembly lines. As well, combining academic and practical work experience was a problem for the schools. Distance learning, delivered via the Internet, provided a solution for both issues.

- The fifth pattern involves programmes that provide information to an unlimited number of people. For example, some elementary schools create virtual companies on the web allowing students to experiment with virtual sales of locally produced products, or local volunteers and junior high school students start virtual companies and incorporate their own ideas to compete for sales with web-voting used to simulate purchases. As purchases vary day by day, the companies must modify their products in response to orders or change their prices to compete more

effectively. Allowing unlimited numbers of individuals to participate in a virtual reality creates an experience impossible in the classroom setting without access to the Internet.

These are but a few examples of the ways that ICT is being used in Japanese education.

Examples of training

It is accepted that training and instruction are required to promote the use of information technology in education. Accordingly, beginning in 2002, elementary schools began introducing ICT training into individual subjects or into their periods of integrated study. Also, starting in fiscal 2002, use of ICT became a requirement in technical and home economics classes in junior high schools. As of 2003, information technology became a required subject in high schools.

In connection with these efforts, training is being provided to teachers with the goal of equipping them with the necessary ICT skills. One example of a programme is "Training to Foster Instructors in Educational Use of IT." This national programme aims to educate leaders at the prefecture level and is offered for three-to-five day periods during school summer vacations. Approximately 2,000 individuals receive this training each year. Another example is a programme called "Basic Computer Training" by prefecture boards of education. This training is provided for all teachers who have several years of teaching experience. Between 30,000 and 35,000 teachers receive this training annually.

Table 6 shows the percentage of teachers who received some form of training during 2002. The highest proportion was found in elementary schools. The percentage of teachers receiving training declines up the school hierarchy. Virtually all of the training was provided either by schools or at the national or prefecture level. Not included in the table is the handful of cases in which training was received in university courses open to the public or at training seminars organised by private businesses. Overall, the amount of training provided has increased slightly since 1999. The proportion provided at the national or prefecture level has declined, while the level of training provided by schools stayed fairly constant. Since there is no national standard for training, there are dramatic differences from one board of education to another and from one school to another.

In 2003 an online e-learning training system called the e-Teacher Project was developed. Instead of a conventional classroom-based approach, this project encourages teachers to acquire ICT skills during their free periods by using the courses available through the e-Teacher Project. This inservice training is important because information technology courses are now a required part of the curriculum that teachers need to be able to teach, and university teacher training programmes are still not producing teachers with the necessary qualifications. As a result, providing training to teachers already in the labour force has become the biggest challenge confronting educational use of ICT in the country.

In 2001, the Japan Association for Promotion of Educational Technology began offering a certification examination for "educational information technology co-ordinators," who would then be well versed in ICT and provide support for other teachers in its use. The objectives of the certification examination are to establish a new position and to provide ICT training for teachers so they might take the position. To date only a few have received this certification and, since it is still very new, it is not yet widely recognised. Still, providing this kind of support by ICT specialists instead of depending entirely on teachers' self-study may become increasingly important.

Table 6: Percentage of teachers receiving training

Type of school	Within the fiscal year (%)	National or Prefecture training (%)	School-provided training (%)
Elementary	105.9 (68.1)	20.9 (41.0)	70.5 (56.4)
Junior high	67.5 (56.2)	12.6 (39.4)	46.9 (48.7)
High school	44.6 (41.4)	8.0 (36.6)	31.9 (49.6)
Schools for the disabled	55.7 (54.9)	8.9 (32.2)	41.1 (59.8)

Note: Figures in parentheses are data from fiscal 2000.

Source: MEXT (2002), " Survey of IT Education in Schools," www.mext.go.jp/a_menu/shotou/zyouhou/index.html/

Constraints on the use of ICTs

When elementary and junior high school teachers were asked to identify barriers to the use of ICT in classrooms,

their most frequent answers were as follows:

- Insufficient number of computers (40.6%)
- Greater preparation time required for classes using computers (38.6%)
- No free time for training (37.7%)
- Lack of software usable by teachers and students (33.3%)[9]

While highlighting the lack of both hardware and software, these answers also reveal the plight of teachers who have insufficient time to acquire computer skills and prepare classes in which ICT is to be used. The combination of lack of skills and time is a fact of teacher life. But the shortage of computers is one problem that can be readily solved. Also, as ICT use becomes more pervasive, the lack of basic knowledge of how to operate equipment will become less pressing.

The real issue, then, is the amount of preparation time required. Case studies reveal that ICT use most often is a special event in a lesson. It is not easy for teachers to make frequent use of ICT in everyday teaching without adequate preparation. Teachers lack the know-how of why, when and how to use the technology. This problem cannot be solved by time alone. Research, training and repeated practice are essential.

Analysis

As indicated, the last few years have seen fulfillment of most national policy targets for ICT use in classrooms. The infrastructure is largely in place. As of 2001, the penetration rate of household Internet access had reached 61 per cent. It is no longer unusual for a student to access the Internet at home as well as at school.

The critical question is no longer that of knowing how to operate a computer or browse the Internet for information. The issue now is how to successfully incorporate ICT into the teaching process. Specific methods for achieving this aim are not yet in place. High-school teacher training programmes to meet the demand for teacher-experts in information technology have only just been started, and most schools must still rely on retraining those teachers currently in the classroom. It is not at all easy for teachers to obtain the training they need. In addition to providing training opportunities, it is vital to build environments that facilitate such training.

Although experience is being accumulated in the use of ICT as part of the teaching process, more academic research in this area is required. What is the effect of ICT on the educational experience? What are the successful factors in using ICT in classrooms? How are cost and the effectiveness of ICT use balanced?

NOTES

1 For more information on national level steps to promote ICT, see the home page of the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society, *www.kantei.go.jp/jp/singi/it2/index.html/*.
2 See "E-Japan Strategy II" (*http://kantei.go.jp/jp/singi/it2/kettei/030702ejapan.pdf*) for a description of the basic direction of Japan's ICT strategy. "E-Japan Major Plans 2003" describes concrete programmes based on that strategy.
3 The 100 School Project finished in 1998. The history of the project can be found at *www.edu.ipa.go.jp/100school/*.
4 The Information Technology in Education Project was one of a series of four projects entrusted to a government ministry and agency task force reporting directly to the prime minister and cabinet. Between 1998 and 2000 approximately 9,100,000,000 yen was invested in this project (*www.mext.go.jp/a_menu/shotou/zyouhou/index.htm*).
5 The Japan Association for Promotion of Educational Technology's Computer Education Practical Idea Award has collected approximately 700 case studies, of which 10 to 15 have been chosen for the award (*www.japet.or.jp/idea/index.cfm*).
6 The MEXT Internet Utilization Concours (NETCON) has been the subject of presentations to MEXT, the cabinet, the Prime Minister's Office, METI, and the Asahi Shimbun. Ten prizes are awarded each year (*www.netcon.gr.jp*).
7 Additional case studies can be found at*http://thinkquest.gr.jp/index.html*, the website for the international ThinkQuest contest managed in Japan by the School Internet Promotion Association and *www.nicer.go.jp/itnavi*, the "IT Teaching Practice Navi" website of the National Center for Educational Information at the National Institute for Educational Policy Research.
8 "IT Contributions to Learning Ability: Realities and Perspectives" (Committee to Promote IT Use in Primary and Secondary Education, 2002), *www.mext.go.jp/a_menu/shotou/zyoujou/index.htm*.
9 See note 8 above.

People's Democratic Republic of

Laos

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

Several government agencies are involved in the development of information and communication technology (ICT) policies and programmes in Laos. The Ministry of Communication, Transport, Post, and Construction (MCTPC) is responsible for national telecommunications policies and regulation. The Science, Technology, and Environment Agency (STEA) has the authority to administer policies and programmes that fall under those three subject matters. The government has also established the Lao

National Internet Committee (LANIC) to formulate and regulate national Internet policies. The following government bodies comprise the LANIC: the MCTPC, the Ministry of Information and Culture (MOIC), the Ministry of Interior, the Ministry of Foreign Affairs (MOFA), and the STEA. The MOIC is also technically responsible for regulating Internet content, though there are few Laotian sites for it to monitor.

In 1996, the STEA was given the mandate to develop a national plan for information technology (IT). The resulting "Lao National Plan on Information Technology: Master Plan up to Year 2000" outlined three main projects: the creation of a Lao code page, software standards and a government intranet. Unfortunately, the plan ended in 2000 without realising these goals.[1]

Currently, the MCTPC, with support from the Japanese International Cooperation Agency (JICA), is developing a Telecommunications Master Plan for the period 2003-2015. According to the MCTPC, this plan will outline the responsibilities within the government regarding IT and clarify that MCTPC has authority over all ICT policies.[2]

The Ministry of Education (MOE) has developed a three-phase master plan for IT development in education. The focus of each phase is as follows:

- The establishment of a ministerial intranet system with links to provincial offices and the National University of Laos (NUOL);
- The incorporation of ICT content into the secondary and tertiary curriculum;
- The promotion of distance learning and e-learning through ICT.

In 2000, the ministry requested international assistance in developing an IT curriculum under phase 2 for the NUOL.[3] The emphasis of the MOE, however, continues to be on basic education, with 47.3 per cent of public expenditure on education dedicated to pre-primary and primary schooling.[4]

Current level of ICT access and use

Overall, use of ICT in Laos is limited. Government agencies have little experience in using ICT, and the few officials who use the Internet do so primarily for exchanging e-mail. Likewise, the business sector has not been active in developing Internet-related applications. Few Laotians have access to computers or the Internet, and less than 2 per cent of Laotian households have a telephone. Although there are approximately 60 Internet cafes in Laos, most of them are in Vientiane.[5] Thus, the 80 per cent of the population living in rural areas have even less access to ICT than Laotians in the capital or tourist areas.[6] According to an e-ASEAN (Association of Southeast Asian Nations) Readiness Assessment conducted in 2001, Laos ranked last out of the 10 ASEAN countries in terms of e-infrastructure, e-society, e-commerce and e-government. As such, it was classified as an "emerging" readiness country, characterised by the need to build basic ICT infrastructure.[7]

The MOE has received computer equipment and technical assistance from the World Bank, the Asian Development Bank, l'Agence de la Francophonie, and other development partners. As a result, it has a relatively high ICT penetration. As of 2002, the MOE and 11 provincial offices share roughly 150 computers, 40 of which are Internet-compatible and have a basic intranet system. This ICT presence within the ministry, however, does not indicate a high level of ICT awareness or planning for the school system. Rather, it reflects the MOE's "top-to-bottom" approach toward IT development. Under this approach, the MOE will focus first on ICT development within itself, then within the NUOL and then on the integration of ICT into secondary schools.[8]

At present, almost no public primary or secondary schools in Laos have access to the Internet, and formal education in ICT or computer science is not available below the tertiary level. Although the MOE reportedly has plans to provide computers and Internet access to two secondary schools in each province by 2005, these computers will be primarily for use by the administrative staff. The MOE has also indicated that it plans to support basic computer courses at the secondary level.[9] However, given that ICT is not incorporated into the national curriculum at the primary or secondary levels, such computer studies may be restricted to after-school hours, which may not be feasible for either students or teachers.

One reason for the limited use of ICT in Laos is the relatively late introduction and development of mass media and Internet technologies within the country. Radio and television broadcasting in Laos did not begin until 1960 and 1993, respectively. In addition, Laos did not have sustained Internet connectivity until 1996, making it one of the last Southeast Asian countries to be online.[10]

Likewise, the NUOL was not established until 1995 and has not been active in the development of ICT. The NUOL has a computer lab, funded by the Japanese government, of approximately 20 computers with LAN and Internet connectivity. Although the facility is primarily for use by the engineering faculty, fee courses are also held there, and the NUOL now offers an undergraduate computer science programme.

One promising trend is the rise in demand for the Internet among young educated and urban Laotians. This trend stems from a unique paradox in the higher education system in

Laos. Prior to the opening of the NUOL, most students receiving college degrees studied outside of Laos and were exposed to the Internet during that time. Upon their return to Laos, they sought to remain electronically connected to the outside world. In this way, the absence of a national university seems to have contributed to an increase in ICT awareness among this population. Private training institutions for computer, typing and English skills are also in demand among urban youth.

Radio and television usage in Laos is also on the rise. Radio, in particular, is a critical media outlet, with more than 50 per cent of Laotian households owning a radio. The absence of local cinemas and the availability of video technology across the border in Thailand may have contributed to the rise in video use. In 1997, 20 per cent of Laotian households had a video recorder, a relatively high percentage given the average level of income. Laotians living close to the Thai border have also developed an increased awareness of Internet technology through Thai television broadcasts and advertising.[11]

Major initiatives

The Jhai Foundation and Schools Online established the first Internet Learning Center (ILC) in Laos in the rural Phonmee secondary school. Computers were set up in a renovated classroom, and approximately 40 teachers and students received computer training. The Center also serves the needs of the community by opening for public and business use after school hours. The Phonmee ILC project received the Stockholm Challenge award for education in 2001. The Jhai Foundation and Schools Online have now set up three new ILCs in other parts of the country.[12] The World Links for Development Program is also working with the Jhai Foundation to provide wireless connectivity and refurbished computers to schools in seven sites across the country. Similar to the Phonmee model, the schools will also be used as community telecentres.

ASEAN and UNESCO have launched regional ICT in education projects that include programmes in Laos. ASEAN, along with several development partners, is implementing a project on strengthening ICT in schools and establishing a schoolnet. The general objectives of the project are to share practices on using ICT in schools, to test various models of ICT-based teaching and to improve access to educational resources through the establishment of a schoolnet in ASEAN countries. ASEAN has also held a number of ICT programmes, workshops and seminars for representatives from member countries.[13] Regional UNESCO projects that encompass Laos include a project on improving the management and delivery of technical and vocational education through the application of ICT and a project on promoting successful policy models and strategies of integration within Asia and the Pacific region.[14]

The European Commission has also begun a project in Laos under its Asia IT&C (Information Technology and Communication) Program. The objective is to apply European Union developments in digital media technologies to improve the quality of education administration and delivery in Asia with a focus on vocational, technical and general education.[15]

In recent years, CISCO Systems, Inc. and the United Nations Development Programme (UNDP) held discussions with the Lao government to explore the establishment of a CISCO Networking Academy Program in Laos. However, it is unclear whether any agreement was reached.

Examples of training

In 2000, the STEA, with assistance from UNESCO and the Center of International Cooperation and Computerization of Japan, established an IT Training Center. Located within STEA, the Center provides system administration and advanced IT courses to Laotian engineers, basic IT skills development training to STEA branch officers, and general training in IT utilisation to government officials (see *www.stea.gov.la/English.STEAWeb.htm*).

Training has also been provided to participants from Laos under the Southeast Asian Ministers of Education Organization (SEAMEO) INNOTECH programme. In 2002, for example, a course was held in the Philippines titled "Technology Applications in Education: Teachers and Teacher Trainers" (see *www.seameoinnotech.org*). SEAMEO INNOTECH has also undertaken a project on using ICT for HIV/AIDS preventive education in schools in the high-risk border areas of the Greater Mekong Subregion.

In Laos, there is a rising demand for ICT training. The public sector lacks the capacity and human resources to meet this demand. Therefore, the private sector has played an increasing role in providing ICT-related training. In a 2000 survey of six top business administration institutes and computer retailers in Laos, UNDP found that they offered ICT-related courses in the following categories: general computing, typing, Internet introduction, computer hardware, database, programming and computer-aided design.[16]

Constraints on the use of ICT

There are numerous constraints on the use of ICT both within Laos in general and within the education sector specifically:

- **Lack of a co-ordinated ICT master plan:** Although several government agencies have developed ICT plans and projects, there is a lack of co-ordination among these groups, which has created uncertainty about the roles of these agencies and about which agency is in charge of overall ICT planning. In particular, the hierarchy between STEA and MCTPC on ICT matters is unclear. Such a lack of co-ordination results in numerous independent initiatives without a clear prioritisation of the government's ICT needs.

- **Lack of ICT infrastructure:** The current telecommunications infrastructure does not allow for high-speed information access, and telecommunications access is lacking outside urban areas. There is also an insufficient legal framework for e-commerce and related ICT laws. In addition, there is a lack of Laotian web-based content, and the domestic standard for the Lao font does not meet international standards.[17]

- **Lack of knowledge base for ICT:** The government of Laos, including the MOE, lacks the necessary ICT expertise to formulate and implement a co-ordinated national ICT policy. Among the general population, there is also a considerable lack of ICT awareness and practical experience. UNDP Human Development Indicators (2003) show that educational attainment overall is low in Laos with an adult literacy rate of only 65.6 per cent and a combined gross enrolment rate of 57 per cent. In addition, Laos lacks local ICT training facilities and manpower. Most ICT personnel from the government and private sector received their training abroad. Those who get training within Laos do so through private colleges and companies. In 1998, the NUOL began offering a computer science degree programme; however, both NUOL and private training institutions suffer from a shortage of ICT reference and training materials.[18]

- **Lack of financial resources:** Laos is one of the least-developed countries in the world, ranking 135th out of 175 countries in the UNDP 2003 Human Development Index. Gross domestic product (GDP) per capita in Laos is roughly US$ 1,620, with approximately 39 per cent of the population living in poverty.[19] Therefore, most Laotians cannot afford computer equipment and Internet access. The government also lacks the financial resources to implement a large-scale ICT in education project, since it already relies heavily on donor assistance to fund its poverty alleviation and development programmes. In 1997, for example, foreign aid made up 38 per cent of the government's budget.[20]

- **Lack of awareness:** The potential benefits and applications of ICT are not well understood in Laos, with the local media presenting scant information on ICT. Even within the government, there is not a clear awareness of how ICT could benefit the population beyond the use of the Internet for e-mail purposes.[21] As a result, there is little public incentive to improve ICT planning and access.[22]

Analysis

Laos faces substantial challenges in developing an ICT infrastructure and integrating ICT into education. The first priority should be to clarify the roles and responsibilities of the various agencies involved in ICT planning, including the MOE. At present, the MOE appears disconnected from other national ICT actions, so bringing the MOE into the process may create beneficial linkages and reduce initiative redundancies.

In terms of achieving increased ICT use in the short term, one potential area for government action is in vocational, technical and continuing education. The rising demand for private ICT training institutions indicates that public sector training programmes may be ineffective in meeting the demands of today's job seekers. In order to build the necessary ICT base for Laos, the MOE may need to strengthen its incorporation of ICT in these programmes. Alternatively, the government could provide a supportive climate for the further growth of private sector training institutes. One step in this direction would be to reduce the high import tariffs that currently exist on computer hardware.

Some factors that could benefit Laos in its ICT development are the presence of young Laotians with ICT experience, the interconnectedness of the country with Thailand, and the Laotian diaspora. The interest in ICT among young urban Laotians and the presence of those trained abroad in ICT indicates that there is both a demand for ICT and a supply, if limited, of those who can provide training and awareness. In addition, Laos may be able to profit from the ICT development work that Thailand has already undertaken. Thailand is the largest foreign investor in Laos, and that includes the telecommunications sector. Given the absence of Lao-language Internet-based content and the fact that many Laotians understand Thai, there may be opportunity to capitalise on Thailand's achievements in ICT. Lastly, the Laotian diaspora could also play a role in promoting the benefits of ICT and launching Internet or other ICT-related ventures.

NOTES

1 Boualoykhong Chansavat and Phet Sayo, "E-Readiness Assessment in the Lao PDR" (Vientiane, Lao PDR: UNDP/UNV).
2 "Internet on the Mekong: Lao PDR Case Study" (International Telecommunication Union, March 2002).
3 See note 1 above.
4 See UNDP Human Development Indicators 2003, *www.undp.org/hdr2003/indicator/cty_f_LAO.html.*
5 See note 2 above.

6 See note 4 above.
7 See "E-ASEAN Readiness Assessment, Executive Summary – 2001 Assessment," (24 October 2001), *www.e-asean.info/reports/ASEANe-ReadinessAssessment-ReportforPublicBW.pdf.*
8 See note 1 above.
9 See note 2 above.
10 See note 2 above.
11 See note 2 above.
12 See Jhai Foundation,*www.jhai.org/technology.htm*; Schools Online, *www.schoolsonline.org/ whatwedo/laos.htm.*
13 See "ASEAN Annual Report 2002-2003," *www.aseansec.org/ar03.htm;* also *www.unesco.org/bangkok/education/ict/unesco_projects/JFIT/schoolnet/project.htm.*
14 See UNESCO websites: *www.unesco.org/bangkok/education/ict/unesco_projects/JFIT/TVE.htm;www.unescobkk.org/education/ict/.*
15 See *http://europa.eu.int/comm/europeaid/projects/asia-itc/html/main.htm.*
16 See note 1 above.
17 See note 1 above.
18 See note 1 above.
19 Per capita income measured in purchasing power parity (PPP) terms. UNDP Human Development Indicators 2003, see note 4 above.
20 "Lao PDR-Country Report, Asian Forum on Information and Communication Technology Policies and e-Strategies" (Kuala Lumpur, Malaysia: International Telecommunication Union, 2002), *www.apdip.net/asian-forum.*
21 See note 2 above.
22 "Assessment of Internet Technology for Integration into the Higher Education Teachers' Instructional Support System in Cambodia, Laos, and Vietnam" (Bangkok, Thailand: Continuing Education Center, Asian Institute of Technology Extension), *www.panasia.org.sg/grants/awards/00115fr.htm.*

Mongolia

ICT USE IN EDUCATION

Mr Sukhbaatar Enkhjargal
Ms Lkhagvasuren Ariunaa

National policies, strategies and programmes

The Mongolian information and communication technology (ICT) sector has had a lengthy period of development, which received a boost in 1994 with the establishment of the first Internet service provider (ISP) in the country, Datacom Co. Ltd. Then, after a period of relative inactivity, the next serious attempt to address ICT policy was undertaken in 1999, when the First National ICT Summit was organised and the "ICT Vision-2010" policy document developed with contributions from representatives of government organisations, the business sector and civil society. The Parliament of Mongolia

adopted the ICT Vision-2010 in 2000 as a blueprint for ICT development in the country. According to the Vision document, the mission is to develop a knowledge-based society and to improve the quality of people's lives.

ICT Vision-2010 has three major components: a government-legislation framework, a business-economy framework and a people-society framework. Within the people-society framework, the goal is to "create a favourable environment for Mongolian citizens to communicate freely among themselves and with the world community, ensure opportunities for their equal and active participation in social life and improve quality of people's lives."

In January 2002, representatives of government, the private sector and non-governmental organisations (NGOs) sat together to develop a mid-term strategy and action plan to implement ICT Vision-2010. Both strategy and action plan had three major components, each outlining activities, specified time lines, an organisation responsible for implementation and the donor or national support required to achieve the objectives. Although the mid-term strategy, action plan and ministerial policy document are in place, there has been no money allocated in the state budget for its implementation.

Meanwhile, the Ministry of Education, Culture and Science (MOECS) has used Vision-2010 as a model to implement ICTs in the education sector, developing an action plan which was approved in 2001. MOECS's vision for ICT in education has four major components:

- Training (to utilise all possible resources to introduce ICT in all levels of education);
- Hardware (to provide hardware and software necessary for training in ICT);
- Teaching staff (to provide support for highly motivated staff);
- Information ware[1] (to develop a sectoral information and database to improve conditions for better information services).

The limiting factor in integrating ICT into education is that the focus has been on the teaching of ICT as a subject rather than the way in which it can be integrated into the teaching/learning process.

Mongolia has taken steps to create or amend laws concerned with the development and use of ICTs. The telecommunications law of 1995 was amended in 2001, there is a law on radio frequency, and minor amendments have been made to the patent laws, Civil Code and technology transfer law. Recently, the Ministry of Infrastructure (MOI) developed draft ICT laws after securing input and recommendations from stakeholders. A working group of 15 members (representatives of NGOs, government, business and others) was established to revise the law. According to the MOI, the revised draft law was originally planned for presentation to Parliament in September 2003. Representatives of the working group and donor organisations approached the Minister requesting a delay in submitting the draft law stating a need for broader public discussion with NGOs, government organisations, members of Parliament, media and business as well as expressing a need for consulting with international experts.

Current level of ICT access and use

Basic Education (Primary/Secondary)

According to statistics of the MOECS published in April 2003, there are 2,041 computers in 518 schools, or four PCs per school in average. Most of the computers are used for teaching Informatics in grades 8 to 10 with a limited number of computers available for use by staff and teachers. Within the Informatics curriculum, the pupils are taught logistics, programming languages and applications of Microsoft Office. The use of computer-assisted instruction in other secondary subjects is quite limited. In urban areas there are a number of projects evaluating the deployment of ICT in basic education. One of these projects addresses utilisation of open source standard applications and software, such as Linux.

Vocational Education

Vocational education is currently in a revival phase after near abandonment in the 1990s. At present, the greatest activity is in fee-based, short- or long-term computer-based training courses offered by individuals, private sector or private institutions.

Teacher Training

This aspect of the plan is being addressed in two ways: pre-service and inservice. The pre-service teacher training is offered mostly at the Pedagogical University, the leading institution for training secondary school teachers. There are two curricula: one for Informatics teachers and another for non-Informatics teachers. They, of course, differ in course content, the intended use of the computers, as well as application to the course.

The Informatics teacher-training curriculum involves instruction in the use of logistics, programming languages and applications such as Microsoft Word, Excel, PowerPoint, and web design. Recently, a limited number of classes have been offered to provide training on basic hardware maintenance and troubleshooting.

The non-Informatics teacher training curriculum is limited to instruction in office applications with future extension likely to the other subjects. Recently, the Computer and Information Technology School of the Mongolian State Pedagogical University has been involved in the development of a curriculum for non-Informatics teachers[2] as part of the Teacher-2005 project of MFOS.[3]

Inservice teacher training appears to have been abandoned with no new, upgrading, or retraining courses offered. According to a recent survey, teachers state there is a lack of hands-on opportunities for practice using computers and there are a limited number of computers for use in classes and for after school work.

Non-formal Education

In past years the non-formal education sector has used TV or radio almost exclusively because there was little penetration of computers in the rural areas where most recipients of non-formal education were residing. However, recently the number of computers in aimag centres[4] has increased and there is greater access to the Internet, enabling non-formal education to become involved in distance education offerings.

According to some surveys and research, two types of digital divide exist in Mongolia: that between urban and rural areas, and that between the downtown and suburbs. The digital divide has increased dramatically lately with the introduction of PC game rooms and centres dominated by male-oriented action games which has resulted in boys becoming increasingly interested in computers.

The Telecommunication and Information Technology School of Mongolian University of Science and Technology and Post and Telecommunications authority will provide retraining for public servants. Training is to be delivered in 12 aimags and Ulaanbaatar using distance education techniques and technologies.

The recently developed and introduced education portal, www.mongoleducation.mn, is an example of a tool used for sharing experience and knowledge among teachers on any subject or policy issue.

Major initiatives

- **www.knowledge.mn:** A project was initiated in 1998 by the Internet and Information Centre, an NGO, and supported by IDRC of Canada with the aim of providing web-based information for teachers and students.

- **www.mongoleducation.mn:** This project of the Mongolian Foundation for Open Society (Soros Foundation) provides a web portal for secondary school teachers. Its purpose is to supply a forum for public discussion, sharing knowledge and experience in the development of curriculum materials, teaching methodologies, etc.

- **Internet for Schools of MFOS:**[5] In 1999, following implementation of the Education Sector Development programme of ADB, the Internet for Schools project was developed and supported by MFOS (Soros Foundation). MFOS supplied 10 PCs to each aimag school while Soros allowed local area networking between computers to occur at each school and enabled access to the World Wide Web.

- **iEARN**[6] **and ThinkQuest:**[7] Projects were implemented by MFOS (Soros Foundation) to provide access to already developed content and to assist in content development by Mongolian pupils and students.

- **Education Sector Development Program of ADB:**[8] In 1998, this programme was launched with the purpose of: furnishing over 90 secondary schools in rural and urban areas with computers, providing training for Informatics subject teachers and providing technical support for the equipment supplied.

- **Academic Network – Erdemnet:** As an initiative within the Education Sector Development Program of ADB, in 1999, a network of academic institutions and schools established an ISP, Erdemnet. It was set up at the Computer Science and Management School of the Mongolian University of Science and Technology.

- **Sakura Project of JICA:** This project provides secondhand computers using open source software (Linux-based operating system), the Star Office package and access to an e-mail system to some schools. The connection to the Internet was made available through Erdemnet. Within the framework of the project, manuals were developed using Linux OS and the Star Office package and training was provided to teachers and students on their use.

- **MIDAS Project:** The Mongolian Information Development Application Scheme (MIDAS) project, supported by MFOS (Soros Foundation) and UNDP/APDIP, has assisted in the developmsent of a variety of Mongolian language education software packages, such as the Library for University software (LIB4U), RENOR 2 (an application for teaching Math and the alphabet to primary school pupils), online and off-line dictionaries, online Math applications, Mongolian-language typing tutor (Fast Type) and others. (See www.ict.mn/midas.)

- **E-learning:** This project of IDRC of Canada will pilot distance learning course packages that have been developed by Infocon, ESPI, Datacom and others to address English language, gender, online Math and ICT education issues. (See www.elearning.mn.)

- **Cyber Aimag Project:**[9] As part of this project of MFOS, three secondary schools of three aimag centres were connected to the Internet via wireless radio-modem connection, enabling access to the World Wide Web. This access has now broadened training on both basic computer and application skills and web page development for teachers and pupils.

- **Parliament members' projects:** As part of their election agenda, most members of Parliament included support for computer supplies in schools. At present no specific data is available on how many computers were supplied and to which regions and schools.

- **Rotary Club Project**: The Rotary Club of Mongolia and its branches have developed initiatives to furnish secondary schools with computers and equipment. At present, over 20 schools have been supplied with at least five computers each. (See www.rotarymongolia.mn.)

- **Project of the Mongolian Association of Cooperation with Oceania Countries:**[10] The association, in cooperation with Oceania countries, has supplied 64 secondhand computers to 17 rural schools.

- **Indian government project:** The Indian government committed support of US$ 1 million for ICT in Mongolia. A teleconferencing facility with computer labs was established in the Communications School of the Mongolian University of Science and Technology. In addition, five Internet centres with five computers were established in five aimags.

- **Japan-Mongolian Centre:** The Japan-Mongolian Centre, established in 2002, provides professional training for Mongolian ICT professionals. A number of scholarships and fellowships were offered to Mongolian ICT professionals to study in Japan for a period of six months or more.

- **Private School Initiatives:** To be competitive in the market-driven situation in Mongolia, private schools and institutions are offering short and long computer degrees and ICT courses.

Most of the initiatives described are recent projects that face the challenge of sustainability upon completion, since secondary schools have limited budgets for ICT development and staff. The major partners for ICT in education are the Mongolian Foundation for Open Society (Soros Foundation), ADB, UNDP and JICA.

Examples of training

Following are some examples of training being provided:

- **Education Sector Development Programme of ADB:** Training workshops were conducted on the MIS, computer training for staff of educational and cultural centres, teachers of informatics, pupils and others.

- **Cyber Aimag Project of MFOS (Soros Foundation):** Training on computer use, access to the Internet, development and update of websites, hosting websites, online chats and discussions, troubleshooting and technical support were conducted.

- **Internet for Schools Project of MFOS (Soros Foundation):** Training was conducted on use of computers, applications, accessing the World Wide Web, using an e-mail system, etc.

- **Joint pilot project of MIDAS, MFOS and Khuree ICT Institute:**[11] Training was conducted for non-Informatics tea chers of Darkhan-Uul aimag on computer use. Laptop computers were utilised in the sessions to demonstrate their mobile capability. A needs assessment on computer availability was conducted with participants. At the end of the week, ICT companies and institutions showcased their software and their application(s).

- **Joint project of MIDAS, UNV-JTF and Khuree ICT Institute:** Piloted in the Khentii aimag (east of Mongolia), the training was conducted for secondary school teachers and administrators of the local governor's office on the use of computers for everyday activities and troubleshooting.

- **E-learning:** Training on use of online content in English, Gender, Math and ICT was conducted for teachers to assist them in using computer-aided learning.

- **Mongolian Development Gateway:** Pilot training was conducted in the Umnugobi aimag on the use of the Internet and development of websites. (See www.gateway.mn.)

- **CISCO Academy Project of UNDP/APDIP and CSMS:** Established in 1997, the Cisco Academy offers courses on CCNA with online access to the

Cisco Academy website. Over 100 people have been trained.

- **Project of the Indian Government:** The staff and teachers of the Communications School of the Mongolian University of Science and Technology have attended short- and long-term specialised training in India.

- **Sakura Project of JICA:** Training was conducted among teachers and pupils on the use of computers, followed by training on the use of Linux, StarOffice packages and mailing software, prior to the distribution of computers.

- **E-learning Center:** The goal of the E-learning Center, which was established with the support of the Center for International Cooperation for Computerization of Japan (CICC) at the Computer Science and Management School of MUST in October 2003, is to develop e-content for distance education. The Center is equipped with two servers, four host machines and CULTIIVA-2 software.

- **Open Web Centre Project of MFOS (Soros Foundation):** The goals of this project are to provide access to computers and the Internet for civic organisations, to develop training materials and to provide online and off-line support for development and update of websites. (See www.owc.org.mn.)

- **UNV-JTF Project for Disabled Children and Teachers of the Pedagogical University:** The purpose of this project was to introduce a new communication tool to children who are deaf and mute. With the support of a sign language teacher, 29 students from a special school were trained in the use of computers and development of websites.

Even though extensive training and courses have been conducted, there is still a considerable demand and need for basic to advanced levels of ICT training for Informatics and non-Informatics teachers, students, NGOs and others. Although the comprehensive ICT education strategy was developed and adopted by the Government of Mongolia, almost all projects lack sustainability, action plans and activities to achieve set goals.

Constraints on the use of ICT

There are a number of constraints on ICT development in the country, each of which need to be addressed within the framework of policy, infrastructure, human development and capacity-building, and content and learning materials.

Policy

There is a need for a thorough policy approach that addresses issues such as the choice of operating systems, the development of software and training materials, staff training and the way that ICT is applied in education.

Infrastructure

- **Connectivity:** The connectivity situation in Ulaanbaatar and some of the relatively developed aimags is no longer an issue, although the provision of certain bandwidth for education purposes should be negotiated with the Internet providers.

- **Hardware:** In the last two years, the hardware situation has improved drastically in aimag levels. However, there is a need to address the issue of supplying computers to some schools. Moreover, the number of students per computer, maintenance, troubleshooting and use of computers by teachers still require attention.

- **Affordability:** As mentioned above, the budget of secondary schools is limited for maintenance, troubleshooting, telecommunications and Internet connections, which affects maximum utilisation of hardware and software.

Human Development and Capacity-building

There is a need for total revision of staffing in schools and development of pre- and inservice ICT training for all teachers and administration of schools because of low computer penetration, lack of professionally trained Informatics teachers in rural schools and households and lack of training materials and curriculum.

Content and Learning Materials

The curriculum for prospective Informatics and non-Informatics teachers should be revised and include compulsory ICT training for all. The lack of off-line training, teaching materials and curriculum (CD-ROMs, DVDs, manuals, guides, etc.) has affected the computer knowledge and skills of secondary school graduates, and they are therefore penalised upon entering post-secondary institutions.

The increasing number of Internet cafés and game centres provides favourable conditions to introduce touch-typing software in the form of games, which alleviates the problem somewhat.

Analysis

The following issues need to be addressed in order to enable wide-scale ICT application in education in Mongolia:

- A specific action plan is needed to introduce ICT in education rather than ICT education itself. Policy documents need to be developed with a legal and regulatory framework favourable for the involvement of business. The approach should cover ICT use in distance and classroom education. To develop a sound policy document on ICT in education, a number of stakeholder meetings should be held. Stakeholders should not be limited to educational experts, but should include ICT businesses and companies, NGOs, representatives of parents, students, media and governmental officials. The meetings should develop recommendations on policies to attract businesses which would support education and encourage institutions to develop content and training packages as well as materials that can be delivered through schools by teachers, advanced students, clubs, etc.

- There is a need to introduce a nationwide pro-computer literacy programme for teachers, pupils, school staff and parents that has a management information system component which is user friendly. Further, there is a need to address the copyright issues around software and its application to education.

- The development of manuals, guidelines and textbooks (including e-textbooks and e-contents) needs to be addressed.

- ICT training should be integrated into all school subjects where possible. For example, computers can be used for writing essays, reports and presentations, or for analysing data in Physics, etc. This can be done with minor adjustments to the curriculum of Informatics and non-Informatics subjects.

- There is a need for online and off-line Mongolian language content of manuals, guides, teacher and student books, course materials, help and support desks, etc. Special attention should be paid to the development of computer-based teaching materials on specific subjects of the curriculum.

Appendix 1

Glossary of acronyms

ADB: Asian Development Bank
APDIP: Asia-Pacific Development Information Programme
CCNA: Certified Cisco Network Associate
CICC: Center for International Cooperation for Computerization, Japan
CSMS: Computer Science and Management School
ESPI: English for Special Purposes Institute
iEARN: International Educational and Research Network
ICT: information and communication technology
IDRC: International Development Research Centre
JICA: Japanese International Cooperation Agency
MFOS: Mongolian Foundation for Open Society (Soros Foundation)
MIDAS: Mongolian Information Development Association
MIDAS: Mongolian Information Development Application Scheme
MIS: management information system
MOECS: Ministry of Education, Culture and Science
MOI: Ministry of Infrastructure
MSPU: Mongolian State Pedagogical University
MUST: Mongolian University of Science and Technology
NGO: non-governmental organisation
UNDP: United Nations Development Programme
UNV-JTF: United Nations Volunteer-Japanese Trust Fund

NOTES

1 Decree No. 151 of Minister of Science, Technology, Education and Culture, Ulaanbaatar 2000.
2 Choijoovanchig, "Curriculum of Informatics Subject for Non-informatics Students" (Ulaanbaatar, 2003).
3 "Teacher-2005" project of MFOS (Soros Foundation), starting from 2003.
4 Aimag is a second by size administrative unit of Mongolia. There are 21 aimags in Mongolia with a population of 15,000 to 45,000 each.
5 Annual report of MFOS (Soros Foundation) 1999–2001.
6 iEARN is a global network to enable young people to use the Internet and new technologies to engage in collaborative educational projects, www.iearn.org.
7 ThinkQuest is an international contest where teams of students are engaged in the development of educational websites, www.thinkquest.org.
8 "Report of Education Sector Development Program of ADB and MOECS" (Ulaanbaatar: 2002).
9 Annual Report of MFOS, 2002.
10 Purevjal, A., "Mongolian and Korean Cooperation in ICT Implementation in Education and Science Sector of Mongolia: Multiple Language Processing for Globalization and Korean-Mongolian IT Exchange" (Ulaanbaatar, 2003).
11 Report among schools and teachers in Darkhan-Uul aimag, joint project of MFOS, MIDAS, Khuree ICT Institute.

Malaysia

ICT USE IN EDUCATION

Ms Tian Belawati, Ph.D

National policy

The Malaysian government has introduced various initiatives to facilitate greater integration of information and communication technology (ICT) to enhance the effectiveness of education and training programmes. This was outlined in the country's ICT Master Plan, finalised in 2001.[1] The long-term vision of the plan, Vision 2020, calls for sustained, productivity-driven growth, possible only with a technologically literate, critically thinking workforce, prepared to participate fully in the global economy of the 21st century. At the same time, Malaysia's National Philosophy of Education calls for "developing the potential of individuals in a

holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious."

The Ministry of Education sees ICT as a tool to revolutionise learning, to produce richer curricula, to enhance pedagogies, to lead to more effective organisational structures in schools, to produce stronger links between schools and society and to empower learners. The ministry's articulation of the vision for ICT in education focuses on three major areas:

- ICT provided to all students so that it is used as an enabler to reduce the digital gap between schools;
- ICT used in education as a teaching and learning tool, as part of a subject and as a subject by itself ;
- ICT used to increase productivity, efficiency and effectiveness of the management system.

As a result, the Malaysian education system is being transformed to create a new generation who are adept with the new technologies and are able to access and manage the information explosion. Malaysia's ICT developmental plan for the next 10 years aims to:

- Intensify the development of ICT infrastructure;
- Expand access to and equity for ICT facilities;
- Improve assessment and evaluation systems using ICT;
- Emphasise ICT integration in teaching and learning processes;
- Improve the ICT knowledge and skills of students, teachers and other personnel;
- Intensify ICT usage in education management;
- Improve the management and maintenance of ICT equipment;
- Increase research and development efforts in ICT.
- Increase co-operation between educational institutions and the community towards expansion of ICT in education.

Current level of ICT access and use in education

Malaysia ranks 17th in the top 25 countries of Internet users. The growth of ICT users in Malaysia over the last two years was over 50 per cent increasing the number from around 3.7 million to 5.7 million users. The percentage of the total number of Internet users to the total population (23,396,700 people) is around 24 per cent This is much higher than Internet penetration in other ASEAN countries such as Indonesia (two per cent) that ranks 21st and Thailand (5.7 per cent) that ranks 25th.[2] One likely factor that contributes to the greater Internet use in Malaysia is the high fixed telephone connection with 66 per cent of Malaysian households having phones.[3]

As of 2001, Malaysia had the second-lowest dial-up Internet cost among the ASEAN countries: Singapore ranked first without any charge for an Internet service provider (ISP) subscription. According to the International Telecommunication Union (ITU), the average cost for accessing 30 hours of Internet in Malaysia was less than US$ 20 (including costs for ISP subscription, telephone usage and rental). The cost for the ISP subscription itself was only around US$ 5, which was much lower than in Thailand and the Philippines with an average of around US$ 19, and Indonesia with an average of about US$ 25.[4] According to Harvard (www.cid.harvard.edu), the annual cost of 20 hours of monthly Internet access in Malaysia is approximately 4.85 per cent of the country's GDP per capita.

As of 2000, 31 per cent of Malaysia's 7,217 primary schools and 54 per cent of its 1,641 secondary schools had PC facilities: 10 per cent of primary schools and 34 per cent of secondary schools had Internet access.[5] However, the distribution of Internet services among schools is still uneven. With 100 per cent Internet connectivity of schools in the Klang Valley (the region around Kuala Lumpur), but few schools in rural areas connected, a national digital divide definitely exists. Outside the Valley, it is estimated that around 1,000 schools (approximately 12 per cent) do not

Table 1: School access to ICT (2000)

Level of schools	Number of schools	Number of students	Number of teachers	Number of schools with PC	Number of schools with Internet
Primary	7,217	2,870.667	247,204	2,202	739
Secondary	1,641	1,794,515	150,681	883	559
Total	**8,858**	**4,665,182**	**96,523**	**3,085**	**1,298**

Source: INFOSOC Malaysia as cited by ITU, 2002.

even have telephone lines. Table 1 shows the condition of school access to ICT in 2000.

The need to integrate ICT in teaching and learning at all levels of education is deemed essential. Therefore, the Ministry of Education has earmarked 30 per cent of its annual budget (approximately MYR 4.2 billion) to connect another 230 rural schools to the Internet: 120 will be connected with ISDN lines, 100 with PSTN lines and 10 with VSAT connection.[6] As a result, more recent data from the Malaysian Ministry of Education indicate improvement in ICT use over the 2000 figures. As of early 2003, almost all educational institutions had at least one computer laboratory equipped with Pentium class PCs. Specifically, about 75 per cent to 90 per cent of schools and 100 per cent of universities have access to the Internet through either dial-up, broadband, leased line or cable-broadband connection.[7] With these facilities, it is expected that the usage of ICT in teaching and learning as well as in education management will be increased. Furthermore, to prove the Ministry of Education's commitment to ICT in learning, computer literacy elements are included in the National Pre-school Curriculum, which started to be implemented in 2002.

Major initiatives

Beginning in 1999, Malaysia began to establish ICT-enabled "smart schools" (www.moe.edu.my/smartschool/), through a contract with Malaysian TELEKOM under the Telekom Smart School Sdn Bhd (TSS) project. To date, there are 90 such schools. Smart schools are designed to introduce technology and deliver education in a better way. The pilot applications developed teaching/learning materials (first step was for four subjects: Bahasa Melayu, English, Science and Mathematics), a more accurate assessment system and an integrated management system. The government envisions that all schools will be converted into smart schools by the year 2010.[8]

There are three categories of smart schools, A, B and B+:

- Smart schools type A (Model Bilik Darjah Penuh): Each classroom within the school will be equipped with six PCs. Every school will also be supplied with at least five notebook computers, six support service units, equipment for networking, A3-size laser printer, color printer, multimedia software, video presentation equipment and a leased line connection to the national ICT superhighway. The government will supply at least 390 PCs for primary schools and 520 PCs for secondary schools in this category.

- Smart schools type B (Model Makmal): Each classroom within the school will be equipped with 20 PCs. Every school will have at least 37 PCs and will also be supplied with at least two notebook computers, six support service units, equipment for networking, an A3-size laser printer, an A4-size laser printer, color printer, multimedia software, video presentation equipment and a leased line connection to the national ICT superhighway.

- Smart schools type B+ (Model Bilik Darjah Terhad): 15 selected classrooms within the school will be equipped with five PCs. Every school will have at least 81 PCs and will also be supplied with at least two notebook computers, six support service units, equipment for networking, an A3-size laser printer, an A4-size laser printer, color printer, multimedia software, video presentation equipment and a leased line connection to the national ICT superhighway.

In addition, a number of non-governmental agencies are very much involved in the drive to introduce ICT into schools. For example, the Chinese Smart Schools project aims at setting up computer laboratories in more than 100 selected Chinese stream primary schools throughout the country. To date, there are an estimated 250 schools, primary as well as secondary, that have their own websites (see, for example, *www.jaring/my/tkc/right.html,* or *www.homestead .com/skkpasirputeh/uji.html).*

Other portals extending the use of ICT in education have been developed by the private sector. Educational portals such as "my-e-tutor" (www.myetutor.com) and "e-tuisyen" (www.e-tuisyen.com) allow those people with Internet the option of expanding or acquiring knowledge online, of accessing interactive multimedia tutorials and of developing personalised learning programmes. However, accessing those online courses, which follow the Ministry of Education's curriculum, requires a subscription fee of MYR 38 for primary courses and MYR 48 for secondary courses.[9]

Examples of training

In an effort to increase ICT use within classrooms, the Malaysian government requires all teachers to take basic informatics courses in teachers' college. As well it provides intensive and continuous ICT training for teachers. Between 1996–2000, it is reported that about 30 per cent of the teachers received some form of ICT training.

As well, school principals, administrators and other support staff within the education system have also been targeted for ICT training. Topics include education management information systems, an information literacy course for principals and administrators, and a computer management course for principals.

In the non-formal education sector, women in Sabah, including single mothers, will now benefit from free ICT training courses jointly offered by the federal Ministry of Women and Family Development and Sabah Skills and

Technology Centre (SSTC). The courses began in January 2003 with a targeted enrolment of around 320 women by year-end. Participation in the courses is open to Malaysian women in three categories: working women, non-working women and women entrepreneurs. The objective is to ensure that women are given the opportunity to develop their skills in the ICT field.[10]

Constraints on the use of ICT

The major factors perceived to inhibit the growth of ICT use in Malaysian education is described by Lee Huei Min, Senior Analyst with IDC Malaysia, are "the cost of Internet access, which includes the cost of hardware, access and knowledge [and the stagnant] Internet experience…as broadband Internet applications are yet to be deployed."

Another constraint that seems to hinder the actual use of ICT in classrooms is the lack of teachers' ability to integrate ICT-related skills they have learned into their teaching activities.

Analysis

Although Internet access is not a barrier and the cost for it in Malaysia is one of the lowest in ASEAN countries, the growth of Internet access is still perceived to be slow. The data shows that the distribution of Internet services among schools is still uneven. There is still a national digital divide with 100 per cent Internet connectivity of schools concentrated within the region around Kuala Lumpur. Outside this area, around 1,000 schools (approximately 12 per cent) do not even have telephone lines.

The Malaysian Ministry of Education regards the need to integrate ICT into the teaching and learning at all levels of education as a high priority. In this regard, as part of the smart schools project, the government conducts training that includes pre-service and inservice training of teachers, training of school administrators and other school staff, fosters the use of electronic books and sets up a pilot project on e-learning. Nevertheless, between 1996 and 2000, only 30 per cent of teachers received some form of ICT training, only a small number were able to integrate it into their teaching and few have the expertise to build courseware. Therefore, the number of teachers who incorporate ICT in their lessons to develop interesting and effective teaching and learning remains low.

In summary, although the Malaysian government has concentrated its efforts to enhance the use of ICT in schools, the impact of it on the actual practice of teaching and learning has not yet been significant. It is still a challenge for the Malaysian Ministry of Education to convince teachers who still use traditional methods of teaching and learning and are less inclined to embrace change to incorporate ICT into their instruction.

Malaysia also faces problems related to the digital divide. The inequality between the haves and have-nots is shown creating websites by students in more advantaged schools who have acquired computer/ICT skills beyond the basic, while others in less advantaged schools have never even used a PC.

NOTES

1 "ICT Policies of Selected Countries in the Asia-Pacific" (UNESCO, 2003), www.unesco.org.
2 "Internet Usage in Asia (Internet Users and Population Statistics for Asia)" (Internet World Stats, 2003), www.internetworldstats.com/asia.htm.
3 "Multimedia Malaysia: Internet Case Study" (International Telecommunication Union (ITU), 2002), www.itu.int/ITU-D/ict/cs/malaysia/material/mys%20cs.pdf.
4 Michael Minges, "Measuring the Internet in South East Asia" (2001), www.itu.int/ITU-D/ict/cs/Malaysi./
5 See note 3 above.
6 See note 3 above.
7 Statistics as provided in response of Ministry of Education to survey questionnaire.
8 Juraida bt Umat, "Web-based dissemination and utilization of learning resources: tigerweb project" (2000), http://gauge.u-akugei.ac.jp/apeid/apeid00/seminar/papers/Malaysia/Apeid2000_Malaysia.htm.
9 See note 3 above.
10 "Sabah Women to Benefit from Free ICT Courses," Daily Express News, 13 January 2003, www.digitalopportunity.org/article/country/970.

Myanmar

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

The Government of Myanmar has developed a 30-year long-term education development plan that incorporates the vision of creating "an education system that will generate a learning society capable of facing the challenges of the Knowledge Age."[1] Information and communication technology (ICT), through e-education, appears to be recognised under this plan. The Myanmar Education Research Bureau, the agency responsible for non-formal education, has indicated that the following ICT in non-formal education objectives

are included in the national plan: increasing education opportunities through the use of ICT in schools and community learning centres (CLCs), increasing the production of audiovisual and multimedia teaching materials for schools and CLCs, and retraining instructors for effective use of ICT.[2]

In addition to the Ministry of Education, which is responsible for the development and management of the education system, the Government of Myanmar has established the Myanmar Naing-Ngan Education Committee to co-ordinate education activities at the national level and to serve as the highest-level decision-making body for the education sector.[3] Myanmar is also a party to the e-ASEAN (Association of Southeast Asian Nations) Framework Agreement, and accordingly, the government has formed a Myanmar e-National Task Force to promote ICT. The government also established the Myanmar Information and Communication Technology Park in 2001 to promote private sector ICT development (see www.mict-park.com.mn).

Current level of ICT access and use

ICT access and use in Myanmar is limited. Telephone density is one of the lowest in the world at roughly 0.6 per cent and it is estimated that there are only 50,000 personal computers in use in the country. In addition, until recently, all telecommunications services were provided and controlled by one organization: the Myanmar Post and Telecommunications (MPT), a division of the Ministry of Communications, Posts, and Telegraphs (MCPT). Although a second telecommunications provider, Bagan Cybertech – a partly state-owned enterprise – was granted authority to operate, the ICT base from which to engage in education programming remains weak.

Within the education sector, distance education seems to have the longest experience with ICTs. Distance education in Myanmar began in 1970 with a correspondence course for inservice teachers at the Institute of Education. Today, there are two universities for distance education: the Yangon University of Distance Education (for lower Myanmar) and the Mandalay University of Distance Education (for upper Myanmar). These universities use several delivery systems, including radio lessons, cassettes, TV programmes and – the latest initiative – lessons through e-education learning centres.[4]

Major initiatives

In recent years, the Government of Myanmar has launched several programmes to increase the role of ICT in education. The Ministry of Education has installed multimedia classrooms in more than 400 primary, middle and high schools across the country. These multimedia classrooms contain print and electronic media, computers and language laboratories. The government also introduced an e-education initiative that uses satellite communication and an electronic data broadcasting system to relay education programming to more than 500 e-education learning centres that offer language training and undergraduate studies. E-learning centres, e-resource centres and computer training centres have also been set up at several institutes of higher education. It is not clear whether overlap exists in the multimedia, e-education and e-learning centre initiatives.[5]

In the area of non-formal education, the government has established an estimated 480 CLCs across the country. The main purpose of the CLCs is to provide non-formal education, continuing education and skills training in response to needs of the local communities. These programmes typically include basic literacy, post-literacy and non-formal primary education for out-of-school youths, and skills training for the community. Videos, puppet shows and other printed materials are used to disseminate information and learning. The Myanmar Literacy Resource Center also uses mass media and video technology to provide continuing education.[6]

The government has also opened at least two New Century Resource Centers (NCRCs) in upper and lower Myanmar to provide continuing learning and research opportunities and to provide access to e-education for the public. The centres are equipped with computer training rooms, language laboratories, e-learning centres and e-education resource facilities. ICT-related courses available at the NCRCs include computerised accounting, Windows 2000, software engineering, network engineering, hardware engineering, a postgraduate diploma in multimedia arts and a diploma in information technologies. The centres also utilise video, audiotapes and compact discs.[7]

Malaysia has provided assistance to Myanmar to launch a Smart School pilot project. Under the project, Malaysia has supplied computers to three primary and high schools in Yangon. Bagan Cybertech provided Internet connectivity to the schools and has announced plans to sponsor the connectivity for an additional 100 schools with multimedia classrooms.[8]

ASEAN and UNESCO are undertaking regional ICT in education projects that include Myanmar. ASEAN, along with several development partners, is implementing a regional project on strengthening ICT in schools and establishing a schoolnet. The general objectives of the project are to share practices on using ICT in schools, to test various models of ICT-based teaching and to improve access to educational resources through the establishment of a schoolnet in ASEAN countries. ASEAN has also held a number of ICT programmes, workshops and seminars for representatives from member countries.[9] Regional

UNESCO projects that cover Myanmar include improving the management and delivery of technical and vocational education through the application of ICTs, promoting successful policy models and strategies of integration within Asia and the Pacific region, and using ICT for non-formal education.[10]

Examples of training

To support the multimedia classroom initiative, training for teachers on the use of multimedia equipment is being offered at the Central Institute of Civil Service for basic education teachers, and a post-graduate diploma in multimedia arts is now available at the Institute of Education (see *www.myanmar.com/information/computer/IT_Edu/IT_Edu.html*).

The Sasakawa Peace Foundation of Japan has also funded training programmes on ICT in education for educators and technicians from Myanmar. In 2002, for example, the Foundation sponsored two training programmes on distance education management and technology representatives from the "CLMV bloc" – Cambodia, Laos, Myanmar and Vietnam. Thailand donated six sets of distance learning equipment to each country following these two training programmes.[11]

Training has also been provided to participants from Myanmar under the Southeast Asian Ministers of Education Organization (SEAMEO) INNOTECH programme. In 2002, for example, a course was held in the Philippines titled "Technology Applications in Education: Teachers and Teacher Trainers" (see *www.seameoinnotech.org*). SEAMEO INNOTECH has also undertaken a project on using ICT for HIV/AIDS preventive education in schools in the high-risk border areas of the Greater Mekong Subregion.

The private sector has played an increasingly active role in education activities, in particular in ICT, language and business training. Private ICT training institutes typically offer computer courses such as word processing, computer programming, desktop publishing and graphic design.[12]

Constraints on the use of ICT

There are numerous constraints on the use of ICT within Myanmar generally and within the education sector specifically:

- **Lack of infrastructure:** According to an e-ASEAN Readiness Assessment conducted in 2001, Myanmar ranked ninth out of the 10 ASEAN countries in terms of e-infrastructure, e-society, e-commerce and e-government. As such, it was classified as an "emerging" readiness country, characterised by the need to build basic ICT infrastructure.[13]

- **Lack of financial resources for ICT education:** Myanmar is one of the least developed countries in the world, ranked 131st out of 175 countries in the UNDP 2003 Human Development Index. Gross domestic product (GDP) per capita in Myanmar is roughly US$ 1,027. While international isolation and donor country sanctions restrict the government of Myanmar's access to foreign aid, the government's main spending priority is its military. Public expenditure on the military is roughly five times greater than spending on education.[14]

- **Limited access to and awareness of ICT:** According to the non-governmental organization Reporters Without Borders, Myanmar is one of the countries most shut off from the Internet. According to the United Nations Development Programme (UNDP) Human Development Indicators (2003), the country has less than 10,000 Internet users out of a population of 50 million. In addition, the government reportedly restricts access to a local Internet substitute, the Myanmar Wide Web (MWW), which functions as a national intranet with links to only a few dozen government-approved sites. The government also allegedly controls the establishment of e-mail accounts and websites, with government agencies monitoring e-mail traffic and website content.[15]

Analysis

Objective information on the current state of ICT in education in Myanmar is limited. The majority of data on education planning and programming come from government sources, and the reliability of the information is difficult to verify. At the same time, sources of information on conditions tend to be subjective as well.

Based on the limited information available, there appears to be a mixed outlook for the incorporation of ICT in education in Myanmar. On the one hand, the government is reportedly making progress in incorporating ICT into its education policies and programmes. The relatively high level of literacy may also prove to be an advantage in building an ICT human resource base, although literacy in English, arguably the language of the Internet, is quite low.

On the other hand, Myanmar is still a developing country with limited financial resources and numerous development challenges. However, due to the prevailing political climate in the country, the United States, the European Union and other potential donors have sanctions in place that prohibit the provision of non-humanitarian assistance to the Government of Myanmar. In addition, multilateral

institutions, such as the World Bank and the Asian Development Bank, have generally been restricted from operating in Myanmar. Therefore, the country is currently unable to tap into most pools of international development assistance to implement ICT in education vision.

In sum, the government's alleged restrictions on using the World Wide Web, control over the MWW, monitoring of e-mail and intranet usage and punishment for ICT usage violations likely inhibit the development of Internet-related programmes. Not only might such policies have a chilling effect on interest in the Internet, but they may also impede individual and private sector ICT ventures.

NOTES

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Philippines

ICT USE IN EDUCATION

Ms Tian Belawati, Ph.D

National policy

The Philippine government believes that to foster lifelong learning skills in learners, educational development with a principal focus on quality and access should form the core of its information and communication technology (ICT) programme. The Philippines' Information and Communication Technology Plan[1] sets forth the following objectives:

- To provide physical infrastructure and technical support that makes ICT accessible and useful to students, teachers, administrators and support staff;
- To develop competence in using technology, in designing, producing, and using ICT-based instructional materials;
- To ensure access to the latest developments in ICT and to support research and development;
- To undertake a curriculum improvement programme focused on the integration of technology;
- To promote the use of appropriate and innovative technologies in education and training.

For the population of almost 80 million, the targets to reach by 2009 are:

- Seventy-five per cent of the public secondary schools and 50 per cent of the elementary schools will have a computer lab equipped with basic multimedia equipment;
- All public science-oriented secondary schools will be connected to the Internet;
- All public schools will have an electronic library system;
- Seventy-five per cent of the public school teachers will have been trained in basic computer skills and in the use of the Internet and computer-aided instruction (CAI);
- All public schools will be provided with appropriate educational technology equipment packages.

Current level of ICT access and use

According to Internet World Stats,[2] the number of Internet users in the Philippines is around two million people (1.1 per cent of its population). Further, a Department of Science and Technology (DOST) survey showed that among the 16 regions in the country, access to information technology at the secondary school level varies from a low of 34 per cent to a high of 98 per cent.[3] Metro Manila, as the centre of commerce and industry in the country, has the greatest access to computers, while the Visayas and Mindanao have the least. More specifically, the International Telecommunication Union (ITU) reported that, in 2000 to 2001, only about 17 per cent of 7,509 secondary schools were equipped with PCs, and about 1.16 per cent of this group had access to the Internet.[4]

Furthermore, the 1996 General Appropriations Act (GAA) laid the groundwork for procurement of hardware and software, teacher training and courseware development. For fiscal year 2002 alone, PHP 155,000 (US$ 2,800) was allocated to cover the following: 87.5 per cent for the provision of computers (Windows-based with provisions for networking) and printers; 1.7 per cent for the procurement of courseware and 10.8 per cent for staff development. Six hundred and sixty-six public secondary schools and more than 7,000 secondary school teachers and principals have benefited from this project. An additional 258 schools across the country are expected to benefit as well.

The use of ICT in education varies from school to school. A recent report[5] shows that:

- In the majority of private elementary schools, familiarisation with the computer starts in grade 2, while in the public elementary schools, where the technology may be available, introduction to basic computer operations starts in grade 4 as an area of study in Home Economics and Livelihood Education (HELE).
- At high school, computer applications for further skills enhancement are introduced as an area of study in Technology and Home Economics (THE). This includes word processing, spreadsheet, database management, creating PowerPoint presentations and using the Internet. In some private schools, the study of computers extends to more complex operations such as programming and website development. The complexity of skills development depends on the availability of ICT resources in schools.
- Computers are used mainly in THE for formal study of the technology, with relatively limited application to other learning areas. The integration of technology across the curriculum has been constrained by the lack of ICT resources.
- In non-formal education, there is very limited use of information technology because out-of-school youth and adults participating in non-formal education programmes generally do not have access to computers.

Knowledge of gender issues in ICTs is hampered by the lack of reliable statistics. Few studies have kept gender statistics on users of public access facilities. However, in virtually all that have, the number of women users is much smaller than that of men.[6] A survey on the use of ICTs by women's organisations in selected countries of Asia and the Pacific, including the Philippines,[7] indicated that women and men have not benefited equally. Women in particular have to contend with ideological, systemic and institutional barriers to accessing ICTs.

Highlights of the survey findings include the following:

- Women's groups that have been able to tap into the potential of ICTs have experienced benefits and increased opportunities to conduct research and gain access to news and information, improve organisational and personal knowledge skills, monitor and participate in global women's initiatives, disseminate information and publicise materials, lobby development causes at local and regional levels, exchange information and experience, co-ordinate activities both in country and abroad, contribute to civil society and local communities, identify new contacts and development partners and apply for donor funding and other forms of technical support;

- The dominant use of ICTs is for e-mail, which is primarily used for administrative purposes and correspondence with donors and regional and international partners. The Internet, on the other hand, was found to be useful for networking, information access and advocacy.

Major initiatives

Major initiatives of ICT use in education include the following:[8]

- **The "DepEd Modernization Programme",** which began in 1996, involves the introduction and use of modern technology to improve teaching and learning, educational management and support operations in the educational system.

- **The Act of 1998** (R.A. 8525) was passed to generate private sector participation in the upgrading and modernisation of public schools, especially those in underserved provinces. The project has four components: curriculum improvement, teacher training, courseware development and procurement of hardware and software. Recipient schools were selected based on the criteria adopted under the Computerisation Program. In all, 110 public high schools received computers in 1996 under the DOST Engineering Science Education Project (ESEP) and an additional 68 public high schools were recipients under the DOST Computer Literacy Program. DOST continues to allocate some PHP 20,000,000 to 30,000,000 (US$ 400,000 to 600,000) annually to support computer acquisition in schools. In 2002 and 2003, 125 public high schools were to be provided with 10 to 15 computers along with the corresponding teacher training programmes (see Appendix).

- **The Science Education Institute (SEI) initiatives** include the provision of Mobile IT Classrooms (MITCs), ICT Mediated Science&Technology Learning Programs, Mini Computer Laboratories, and development of Computer-based Teaching (CBT) modules. The MITC is a classroom housed in an air-conditioned bus, which is custom made to accommodate 32 students and a teacher. It is equipped with 17 laptop computers, two multimedia projectors, a television set, two VHS players, a public address system, two power surge protectors, a vacuum cleaner and two fire extinguishers. The ICT Mediated S&T Learning Program is for a selected number of elementary and secondary schools which are provided with one to three computers, one printer and one microscope that can be linked to the computer. These facilities are intended for teaching purposes and for limited hands-on activities for students. The Mini Computer Laboratory, installed in selected public schools, consists of four or five computers, a printer and software for Science and Mathematics. The mini-laboratory is used for demonstration and teaching, but may also be used by students for research-related activities. Some 164 schools were expected to benefit from the programme in 2002. Finally, the CBT modules are CD-ROMs, developed by SEI, to facilitate teaching and learning in General Science, Biology, Chemistry, Physics and Mathematics I-IV at the secondary level. The modules have been distributed to 110 S&T-oriented high schools, 1,145 recipients of the computer literacy programme of DepEd, 122 school recipients of the PCs for Public High Schools Project and 100 other school recipients in the different regions of the country.

- **The Bridgeit Programme,** locally called "text2teach," is part of the global Bridgeit Programme, which delivers digital learning materials to schools using mobile technology.[9] Each school is equipped with a satellite dish, 29-inch television set with rack, a 40-gigabyte digital video server/recorder to record and store video clips and two to three mobile phones. The Philippines is the only Asian country in the Bridgeit Programme which enables grade 5 and 6 students from selected public and private schools to view educational science videos downloaded with the help of mobile phones and satellite communication systems right into their classrooms. It is expected that more than 13,000 pupils will experience this teaching approach.

Other initiatives undertaken by the Department of Education (as parts of the Adopt-A-School Act) at the elementary level include the following:

- **Development of multimedia packages with ABS-CBN Foundation Inc:** To date 56 videotapes profiling outstanding instructional practices in

English, Science and Mathematics have been produced.

- **Computer Education for Elementary Schools (CEDES):** A computer education curriculum for grades 1 to 6 that has been developed and piloted in 10 divisions. A training programme in basic computer education supplemented the project for 24 teachers from six regions in August 2000.

- **TV-Assisted Instruction Project:** Launched by the Department and the ABS-CBN Foundation in 1994, this project aimed to introduce innovative technological approaches to upgrade instruction using tele-lessons. The 30-minute television shows such as *Sineskuela, Hiraya Manawari, Bayani, Math-Tinik* and *Epol/Apple* were aired from Monday to Friday.

- **Eskuela ng Bayan Project:** Proposes to standardise basic education by providing public elementary schools access to educational materials in English, Filipino, Mathematics and Science. It also provides access to the Internet and makes available information on non-formal education through an educational cable channel. The project includes a website for potential and currently participating schools which is also accessible to students and out-of-school groups. The website has teaching aids for teachers to use in enrichment programmes, e-mail services, chats and links to other sites for online education.

- **In collaboration with University of the Philippines National Institute for Science and Mathematics Education (UP-NISMED):** A project to integrate ICT in the 2002 Basic Education Curriculum (BEC). A framework for ICT integration in Science and Mathematics for K to grade 10 was developed. Similar frameworks for other learning areas are now being developed.

- **Information Technology Centers:** These centres of excellence in information technology, crossing traditional boundaries, were established in order to focus on the needs of a greater number of learners. There will be three IT Centers: two elementary and one secondary, in each of the 15 regions. Each will be provided with a laboratory equipped with computers, printers, peripherals, a multimedia projector, an air-conditioning unit and software programmes. Teacher training will also be a component. For the first year of operation, operating funds are provided by the Department, and the Local Government Unit (LGU) will supply funds for the maintenance and continuous operation of the facilities.

At the secondary level these initiatives have taken place:

- **DepEd Computerization Program (DECS):** In 1999 and 2000 undertook to provide networking among schools, access to the Internet and capability for electronic instruction. Three hundred and twenty-five public secondary schools have benefited from the programme.

- **Project LINK:** Scheduled to be operational in 2003. It has two components: technology access and development and teacher training. The former involves upgrading computer facilities to ensure connectivity that will provide access to the information highway. The latter involves the teachers of recipient schools, who will receive instruction on the use of the Internet for research and distance learning.

- **Continuing Studies Via Television (CONSTEL):** The first educational TV programme in the country to make use of the latest broadcast satellite technology combined with well-researched and carefully produced tele-lessons. The project aims to train elementary and secondary school teachers to become more competent in teaching English, Science and Mathematics. The project is being implemented in co-ordination with UP-ISMED and NBN. Telecourses in English and Science have already been developed.

- **Sci-DaMath Competition:** An annual Sci-DaMath competition which is a collaborative endeavour in sustaining the Science and Mathematics education through drama activities, which intend to increase the awareness of the learner and the public in Science and Mathematics.

- **e-MAGE 2000 (Math Games for Excellence):** A collaborative intervention with the private sector to enhance the teaching skills of math trainers through the use of information technology. Teacher training on using indigenous games in instruction and teacher-made computer-aided instructional materials in Mathematics were to be developed.

- **PCs for Public Schools Project (PCPS):** funded through a grant of PHP 600,000 (US$ 12 million) from the Government of Japan, secured largely through the initiative of the Department of Trade and Industry. The grant has benefited 996 public secondary schools across the country through the provision of 20 desktop computers, two printers, one fax/data/voice external modem with cable, one software package and teacher training to each of recipient-schools.

In the non-formal education sector, a network of 25 community-based radio stations has been set up under the *Tambuli* (horn) project. It was set up in 1993 as part of Aklan College's agricultural extension work, and was designed to promote community radio. To become part of the Tambuli Aklan network, a radio station needs to use a community participatory model of operation,[10] which has to be managed by a community media council (CMC) that ensures local participation through representation from a variety of sectors of the local community to which it is broadcasting. The media council includes representatives from the local church, government, market vendors, police, health authorities, taxi drivers, farmers, senior citizens, rural women, youth and business. One example of a member radio station is DYMT-FM, which broadcasts from the premises of the Aklan State College of Agriculture (ASCA).

Examples of training

Starting in 2000, the Philippine Department of Education has given preference in hiring teacher-applicants who were computer literate. In most teacher training institutions, computer education is now a required course. For those who are already employed as teachers, inservice is provided in several ways:

- Intensive training on electronics and assembly of computers for THE teachers of 110 S&T-oriented high schools and other special science high schools is offered. The objective of this training is to ensure that teachers in schools with special S&T programmes have the appropriate technology skills. The Science Education Institute (SEI) allows recipient schools to keep the computers assembled by their teachers after the completion of their training.

- Training using computers in classroom management and instruction started in 1997 as a component of the Department's computerisation programme. It has reached about 7,500 teachers of English, Science, Mathematics and THE (including those in elementary schools) and 691 school administrators.

- The PCs for Public High Schools Project is aiming to train 20,000 teachers over a period of two years under the Intel Teach to the Future Training Program. The training was initially for 1,000 teachers of the recipient schools. Each one of these 1,000 teachers is expected to train 20 additional teachers to reach the goal of 20,000 teachers trained by the end of the project.

- Training is provided by SEI of DOST on robotics and the use of advanced ICT facilities in Physics. The Physics teachers of the Philippine Science High School acted as trainers for Physics teachers of other public science high schools being supervised by the DepEd. Robotics facilities were given to the participating schools in the programme.

- Training programmes have been developed on the use of graphic calculators for Mathematics and Calculus for Science and Mathematics teachers in public schools. The Mathematics Association of Teacher Education Institutions (MATHTED) was tapped to handle the teacher training programme participated in by Mathematics teachers from 110 S&T-oriented high schools and other public science high schools.

- Distance training through CONSTEL is available for teachers who are unable to partake in face-to-face training in English and Science. The project has three components: development of instructional materials for teachers; production and distribution; and teacher training. The materials that have been produced and distributed to more than 2,000 schools nationwide include videotapes for English and Science teaching. Fifty-eight teachers of English and 91 teachers of Physics have been trained in the use of the materials. Videotapes in Mathematics will be produced and distributed by the Foundation for Upgrading the Standard of Education (FUSE).

- Training and capacity-building of women's non-governmental organisations (NGOs) and grassroots groups on various ICT skills is available. Some examples are the Women's Electronic Networking Training (WENT) series by AWORC and Wired Fridays, a grassroots women's training project on ICTs by Isis International-Manila.

Constraints on the use of ICT

Even though the Philippine government has initiated several programmes and projects for the use of ICT in education, real implementation in day-to-day learning is still limited. Teachers' fear of technology still hinders the optimal use of ICT-related skills in their teaching activities. Other constraints include the traditional mindset of the school principals, inadequacy of ICT facilities, the lack of adequate maintenance of the available/existing ICT resources, dependence for financial investment on the central government and dependence on ICT service providers for software/courseware.[11]

Despite various training programmes having been provided to teachers, there is still a need to embark on a comprehensive and sustained inservice training for teachers. Likewise, a systematic development programme for education managers needs also to be implemented to change the mindset of principals so they appreciate the value of ICT in education.

Although almost all initiatives involve some allowance for procuring ICT hardware and software, equipping schools with ICT facilities is still a problem. Therefore, given the budgetary constraints, the participation of other stakeholders like local government units, parent-teacher-community associations (PTCAs), NGOs, and the private sector needs to be encouraged to provide the education technology packages. Considering the lack of technical staff for maintaining computers and computer networks, as well as providing user support for Internet-related activities, lease arrangements rather than procurement should be explored as an alternative.

Another constraint that has had a significant impact on the use of ICT in classrooms is the availability of courseware. Applications and courseware currently available are predominantly productivity tools provided by ICT service providers. Schools, therefore, are limited to teaching the tools rather than using the tools to teach and learn. Without a variety of subject-specific applications, the curricular usefulness of the technology will not be fully realised. It is therefore necessary to develop a system to produce ICT-based education, including the development of ICT-based materials in teacher training.

Analysis

Data and information available show that the Philippines have eagerly embraced ICT in education. With facilitation by the Department of Education, and collaboration with the private sector, several initiatives have successfully equipped a number of schools with ICT facilities. Nevertheless, the initiatives have not insured that teachers fully use the facilities for teaching purposes.

A survey of 4,310 secondary schools (both public and private), conducted by DOST, showed that 84.1 per cent of the computers in schools are being used for instruction while the rest are used for office work. Among the computers used for instruction, 50 per cent were being used in THE while only 11 per cent and nine per cent of these computers were being used for Science and Mathematics instruction, respectively. Likewise, 15.2 per cent of the teacher-respondents said that they used computers for instructional purposes (56.5 per cent) and office work (43.5 per cent). Student-respondents also claimed that 92.1 per cent use computers for learning while 7.9 per cent use computers for other purposes. The survey also found that recipient schools are still dependent on external agencies for the maintenance of computers. About 45.1 per cent of the 2,405 schools surveyed engage the services of outside technician. A factor hindering bringing Internet to more schools is that only 38.9 per cent have telephones. Among schools that have telephone lines, the majority (81.1 per cent) do not have an Internet connection.

The Survey of Information and Communication Technology Utilization in Philippine Public Schools, conducted by the Foundation for Information Technology Education and Development (FIT-ED) in the latter part of 2001, revealed that student-computer and teacher-computer ratios are still considered poor and need to be improved. Furthermore, it was revealed that institutionalisation of technology integration in the curriculum has not been realised. One hundred recipient-schools under the 1996 DECS Computerization Program were included in the study.

In summary, it is fair to state that the use of ICT in teaching practice in Philippine schools is still not widely implemented because of uneven access to ICT facilities and the Internet, poor ratios of students to computers and teachers to computers, and the low levels of technology integration in the school curriculum.

NOTES

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APPENDIX

The Adopt-a-School Partners

Company/Organisation/ Institution	Recipient school	Name of project	Support/Intervention
ABS-CBN Foundation, Inc.		Multimedia Project	56 educational videotapes comprising Hiraya Manawari, Bayani, Apol Epol, Math Tinik and other ABS-CBN produced shows for viewing by public school children
Aboitiz Foundation	17 schools in Cebu	Aboitiz Adopt-A-School Project	20 computers and printers for teacher and student use
Ayala Foundation Inc.	CENTEX Mla. and CENTEX Batangas	Center of Excellence (CENTEX)	Funds for the establishment of a computer laboratory, with 11 PCs and 2 printers for each school; access to the Internet for high schools
AMA Foundation	100 schools under the PCPS project	Computer training programmes	Series of computer training programmes for teachers
A. Andes (author and publisher)	80 public high schools	Book Donation Project	Computer application books
Books for the Barrios Foundation	36 public elementary schools	Model of Excellence Project	Computer hardware
Citibank	Mandaluyong High School	Computer donation	21 computers
Coca-Cola Export Foundation Corp.	15 high schools in Metro Manila and the Visayas	Ed. Venture Project	Internet connectivity for schools; teacher training in the use of the Internet; telecollaboration among schools
Intel Phils.	755 high schools (1st batch) 500 high schools (2nd batch)	Intel Teach to the Future Training Program	Funding support for the conduct and monitoring of the school-based training for high school teachers
Japanese government	1,000 public high schools	PCs for Public High Schools Project	Curriculum development; procurement of hardware; training of teachers; courseware development
Makati Business Club	100 high schools	Connect ed. ph	Computer laboratories; software; training; Internet connections
Metrobank Foundation	6 special science elementary schools 16 RSHS	Computer donations; lab equipment donation	60 computers (486 model) Around 2.5M-worth of lab equipment and PCs
Philips Electronics and Lighting Co.	Manila Science High School P. Burgos Elementary School	Philips Educational Room (PER) Project	10 PERs, each PER serving as a one-stop electronic Library for learning and data gathering
STI	4,500 public high school teachers	Teacher training programme	Hands-on training in basic information technology

Republic of
Korea

ICT USE IN EDUCATION

Ms Jung Sun Hahn, Ph.D

National policies, strategies and programmes

Introduction

Entering the 21st century meant different things to different countries. To the Republic of Korea, it meant a paradigm shift from an information-based society to a knowledge-based society. The new paradigm requires changes in the social and economic environment, in social and cultural behaviour and in human resources. The knowledge-based society needs workers who are efficient and

effective using information and communication technology (ICT) and education; therefore, should be adapted to the needs of the society.

Policy Goals and Action Plans

The goal adapting education to the knowledge-based society is when to educate competent people who are knowledge providers, problem-solvers, good communicators and self-disciplined lifelong learners. To foster such competent people, the Ministry of Education and Human Resources Development (MOE & HRD) announced the Comprehensive Plan for Developing ICT use in Education.[1] The plan was to be carried out in two stages: the first from 1995 - 2000 and the second from 2001 - 2005. The second stage education reform includes standardising ICT skills and revising curricula, maintaining financial subsidies, narrowing digitally divided nations and people, monitoring progress and usage and operating e-governance in education.

Current Implementation Status

The second stage of the plan targets four major groups: elementary and secondary education, research institutions and universities, lifelong education and educational administration.

- ICT use in elementary and secondary education involves revamping curricula - developing and disseminating educational content, developing ICT utilisation skills of teachers and creating infrastructure conducive to ICT.

- The promotion of ICT use in universities includes constructing ICT infrastructure, promoting ICT use in science and research, using ICT in the teaching-learning process, digitising the library collections and promoting ICT use in academic administration. There are four cyber campus consortiums and 17 cyber universities.[2] Among the cyber campus consortiums, Korea Cyber University (KCU) consortium (*www.con.kcu.or.kr*) and Seoul Digital University consortium (*www.sdu.ac.kr*) have the largest member universities, the former with 38 and the latter with 42.

- There have been a variety of services in lifelong education: a comprehensive lifelong education information system, a lifelong learning network, a guidance counselling network, a comprehensive information system of national human resources development, a comprehensive credit bank information system, a lifelong contents development and the cyber-learning systems of broadcast and correspondence high schools.

- In the area of the educational administration, adapting to the knowledge-based society has two goals: one is to develop the National Education Information System (NEIS – see *www.keris.or.kr*), and the other is to improve the efficiency of education administration through computerisation in the MOE & HRD. NEIS is an electronic system that connects all educational administration services of schools, other educational institutions and offices through the Internet. It is designed to improve the quality of education by reducing the workload of teachers, allowing students and parents access to student information, and to increase the productivity of educational administrative institutions by sharing information. NEIS started its services in March 2003, and it is currently used by 96.9 per cent of schools.[3] The MOE and HRD is computerising educational administration within the ministry to improve its efficiency using an electronic document processing system.

Budget and Sources of Funding

The MOE and HRD secured KRW 158 billion (about US$ 130 million) for the use of ICT in education in 2002, KRW 139 billion (US$ 115 million) for 2003 and KRW 100 billion (US$ 85 million) for 2004 respectively.[4] The funds are strictly public schools and national colleges and universities excluding private schools and universities. The MOE and HRD amended the enforcement rules to subsidise local education in 2001 and secured a budget of KRW 300 billion (US$ 250 million) in 2002.[5] Private sectors have also participated in sharing costs by donating PCs and providing free training.

Gaps, Limitations and Needs

There are several gaps, limitations and needs in the system. First, there is not enough software available to meet the demands of the hardware in use at schools. It also has been difficult to develop and utilise educational information and materials due to the lack of standardisation. Several issues - copyright, privacy and negative use of Internet - remain unresolved. As well, the digital divide is a problem between the haves and the have-nots.

Current level of ICT access and use

Summary of Technologies Being Used

The major technologies being used in schools are radio, television, computer and the Internet. The two representative organizations are the Educational Broadcasting System (EBS) *(www.ebs.co.kr)* and KERIS (*www.keris.or.kr*).

EBS provides educational programmes for early childhood education, pre-school education, primary/secondary education, teacher training and lifelong education through five channels: one FM radio channel, VHF and UHF

television channels, and two cable and satellite television channels (Plus 1 and Plus 2). Each channel airs programmes for the specific target groups with focused content. VHF television airs the lifelong educational programmes, and the Plus 1 satellite channel airs curriculum instructional programmes for high school students. Plus 2 broadcasts curriculum instructional programmes for primary and secondary school students, for vocational education and for foreign languages. FM radio specialises in cultural, educational information and foreign-language learning programmes.

EBS also produces vocational education programmes in conjunction with the Korea Research Institute for Vocational Education and Training (KRIVET – *www.krivet.re.kr*). Vocational programmes are supported by MOE and HRD and by the Ministry of Labor. EBS also airs the Korea National Open University (KNOU – *www.knou.ac.kr*) programmes as well as Air and Correspondence High School programmes. They have also begun a service in Internet job broadcasting, and provide the audio-on-demand (AOD) and the video-on-demand (VOD) services of all the aired programmes except copyrighted foreign-made motion pictures. EBS is internationally recognised for its documentary programmes. Fifty-five per cent of the televised programmes of EBS are for lifelong education and 45 per cent are for curriculum instruction; 88 per cent of the FM programmes are for lifelong education and 12 per cent are for curriculum instruction (see Appendix 1).

KERIS, which was established in April 1999 as a government-funded institution under the educational research information law, is the leading educational and research organisation in Korea. KERIS provides service via the educational network (EDUNET – *www.edunet.net*), operating Research Information Service System (RISS – *www.riss4u.net*). KERIS has been at the forefront of enhancing the quality of national education and has made significant contributions.

Digital Divide Issues

To narrow the gaps between the haves and the have-nots, MOE & HRD established a plan for promoting ICT use and distributing PCs to children from low-income families in April 2001. Half a million children were selected and given the opportunity to take lessons on computer use and to practice online communication. Among those who have taken the courses, 50,000 students will receive free PCs and money for communication fees for five years.[6] Despite this programme, however, a recent survey showed that the Internet users of low-income families has dropped from 38.7 per cent in 2001 to 22.9 per cent in 2002.[7]

Due to budget allocations, there also exists a gap between various cities and provinces in the use and promotion of ICT, and there is a need to clarify the responsibilities between the national and local governments in order to narrow this information gap. Article 8 of the Framework Act on Information Promotion describes the responsibilities of different levels of government.

Another gap is between males and females. The KERIS study on elementary and secondary school students shows that male pupils use computers longer and are more familiar with them than their female counterparts. The research concluded that the gap in exposure and familiarity to computer is related to parents' attitudes towards computer usage. More female respondents said that their parents give priority to boys in the family when it comes to using computers.

Nature and Role of Partnerships

Partnerships for ICT use in education exist in a variety of forms in several government agencies, government-funded organisations and the private sector. The central government ministries, such as MOE and HRD, the Ministry of Labor, the Ministry of Information and Communication, the Ministry of Commerce and the Ministry of Industry and Energy develop and disseminate ICTs, digital content and training and education for educators, students and citizens. Local government agencies co-operate with private sector organisations in establishing computer labs and offering training sessions. Several government-funded and non-profit organisations are also actively involved in ICT use in education (see Appendix 2).

Major initiatives

The government, private sector, research organisations, schools and universities are all co-operating to fulfill the nation's ultimate goal of constructing a knowledge-based society. The government has enacted and implemented the Comprehensive Plan, enforced necessary regulations, acts and laws, and restructured the research and academic organisations adding new functions for ICT dissemination (see Appendix 3).

Upon the completion of the first stage of the Comprehensive Plan for Developing ICT Use in Education (1995 - 2000), Republic of Korea was evaluated as having the best educational infrastructure in the world. Certainly, the advanced ICTs, the full coverage of high-speed communication networks in the nation and the best ICT industries laid a solid foundation for making ICT use feasible in education.

During the first stage of the Comprehensive Plan, the focus was on computer literacy for educators, students, workers and citizens. Education for ICT literacy has been undertaken to provide equal access to information and to reduce the information gap within the public education. The government has required mandatory ICT education for elementary school students from grades 1 to 6. For secondary school students, ICT education is an elective, but in 1999, an ICT skills recognition system was implemented, requiring all high

school graduates to take either ICT courses or an ICT skills test.[8] In addition, in every subject more than 10 per cent of classroom activities are supposed to make use of ICTs.

In the second stage the focus shifted from literacy to utilisation, not as a special subject or a technical education, but as something to be integrated with all subjects. Therefore, teaching-learning process plans for ICT use are now constructed and implemented in the teacher training programmes. The Seventh School Curriculum emphasises ICT utilisation and the integration of ICT knowledge and skills into the curriculum.[9]

The most noticeable aspect of ICT education in the Republic of Korea is the definition of the target learner, which has not been limited to educators, students or government workers, but instead includes individuals regardless of age, income, social status, education or gender. Universities, several government-funded organisations and industries offer the necessary training for ICT users for free or with minimum tuition fees. During this second stage, to diagnose the progress of ICT use in education, the government, in co-operation with research institutions, is developing the standardised educational indicators of ICT use in education that, up to the present time, have been used for elementary, secondary and higher education. Indicators for special education and for lifelong and vocational education are underway and will be completed by 2003 and 2004 respectively. In addition, ICT Skills Standards for Teachers (ISST) and its curriculum were developed during 2002 and 2003.[10]

It was recognised that to use ICT effectively, the proper environment is needed, including the necessary computer hardware, basic peripherals and software. The government has funded these needs for universities, research organisations and elementary and secondary schools, and the Classroom Advancement Plan (1997 -1999)[11] standardised the provision per class as one PC, television, beam projector and printer.

During the implementation of the plan, several needs were identified: training, good quality educational content and utilisation plans. This led to the revised Classroom Advancement Plan being enacted at the end of 1999. It reduced the PC distribution, but enhanced the utilisation rate. It also focused on building school intranets. And in 2002, the Comprehensive e-Learning Plan announced that connectivity would be provided to all schools.

Educators, organisations and private vendors are helping to develop the necessary software, books and training materials, and these are evaluated and certified by KERIS. As well, organisations such as the Education Software Promotion Association, the Korea IT Industry Promotion Agency and the Korea Software Industry Association are actively involved in developing and promoting good quality software. Each year, there are several educational software contests for different levels of participants. Since 1998, educational exhibitions have been held to show new software to educators and to provide opportunities to software developers to advertise their products. The Sixth Education Information Expo (EDUEXPO) in 2003 toured four major cities and drew about half a million people.[12]

It was also determined that for easy and quick access to a wide variety of educational content, a collective database was needed. To meet the need, EDUNET (*www.edunet.net*), operated by KERIS, was launched in 1996. As of June 2003, EDUNET had 5.3 million subscribers[13] and 3.8 million monthly users.[14] Fifty-four per cent of the subscribers are elementary and secondary school students and six per cent are teachers. (Eighty per cent of all teachers in the nation are subscribers.)

To meet the needs of higher educational institutions and research organisations that require fast and accurate sharing of information and research results, KERIS operates Research Information Service System (RISS), a portal site.[15] It is connected to all the university libraries in the nation as well as to major international databases such as OCLC in the United States, the British Library in the United Kingdom, KINETCA in Australia and NII in Japan. It is also connected to the National Library of Korea (*www.nl.go.kr*), the Korean Social Science Data Center (KSD C – *www.ksdc.re.kr*), the Korea Social Science Library (KSSL – *www.kssl.or.kr*) and LG Sangnam Library (*www.lg.or.kr*). The most widely used comprehensive databases are Nationwide Resource Sharing of RISS and the National Assembly Library (*www.nanet.go.kr*).

KERIS also operates the APEC Youth Internet Volunteer (AYIV) programme and the APEC Cyber Education Network (ACEN – *www.acen.or.kr*) project. These two projects were launched in 2001 as a result of the APEC Forum in Seoul in March 2000 and the suggestion at the Seventh Meeting of APEC in Auckland, New Zealand, by President Kim Dae-Jung, Republic of Korea, for an "e-education project." The purpose is to alleviate social and economic disparities by developing human resources among member economies through educational co-operation.

In 2002 the Digital Data Support Center was installed in a selected Office of Education. KERIS has implemented a metadata system and is preparing to implement e-learning contents standardisation. The Korea Association of Cyber Education (KAOCE – *www.kaoce.org*) is actively involved in promoting e-learning and building a cyber education community. KAOCE, one of the leading e-learning research and development organisations, also conducts seminars and workshops and is pursuing e-learning contents standardisation.

Examples of training

Effective ICT utilisation depends heavily on the abilities of the teachers. Various pre-service and inservice teacher training

programmes are offered. In the pre-service training, students are required to take from six to 20 credits of ICT courses.[16] Teacher colleges and colleges of education are offering new courses on information and ICT use, updating teaching learning methods and integrating ICT use in all classes. A significant amount of funding has been allocated to teachers' colleges to install the necessary hardware and software and to provide a proper learning environment.

At the inservice training level, one-third of the teachers have received training every year since 2002.[17] The training is divided into five target groups: inservice teachers, principals or vice-principals, professional instructors, ICT specialists and excellent teachers. The content of the training includes information literacy, multimedia courseware development and use of ICT in the teaching-learning process.

As teachers have shown more interest in learning how to integrate ICT in their classroom teaching than in learning how to develop courseware, a Plan for ICT Use: Training Program Development by Subjects was undertaken in 2002 as a two-year project. The plan seeks to document the teaching-learning goals of the 10 basic subjects from the Seventh School Curriculum. Under the plan a teaching-learning model is to be developed for ICT use in each subject and implemented in the classroom teaching. The process of implementation is meant to be documented and then adapted to the teacher training programmes. A total of 11 subject training programmes were developed and 20 teaching-learning models in five subjects for ICT use were completed.[18]

KERIS has been the main organisation for providing teacher training; however, 46 institutions are now certified as distance education institutions for teacher training. They include teacher colleges, colleges of education, private sector organisations and city and province training institutions. As well, on their own teachers have shown the initiative to learn more about ICT use in education. Many have organised study groups on each subject by city or by province and have met for lectures, seminars, workshops, symposiums and to develop educational materials.

Constraints on the use of ICT

In an effort to address the constraints on the use of ICT, in January 2001 the government enacted the Act on Solutions for the Digital Divide.[19] This act seeks to promote a higher quality of life and the balanced development of the economy by guaranteeing free access and free use of information networks to people who have difficulties with access due to economic, regional, physical or social barriers, such as people with low incomes, residents of farms or fishing villages, people with handicaps, the elderly and women. According to a survey conducted by the Korea Institute of Special Education (*www.kise.go.kr*), income level and residential region are important factors in predicting ICT use. The government should be more active in reducing the digital divide and developing substantial long-term support for these students.

Students in special education also need support. Special education is categorised into two major fields: students with disabilities and gifted students. Several organisations support and provide training for ICT use in special education. For example, the Korea Institute for Special Education has installed eight distance special education broadcasting systems and is conducting distance special education training and counselling for teachers and parents. KERIS is also active in this area, as are some private industries with the support of the Ministry of Health and Welfare, the Ministry of Labor and the Offices of Education in the cities and provinces.

Analysis

Just as students cannot learn from a pencil, they cannot learn from ICT. A good quality pencil cannot improve a student's learning, but it can, however, help that student write easily and comfortably. Similarly, ICT does not guarantee that a student will learn, but it can help a student find information quickly and easily.

Educators should think carefully about what effectiveness of ICT use in education really means. Further, they should think how students' learning should be evaluated. Students learn from thinking, and thinking mediates learning. Thinking is engaged by activities. Simply using ICT in the teaching-learning process does not improve students' thinking, unless the ICT is used in a way to improve thinking. Training programmes for educators and students are focused on computer literacy and ICT utilisation, but none of them cover critical thinking, problem-solving, communication, interpersonal skills or how to further construct one's knowledge based on the collected information via ICT.

New approaches and methods should be designed to teach these basic skills. ICT should be used to create different activities that engage different kinds of thinking. The important factor is that the role of teachers and the contributions of technologies in learning are indirect. They can stimulate and support activities that engage learners in thinking, which may result in learning. In the future, policies and action plans should be designed to promote thinking skills, and ICT should be used as the useful and convenient tool for helping students to think.

Clearly, the Republic of Korea has developed the best educational infrastructure in the world. The current problems, however, are determining how to maintain that infrastructure, how the infrastructure should best be used and what should be transmitted on the information superhighway. Recent surveys gave grim reports of the negative use of ICT by elementary and secondary students. Students are consuming

too much time chatting and playing games, and in accessing pornographic sites. Recently the information and communication ethics education has been started by the educational offices in cities and provinces. In order to be effective, ethics training programmes for teachers and parents should also be provided. Moreover, parents' abilities to use ICT is critical to oversee their children's computer use and Internet access.

As a result of the research that KERIS has done on SCORM (Sharable Content Object Reference Model), a methodology for developing educational contents works has been developed. When the methodology is applied to all subject matters, adaptive learning, which makes it possible to tailor instruction to individual needs, will be exercised. More research should be conducted and effort placed on developing better quality educational programmes, applying e-learning contents standardization, studying new ways of using ICT and integrating ICT in daily learning activities. In the 21st century, teachers should also recognise their new roles as facilitators, coaches, advisors and guides who can diagnose students' needs and meet those needs at the right time with the right amount of assistance.

APPENDIX 1

Ratio of educational programmes of the Educational Broadcasting System (EBS)

Medium		Total broadcasting (hours)	Curriculum instruction	(hours/%)	Lifelong education	(hours/%)
TV	Terrestrial TV (VHF/UHF)	6,980	770	11.1%	6,210	88.9%
	Satellite TV (Plus 1)	7.750	7,748	96.15%	302	3.95%
	Satellite TV (Plus 2)	8,330	2,291	27.5%	6,039	72.5%
	Sum	23,060	11,509	44.9%	12,551	55.1%
Radio	FM	8,400	1,020	12.1%	7,380	87.9%
	Total	**31,460**	**12,529**	**39.8%**	**19,931**	**63.3%**

APPENDIX 2

Government Agencies and Non-profit Organizations in ICT

Air and Correspondence High School	achs.kedi.re.kr	• 39 Air and Correspondence High Schools in the nation • Provides high school education for students who missed school to attend regular high schools
Educational Broadcasting System	www.ebs.co.kr	• EBS is dedicated for public broadcasting and education • Broadcasts educational programmes for all ages from kindergarten to adult
Education Software Promotion Association	www.espa.or.kr	• Conducts R&D in promoting educational S/W • Develops databases for educational S/W • Conducts S/W analysis and management • Provides technical assistance and dissemination of new techniques • Sets up the training centers in cities and provinces • Conducts and provides certification of computer skills

The Federation of Korean Information Industries	www.fkii.or.kr	• Promotes information technologies in Republic of Korea as a national non-profit organisation
Korea Agency for Digital Opportunity & Promotion	www.kado.or.kr	• Provides Internet access environment where needed • Promotes international cooperation to narrow digital gaps within nation and among nations • Initiates national information education for public • Educates for proper use of information to limit abuse
Korea Association of Cyber Education	www.kaoce.org	• Builds cyber education communities to promote and activate e-learning • Exports educational content and promotes knowledge industry • Resolves educational problems
Korea Association of Educational Information & Broadcasting	www.kaeib.or.kr	• Conducts research on educational information and broadcasting
Korea Database Promotion Center	www.dpc.or.kr	• Central organisation of databases and digital contents for 21st century • Builds a foundation for digital content dissemination and activation • Builds cooperative network and conducts research
Korea Educational Development Institute	www.kedi.or.kr	• World class national centre for education policy and research
Korea Educational Development Institute	www.kedi.or.kr	• World class national centre for education policy and research
Korea Education & Research Information Service	www.keris.or.kr	• Provides educational services via EDUNET • Promotes full utilisation of ICT in education • Secures and provides educational contents and core software programs • Offers training courses for educators and students • Helps schools and related government agencies with administrative digitalization • Provides a high-tech system for cyber and lifelong educational services • Sets up computerized systems at school libraries
Korea Education Frontier Association	www.kefa.or.kr	• Develops systems for educational information • Establishes foundation for research • Enhances education, training, and public relations for ICT use in education • Promotes international exchange in research, development, and skills
Korea Information Strategy Development Institute	www.kisdi.re.kr	• Provides a new vision for building information society in 21st century • Strengthens position as leading research institute in mapping out strategy towards knowledge-based economy
Korea IT Industry Promotion Agency	www.kipa.or.kr	• Promotes software exports • Promotes software start-ups • Enhances competitive edge of digital contents • Operates international IT support centre • Improves software process • Conducts research and analysis
Korea National Open University	www.knou.ac.kr	• Applies and delivers diverse learning systems and educational programmes via Internet, on-line, cable TV, EOD (Education on Demand), CD-ROM, and radio
The Korea Research Institute for Vocational Education & Training	www.krivet.re.kr	• Conducts research on technical and vocational education • Supports network of stakeholders in technical and vocational education and provides training and human resources development • Supports government policies to develop the vocational capacity
Korean Society for Educational Technology	www.etkorea.com	• Improves learning environment and resolves learning problems with educational technology • Services for educational and professional activities
Korea Software Industry Association	www.sw.or.kr	• Promotes domestic software industry • Implements technical research projects with cooperation of industries
National Computerization Agency	www.nca.or.kr	• Promotes ICT for central and local government agencies • Supports policy development

APPENDIX 3

Acts, Regulations, and Laws to Promote ICT Use in Education

ICT Use in Education

1991: Research and Development of Information and Communication Act
8/4/1995: Framework Act on Information Promotion
1/16/2001: Act on Promotion of Information and Communications Network Utilization and Information Protection

Copyright Law

1/28/1957: Copyright Law
3/8/1991: Copyright Law (Revised) - Added Library Promotion
3/24/1994: Copyright Law (Revised) - Added Library Promotion and Reading Promotion
1/12/2001: Copyright Law (Revised) - Added Copyright Protection of Digitized Materials and Its Dissemination
4/3/2003: Copyright Law (Revised) - Added Copyright Protection under the Digital Network Environment and Use of Digitized Materials

Software Industry Promotion Law

12/1987: Software Development Promotion Act
12/6/1995: Software Development Promotion Act (Revised)
1/21/2000: Software Industry Development Act (Revised)
7/25/2003: Software Industry Development Act (Revised) - Added Dispute Mediate Committee

Lifelong Education Law

8/31/1999: Lifelong Education Law
3/13/2000: Enforcement Decree of the Lifelong Education
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Thailand

ICT USE IN EDUCATION

Ms Tian Belawati, Ph.D

National policy

In line with the global trend, the Government of Thailand recognizes the importance of information and communication technology (ICTs) for achieving broader social and economic objectives. To utilise the full potential of ICTs, Thailand's National ICT Plan has set three agendas:

- *To invest in an equitable information infrastructure to empower human ability and to enhance life quality;*

- To invest in people to build a literate populace and an adequate information technology manpower base; and
- To invest for good governance.

The first item refers to investment in national information infrastructure (NII), which includes a wide range of equipment and technologies that have to be universally available at affordable costs. The second item refers to investment in ICT skills-related human resource development, and the final item refers to supporting efforts the government needs to accomplish in order to be the driving force of ICT implementation.[1]

The National ICT Plan specifically states that information technology needs to be an integral tool in education and training at all levels, and must not be restricted to science and technology but must include humanities as well as the arts.[2] This should include initiatives to:

- Provide all teachers, college lecturers, professors, school children and college students with the opportunity to learn to use ICTs. The objective is to employ ICTs as an enabling tool to access information and gain knowledge through self-paced learning, or through interactions with teachers and fellow students.
- Link schools, colleges, universities and libraries electronically to provide students, teachers and lecturers with an enriched environment in which distant resources can be made available remotely at one's fingertips.
- Make full use of ICT and distance education to meet the needs and aspirations of all citizens for continuing education and skills upgrading regardless of age, profession, distance or geography. Special attention must be given in particular to people with disabilities.

Current level of ICT access and use

Thailand is an ASEAN countries with a population of over 62 million. Statistics of communication infrastructure are quite impressive. Data show that in 2000, 76 per cent of the households in Bangkok had telephone connection, although only around 28 per cent of households in the whole of Thailand were connected.[3]

The growth of ICT users in Thailand within the last two years was over 50 per cent, increasing from around 2.3 million to over 3.5 million users.[4] Thailand ranks 25th in a list of the top 25 countries with highest number of Internet users.[5] The number of Internet users is around 5.7 per cent of the total population. This is higher than Internet penetration in other ASEAN countries such as in Indonesia (two per cent) that ranks 21st, although it is lower than Malaysia (24.4 per cent) that ranks at 17th.

The cost of the Internet in Thailand is lower than in some other ASEAN countries. For example, the cost of an Internet subscription from an ISP (Inet-Gold) ranges from 13 to 15 baht per hour (US$ 0.39 to 0.45) for "pay in advance" packages, or from 2,700 baht to over 12,000 baht (US$ 81 to 360) per month for a "multiple package."[6]

The specific goals of ICT implementation in education are the following:[7]

- Implement a "national school-information action programme" with the target of providing all state schools with at least one PC per 80 primary school pupils and at least one PC per 40 secondary school pupils within five years; allocate an annual budget of 1,000 million baht (US$ 30,000,000) to equip state schools with up to 30,000 PCs a year, a substantial number of which will be linked into networks; and connect all universities, colleges and secondary schools to Internet.
- Establish a "national interactive multimedia institute," which will oversee the development and dissemination of interactive multimedia technologies. An annual budget of at least 400 million baht (US$ 12,000,000) to support the development of technologies and courseware packages.
- Intensify ICT manpower production at all levels, with the target of doubling the supply of computer and telecommunication manpower in five years.

However, by the year 2000, only 22.5 per cent of secondary schools and 1.19 per cent of primary schools were connected to the Internet.[8] Within these schools, the ratio of students to computers was about 40 secondary school students per computer and 114 primary students per computer (see Table 1).

As of 2000, Thailand's Ministry of Education has been able to provide almost 190,000 PCs, more than 150,000 of which were used in learning/instruction processes (see Table 2).

In those schools with computers, most have been integrated into the curriculum using both PC standalones and networked units. The predominant use of computers by teachers and students is for word processing, using a spreadsheet for data analysis, using a database for organisng research data, using hypermedia for publishing works on the Internet and using both the Internet and CD-ROMs for searching information.

Table 1: ICT Facilities in Schools by 2000

Indicators	Goals	Status by 2000
Ratio of secondary schools connected to the Internet	100%	22.50%
Ratio of primary schools connected to the Internet	100%	1.19%
Computer student ratio: Secondary school	40:1	40:1
Computer student ratio: Primary school	80:1	114:1

Examples of major initiatives

Many ongoing national projects have been instrumental in providing learning resources through various types of networks. Initiatives to enhance ICT use in the education sector include the following:

- **SchoolNet** started in 1995 as a pilot project to provide Internet access to 50 schools. Presently, it connects over 5,000 schools to the Internet.[9] The network has been designed to serve the goal of universal access for every school nationwide. More specifically, a school pays only the telephone charge at the local-call rate per connection (at US$ 0.08 per call), and no Internet access charge, regardless of where they are located. Furthermore, content creation programmes and activities have been initiated to promote the use of Internet in teaching and learning. For example, a digital library and archive have been created which contain digitised materials in various forms, have proper indexing and a search engine for ease of use. An easy-to-use tool was also developed for teachers to create their own content or teaching materials to add to the digital library. (See the website *http://school.net.th* for more information.) The SchoolNet Project achieved a "universal access" status in 1997 and is cited in UNDP's Human Development Report of 2001.

- **A tele-education project** for the non-formal education sector via the Thaicom satellite and run by the Department of Non-Formal Education is coupled with General Education's tele-education project via Klai Kangwol School.

- **The UniNet Project,** under the Ministry of Education, connects public universities via a high-speed fibre-optic network providing teleconferencing facilities among campuses throughout the country.

- **The Information Technology Project,** under the initiatives of HRH Princess Mahachakri Sirindhorn, has been working at a grassroots level to develop lessons for the sector as a whole.

Other projects underway include a donation programme for used computers, ICTs for people with disabilites, multimedia for young hospital patients, ICT for cultural promotion and also ICT training for prison inmates.

One comprehensive effort to utilise ICT in the non-formal sector is being made by the Mirror Art Group (MAG), a non-governmental organisation (NGO) based in the northern town of Chiang Rai. MAG's projects are focused on the hill tribes of northern Thailand (the Akha, Hmong, Karen, Lahu, Lisu and Mien). MAG's innovative approaches for programming include helping hill tribes harness the power of modern computer communications and broadcast technologies to create an education system that eliminates traditional

Table 2: Number of schools, students and teachers using ICT by levels

Level	Schools	Students	Teachers		Use of PCs		
			Total	Trained	For instruction	For office	Total
Primary	30,476	6,633,809	358,781	71,442	56,442	1,959	58,401
Secondary	2,669	2,638,465	125,983	25,000	48,750	16,420	65,170
Vocational	413	592,857	19,118	8,542	23,240	120	23,360
Non-formal	1,007	991,464	4,041	3,010	932	103	1,035
Racha Mongkol In.	61	93,363	5,734	3,560	9,419	2,079	11,498
Rajabut In.	41	507,342	8,160	4,405	16,125	4,747	20,872
Religion	405	67,360	4,388	415	345	99	444
Total	**35,072**	**11,524,660**	**526,205**	**116,374**	**155,253**	**25,527**	**180,780**

communication barriers by establishing a connection between remote villages and the rest of the world using a satellite dish.[10] Here are some of their other points of focus:

- The Youth Network aims to restore youth pride in tribal identity while giving them a support network and helping them adapt to adulthood in modern Thailand. The network organises a wide range of activities from Saturday computer, English and Thai lessons to large campaigns/discussions on complicated topics such as drugs, gender issues and sex education. MAG uses a website for soliciting donations of books and other resources as well as recruiting volunteer teachers. So far, MAG has attracted more than 1,500 volunteers to Chiang Rai to work on the project.

- The virtual museum of hill tribes is a development to preserve the culture of the six major tribes and to show it to younger generations and outsiders. The customs and ceremonies are presented through a website. The Internet link from the physical counterpart museum in the village will initially be done with solar power due to electricity being unavailable in the village.[11]

- The development of *ebanok,* a web commerce site that is designed to sell handcrafted products made by community members of the hill tribes.

- The creation of Bannok TV (*www.bannoktv.com*) to help fill the need for positive media images of hill tribe people, and to provide an information forum capable of reaching the remote villages of Mae Yao. Bannok TV is supported by an extensive community video archive, which is a multimedia collection that documents traditional ceremonies, songs, customs, costumes, farming practices, weaving methods and hunting techniques. MAG uses the archive to produce educational documentaries for hill tribe people and lowland Thais. In addition to video, MAG also makes audio recordings of a vast array of hill tribe songs.

Examples of training

To promote the use of ICTs in the classroom, Thailand has allocated substantial money for various training programmes. As shown in Table 2, about 71,442 teachers and related personnel out of 358,781 at the primary levels, and 25,000 out of 125,983 at the secondary level have been trained. Around 21 per cent of the teachers have received training to date.[12] The content of ICT training depends on the needs of each group. but Microsoft Office, Visual Basic, Power Builder, FOXPRO, MS ACCESS, SQL, HTML, CAI have been the most requested.

The training has been conducted in collaboration with Rajabhat Institutes. Currently eight of their 36 campuses nationwide are able to offer Internet training courses. These eight campuses are in different provinces and can serve as regional training centres for schools in those areas. Through the regional training centres, schools save tremendously on travel expenses.

Constraints on the use of ICT

In the process of carrying out developmental work on ICT for education, many issues and problems arise that require appropriate remedies. They fall into three groups:[13]

Accessibility and affordability:

- Extensive telecommunication infrastructure is a prerequisite;
- Highly centralised access;
- Long-distance call from remote areas;
- Digital divide within the nation.

Need for appropriate content:

- Present focus on basic computer skills and English;
- Lack of software with Thai content;
- Lack of evaluation standards;
- Lack of input from private sector.

Need for ICT literate teachers:

- Short courses have not much impact, but peer training effective;
- Lack of sustainable and systematic professional development;
- Need for realistic objectives in training programmes.

Analysis

Thailand has started to prepare its primary and secondary education systems for the digital era. The initiatives and incentives given to the school system show that much has been accomplished already. The initiatives taken by the non-government sector such as those of MAG promise a lot of things for the non-formal sector. MAG's programmes show innovations in utilising ICTs without being hindered by the absence of fundamental necessities such as electricity. Nevertheless, it seems that the initiatives are mostly project-based and have not really touched the fundamental issues such as more equal and affordable access to the Internet.

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Viet Nam

ICT USE IN EDUCATION

Ms Tian Belawati, Ph.D

National policy

As early as 1993 Viet Nam recognised the importance of developing an information and communication technology (ICT) policy, but it did not publish a Master Plan for ICT in Education until 2001.[1] Based on a review of similar policies in other countries, the Ministry of Education and Training (MOET) of Viet Nam noted that information technology "has been used as a tool for teaching all subjects and there is no fixed curriculum. Teachers should be innovative in applying IT to their subject teaching. [The] concept of education technology [was] built into IT application." The Master

Plan focuses on meeting the demand for ICT human resources; educational reform in content, teaching and learning methods; study modes; and educational manageme nt.

In the Master Plan, Viet Nam aims to develop a computer-based information network system for education and to improve computer ratios at educational institutions (every school is expected to have at least one classroom with five computers). For the period 2001–2005 the objectives for IT development are as follows:

- To build ICT infrastructure for education and training. This consists of computer networks (local networks, intranets, Internet), computer rooms in schools, computers in all educational institutions (schools, colleges, universities, provincial departments, MOET departments) linked together providing access to various databases and resources for teaching and learning activities and educational management.

- To develop the ICT human resource for sector by preparing up to 25,000 or 30,000 trained specialists at all levels of qualification. Specialised ICT training programmes for other disciplines are developed to promote ICT applications in all different fields. Flexible training modes with quality training are encouraged.

- To use ICT as a tool to promote innovative thinking, initiatives, communication, independent problem-solving skills, information searching and processing skills to facilitate lifelong learning for all people. To apply ICT to any subject, at any school, at any level through use of educational software (software for teaching, learning, testing and evaluation).

- To build suitable curricula, teaching methods and student evaluation systems for teacher training programmes and to revamp educational management through student databases, teacher databases, databases for educational institutions as well as legal and regulation documents. This information system will allow faster and more efficient decision-making.

- To reach the goal of at least 25,000 trained ICT specialists by 2005 by strengthening training quality at all ICT faculties, increasing technical and practical works, regularly revising IT faculties and updating their programmes, setting up more ICT faculties at other state universities, increasing the intake into two-year training programmes for technicians and technologists with more emphasis on practical skills, encouraging second degree training in ICT for graduates holding bachelor's degrees in other disciplines, creating a quality accreditation committee for reviewing programmes at ICT faculties and at other ICT training levels, setting up joint training programmes with foreign universities, and by encouraging students, lecturers and researchers to study in developed countries. As far as ICTs in schools are concerned, the major aims of the Master Plan include providing general knowledge about (1) computers and IT for all school teachers and students, (2) computer use for teaching and learning other subjects and (3) computer use for school management.

Current level of ICT access and use

Viet Nam has moved ahead in Internet access since the first Internet service provider (ISP) licences were granted in 1997. As of 1999, Viet Nam had two low-speed lines connecting Hanoi and Ho Chi Minh City to the outside world.[2] Internet use in Viet Nam from 2000 to 2002 increased by about 100 per cent. However, the number of Internet users in 2002 was still very low, at about 0.2 per cent of its total population.[3]

The small number of Internet users is due partly to the high cost of Internet access, which before 1999 was one of the highest in the world.[4] Although the cost now is slightly lower, it is still considered very high by most Vietnamese. The International Telecommunication Union (ITU) reported that the cost for accessing the Internet in Viet Nam is almost US$ 40 per 30 hours (this includes the cost for ISP subscription and telephone usage). Furthermore, since Internet access is mainly done through telephone lines, the low percentage of users reflects telephone availability in the country since only eight per cent of Vietnamese households have a telephone.[6]

In the education sector, the MOET used its own budget to supply computers and other ICT equipment to universities and schools in the early 1990s. This played a vital role in introducing ICT teaching in schools and universities. Subsequently, many local authorities and communities used their own budgets to set up computer rooms in schools. As of 2000, about 80 per cent of secondary schools (out of 1,760) have at least one computer, but only a few primary schools (out of 22,200) have set up computer rooms. Nevertheless, some private schools in big cities have better facilities. An example is the Hanoi Amsterdam High School. From the "Maths-gifted class" that graduated in 1991, 16 of the 26 students had e-mail addresses. Many are working in the ICT sector or in government institutions of one form or another, including universities. Another example is the ChuVanAn Secondary School, which has an active alumni section that helps provide computers for the school. Generally, however, given the relatively high costs of Internet access, it is only those students whose parents are able to pay that have access to ICT facilities.

Furthermore, ICT has now become a compulsory subject in specialised upper secondary high schools (grades 10, 11 and

12). In other general (upper and lower) secondary schools and in primary schools, ICT teaching is optional depending on computer availability. (In the beginning, computers were utilised exclusively for teaching ICT.)

Examples of major initiatives

Several international co-operative projects have been established:[8]

- Canada, Australia and Japan provide assistance to improve ICT facilities in Vietnamese universities and scholarships for Vietnamese students.
- The Institute for Francophone Informatics (French) offers a master's programme in ICT for 25 students every year.
- Some foreign information technology companies set up ICT training centres.
- Apple, Microsystem, HP IBM, COMPAQ and Coca Cola offer assistance to Viet Nam education, including setting up ICT training centres and conducting ICT-related training.
- The World Bank and Asian Development Bank gave financial assistance to improve ICT facilities in universities, colleges and provincial educational departments.

As well, an educational network, EduNet, has been designed to link all universities, colleges, provincial departments of education and MOET departments.[9] Despite the slow progress due to low investment, this initiative has prompted other projects to take off, including ICT teacher training and teaching ICT as a subject in schools.

Another project has been the development of an inter-linked network of learning centres in secondary schools and youth centres across Viet Nam known as the Coca-Cola Learning Centers.[10] Coca-Cola established the network in partnership with Viet Nam's Ministry of Education-Training and the National Youth Union. It is to provide a dynamic environment in which Vietnamese youth can extend their education through ICT access and tools. Covering 33 provinces and cities and benefiting an estimated 10,000 students and their teachers, 40 centres have so far been built. Staffed by teachers, Learning Centers are equipped with computers providing Internet and e-mail access, software and books in a comfortable learning environment for use both during and after school hours. The programme is expected eventually to cover each of Viet Nam's 61 provinces and cities and to provide a dynamic environment in which Viet Nam's young people (in and out of school) can extend their learning and development opportunities through information technology access and tools. Even though there is no specific information on the learning programmes conducted within the centres, the programmes include the annual Young Leaders of the Future contest, covering a number of academic disciplines and involving the 200 top students enrolled in the Learning Center programmes.

Another effort of the government is the development of a CD-ROM containing information on citizens' rights called "Your Lawyer," by the Office of the National Assembly (ONA). This is an attempt to educate people about law and order and to make Viet Nam's laws accessible in simple language. The CD-ROM adopts a step-by-step approach to guide the reader through the vast array of rules, regulations and forms relevant to a multitude of day-to-day legal topics in Viet Nam. Copies are to be distributed to offices of delegates to the National Assembly in all 61 provinces, offices of provincial People's Councils, media organisations and to the 7,000 post offices in all 12,000 localities.[11]

Other projects are aimed at:

- Developing, collecting and adopting educational software;
- Enhancing the development of databases for educational management;
- Enhancing ICT training programmes for teachers;
- Creating schools with good ICT application in teaching and management;
- Providing high-quality training programmes for ICT lecturers and researchers;
- Building joint ICT schools or colleges (including 100 per cent foreign investment) for ICT training.

Unfortunately, there is no data or information available to the author to elaborate on the above initiatives.

Examples of training

Since 1990, various ICT teacher training programmes, including short courses and an ICT bachelor's degree, have been set up to meet the increasing need for ICT teachers. In 1999, through the Secondary School Teacher Training Project, most of the teacher training colleges acquired modern computer rooms to facilitate training ICT teachers. Furthermore, training programmes for ICT technicians have been set up at various vocational training schools. ICT training for educational management officials has been carried out routinely to improve their knowledge and skills. As a result of these training programmes, teachers should now have a

broader understanding of the role of computers and ICT in education.[12]

In a broader scope, the Japanese government has initiated a Japan-Viet Nam Portal project to improve Viet Nam's ICT workforce. Started in March 2002, the programme strives to improve the quality of ICT work produced by the Vietnamese and to teach the workers Japanese language skills. The Vietnamese government has also gone the way of other techno-developing countries like China and India in sending promising ICT students to North America to receive workplace ICT training and to learn about current developments in ICTs. These measures should assist Viet Nam in developing a larger pipeline of ICT workers (assuming the students don't emmigrate to other more developed countries), which in turn will help to meet the government's goal of US$ 300 million for software exports and US$ 200 million for domestic software production by 2005.[13]

Constraints on the use of ICT

As in other developing non-English speaking countries, constraints on ICT use in education seem to be related to content and access. Specifically, significant problems in Viet Nam include:

- The lack of Vietnamese language software for use in educational applications. This effectively restricts the likely user population for the Internet to the 10 per cent or so of Vietnamese who understand some English;
- The limited ICT facilities that do exist have not been effectively used in general teaching, training and educational management;
- The limited access to Internet for education due to high cost of access;
- Lack of qualified personnel, including trained teachers.

Analysis

Viet Nam has been eager to be one of the hubs for ICT development in South-East Asia as indicated by its comprehensive Master Plan with specific emphasis on developing a skilled ICT workforce. Further evidence is the IT in Education Master Plan of 2000, which aims to broaden the ICT degrees offered at state institutions. Nevertheless, efforts seem to be still tinkering with the establishment of infrastructure to secure greater access of the Vietnamese to ICTs especially those in the education sector (including the students). As recommended by Viet Nam's country report for the APEID conference, a formal programme should be developed to extend the level of access to computers and to improve computer skills in order to encourage Internet take-up among students in primary and secondary schools. This could include the establishment of computer clubs to encourage students to explore the Internet and to develop research projects, the inclusion of some element of computer training (e.g., keyboard and mouse skills) as a compulsory element of the secondary school curriculum and the provision of PCs in school classrooms.

Realigning prices towards regional norms is an urgent priority. Currently Viet Nam's rates for domestic and international leased lines are among the world's most expensive, which inevitably causes higher prices for local ISPs and for Internet access.

Most importantly, since the majority of Vietnamese do not speak English, the lack of Vietnamese language software for use in educational applications should also be overcome. Access alone will not enhance the use of ICT in education without the availability of relevant and understandable content. Some programmes devoted to content development in the local language should be initiated. Accordingly, it seems that any international assistance to enhance the use of ICT in Viet Nam's education should be focused on the elimination of the four types of digital divide: access, human resources development, language and content.

NOTES

1 "Master Plan for Information Technology in Education for the Period of 2001–2005" (Ministry of Education and Training, 2000), *http://gauge.u-gakugei.ac.jp/apeid/apeid00/seminar/papers/Viet Nam/TOKYO2000_paper.doc*, and "ICT Policies of Selected Countries in the Asia-Pacific" (UNESCO, 2003), *www.unesco.org/bangkok/education/ict/teaching_learning/pri_sec_edu/Viet Nam.htm.*
2 Jeremy Lieb, "Worldwide Internet Population: Asia" (1999), *www.commerce.net/research/stats/analysis/WWInternetPopul-Asia.pdf.*
3 "Internet Usage in Asia (Internet Users and Population Statistics for Asia)" (Internet World Stats, 2003), *www.internetworldstats.com/asia.htm*.
4 See note 2 above.
5 Michael Minges, "Measuring the Internet in South East Asia" (2001), *www.itu.int/ITU-D/ict/cs/Malaysia*.
6 E. Rathgeber, "Gender and Telecentres: What have we learned?," presentation at World Bank Gender and the Digital Divide Seminar Series (2002), *www.worldbank.org/gender/digitaldivide/Eva%20Rathgever.ppt*.
7 See note 1 above.
8 See note 1 above.
9 "E-Learning in Asia and Beyond: Coca Cola Learning Centers" (2003*)*, *www.unesco.org/bangkok/education/ict/teaching_learning/pri_sec_edu/Viet Nam.htm* and *www2.coca-cola.com/citizenship/education_asia_digital_divid.html.*
10 "CD-ROM in Viet Nam puts laws in citizens' hands," *Newsfront of United Nations Development Programme* (2003), *www.learningchannel.org/external.*
11 See note 1 above.
12 See note 1 above.
13 See note 5 above.

map of the Pacific Island Countries

Pacific Island Countries

Australia • Cook Islands • Fiji • Kiribati • Federated States of Micronesia • Marshall Islands • Nauru • New Zealand • Niue • Palau • Papua New Guinea • Samoa • Solomon Islands • Timor Leste •Tonga • Tuvalu • Vanuatu

Australia

ICT USE IN EDUCATION

Mr Som Naidu, Ph.D
Ms Carol Jasen

National policies, strategies and programmes

The Australian Commonwealth (Federal) Government develops national policies and strategies for the use of information and communication technology (ICT) in primary, secondary and vocational education. Australian state and territory governments develop policies and strategies for the use of ICT in primary, secondary and vocational education, adult community education (ACE) and adult multicultural education (AMES). (See Appendix 1 for a glossary of acronyms used in this chapter.)

A range of implementation models and approaches are being adopted for the use of ICT in teaching and learning. The integration of ICT in education includes project-based, inquiry-based, individual and collaborative learning models. Students studying in the vocational sector (e.g., VET, TAFE) are increasingly required to undertake subjects and courses online or via a blended delivery mode of face-to-face and online learning. Online courses may include interactive multimedia courseware and online assessment tasks, tests and quizzes. Assessment of student learning may take place within a computerised learning management system such as WebCT or Blackboard, enabling teachers to track, assess and mark electronically submitted student work. In secondary and primary education, students may undertake project-based learning via Internet-based projects and specially developed online curriculum content.

Policy Goals and Action Plans

Overall, numerous policy goals and action plans have been developed and implemented at all government levels to enable the widespread implementation of ICT in all sectors of education. Policies, plans and strategies may be accessed via the government, organisational and taskforce websites listed in Appendix 2. Some strategies and initiatives extend outside of Australia and encompass neighbouring countries such as New Zealand.

Current Implementation

ICT in education is widely implemented throughout Australia at federal, state/territory and local government levels.

The non-formal education sector in Australia is extensive and includes ICT use in education conducted at neighbourhood houses, ACE, AMES, CAE, TAFE, University of the Third Age, local municipal libraries and community learning centres. However, these informal courses may also provide pathways into accredited ICT courses in accordance with the Australian Qualifications Framework (AQF).

Budget Allocations and Funding Sources

Funding for the implementation of ICT in education comes from federal and state/territory government budgets. Examples of budget allocations and expenditure for the implementation of ICT in education may be accessed via the federal and state/territory contact websites listed in Appendix 2.

Gaps, Limitations and Needs

Identified gaps, limitations and needs in ICT in education occur in relation to indigenous Australians, older Australians, women, people with disabilities, people in remote locations, and socio-economic disparities. Some initiatives have been introduced to enhance equity in these areas and are discussed under digital divide issues, concerning those who have access to ICT and those who do not.

Current level of ICT access and use

Table 1 provides a general overview of the current level of ICT use in primary, secondary, vocational and community education.

Digital Divide Issues

Educational policies and strategies have been developed to address identified digital divide issues at federal and state/territory government levels. These issues relate to indigenous and older Australians, women, people with disabilities, people in remote and rural locations, and those with relevant socio-economic factors.

Indigenous Australians. Some Aboriginal education policies promote ways in which new technologies can meet the learning needs of Aboriginal students. The Northern Territory DET's Indigenous Education Strategic Plan[1] proposes new communications networks for all schools including major remote sites, and all teachers to have a minimum level of computer literacy and related teaching competencies. Similarly, the New South Wales Department of School Education's Aboriginal Education Policy 1996 and Review 2001–2005[2] includes a proposal for research into the application of ICT to teaching and learning of Aboriginal languages, and ways that new technologies can be used to meet the learning needs of Aboriginal students.

Older Australians. The Federal Government programme Basic IT Enabling Skills (BITES) for Older Workers[3] provides workers aged 45 years and older with the opportunity to undergo nationally accredited training in ICT skills. Courses are also conducted for older Australians at nationwide campuses of the University of the Third Age[4] and at the Victorian CAE.[5]

Women. Education Queensland's Girls and ICTs Initiative[6] aims to build new pathways and models that break down barriers to girls' participation in, and enjoyment of, ICTs. Informal and formal ICT skills training is also conducted specifically for women at local ACE[7] providers, including women's neighbourhood houses. The Victorian Government's Women's Web Project[8] provides women in rural, isolated areas with Internet training and access to community Internet services. However, a "gender gap" persists: for example, in 2002, Education Queensland found that of those enrolled in the Year 12 course Information Processing and Technology, 22 per cent were girls, compared to 78 per cent boys. If this trend continues, girls

*Table 1: Technologies used in primary, secondary, vocational and community education**

Type of technology	Uses	Extent of use by sectors
Satellite broadband network, includes software that allows video/audio interaction between teachers and students, interactive whiteboard and controlled Internet access.	High-speed networking. General teaching and learning across the curriculum: project-based, inquiry-based, individual learning.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*
High-speed broadband telecommunications network.	High-speed networking. General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government and non-government primary and secondary.*
Hardware: desktop computers, printers, scanners, file servers, notebook computers, active local area network (LAN) products, uninterruptible power supplies (UPS).	General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE providers, CAE and AMES.*
Server software: Microsoft Education - Windows 2000, NT 4, Exchange 2000, SQL 2000, site, ISA 2000, SMS 2.0 Standard, Host Integration, Systems Management and Proxy servers.	General teaching and learning across the curriculum: project-based, inquiry-based, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE and AMES.*
Desktop software: Microsoft Academic Select - Office Premium 2000, Office Macintosh Edition 2001, Encarta Reference Suite, Visual Studio, Office Starts Here, Windows 32-bit operating system upgrades, Back Office Client Access Licence. Range of Microsoft Multimedia Titles. Multimedia CD-ROM.	General teaching and learning across the curriculum: project-based, inquiry-based, multi-tasking, individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE and AMES.*
Internet.	Library and research. Government, Education Department Web sites. Development of education Web sites. Online learning/e-learning/distance learning: project-based, inquiry-based individual/collaborative learning.	*Government primary and secondary, TAFE, ACE, CAE, AMES. Private schools and private education providers.*
E-mail.	Communication between teachers, between teachers and students, and between students.	*Government primary and secondary, TAFE, ACE, CAE, AMES.*
Television transmission.	General teaching and learning across the curriculum.	*Primary and secondary.*
Radio transmission.	General teaching and learning across the curriculum.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*

*Technologies listed are used in Victoria (except those for the School of the Air). All states/territories throughout Australia use similar technologies. A national strategy for technologies, infrastructure, interoperability and online course content is currently being developed by The Le@rning Federation.

and young women are at risk of being excluded from the new and emerging jobs of the future as a result of inadequate ICT skills.

People with disabilities. ANTA's Bridging Pathways 2000–2005[9] is a Federal Government strategy and blueprint for increasing opportunities for people with a disability in VET. However, there is no ICT focus in the strategy. Many TAFE institutes throughout Australia conduct the vocational course Certificate in Work Education for special needs students. The course includes a core ICT subject.

Equity of access. The Victorian DET initiative Bridging the Digital Divide 2000–2002[10] provides AUD 23 million over three years for additional computers and networking to ensure equity of access to ICT for all students, regardless of socio-economic or geographic disadvantage. The Networking the Nation Project[11] assists educational development of rural Australia by funding projects that enhance telecommunications infrastructure and networks and reduce access disparities to telecommunications services and facilities. Some TAFE institutes conduct off-

campus courses in ICT skills at Certificate 1 and 2 levels, including courses for homeless and drug-addicted youth.

Nature and Roles of Partnerships

Existing ICT in education partnerships include those between all states/territories and between Australia and New Zealand. Examples of partnerships include the following:

- The Le@rning Federation:[12] an AUD 70 million initiative between all Australian and New Zealand Ministers of Education, to develop online interactive curriculum content, interoperability and infrastructure, to support teachers and enhance student learning.
- TAFE Frontiers:[13] a consortium partnership between TAFE, RTOs, AMES and ACFE.
- VET in Schools:[14] a partnership between TAFE and secondary schools for courses including IT and online courses.
- National Bandwidth Project:[15] partnerships between all Australian state/territory education sectors regarding national bandwidth standards.
- ICT in Schools Taskforce:[16] partnerships between all states/territories regarding ICT initiatives in education.
- Teachers of the 21st Century:[17] partnerships between federal and state/territory education sectors, teachers' associations, Catholic and independent schools.

Major initiatives

Table 2 provides examples of some current major initiatives across all education sectors.

Evaluation Reports of Major Initiatives

Whilst numerous discussion papers, strategic planning papers and implementation proposals exist for ICT use in education, thorough, long-term evaluations of ICT initiatives, projects and strategies are not always undertaken. Summary documentation of state/territory ICT initiatives is seldom available in an aggregated format. According to a spokesperson for The Le@rning Federation, many ICT in education projects are not evaluated as they are ongoing and "morph" or progress forward into the next phase of the initiative concerned. Following are a few examples of evaluations:

- Deakin University, 2002. "Evaluation of the Notebooks for Teachers and Principals Initiative." *www.sofweb.vic.edu.au/ict/notebooks/research.htm*. (An independent evaluation has revealed that in international terms this initiative has been groundbreaking. By June 2002, 91 per cent of all teachers and principals had a notebook computer. Nowhere else in the world has a government provided this level of support to its teachers and principals to assist them to integrate learning technologies into their daily working lives.)
- Learning Technologies Board, 2000. "Learning Networks Trial: Evaluation." Victoria: OTTE Publications. *www.otte.vic.gov.au/publications/LTLearningNetworks/index.htm*. (Evaluation of online learning networks as a vehicle for increasing choice and participation in VET through shifting the mode of educational delivery.)
- MCEETYA. 2002, 2003. "Learning in an Online World: The school education action plan for the information economy." Progress reports 2002 and 2003. Tasmania: MCEETYA ICTs in Schools Taskforce. (Unpublished progress reports on the implementation and integration of ICT in all schools, in order to improve operations and business practices, to improve student learning and to offer flexible learning opportunities throughout Australia and New Zealand.)

Provision of training

Current Examples

Training needs have been addressed by the introduction and implementation of a number of programmes in the primary, secondary and vocational sectors to encourage teachers to use ICT for teaching and learning. The following are some examples:

- The Notebooks for Teachers Program[18] provides notebook computers and ICT skills training for all teachers and principals in Victorian Government primary, secondary and TAFE sectors, to support the effective integration and use of learning technologies into the classroom and in administrative practices. Similar programmes are conducted in other states/territories.
- ICT Skills for Teachers[19] is an accredited training course for all TAFE teachers, providing the skills and knowledge required to enhance teaching and learning practices via the use of ICT technologies.

Table 2: Current major initiatives in primary, secondary, vocational and community education

Major initiatives	Delivery models	Sectors and partners
The Le@rning Federation: From 2001– 2006, a AU$ 70 million initiative to develop nationwide online interactive curriculum content for Australian and New Zealand schools, to support teachers, enhance student learning and improve educational outcomes. *(www.thelearningfederation.edu.au/tlf)*	Online learning via the Internet.	*Primary, secondary.*
Global Classroom Project: Australian and international schools have participated in a range of collaborative online projects over the past seven years. *(www.sofweb.vic.edu.au/gc/index.htm)*	Online, collaborative learning via the Internet.	*Primary, secondary Australian and international schools.*
Australian Flexible Learning Framework: World-class AU$ 20 million per year initiative to create and share knowledge about flexible learning and to support its take-up in the VET sector. *(http://flexiblelearning.net.au)*	Flexible learning, online learning via the Internet.	*VET.*
Mobile Computer Learning Libraries Program: AU$ 1.5 million project providing access to ICT training for ACE learners in remote locations in Victoria. *(www.otte.vic.gov.au/ettenews/issue5.htm#article5)*	Blended (face-to-face and online) delivery via 414 laptop computers in mobile libraries/labs.	*ACE in remote and isolated communities – regional, rural and urban.*
TAFE Virtual Campus: Victorian Government service for students to access over 800 fully accredited TAFE courses online and the WebCT learning management system (LMS). *(www.tafevc.com.au)*	Online learning and WebCT LMS.	*TAFE, AMES, ACE, secondary.*
Learnscope Project: Federal online professional development project for teachers focusing on ICT, flexible learning skills, e-learning and the application of new technologies for learning. *(www.learnscope.anta.gov.au/LearnScope/home.asp)*	Flexible delivery, online learning.	*VET.*
Wide Area Network: Victorian Government DET 2003– 2004 budget allocated AU$ 8 million over four years to give non-government schools continued access to the Internet via high speed, broadband telecommunications network. *(www.det.vic.gov.au/det)*	Infrastructure.	*Victorian Government and non-government primary, secondary.*
Interactive Distance E-learning Initiative: Federal Government AU$ 17 million project for a satellite network to cover the Northern Territory and parts of New South Wales for School of the Air classes in remote regions. *(www.dcita.gov.au)*	Distance learning using video cameras, electronic whiteboards and Web cameras.	*School of the Air at government primary, secondary, TAFE and vocational training in remote locations.*

- WebCT Training[20] provides training in the WebCT learning management system (LMS) and is conducted for teachers in TAFE, RTOs and ACE. Training is usually in-house, mixed-mode delivery of face-to-face and online.

- LearnScope[21] is a major national professional development programme for teachers, focusing on the application of new learning technologies to achieve more flexible learning in VET in the transition to the information economy.

Undergraduate and postgraduate teacher training courses throughout Australia include subjects and courses in the use of ICT in education. Courses such as Computers in the Classroom[22] are compulsory in Bachelor of Education courses. Specialist postgraduate certificate, diploma and master's courses have been developed in computer education with topics including computer ethics, computers in the curriculum, evaluation of curriculum software, ICT and the Internet, multimedia development, robotics, programming, and information technology resources for teachers. The Indigenous Education Strategic Plan 2000–2004[23] is a Northern Territory DET strategy specifying that teacher training programmes for teachers of Aboriginal students are to include ICT skills.

Recently trained teachers graduate with competent ICT skills, including multimedia software development skills for use in education. The training is effective and new teachers appear to be competent in, and comfortable with, the use of ICT in teaching and learning. However, some older teachers are largely lacking in ICT skills and require training. There appears to be reluctance on the part of this cohort to adapt to and adopt the use of new technologies in education.

Future Training Needs

Currently, further incentives are needed in education environments to encourage some older teachers in the primary, secondary, vocational and community education sectors to acquire ICT skills. Recognition of ICT skills as "advanced" in terms of promotion and/or higher remuneration is perceived as an encouragement. For example, the Tasmanian DET's ICT in Education (K12) Strategic Policy 2002–2005[24] states that all staff in school leadership positions will demonstrate competence and ongoing commitment to developing skills in the use of ICT in teaching and learning as a requirement for promotion.

Constraints on the use of ICT

Rural and Remote Regions

Australian telecommunications infrastructure and access have been constraints in rural and remote regions. The independent report, "Regional Telecommunications Inquiry: Connecting Regional Australia,"[25] made a number of recommendations for improvements. However, the Interactive Distance E-learning Initiative has been introduced to alleviate the challenges associated with the use of ICT in education in remote locations.

National Policy on Infrastructure, Inter-operability and Course Content

Constraints occur between federal and state/territory governments in relation to national policy development for the use of ICT in education. In the past, it has been difficult to implement nationwide policies and strategies regarding bandwidth standards, infrastructure, inter-operability, online course development, learning managements systems, etc. The Le@rning Federation projects and initiatives have been developed in response to these constraints.

Constraints also exist in relation to the use of ICT in education for indigenous Australians, women, people with disabilities and older Australians.

Analysis

Overall, current Australian federal and state/territory policies, plans, strategies and initiatives for ICT in education are well conceived and progressive. However, there is a need to more fully address how the use of ICT in education might benefit various groups:

- Aboriginal students in a context harmonious with their indigenous cultural beliefs.
- Students with disabilities and/or impairment also require improved access to ICTs via modified hardware and software applications.
- Further strategies are required to encourage older Australians and women to engage in ICT education, perhaps via informal, low-cost training conducted at convenient local venues, or via the extension of the mobile computer lab/library initiative.
- A comprehensive, national project to provide low-cost/no-cost computer hardware and software – recycled from industry/commerce – to Australians from low socio-economic backgrounds would break down the "digital divide" between computer owners and non-owners. This would enhance access to ICT and its use in education for all students regardless of income levels.

APPENDIX 1

Glossary of acronyms

ACE: adult community education
ACFE: adult community and further education
AMES: Adult Multicultural Education Services
ANTA: Australian National Training Authority
AQF: Australian Qualifications Framework
BITES: Basic IT Enabling Skills (for Older Workers)
CAE: Council of Adult Education
DET: Department of Education and Training
ICT: information and communication technology
IT: information technology
LMS: learning management system
MCEETYA: Ministerial Council for Education, Employment, Training and Youth Affairs
OTTE: Office of Training and Tertiary Education
RTO: registered training organisation
TAFE: technical and further education
TLF: The Le@rning Federation
VET: vocational education and training

NOTES

1 "Indigenous Education Strategic Plan 2000–2004." *www.education.nt.gov.au.* Northern Territory DET's plan for indigenous education. Equity in ICT education.
2 "Aboriginal Education Policy 1996 and Review 2001–2005." *www.schools.nsw.edu.au.* NSW Department. of School Education policy regarding ICT to meet the learning needs of Aboriginal students. Equity in ICT education.
3 Basic IT Enabling Skills (BITES) for Older Workers. *www.itskills.dest.gov.au.* Provides workers aged 45 years and older with the opportunity to train in IT/ICT skills. Equity in ICT education.
4 University of the Third Age (U3A). *www.u3acanberra.org.au.* Australia-wide education for older Australians. Equity in ICT education.
5 Council of Adult Education (CAE). *www.cae.edu.au*. Largest provider of adult and community education programmes in Australia, including ICT and IT training and courses. Equity in ICT education.
6 Girls and ICTs Initiative. *http://education.qld.gov.au/itt/learning/html/girls-ict.html.* Queensland Government initiative for girls and ICTs. Equity in ICT education.
7 Ministerial Council on Education, Employment, Training and Youth Affairs and Curriculum Council, *Ministerial Declaration on*

Adult Community Education (Victoria: Department of Education and Training, 2002). *www.curriculum.edu.au/mctyapdf/ace_declaration.pdf.*
ICT courses and training for adults and women in ACE. Equity in ICT education.

8 Women's Web Project. *www.womensweb.org.au/pages/default.cfm?page_id.* Equity in ICT education.

9 Bridging Pathways 2000 – 2005. *www.anta.gov.au.* Australian National Training Authority (ANTA) federal strategy and blueprint for increasing opportunities for people with a disability in VET – no specific ITC strategies.

10 Bridging the Digital Divide 2001 – 2002. *www.sofweb.vic.edu.au/ict/bdd/index.htm.* Victorian DET initiative provides AUD 23 million over three years for additional computers and networking. Equity in ICT education.

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12 The Le@rning Federation. www.thelearningfederation.edu.au/tlf. A 2001–2006 AUD 70 million initiative for online course, infrastructure and interoperability development. Partnerships between Australian state/territory and New Zealand governments.

13 TAFE Frontiers. *www.tafefrontiers.com.au.* Peak body supporting registered training organisations (RTOs) within the Victorian VET sector to implement flexible learning. Partnerships between TAFE, ACE and private providers.

14 VET in Schools Program. *http://online.curriculum.edu.au/the_cms/tools/new-display.asp?seq=-9&industry=Vetis.* VET resources developed to assist in the implementation of vocational training packages in schools. Partnerships between VET and secondary education sectors.

15 National Bandwidth Project. *www.noie.gov.au/Projects/environment/bandwidth.* Major Commonwealth Government study into the likely availability and price of bandwidth in Australia. Partnerships between all Australian states/territories in all education sectors.

16 ICT in Schools Taskforce. *www.aictec.edu.au/advisory/reports/ictst/default.htm.* Major national collaborative, advisory and advocacy group on the use of technology in school education and the development of national services such as EdNA Online. Partnerships between all Australian state/territory education departments and non-government school sectors.

17 Teachers of the 21st Century. *www.qualityteaching.dest.gov.au/Content/Item_282.htm.* Commonwealth Government initiative to improve teacher quality, increase the number of highly effective Australian schools and maximise student learning outcomes. Partnerships and teacher training (including training in ICT).

18 Notebooks for Teachers Program. *www.sofweb.vic.edu.au/ict/notebooks.* Notebook computers and ICT skills training for all teachers and principals in Victorian government primary, secondary and TAFE sectors. Teacher training.

19 ICT Skills for Teachers. *www.tafevc.com.au/ict/htm/resources.htm.* An accredited training course for all TAFE teachers, providing the skills and knowledge in the use of ICT technologies. Teacher training.

20 WebCT Training. *webct.com*. Training in the WebCT learning management system for teachers in TAFE, RTOs and ACE. Teacher training.

21 LearnScope. *www.learnscope.anta.gov.au.* Major national professional development programme for teachers focusing on the application of ICTs and flexible learning in VET. Teacher training.

22 Computers in the Classroom. *www.unimelb.edu.au.* Subject taught in undergraduate teacher training courses such as the Bachelor of Education (secondary and primary) in the Faculty of Education, at University of Melbourne. Teacher training.

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24 ICT in Education (K12) Strategic Policy 2002–2005. *http://connections.education.tas.gov.au/Nav/StrategicPolicy.asp?ID=00000145 24.* Tasmania DET strategy for the implementation of ICT in education.

25 "Regional Telecommunications Inquiry: Connecting Regional Australia." *www.telinquiry.gov.au/rti-report.html.* Report developed for the Commonwealth Government by the independent Regional Telecommunications Inquiry.

Cook Islands

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Cook Islands comprises 15 islands with a land area of 240 square kilometers, spread over 2.2 million square kilometers of sea. The population of 20,407[1] is bilingual (Cook Island Maori and English). Rarotonga is the main island with the parliament, government department headquarters and the main commercial centre. Politically, the nation is self-governed but in close association with New Zealand. Parliament comprises 24 members elected every five years. The Cook Island economy is based on the export of some agricultural produce, handicrafts and tourism. The currency used

is the New Zealand dollar. Cook Islands is a member of the regional University of the South Pacific (USP), and hence is part of the privately owned satellite system called USPNet.

National policies, strategies and programmes

ICT Policy and Budget

The Cook Islands information and communication technology (ICT) policy framework is currently at the writing stage. The target date for completion is December 2003. As understood, the framework will follow the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan (PIIPS), a regional ICT strategy agreed and signed by the Communication Ministers of each respective Forum member country.

ICT development is still haphazard and currently led by the private sector. The government sector is a consumer at this point rather than an instigator of development.

The budget allocation for ICT development is about US$ 59,000[2] under the Prime Minister's Office. However, the policy analyst interviewed for this report emphasised that the amount is set aside for policy development only. Other funding sources have been identified but are awaiting official confirmation.

Cook Islands ICT Committee

The ICT Committee was established in March 2003 and chaired by the prime minister who also holds the portfolio for telecommunication. The committee members are representatives of the Ministries of Finance and Education, one from the Office of the Prime Minister, and representatives from the tourism, telecommunication and computer services sectors. The current mandate for the committee is to advise government on ICT matters and develop a strategic plan to promote national awareness of ICT issues.

Current level of ICT access and use

Connectivity

As of 2003, Telecom Cook Islands (TCI) reported that there are 6,180 telephone lines connected relative to a population of 13,400. That is, approximately 46 per cent of the population has access. Mobile customers have reached 1,499 and 1,200 Internet customers. Internet connection is currently available only in Rarotonga, Aitutaki and Mangaia and serviced by a single Internet service provider, Telecom's *oyster.co.ck*.

Telecom's Internet backbone connectivity is provided from two independent sources: Teleglobe in Canada (PITANET) and Voyager in New Zealand. TCI claims that international access is very expensive because of satellite and access costs.

E-mail

Public schools connected to the Education Network (EduNet) have e-mail facilities. EduNet is a partnership between the Ministry of Education and Telecom Cook Islands (TCI). The overall vision of the EduNet project is to provide schools and the Ministry of Education with the technology that will facilitate distance education goals. To quote directly from the proposal "the completion of the project will enable the Ministry of Education to conduct and deliver its Distance Education programmes in a timely and effective way, supported by the establishment of a Distance Education Centre for the explicit purpose of writing and producing course programmes and resources suitable for Cook Islands conditions."

TCI will install as well as manage the telecommunication network for this project. The initial phase was implemented on Rarotonga in late 2000 and some form of training has been conducted to facilitate access for all the schools connected to the network. There is still a long way to go. The United Nations Development Programme (UNDP) has expressed interest in funding the project; however no confirmation has been received. The official update of the project will be available in December 2003. However, EduNet only offers a single mailbox for each school, and the school principal and another trained staff are the only ones with access to the network. Extending e-mail facilities to the staff in public schools is currently in development.

Private schools with Internet connection also have access to e-mail, but on a very limited basis because of costs.

USP students in Rarotonga have access to e-mail and Internet facilities through USPNet. The establishment of USPNet in its current capacity (e-mail access and teleconferencing capability) has made it possible for students of the Cook Islands to complete a significant proportion of their programme without leaving their families and work opportunities. They are now beginning to utilise this technology to submit drafts and final copies of assignments, communicate with lecturers and course co-ordinators and access online USP courses, particularly in Law. A number of students have taken up this opportunity while the others still need to learn and feel confident in using the technology.

The multimodal facility of the network has provided different modes of learning experiences for the students that include learning from the printed study materials, videoconference tutorials with the lecturer in Fiji and online courses with lecturers based in Vanuatu. There are also audioconference tutorials to support these modes. The different learning modes are beginning to infuse the students with a sense of belonging, forging a spirit of camaraderie within the student population.

The next phase is to make the technology work in the outer islands so that the students there will benefit from the same experience as the students in Rarotonga. Students are advised to fill in a form designed for setting up an e-mail address. Some students also have access to e-mail at work or home. Students studying Internet and video broadcast courses also have access to WebCT, a platform by which they can interact with their lecturer, tutor and other students.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students in Rarotonga only. Students who are enrolled in accounting, information systems, tourism and psychology are the frequent users. Psychology students who are using the videoconference mode find this technology a good substitute for a face-to-face session because it allows for interaction in real time compared to the video broadcast mode. Audio and video teleconference sessions are scheduled daily throughout the week in support of all distance and flexible learning courses of the university. Tapes of video broadcast sessions and audio conference tutorials are sent to USP students in the outer islands.

Internet/World Wide Web for Education

Primary and secondary schools do not have full access to the Internet. Access is subject to the school's financial ability to absorb costs. Instead, some students have access to the Internet through private connections at home or at a parent's workplace. For example, a number of students at Nukutere College, a Catholic school who are familiar with the technology, use the World Wide Web to research school assignments.

USP students are beginning to utilise the web for their research, and download reference materials for their assignments. However, there is still a need to develop confidence in using different search engines, doing advance searches and using electronic libraries and databases.

Some secondary and USP students in the outer island of Mangaia can now access the Internet and use e-mail. Mangaia College, which has a suite of 15 work stations, has just recently been connected to the Internet, which will help USP students and tutors get in touch with the USP Centre in Rarotonga as well as course lecturers at the Suva campus. It will cost Mangaians about US$ 0.10 per minute to access the Internet.

On Rarotonga, examples of Internet use include research for children's assignments and downloading music and games.

Telephone and Facsimile

Telephone and fax are the most common form of communication within and across the islands. Public and private schools, households and organisations have access to telephones and facsimile in Rarotonga and the southern and northern group islands. There are currently about 409 fax machines in the Cook Islands, with 314 in Rarotonga alone.

Computer Use

Learning to use computers for primary and secondary students is incorporated into the school curriculum. Previously called Text Information Management (TIM), the course is now called Information Communication Technology. The course syllabus is currently limited to learning or familiarising students with Microsoft software such as Word, and Excel. Lack of knowledge of curriculum developers and teachers limits full incorporation of ICTs into classroom activities or learning.

Most of the schools in Rarotonga and some outer island schools such as the colleges in Mangaia and Atiu, Aitutaki and Mauke have computer suites with a number of work stations. Secondary students are enrolled in computing courses through the Correspondence School in New Zealand. Teacher trainees also have access to computers within the school for word processing use.

Broadcast Technologies

There are two radio stations in the Cook Islands: Radio Cook Islands and the privately owned KCFM station, established in 1979. KCFM Radio operates only in Rarotonga while Radio Cook Islands broadcasts can be heard in the southern and the northern group islands up to Penhryn. Programmes on both radios are typical and have no educational content. However, Radio Cook Islands announcers utilise time slots for talkback shows to discuss and get opinions from its audience on current issues affecting the country. These talkback programmes are now considered by politicians as a feedback mechanism for the people's reaction to government policy and activities especially as the general election is looming in 2004. There is a plan to utilise radio for a health-related initiative – an information/education campaign targeted at young people on the effects of tobacco.

Cook Islands Television went on air in 1989 and was owned at the time by Cook Islands Broadcasting Corporation, which also owned Radio Cook Islands. After the economic downturn in 1996, the government decided to privatise assets as part of the structural reform programme. Both Cook Islands TV and Radio Cook Islands are now leased to Elijah Communication. Cook Islands Television has only one channel and is viewable only in Rarotonga.

Major initiatives

EduNet

The initial phase in the implementation of the Education Wide Area Network Project (EduNet) in 2000–2001 involved the establishment of the Rarotonga intranet. All primary and secondary public schools are connected to the network. The technology allows e-mail and file-sharing facilities for government schools in Rarotonga connected to the EduNet server located at the Ministry of Education site. Computer sites in schools are able to connect to the server through a dial-up system.

The EduNet service acts as a self-contained extranet but is not connected to the Internet. In this initial phase it acts as a mail server and file server that distributes e-mail, data files and course programmes. It also provides file access and sharing facilities over the network and centralised backup facilities. Schools connected to the network have only a single mailbox. E-mail facilities for the staff are still in development.

Generally, access to the EduNet service is currently limited to school administration and staff. Also in the pipeline is the creation of a website to enable students to have access to the site as well.

Telehealth

The Telehealth project is a partnership between the Ministry of Health and Telecom Cook Islands. The project will use the Internet and e-mail to facilitate medical diagnosis and assistance from specialists in Rarotonga to health care workers in the outer islands. Initial training on the software template was conducted by Telecom early this year. This project is still in its initial phase of implementation.

World Health Organization/USP HealthNet

This initiative, a partnership between the World Health Organization (WHO) and the Ministry of Health/USP, will facilitate ICT access for all medical staff in the region. The project involves education and training on the use of the Internet for research and accessing relevant information from WHO for health alerts and other information. The project also involves infrastructure management. In the Cook Islands, this ICT training is envisaged to be part of the student nurses training programme. The initial training for trainers was planned to commence in September 2003.

Outer Islands Network Upgrade

Telecom Cook Islands (TCI) announced an upgrade to the outer islands network early this year. This upgrade will enable the outer islands to have access to the Internet and e-mail. Mangaia College on Mangaia Island and an accommodation business were the first establishments on the island to connect to the Internet.

Digital Cellular Network

Koka Net cellular network, owned by Telecom Cook Islands, has announced the upgrade of its cellular network from an analogue to a digital system. TCI has a current listing of 1,499 mobile customers connected to the Koka Net. This represents a threefold increase in the number of customers with cellular phones.

Examples of training

Computer Training for the Outer Islands

The USP Centre is currently involved in facilitating pre-degree computer training in the outer islands in association with the National Human Resources Development. This is a high school or Level 2 programme in the New Zealand Qualification Framework. As well, secondary students on Mangaia, Aitutaki and Atiu are doing Level 2 computing through the Correspondence School of New Zealand.

Teacher Training

In 2001, the principal and one staff from each school who was familiar in using computers were given training so each school could log onto the EduNet server and download their e-mail and other information. The trainer was the system administrator running the programme; however, when the system administrator left the ministry, the project slowed down and encountered a number of technical problems.

Telecom also offered some training in using Internet to those schools with Internet connections.

NHRD Computer Training

The National Human Resource Development (NHRD) has funded a computer-training programme to improve the skills of women in the labour force who wanted to change careers and increase their employability. The course offered was a National Certificate in Business Administration Level 2 on the NZQA Framework. It was available only to women in

Rarotonga. Training sites were located at secondary schools that have a large number of work stations available.

Other Computer Training for Young People and Adults

Training in the area of basic PC maintenance, programming and software use was initiated by private training establishments. This type of training is usually conducted during the school holidays with the target group being young people.

Computer literacy and ICT training are mostly done on the job and some training needs were addressed but not in a planned effort. It is hoped that in the setting up of the ICT policy framework, the level of ICT skills in the country can be assessed to provide direction and identify future training needs in all sectors.

Constraints on the use of ICT

The following constraints were identified by participants at the Cook Islands ICT workshop held in June 2003.[3]

- Telecom monopoly: exclusivity agreement not up for discussion until 2006;
- High cost of access: both Internet and toll calls;
- Cost of developing the national ICT infrastructure: lack of economies of scale and high Internet and bandwidth costs;
- High cost of hardware and software;
- Maintenance and replacement costs of hardware due to the harsh environment and unstable electricity level;
- Need for in-country training on ICT including training at all levels of education and sectors;
- Lack of government policy and political will; and
- Good governance issues.

Analysis

While the Cook Islands ICT policy framework is still in the development stage, the country is more advanced compared to many other Pacific countries. This is likely due to the close association with New Zealand and the regular infusion of trained personnel as they complete studies and return to the island country. Further, there was a major government reform of the public service in the mid-1990s and it is assumed that the public service workforce is now working with improved commitment and attitude. Connectivity exists throughout the islands, and schools have all been linked through the EduNet project. The long-established broadcast technologies have developed more and are now moving into educational programmes. However, there remains a need to mount training programmes that will ensure sustainability of trained expertise. In particular, there needs to be an ongoing programme to ensure teachers are oriented and trained before they enter the service.

NOTES

1 From the Census 2001, Statistics Office.
2 From the Budget 2003-2004.
3 "ICT for the Cook Islands," Cook Islands National ICT Workshop Report, June 2003. Participants of the ICT workshop in June 2003 included staff of the different government ministries/departments; ad hoc bodies such as tourism, environment and the police; the private sector such as Telecom Cook Islands, computer businesses, Cook Islands Television and Cook Islands News; island secretaries from the north and southern groups; and NGOs such as WWF, Cook Islands Association of NGOs (CIANGO) and National Council of Women.

Fiji

ICT USE IN EDUCATION

Ms Salanieta Bakalevu, Ph.D
Mr Anare Tuitoga

BACKGROUND

Education

Education in Fiji is a partnership between government and the communities. The government pays a large proportion of teachers' salaries and provides grants while school committees manage the financial operations of the facilities and infrastructure. Of the total 700 primary schools only two are government-owned, and of 156 secondary schools, 12 are government-owned. Committees manage the rest. While this unique partnership in the management of schools

promotes a sense of identity and common purpose, it also has a bearing on critical choices that schools make, such as the utilisation of new technologies. After all, technology (and maintenance) is not cheap.

Information and communication technology (ICT) in education in Fiji is still developing, and its potential is yet to be felt. At the Ministry of Education (MOE), a network system is being established, a Ministry website is under development and Internet and e-mail access is limited. While about half of all secondary schools have computers, only a few of the larger ones in urban centres have Internet and e-mail access, and fewer still have their own websites.

Telecommunications

Fiji's domestic telecommunications industry comprises three companies that are partly privatised and partly publicly owned. They operate as monopolies under exclusive licence arrangements. All companies are owned by ATH of which the government is a major shareholder.

Internet access and use is still developing. Currently there is one Internet service provider (ISP), which provides dial-up connections via traditional telephone lines and, more recently, over digital ISDN lines. However, the ISDN is available only in the capital, Suva, and at a cost that puts it out of reach of most except large businesses. Until recently no Internet access was available in those parts of the country where there are no telephone lines or where the lines are of poor quality. Access to the various high-speed options (broadband access) that is widely available in more developed countries is limited to the larger organisations like USP that have higher traffic and capacity. Despite the limits on Internet access, most organisations have embraced the World Wide Web enthusiastically.

National policies, strategies and programmes

ITCS is the official government department for providing information technology services, which include policy formulation and expert advice, systems development, information technology infrastructure building and management, training and customer support. The government is committed to developing the ICT industry including e-governance. It is also aware of the current monopolistic framework for telecommunications and is intent on making the industry more efficient.

Government Strategic Plan

The ICT goal in the Government Strategic Plan[1] is "universal access to internationally competitive ICT services." This goal transfers into the policy objectives that include the reduction of telecom rates in the short term by promoting more dialogue between investors and providers to negotiate favourable rates; increased coverage of telecom services, especially to rural areas; liberalisation of the telecom sector through more competition and the removal of exclusive licences; alignment of ICT training to developments in the employment market; and the introduction of e-government for greater efficiency of service.

Performance indicators include: the reduction of telephone charges and removal of exclusive telecom licences by 2005; increased competition with more ISPs; telecommunication access to at least 400 more unconnected villages by 2005; quality standards; an additional 10 schools per year with computers and Internet access and corporate sponsors provided for additional schools; upgrading of computer skills of teachers; adoption of ICT employment skills training modules by information technology training providers; and integration of e-government.

Ministry of Education Strategic Plan

Limited links to education facilities is noted in the eGovernment Strategic Plan.[2] A priority of Year 2 (2004–2005) of the plan is to focus on information technology infrastructure for education to include links to schools and database implementation. This operation is estimated to cost FJD 1 million.

Objective 9 of the MOE Strategic Plan deals specifically with the exploration and use of technology. It includes plans for establishing network systems for the ministry, as well as information technology centres and distance education centres at strategic locations. These will, respectively, offer ICT services and provide support for teaching and learning in schools.

Regional ICT Centre

USP, working with the Fiji government and JICA,[3] plans to lessen the digital divide by establishing the PCIT, which is expected to play a leading role in carrying out a variety of activities for human resources development in ICT throughout the Pacific region. Because of USP's strategic location in Fiji, the benefits of this venture for the country are great.

Current level of ICT access and use

Telecommunication Services

The amount of traffic/telecommunications capacity at all schools and teacher training institutions is fairly small. Thus the telecommunication service used is either a "thin route"

or "medium route" network. USP's larger capacity and services use broadband networks.

Radio Broadcast

Radio broadcast has a long history in education and remains the most accessible medium for reaching remote rural communities. While most programmes are generally educational, especially those in the local languages, two programmes deserve mention. The first is a daily broadcast for primary schools that is prepared and recorded at the Schools Broadcast Unit and transmitted through Radio Fiji. The programme includes lessons for primary students as well as discussion forums for teachers. The second is developed and transmitted through Radio 95.2 FM of CETC,[4] the training arm of the SPC in Suva. CETC is a regional institution for women committed to community development, and Radio 95.2 is an extension of its training in radio programming and broadcasting.

The challenge for radio broadcasting is to improve transmission (replace old AM transmitters of limited reach) and design more effective programmes. While radio will remain for many more years, the technology is moving to digital broadcasting and Internet radio.

Audiovisual Aids

The Schools Broadcast Unit is a mini media centre for the MOE. It prints learning materials and other documents for schools, and also produces audiovisual aids including audiocassettes, videotapes and CD-ROMs that schools can borrow.

TV Transmission

TV transmission includes the majority of the population, and a modern Free-to-Air (Fiji 1)[5] service reaches most homes. However, its use for specific learning purposes is limited. A few programmes such as *Get Set* for younger viewers; *Dateline,* produced by the Government Film & TV Unit; *Pacific Way,* produced by the Media Centre of SPC; and weekly programmes of the Fijian and Hindi-language cultures and traditions serve important educational purposes for all viewers.

Computer Studies

Computer Studies[6] is an optional subject in forms 5, 6 and 7, but it is yet to make an impact. Only 86 (55 per cent) of all secondary schools take this option. Of these, only 35 have Internet connections.

While there is no curriculum for computer studies below form 5, a few have developed their own for forms 1 to 4. To the best of our knowledge, only two primary schools have computers and do some computer studies. Most schools that offer computer-related studies are located around the major urban centres and funded by Indo-Fijian organisations. This situation reflects the constraints of resources – physical, financial, and human.

Internet

Twenty per cent of schools have Internet access, mainly for the use of teachers. While most schools have more than 10 computers, a few have small LAN networks with a server facility for sharing information and Internet services. Meanwhile, Internet access at teacher training institutions (apart from USP) is poor. The major teacher training institutions have no systems network, only standalone terminals with a dial-up facility in libraries for the use of lecturers and trainees. The major TVET institutions have good Internet access that is used by staff and students to source information and for research. None of the mentioned institutions use Internet for online teaching or WebCT. However, Nadi Muslim College stands out with its most advanced technologies and services in learning, thanks to a private donation.

An overview of the technologies being used in schools, technical/vocational institutions and in non-formal education is provided in Table 1. The differences between the applications in secondary schools and the tertiary level are noteworthy.

Equity issues

While NGOs remain the strongest advocates of equity issues, the government has also instituted policies and strategies along the lines of EFA requirements.[7] However, for obvious reasons, specific ICT focus in equity initiatives is, as yet, minimal.

Indigenous Fijians

Under its comprehensive Blueprint for Affirmative Action on Fijian Education, the government plans to create opportunities and pathways for the improvement of Fijian education. One initiative is the development of information technology and related infrastructure in Fijian schools, which includes the purchase and maintenance of hardware, software and provision of Internet facilities.

Rural Communities

Rural development is a high priority of the government. Rural electrification, improved telecommunication services, and SME training are some of the initiatives underway. NGOs, the private sector and international organisations are also actively involved. Most business houses, including banks, insurance companies and retailers, have community outreach projects with a strong focus on education.

Table 1: Summary of technologies being used (primary, secondary, TVET, non-formal)

Type of technology used	Use of the technology	Sectors using the technology
Radio Broadcast SBU: Recording studio: analog & digital - convertible system CETC: Radio studio with station (FM 95.2): digital	Record programmes on digital audiotapes and sent to Radio Fiji for teaching and learning in schools Training in radio programming and broadcasting	*Primary schools (10– 12 a.m. daily), and primary & secondary teachers* *Vocational/community training for women - regional*
AV Library Service (SBU) Beta cam system; moving to digital system & software	Burn CDs, produce videotapes.	*Primary & secondary school resources*
TV transmission	Teaching & learning Sharing information & knowledge	*Younger viewers* *General public*
Hardware: desktop computers, printers, network systems, power supply	Teaching & learning, especially Curriculum Studies classes. Word: projects, group work, inquiry	*55% secondary schools doing Computer Studies in forms 6 & 7; three primary schools. Teacher training-most.* *TVET- FIT, SPC, TPAF, APTECH, etc.*
Server software: Windows 2000	Teaching & learning services	*Not in the schools; Teacher training: only USP.* *TVET: FIT, SPC, TPAF and few others.*
Desktop Software: MS Office 97 CD-ROM	Teaching & learning especially curriculum studies classes. Word: projects, group work, inquiry	*86 secondary schools doing Computer Studies in forms 6 & 7; three primary schools. Teacher training-USP, limited in others;* *TVET - most use it*
Thin route or medium route telecommunication application	Low-speed/medium-speed networking. Limited to basic services as per requirement: communication, inquiry and research	*Most schools, TVET and teacher training (except USP); rural centres*
Internet	Library & research; inquiry & project-based learning; development of Web sites	*In schools-mainly for teachers' use. TVET, teacher training (USP, FCAE)-for all*
E-mail	Communication between school and outside and teachers	*Schools-mostly restricted to teachers' use*
High-speed broadband telecommunications network	High-speed networking. General teaching and learning across the curriculum WebCT; distance learning	*Teacher training-USP (USPNet)*

Assistance through donations of stationery and computer hardware has been prominent.

Women

A survey of the 86 schools that teach Computer Science in forms 5, 6 and 7 shows comparable participation of both genders (54 per cent female). Of the teachers who teach Computer Science, 41 per cent are women. Meanwhile at the Ministry of Women, Social Welfare and Poverty Alleviation, an ongoing project on Women in Science and Technology currently has two subprojects: Women in Fisheries, which is being developed in conjunction with USP and SPC, and Women in e-Commerce. The latter is a new venture aimed at empowering rural women and facilitating entrepreneurial skills. A series of activities including identifying producers, comprehensive training in information technology and SMEs, support for production, identifying primary and secondary markets and establishing simple mobile systems of operation are part of a pilot project.

People with Disabilities

All education and training for people with disabilities is managed by NGOs with the government providing teachers and trainers. The main schools have computer laboratories that students have access to. Hilton School for the Disabled has prevocational courses which prepare students for further studies or employment. Despite a constant lack of funding, the services have been very successful.

Youth

Small and micro enterprises in the informal sector are the current priority of youth training and development. A database of needs, capabilities and resources is being compiled. A pilot project in rural banking, among others, is being trialled.

Major initiatives

Telecommunications Infrastructure

The infrastructure capacity via the new Southern Cross Cable Network that links Fiji to Australia, New Zealand and the United States has provided a greatly expanded capacity for data traffic. The network has the impetus for bridging the digital divide and optimising the country's opportunity in transmission.

Modern telecommunication services will shortly be open to rural and outlying islands through projects currently being undertaken by TFL.[8] These include:

- An expansion of the current EasyTel service, a wireless local loop telephone service that is delivered by the CDMA technology.
- A FJD 45 million satellite project that will, over the next 10 years, see rural people receive the full complement of services and solutions available to customers in the urban centre.
- A joint effort with government will see telecentres provide "public" access for learning. (Three centres will be operational by December 2003 and will be in place by the end of the initiative. As far as possible, the centres will operate from schools but will be accessible to communities.)

Computer Studies Curriculum

A project to evaluate the current Computer Studies curriculum was recently completed. The report provided important information that the MOE can use in its revision. The recommendations for the revision include these needs: greater practicality, provision of appropriate laboratory and Internet access, incorporation of the needs of industry and ongoing training for teachers.

Capacity-building

- **Education and training in ICT** are being offered by many institutions including USP, FIT, and TPAF. This is a competitive area of training and there is a wide range of courses at all levels. The quality of courses is very high.
- **ICT in teacher training** for secondary teachers is already in place in USP's degree programmes for secondary teachers. Next year similar information technology streams will be included in primary teacher training at Lautoka Teachers College and USP.
- **Train the Trainers for ICT Skills in Secondary Education** is an ongoing project that funds overseas training in information technology for teachers. Beneficiaries have formed networks and associations for knowledge-sharing, capacity-building and empowerment.
- **General training by Telecom and ITC,** in the form of short courses and workshops, is run for different client groups. For example, to make the telecentres work, training will be provided for the communities.

Constraints on the use of ICT

- **Lack of infrastructure and facilities:** Many schools lack infrastructure and facilities to support ICT. Poor classrooms, limited electricity supply and poor telecommunication links are major problems.
- **High costs:** The cost of computers and peripherals as well as maintenance and transmission are borne by school committees. It is an expensive exercise.
- **Lack of knowledge and skills:** ICT knowledge and skills are in demand in schools. Currently, only 40 per cent of those teaching Computer Studies have an ICT background or qualification; most are either mathematics or accounting majors. A related problem is the lack of expertise for repair and maintenance of technology connections.

Analysis

The government has a strong national ICT plan that will unfold over the next 10 years. However, the plans to liberalise the telecommunications sector and make it more efficient and affordable for users must come sooner rather than later. Exorbitant Internet charges by the monopolistic power of the telecommunications industry have neither commercial reason nor educational sense. The charges put the technology beyond the reach of ordinary citizens, including schools and small businesses, and deprive people and the country of the benefits of the cyber world. There is a very strong feeling nationwide on this issue.

Capacity-building is another important element of the project. The development, upgrading and provision of

infrastructure and technological hardware go hand in hand with ongoing training for potential users. While it is expected that schools will be able to sustain ICT use, it is the non-formal sector that will need monitoring and support. The fast pace of technological advance makes this urgent. Government (in collaboration with other providers) needs to establish new units or restructure other services for this. Otherwise, the burden will continue to fall on schools to serve as the primary agency of support.

The MOE needs a comprehensive plan to provide the roadmap for a more systematic development of ICTs in Education.[9] The plan, which should cover policies and strategies that relate to issues such as inequality, ICT literacy, costs, software, teacher training and rewards, needs to be holistic. How soon the ministry wants to get into distance education is also an important factor in this development. The government-telecom initiated telecentres, expected to be operational soon, may well provide the impetus for the MOE's planned information technology and distance learning centres. Indeed, the telecentres could provide a "home" for such services. Co-ordination of strategies and sharing of resources will be important to avoid duplication, save unnecessary costs and speed up the processes – to benefit schools and the wider communities.

APPENDIX 1

Glossary of acronyms

ATH: Amalgamated Telecom Holdings
CDMA: code division multiple access
CETC: Community Education Training Centre
EFA: Education for All
FIT: Fiji Institute of Technology
FCAE: Fiji College of Advanced Education
ISDN: integrated services digital network
ICT: Information Technology and Communication
ITCS: Information Technology and Communication Services
ISP: Internet service provider
JICA: Japan International Cooperation Agency
MOE: Ministry of Education
NGO: Non-government organisation
PCIT: Pacific Centre for Information Technology
SBU: Schools Broadcast Unit
SME: small and micro enterprise
SPC: Secretariat of the Pacific Community
TFL: Telecom Fiji Limited
TVET: Technical Vocational Education and Training
USP: University of the South Pacific
TPAF: Total Productivity Authority of Fiji

NOTES

1 "Strategic Developmental Plan: 2003–2005," Parliamentary Paper No. 72 of 2002, *www.itc.gov.fj/publications.html#sdp.*
2 "eGovernment Strategic Plan," Working Document, *www.itc.gov.fj/docs/Data3eGovtStrategicPlan.pdf.*
3 "ICT Capacity-Building at USP," www.usp.ac.fj/jica.
4 For information on courses offered, see *www.spc.int/cetc/CourseOffered.htm.*
5 See Fiji TV, *www.fijitv.com.fj.*
6 E. Williams, M. Kato and N. Khan. "Evaluation of Computer Science Curriculum in Fiji Secondary Schools" (USP: 2003).
7 "Education for All: Country Report Fiji" (UNESCO, 2000), *www2.unesco.org/wef/country reports/fiji/contents.html.*
8 See "More Rural Areas Connect," *www.telecomfiji.com.fj*.
9 E.B. Williams, "Information Technology and Distance Education" in *Learning Together: Directions for Education in Fiji. Report of the Fiji Islands Education Commission/Panel* (Suva: Government Printer, 2000).

Kiribati

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Kiribati is situated across the equator, north of Fiji. It consists of 33 islands spread over 5 million square kilometres of sea with a total land area of 717 square kilometres. Of the 33 islands, 21 are inhabited with a total population of 91,985 (2002) that is primarily I-Kiribati. The islands are low-lying and many enclose a lagoon.

Kiribati is a member of the Commonwealth and was originally under British rule until it gained independence in 1979. There is a

legislative assembly (called Mangeaba-ni-Maungatabu) of 36 members, elected every four years. Official languages are I-Kiribati and English. The main island is Tarawa, which has the seaport and airport, with the main commercial centre and government services headquarters located in the district known as Bairiki.

The country's economy is based on revenue from fishing licenses, fish and lobster farming, manufacture of handicrafts and boat building, and remittance from I-Kiribati working overseas. The currency is the Australian dollar.

Kiribati is one of the 12 member countries of the University of the South Pacific (USP), and therefore it has access to the facilities of the university, including the USP Centre on Tarawa and, through it, to the USPNet satellite system.

National policies, strategies and programmes

There is limited policy and regulatory activity in Kiribati.[1] Indeed, there is currently no written policy on information and communication technology (ICT) for the education department in regard to providing computers for primary and secondary schools, although there is agreement with the Regional Forum Country Members policy on ICT. However some initiatives do exist in which the Ministry of Education supports some ICT activity in co-operation with the government-owned company, Telecom Kiribati Ltd (TKL).

Current level of ICT access and use

Currently, the only Internet service provider (ISP) is Telecommunication Services Kiribati Limited (TSKL), which is 100 per cent government owned and a monopoly. TSKL has 2,000 main lines operating at full switch capacity.

As yet, there is no Internet culture and very limited Internet access, with only 40 dial-up ports and about 400 Internet subscribers.[2] Christmas Island has one dial-up modem operating through Telstra.

TKL has provided eight computers in the National Library, five of which are connected to the Internet. Users are charged US$ 2.80 per hour for general computer use and US$ 5.60 per hour for Internet access. The service is more or less a business venture. TKL is planning to set up more computers in other locations as the room restriction prevents expansion of the current lab in the National Library.[3]

There is one Internet cafe in the whole of Kiribati, and it is located at the main office of TSKL in Bairiki, Tarawa.

Elementary Education

There are 90 primary schools throughout the country with a current enrolment of about 14,000. None of them have computers yet.

Secondary Education

While several high schools have computer labs, the only well-supplied school computer labs are at the government-owned high school and the Moroni High School which are located in South Tarawa. The government school is connected to the Internet, but the connection is only available at certain times in order to reduce the high cost of the connection charge. An increasing number of students at these schools later enrol in the USP Centre of continuing education computer course, or they enrol at the Tarawa Technical Institute (TTI).

Some other high schools have computer labs as well, but without Internet connectivity. They get computers from secondhand dealers overseas (Australia and New Zealand) on the initiative of particular school administrators.

Computer awareness programmes in some schools follow the external examination syllabus based in Fiji, while others have made up their own programmes.

Post-secondary Education

USPNet. A satellite system for distance education is provided through the USP for its students. The USP Centre in Kiribati (on Tarawa) provides degree, diploma and vocational certificates through both distance education and onsite courses to all eligible students throughout the country, including those from Christmas Island. Distance education students on Tarawa have access to interactive instruction through USPNet, the communications network of the university. This enables students to complete a large proportion of the courses for the university programmes without having to attend classes on other campuses.

In addition, the Centre has a continuing education programme that is open to the general public. The programme aims to increase the number of computer literate people in Kiribati. The programme is in three stages and the course content includes hardware familiarity, compulsory keyboard skills, word processing, spreadsheet, database, file management and Internet. Students graduating from the three-stage programme should be able to type at 60 words per minute with 98 per cent accuracy. Graduates are issued a Certificate in Basic Computing Skills. The course is heavily subscribed and it has an average enrolment of at least 50 students for each stage – a significant increase since its inception in 1998. The main constraints at the moment are insufficient number of computers and a lack of computer space.

Tarawa Technical Institute. The Tarawa Technical Institute is the only other institution that teaches a certificate programme on computers. Their computer labs have about 20 computers each and there is Internet connectivity in one lab for four computers with the charges being picked up by AusAid. However, the connection is usually turned off to reduce costs – not an uncommon situation across all government offices.

Broadcast Technologies

Radio. Communications to the 17 outer islands is through high frequency radio, grouped in six substations with 20–80 mile hops. Table 1 outlines an initiative to use radio for teaching at the primary level.[4]

In addition to the primary schools programme, there are non-formal education programmes broadcast over radio by the Health and Agriculture departments.

The Agriculture Department's weekly programme broadcast covers small farming techniques and proper animal husbandry. It has a good audience and the evidence of the success of the broadcast is seen in the small farming projects in Tarawa. There are reports that people in the outer islands are also engaged in small farming for cash crops.

The Public Health Department broadcasts information on nutrition, prevention of communicable diseases, particularly AIDS. It backs up its information with posters on AIDS that are set up in strategic locations around Tarawa.

Television. There is no local television service yet, although there is speculation that the Publishing and Broadcasting Corporation (another government company) will initiate a service. The St. Louise High School is the only high school in South Tarawa that has a satellite dish and can connect to TV channels, mainly from Australia.

Major initiatives

An initiative[5] has been launched by TSKL in which all eight secondary schools, the tertiary training schools and the one nursing school with the Ministry of Health are to be provided with two computers each that connect to the Internet. The computers and all the connections are to be provided by TSKL and the schools are then to be charged for an Internet connection at US$ 2.80 per hour. The other 32 junior

Table 1: Radio Broadcast to Primary Schools

Subjects covered in broadcasts	English, Math, Environmental Science, Vernacular Language
Time of broadcasts	Four days a week (Mondays– Thursdays) for two hours from 9:30 to 11:30 a.m.
Target group	Classes 1-6
Preparation site	Broadcast studio in the CDRC compound (funded by the British government)
Service provider	Publishing and Broadcasting Corporation (BPA)
Equipment	Radios given free to all primary schools but funded by UNESCO
Programme budget	• 2003: US$ 15,400 to cover expenses for radio air time and wages of the two officers • 2004: US$ 42,000 to cover additional air time and cost
Objectives	• Provide an additional teaching mode – listening and understanding. • Help reduce the pressure of teaching multiclass school situations that are common in the outer islands. • Provide an additional source of information for teachers – very few primary schools have libraries
Programme use by primary schools	Recent surveys conducted by the Education Department and presenters of the programme revealed that many schools in the outer islands are making use of it, but very few schools in Tarawa are doing so
Constraints	• Not enough air time to include other subjects • Budget allocation is just enough to barely cover expenses for what is being done • The programme still cannot reach the remote parts of Kiribati • Different time zones mean that the eastern Kiribati group is ahead of Tarawa and the rest of Kiribati, which means that synchronous broadcasting is impossible • The plan to have a radio link via TSKL satellite is currently too expensive
Proposal and plans for the future	• Constraints can be eliminated if the department has its own broadcasting unit in Tarawa and Christmas Island. The initial establishment cost may be high but the benefits would outweigh it. • There are plans to use the Internet, but the major constraint is the high charge of the Internet fees.

secondary schools (Forms 1–3), which are funded and run by the government and located in the outer islands, are not included in the project due to their isolation.

Another initiative is the World Health Organization's training of medical personnel. This involves the establishment of a 10-PC computer lab that will have Internet access, and will be used for training of health workers. It is being managed by the USP Centre and there will be technical support provided by USP until the end of 2004. Two workshops are to be provided by USP for health trainers to gain ICT skills. The facility will also be used for distance education studies of Kiribati health workers.

Examples of training

Training is weak in Kiribati. Most of the people skilled in ICT are graduates from USP and other overseas institutions and there are not very many of them. The USP Centre and Tarawa Technical Institute (TTI) offer computer courses that are mainly geared for software applications such as word processing, spreadsheet, database and use of the Internet. The number graduating from these courses is increasing so that the bulk of computer operators in most ministries, and in the private sector, are graduates of these two institutions. The government is showing support for the computer courses by sponsoring civil servants to take TTI computer courses, and refunding fees paid by teachers and other civil servants who successfully complete the USP computer continuing education programme.[6]

Constraints on the use of ICT

The main constraints are a lack of infrastructure (e.g., telephony connections and a lack of computers) and the cost of Internet access. Just getting a telephone in a private home takes about three years.

Analysis

Radio appears to be utilised well for primary education although there is room for extending the programmes to other subject areas. The constraint is likely to be the cost. A likely area for assistance would be to support an independent and dedicated radio station for the Education Department to expand its radio broadcast programmes.

There is a serious deficiency based on the lack of appropriate infrastructure and hardware. A follow-on effect is the lack of access to ICT, and with a major constraint being the charge of Internet access, the increase in telephone connectivity and increasing ownership of PCs in homes will not have much effect unless this is addressed. The monopoly of TSKL does not help the problem. The following are areas that could be considered for further assistance to Kiribati:

- Provide more PC sites and more PCs in schools including primary level.
- Continue the incentive sponsorship programme to encourage educators and students to enrol in computer courses. A good system would be to refund fees to those who successfully complete the course of study. There is a lot of interest in computers but fees are a constraining factor to the majority – particularly to students whose parents do not have regular source of income.
- Formulate regulations and support initiatives that would compel and help the government to give priority to ICT use.

NOTES

1 See the Asia Development Bank's report on information and communication technologies in the Pacific (Vancouver: COL, 2002).
2 See note 1 above.
3 Information provided by Permanent Secretary of Education (Takei Taoaba), Kiribati National Librarian (Kunei Etekiera) and Rakei Tamati (collector of charges for TKL computer use from general public).
4 Information provided by Rubennang Taukoriri, Acting Senior Education Officer.
5 Information provided by Pinto Katia, Manager of Internet Services for TSKL.
6 See note 5 above.

Marshall Islands

ICT USE IN EDUCATION

Ms Ruby Vaa[1], Ph.D

INTRODUCTION

The Republic of the Marshall Islands (RMI) lies north of the equator, southwest of Hawaii. It consists of a double chain of coral atolls and over 800 reefs spread over 2 million square kilometres of sea. The atolls have a total land area of 181 square kilometres. Of the 34 atolls, 25 are inhabited with a total population of 56,000 (2002 figures) who are primarily Marshallese. The official languages are Marshallese and English. The main atoll is Majuro, one of the two main population centres, and the main commercial centre, with seaports, airports and government services headquarters. The other main atoll with a population concentration is Ebeye.

Politically, RMI is associated with the USA through a compact of free association. There is a legislative assembly of 33 members, elected every four years. The elected president is the head of state and leads a cabinet of appointed state ministers.

The country produces fish, trochus shell, oysters, black pearl and clam, as well as some copra. Marshall Islands is one of the 12 member countries of the University of the South Pacific (USP) and therefore has access to the facilities of that institution including the USP Centre in RMI and through it, the USPNet satellite system.

National policies, strategies and programmes

The RMI has recently endorsed a national strategic plan, Vision 2018, to guide the development of the country for the next 16 years. The plan strongly emphasises the need to develop its human resource potential through improved education and specific human resource development initiatives. The report proposes to "establish a knowledge-based economy by equipping Marshallese citizens with internationally competitive skills, qualities and positive attitudes to work and society." The resulting resource development plan is broad and recognises the wide range of development required but does not specifically detail an approach to the co-ordination of information and communication technology (ICT) and ICT programmes.

A report of the National Training Council, Labor Market Report, produced in October 2002, discusses ICT issues. It indicates that ICT skills:

> ...are increasingly important in all RMI government and non-government enterprises, as they are to governments and enterprises worldwide. It is imperative that RMI increases the ICT skills of its workforce in order to communicate effectively both within RMI and to the world outside. It is important that RMI has a pool of multi-skilled young ICT experts to manage its ICT systems. There is currently a worldwide shortage of ICT employees and suitably qualified RMI citizens will be able to compete internationally for work in this field.
>
> There are eight major job categories in the ICT sector. These categories comprise database development and administration, digital media, network design and administration, programming/software engineering, systems analysis and integration, technical support, technical writing, web development and design.
>
> Through interview, RMI managers indicated that they needed people with skills in:

- database development;
- network design;
- systems analysis;
- technical support;
- web development.

The report indicated a need to produce about 50 new ICT graduates per annum for the foreseeable future. This target has not yet been met nor has the labor market expanded sufficiently to create the full demand. It is expected, however, that the demand will eventually develop.

Current level of ICT access and use

The RMI has 78 public schools and 25 private schools spread over 25 atolls. Only five of the atolls have regular power, although some have access to solar power for radio and lighting. As a result only a small number of sites have the infrastructure to allow the use of ICT.

Elementary Education

The major population centres of Majuro and Ebeye have some computers available. Most computers in RMI schools are in Majuro. The eight public elementary schools have computer laboratories that are networked (tenuously) to printers within the laboratory. The majority of the computers have been supplied under the After School Care programme and are intended for student use to build language, math and computing skills after school hours, but they are available for school use during the day.

A plan to link these schools to the Ministry of Education office in a wide area network using wireless links is under investigation and a donor for the service is being sought.

Secondary Education

The high school in Majuro has a computer laboratory, which is used to teach general computing skills. Very little use is made of it as a medium for teaching the broader curriculum.

The high schools in Jaluit and Wotje both have computer laboratories. Satellite links to these two atolls allow Internet connections for these high schools.

Post-secondary Education

College of Marshall Islands. The College of the Marshall Islands (CMI) has the largest education-related computer

facility. It serves three purposes at the moment and a fourth is in development.

The first and major purpose is to provide computing services to college staff. Regular turnover of key staff has meant that the network processes have been extremely limited and used mainly for print services. Using Peacesat for linking to the Internet has been irregular and thus the use of services external to the RMI has been very low.

The second purpose is to provide access to students both for studying and writing. For business studies students, it becomes the vehicle for development of ICT skills. The level of ICT skills being targeted is at the lower end of the employment market. High-level networking and software development are not regularly taught, although an adjunct programme in basic networking has begun in conjunction with the Bank of the Marshall Islands.

Students are also able to use the college intranet where they can access notes posted by faculty and submit assignments. Essentially it is application of distance education processes on the college intranet that allows staff to observe project development and provide more intervention opportunities before projects are completed.

A third purpose is hosting a satellite service linked to the Peacesat, which provides a teleconferencing connection to any outside link. Connection is made mainly to Hawaii, Guam and other Micronesian islands. The satellite station is linked by landline to a second satellite managed for the Emergency Services Center. Together these two satellites have the potential to provide teleconferencing, Internet access and 10 voice links channels. The Emergency Services satellite has emergency service as its first priority, so the network is secondary.

A network of landlines connects the college, the Emergency Center, the Ministry of Health, the Majuro Hospital and the Pacific Regional Education Laboratory (PREL) Office in the Ministry of Education. The teleconferencing service is used regularly by PREL for staff training. It is being further developed at the hospital for use in telemedicine to enable remote medical consultations.

A consortium of local agencies (college, hospital, Ministries of Education and Health) has been established in partnership with the Telecommunications and Information Policy Group (TIPG) at the University of Hawaii to manage the Peacesat connections to ensure there is an appropriate management process for the RMI Peacesat arrangements.

A gateway to the Internet has been provided for education purposes. While it is only a 64K link it provides the college and health services with an alternative link to the current Internet service being provided by the National Telecommunications Authority (NTA), the national telephone carrier. These current services are provided through a rather narrow bandwidth and at a high price of US$ 3.60 per hour or US$ 2,000 per month for a 128K 24/7 link – although the NTA has waived fees for official educational Internet use.

A fourth purpose of ICT functions at the college is to provide a base for students to engage in distance education for the completion of four-year degrees and to provide an alternative source for any specialist subject for two-year degrees not covered by the college. An Internet cafe for distance education students is in development. Internet connections for this service are still under review. This arrangement will reduce training costs since students can remain on island and, in many cases, in their current place of employment.

The USPNet. A complimentary satellite service for distance education is provided through USP for its students. The USP Center in the Marshall Islands provides degrees, diplomas and vocational certificates through both distance education and on-site courses to all eligible students throughout the Marshall Islands. Distance education students have access in Majuro to lecturers and instructors through USPNet, the communications network of the university. This enables students to complete a large proportion of the coursework for university programmes without having to attend classes on other campuses.

Institute of Vocational Education. An Institute of Vocational Education is being developed by the RMI, supported by an Asian Development Bank loan, to cater for early school leavers. It will provide programmes to enhance general development skills and to provide initial vocational training. A computer laboratory has been provided as part of the plan, with a major part of the training provided through interactive use of computers, allowing an individualised training programme for each student. A search for appropriate interactive programmes is currently underway.

In-house Education in the Ministry of Education

The PREL office in the Ministry of Education is linked to the office in Hawaii through the Peacesat satellite network. This facility is used for teleconferences that involve RMI-based personnel in programmes conducted by PREL.

Ministry of Education

The RMI Ministry of Education has received computers from various donor grants but does not yet have an operational network linked to a server. The delay is due to a lack of personnel with technical knowledge. Currently, the Bank of the Marshall Islands is providing support service to complete the installation of the Ministry network and will then provide ongoing support to in-house staff once recruited.

Broadcast Technologies.

Radio and television have been operating for a while in both Marshallese and English. Majuro, that has about half the population, has access to television, one government AM radio station and three FM stations. Majuro also has a large number of video shops. Some of the atolls close to Majuro can also access the AM radio station. The main focus of government radio is music, news and reporting the proceedings of the Nitijela (the local parliament). The radio is not currently used for school or educational broadcasting. Television relays of a number of satellite stations (CNN, BBC, movies, etc.). There are slots for local events, but the media is not used for educational purposes.

Major initiatives

Major initiatives using ICTs have been previously described. Briefly, they are:

- Intranet for tuition use at the college;
- Satellite links through the USPNet;
- Internet cafe for off-island distance education;
- Wide area network for teleconferencing in health and education;
- Planned wide area network to link schools in Majuro, to provide links to the Internet and caching of popular websites;
- Vocational education using computer-assisted training to develop basic language and math skills as well as provide information about vocational options.

Examples of training

So far training has been limited to the CMI and USP. While large numbers have been enrolled in ICT training degrees, very few have graduated. The most qualified graduates are snapped up by the major ICT employer, the Bank of the Marshall Islands, which is building the best pool of ICT expertise in the country.

The Ministry of Education paid for a small number of intern staff (students who were assisting in the installation of network arrangements in the ministry office and schools) to attend network-training programmes in Hawaii, but due to an inability to promptly offer employment, the interns chose to work with the bank instead. This has, however, had a serendipitous benefit because the ministry has established a computer support arrangement with the bank.

The PREL office in Hawaii provides a regular series of ICT awareness and skills development programmes on island.

In summary, the long-term need for trained staff will not be met from current arrangements, particularly those relating to networking, systems administration and software development.

Constraints on the use of ICT

A major constraint is the lack of a focus for ICT development in the country. Each arm of government is developing its own vision with little or no co-ordination. The Ministry of Finance, because it needed to allow online access in major departments of government, has set up a wireless wide area network with US technical support.

General use of ICT outside of the four major centres in the country will be limited until sustainable power sources and innovative uses of technology can be explored. Designs for long-distance radio-supported low-band e-mail are under discussion.

ICT access for elementary students is limited to Majuro and Ebeye. This is exacerbating the disparate nature of educational offerings among children in the RMI. Technical support is very limited even on the sites with large numbers of computers.

Analysis

There is a need to provide a more co-ordinated and focused training initiative in order for the crucial aspects of ICT technical support to be available. Furthermore, follow-on employment opportunities at the Ministry of Education need to be created in order to maintain trained personnel so the expertise is more readily available for education initiatives.

Broadcast technologies appear to be underutilised for education and much potential exists with this medium, particularly given that the atolls are spread over such a wide expanse of water. For instance, the use of radio for delivery of educational programmes as in other Pacific islands could be considered, particularly for schools at the elementary level, while television could be utilised for delivery of distance education programmes. The constraint here is likely to be the cost.

NOTES

1 This paper does not represent an authorised government view. The author, Leatuaolevao Ruby Vaa, co-ordinator of the Pacific reports, provided context and analysis (*vaa_r@samoa.usp.ac.fj*). Other views in this report are of Martin Caust (*mkcaust@fastmail.fm*).

Federated States of

Micronesia

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

The responsibility for education in the Federated States of Micronesia (FSM) is shared between the national government and the individual states of Chuuk, Kosrae, Pohnpei and Yap. The FSM has a strategic plan to provide overall guidance for improving education in the country. However, the states have the primary responsibility for instruction with the national government providing support and assistance. As a result, the individual states also have their own plans for the improvement of education and for the use of information and communication technologies (ICTs).

Free public education is provided for children in the FSM through the completion of grade 8 or age 15. High school attendance is based on passing a high school entrance examination.

Funding for education in the FSM is primarily provided through Compact funds provided by the USA with a significant amount also provided under US federal education programmes. The US regards the FSM National Department of Education as a state education agency (SEA) and each of the state departments of education as local education agencies (LEAs). The majority of funding under these programmes is delivered directly to the individual states. The country has experienced a reduction in the amount of funding provided during the past several years, which has had a negative impact on their ability to meet the educational needs of students.

The FSM supports one institution of higher education, the College of Micronesia – FSM (COM-FSM) with a national campus in Pohnpei and state campuses in each of the states. COM-FSM offers associate's degrees and also has a third-year programme in education. The University of Guam works with COM-FSM to provide the additional courses needed for a bachelor's degree in education on its campus in Guam and via distance learning. In addition, San Diego State University (SDSU) and other universities provide distance learning courses in the FSM.

Well-trained teachers are essential for the development of an effective education system in the FSM, and the national government has recognised the need to improve teacher training. Currently, approximately 85 per cent of the teaching staff have less than a bachelor's degree and a substantial percentage have only a high school diploma. Significant efforts have been made to increase professional development opportunities for teachers through distance learning technologies. PRELSTAR: A Pacific Islands Distance Learning Program and the Pacific Regional Technology in Education Consortium (PR*TEC), funded by the US Department of Education and managed by Pacific Resources for Education and Learning (PREL), have provided both distance learning and face-to-face inservice and pre-service training for teachers as well as training of faculty at COM-FSM in the development and delivery of distance learning courses. However, substantial additional funding will be required to meet the needs of the country.[1]

The FSM has recognised the importance of data-driven decision-making in education. One of the goals in its strategic plan is to develop "appropriate assessment and evaluation systems for all levels of education and will use those systems as the basis for decision-making, resource allocation, and planning and development."[2] Through the US-funded Freely-Associated States Educational Grants Program (FASEGP), staff from the states and the national government have developed a database of information on education in the individual states as part of this effort.

The national and state governments also recognise the need to improve telecommunications access throughout the country and to develop effective information management and communication systems. However, the costs of upgrading this access and extending it to schools throughout the four states will require substantial outside funding both for the initial infrastructure investment and for ongoing recurring costs. Until this funding is identified, the governments will not be able to significantly improve telecommunications access to schools.

The strategic plan specifically addresses the need to develop a technology literate population. The main goal in this area is "to develop a technology literate population to rapidly respond to changing conditions in the world economy" through the following five objectives:

- Provide quality mathematics and science programmes to form the basis for understanding and using current and future technologies;
- Develop student computer literacy for understanding and use of information technologies;
- Develop operational plans for effective use of the Internet and other information technologies for improvement of instructional support staff training and programmes;
- Provide for repair and maintenance and upgrading of technological resources;
- Allocate financial and technical resources for information and communication technologies[3].

Current level of ICT access and use

A total of 195 schools located on islands and atolls across an ocean expanse greater than the area of the continental United States serves approximately 34,179 children in the FSM. Of these schools, 74 have fewer than 100 students and 43 have fewer than 50 students. Most of these small schools are located in remote outer islands.

Telecommunications and power are not available on all islands or to all schools (see Table 1).

The FSM Telecommunications Corporation (FSM Telecom) became an Internet service provider (ISP) in December 1996. Phone and Internet services are available to schools on the major islands of Chuuk, Kosrae, Pohnpei and Yap and on the outer island of Ulithi in Yap State. However, the cost of bandwidth is high and not all schools are connected.

Table 1: Schools and accessibility

State	Schools with power (%)	Accessible from DOE by auto (%)	Accessible from DOE by boat (%)	Accessible from DOE by ocean ship (%)	Accessible from DOE by small plane (%)
Kosrae	87.50	87.50	12.50	--	--
Pohnpei	75.00	82.50	5.00	12.50	--
Chuuk	17.30	18.40	51.00	31.60	--
Yap	40.00	40.00	--	60.00	31.00
All schools in FSM (%)	**37.60**	**39.80**	**29.30**	**31.50**	**6.10**

FSM Telecom operates a reliable fibre/copper ring system and NORTEL digital switch on the four major islands. Internet service is also provided on these islands and the company has steadily increased the bandwidth available. Long distance phone calls to and from states in the FSM currently cost US$ 1–2 per minute; and direct Internet access is available at a cost of US$ 19.95 per month for 10 hours of service, with additional hours charged at US$ 1.95 per hour.

Flat-rate symmetric and asymmetric leased circuits are also available on the main islands. The cost of these services ranges from US$ 1,150 per month for 64 kbps of dedicated bandwidth to US$ 18,350 per month for 1536 kbps. Unfortunately, the high cost of on- and off-island services limits the abilities of the departments of education to provide Internet access to students in schools. Where such access is provided, the schools must restrict use due to limited bandwidth.

COM-FSM has a 512K connection to the Internet through FSM Telecom that provides access for the national campus and all four state campuses. It manages the bandwidth among the campuses through CISCO routers. PREL, through its PRELStar programme, and the University of Hawaii, through its Peacesat project, have collaborated to provide a 128 kpbs videoconference network serving COM-FSM and each of the state departments of education. This network connects with the Peacesat bridge in Honolulu, Hawaii, and is available for use by the education, health and government sectors.

Outer islands with schools and health dispensaries generally rely on high frequency/single sideband (HF/SSB) radios. In Chuuk, for instance, 75 per cent of students attend schools with only this type of access. Future plans to serve the outer islands include the installation of a very small aperture terminal (VSAT) network attached to a wireless local loop (WLL) directly connected to FSM Telecom's digital switch.

At the school level, ICT access varies widely. Computer labs are operating at the main schools in Weno, Chuuk, including Iras and Sabok Elementary and Weno, Chuuk, and Xavier High Schools. In Kosrae and Pohnpei, computer labs are also operating in most schools. On the main island of Yap, all schools are connected though the Yap State Education Enterprising Department's (SEED) wide area network (WAN). This network uses microwave technology to connect all schools. Yap SEED also deploys wireless connectivity at some schools and maintains a computer lab at its offices for use by students and teachers. Computer labs are available at most schools on Yap and on most of Yap's outer islands including Ulithi, Wolei and Satawal.

Distance education is increasingly being used by organisations in the education and health sectors. COM-FSM, departments of education, PREL, SDSU, the University of Guam, the University of Hawaii and other educational businesses are using distance education to provide teacher training in the FSM. The US Army uses distance technologies to provide medical diagnosis, evaluation and training, and the Center for Disease Control and the Health Resources Services Administration use the infrastructure to deliver programme updates. The technologies used range from online courses designed for low bandwidth access to courses using synchronous videoconferencing, videos, traditional print and various hybrid forms of media.

Major initiatives

Despite the high cost of telecommunications access, the low level of teacher training, the lack of funding and the different approaches developed by the four states towards the integration of technology into the curriculum, the past five years has seen an increase in the local telecommunications infrastructure and in the use of technology in the schools.

For example, Yap has made significant progress in providing teacher training in technology integration. Through the efforts of the former Director of Education and his Director of Technology, computer laboratories were installed in most schools, a WAN was developed connecting schools on the main island, a state-of-the-art "smart" classroom was

installed at Yap SEED headquarters for use in teacher training and Internet access was extended to Ulithi. Local SEED staff leveraged the resources provided by PREL, Peacesat, and various private and federal grants to engage both students and teachers in using technology. Learning materials, including early childhood books in Yapese, were developed, as well as art education and web design courses for high school students. Despite this progress, however, the lack of a strategic plan integrating technology into the curriculum has prevented Yap SEED from realising the full potential of ICTs in education. Curriculum developers and technology staff often worked independently of each other. Some of the curriculum developers lacked understanding of educational technology or even basic technology applications and some of the technology staff lacked understanding of curriculum development.

COM-FSM has also made significant progress in integrating technology into its curriculum and in extending educational opportunities by forming strategic alliances with other colleges and universities to improve and extend course offerings through distance learning. It is currently working with SDSU to provide courses for students and with PREL and other institutions of higher education in the region to develop a series of six basic 300- and 400-level courses for teachers with an associate's degree who are working toward a bachelor's degree. The college has also been providing professional development to teachers in local schools under a grant from the United States Department of Education.

From 2001 to 2003, PREL, in collaboration with Western Illinois University, offered a master's degree programme in instructional technology and telecommunications. The programme was designed to train a cadre of educational leaders from the region in instructional technology. One student from each of the four state departments of education and the manager of COM-FSM's technology department participated. Three of these five participants completed the coursework and earned their master's degrees (one was forced to drop out due to a serious health problem and one was unable to handle the heavy course load). These leaders are now working within their local departments of education in the integration of educational technology into the curriculum.

For the past two years, the University of Guam has received funding from the Sasakawa Pacific Island Nations Fund (SPINF) to assist the FSM states in developing distance learning plans. Each state has developed a distance learning plan to address the needs of education, health and government. (These plans are available at *www.demicro.org*.) The University of Guam has co-ordinated its activities in this project with those of PREL and the University of Hawaii to provide co-ordinated assistance and training in the development of these plans as well as regularly scheduled teacher training workshops throughout the FSM.

A major initiative is currently being tested to improve telecommunications to remote islands through the use of satellite broadcast. This system has been designed to provide low-cost telecommunication links to islands with only HF/SSB radio communications. Using a combination of solar-powered receivers, computers and printers, the link provides low speed (9,600 bps) data broadcast throughout the FSM. If the initial tests are successful, this network will allow FSM departments of education to deliver printed material to some of their most remote schools.

Examples of training

Individual departments of education, COM-FSM, PREL, the University of Hawaii, the University of Guam and other organisations have provided training to teachers in the FSM. The individual departments of education have provided a number of workshops, often in collaboration with an institution of higher education or one of the regional service providers. COM-FSM has developed basic ICT training for inclusion in its degree programmes.

PREL is working closely with each of the departments of education in training trainers and teachers in the integration of technology into the classroom. This training focuses on integrating application skills into the curriculum and linking the National Educational Technology Standards (NETS), developed by the International Society for Technology in Education (ISTE), to local curriculum standards. These standards use an integrated, problem-based approach to developing unit and lesson plans incorporating technology. The step-by-step instructions and examples provided in the ISTE materials are particularly useful in working with teachers in the FSM who have little or no experience in developing lesson plans.

Ongoing ICT training is being provided through a 21st Century Community Technology Center grant to department of education staff in Pohnpei and through PREL and the University of Hawaii in all four states. A CD and other support materials are being developed and delivered to operators of the videoconference network in an attempt to improve the availability of the network. Training is provided face-to-face, through videoconferencing and online.

Constraints on the use of ICT

The lack of affordable telecommunications access is a major constraint on the use of ICTs in the FSM. Each of the distance learning plans for the individual states highlights this as a barrier to the integration of ICTs into the curriculum. The costs of providing telecommunications access in the FSM are among the highest in the world because of the country's geographical remoteness and small population.

The market is just not large enough to bear the initial and recurring costs of providing the service.

Second, the departments of education within the FSM are facing severe financial pressures. The reduction in funding under the Compact of Free Association with the US has resulted in a lack of funding for basic hardware and software as well as for required improvements in classrooms or computer labs. Some departments are unable to provide power on a continuous basis to schools. The poor physical condition of many schools results in damage to computers. In addition, the high humidity and salt air of these islands significantly reduces the life of computers unless they are kept in a controlled, air-conditioned environment.

Third, the level of teacher education in the FSM is low. As noted earlier, 85 per cent do not have a bachelor's degree and more than 30 per cent have only a high school diploma. With the current pay scale and physical conditions of the schools, it will be difficult to attract qualified teachers or to require current teachers to continue their formal education.

Finally, all of the training materials available are in English and designed for use with teachers who have a higher level of education, access to a wide variety of resources and high proficiency in English. As a result, it is often difficult for teachers in the FSM to relate to these materials or to understand the language used.

Analysis

The past five years has seen a marked increase in the use of ICTs in the FSM. However, significant further improvement depends on the expansion of the ICT infrastructure, a reduction in bandwidth costs, additional funding for education and improved education and training of teachers.

The FSM cannot afford major investments in ICT infrastructure to remote regions or sustain the ongoing costs of providing that service. Unless bandwidth costs are substantially reduced, students will continue to have very limited, if any, access to ICT. The technology to maximise the efficient use of bandwidth is already being deployed by COM-FSM and Yap SEED, but there still remains a need to increase the bandwidth available for their users.

A small amount of assistance to schools for telecommunications access would greatly increase the use of ICT in the FSM. In the United States, the e-rate programme provides a subsidy for telecommunications access to schools and has greatly increased the use of ICT by making access more affordable. A similar programme, funded by outside sources, would facilitate the use of ICT in the FSM.

The increased use of ICTs will also require additional funding for education for physical improvements to schools, hardware and software purchases, and teacher training. The physical condition of computer labs must be upgraded to protect and extend the life of the equipment. Teacher training in the integration of technology into the curriculum should be ongoing using both face-to-face and distance learning technologies. A training plan should be developed for each of the departments of education to provide for this ongoing training of teachers. However, the plan can only succeed with dedicated funding.

NOTES

1 Catalino Cantero, "Strategic Plan for Improvement of Education in the Federated States of Micronesia" (Pohnpei: FSM National Division of Education, 1997), 8.
2 See note 1 above, p. 37.
3 See note 1 above, p. 71.

Nauru

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Nauru is located south of the equator, southwest of Honolulu, Hawaii. It is a single raised coral island with a land area of 21 square kilometres. The population (2002) is 11,845 with a growth rate of 2.05 per cent.

The economy was based on phosphate mining but that has now run out leaving the nation dependent on investments and aid. There is no income tax or direct tax.

Education is free and compulsory for ages six to 16 years. There are four primary schools: Aiwo (junior primary attached to Nauru College), Yaren Primary, Kayser (together with primary and secondary) and Nauru College (senior primary). There are also four infant schools: Menen Infant, Nibok Infant, Boe Infant, Anen Infant (part of the Kayser College complex). Kayser College (Catholic mission establishment) includes infant, primary and secondary schools in one location. It is helped a little by the government but mostly it is a private educational institution. There are only two secondary schools: Kayser College and Nauru Secondary.

National policies, strategies and programmes

In 2002, the Telecommunication Act came into force and resulted in the establishment of the RONtel Corporation. RONTel stands for Republic of Nauru Telecommunication Corporation. The Act establishing RONTel sets out, among other things, the telecommunication services to be provided and the rates, charges and licensing system. At present, the corporation is working on strategies to implement its mandate.

Current level of ICT access and use

General

- A telephone system comprising twisted pair copper wire telephone lines was installed by a Japanese company in the 1970s. However, most of the lines have rotted away due to soil and water corrosion.
- LAN line Internet connectivity uses the Japanese telephone lines. This is operated by RONTel for the whole island. Because of the status of the telephone lines, only half of the island (Menen, Aiwo, Yaren and Boe districts) are able to use the connection.
- There is a joint venture by Central Pacific Group (Cenpac) and RONTel to operate an Internet cafe that has five PCs for public access.
- There is also a joint venture by Nauru Phosphate Royalty Trust (NPRT) and RONTel to operate an Internet cafe with nine PCs using a dial-up connection.
- Cenpac has 16 modems for local subscribers. It has been in operation since 1998 and one of its roles is to market the domain name ".nr." Cenpac has a newly established website at *www.www.nr* for local online marketing and other notices, announcements and information, in addition to its first website, *www.cenpac.net.nr*. Cenpac is holding discussions with Telstra Australia and Pacific IP (New Caledonia) on the possibility for better Internet access.
- Plans for a Telecom-GSM Mobile service are on hold.

Education

- **Nauru College** is currently equipped with 26 working personal computers to cater to the educational needs of both school children and teachers. Educational software in all key subjects is being used to aid the major areas of the curriculum. Programmes are also utilised to produce creative projects beside the usual papers and research required by regular subjects. The inkjet printer, CD-writer and scanner are used to create posters, postcards, business cards and newsletters that are designed and printed by the pupils in the computer lab, and lesson plans and teaching aids worked on by the teachers. For the past two years even the annual school magazine has been produced through desktop publishing in the lab. At present only five PCs are networked for Internet use. Members of the staff pay a fee for this service every month so they can have the liberty of using e-mail, keeping track of world news and doing educational research.
- **Kayser College** has only had computers for one year. There are 16 PCs networked with a printer, but none has an Internet connection. Basically they are used to familiarise the students with computers. There is only one teacher responsible for all computer training for school children and teachers. This teacher attended PC training with a Japan International Cooperation Agency (JICA) programme.
- **Aiwo Primary, Yaren Primary, Location School and Nauru Secondary** all have computer labs with 12 PCs for student use.
- **Nauru Secondary** has a lab with 20 PCs also for student use.

As well as the above, four district infant schools all received one PC each for staff use. Other schools have received PCs as a donation from Taiwan.

Other ICT

There is an FM radio station, 888 FM, which broadcasts only news and music from 7:00 a.m. to 11:30 p.m. seven days a week. Nauru TV broadcasts news, sports and daily educational programmes from ABC Asia Pacific on how to

speak English properly and from China TV on how to speak Chinese. There are no locally produced programmes as yet.

Nauru TV and Radio Nauru are part of the Department of Economic Development of the government.

Major initiatives

USPNet

Nauru belongs to the regional University of the South Pacific (USP) which is owned by 12 member countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. The university has a privately owned satellite system that was upgraded in 2000 and is fully functional for all 12 countries. It operates under strict conditions agreed to with the national telecommunication carriers. The system allows audio, data and video interaction.

For Nauru, USPNet is the most successful initiative to date and is the system that the USP Centre depends on for communication with other parts of the university. The Centre has a six-PC computer lab dedicated to student use. There is also a PC for audiographics in the audio conferencing studio, and another PC in the library for online searches. As part of the regional university, Nauru benefits from this regional network through which university courses are accessed by video broadcast supported by the WebCT Internet programme. Law courses can be studied online and print-based courses are supported via audio and video conferencing. The Centre is able to participate in regular regional staff meetings as well. In a recent development, university centres and campuses have been linked up so that an "internal" telephone system is accessed.

USP Community Outreach Programmes

USP Nauru Centre also accesses the continuing education programmes that are co-ordinated from Suva, such as the preschool teacher certificate, disabilities studies and community nutrition. Students of these continuing education programmes are mostly women. Before 2001, the Centre conducted computer awareness and training programmes, but these were stopped due to the daily power outage problems. These will recommence once a generator is purchased or the power problem is fixed.

It appears that most women and young people of Nauru are beginning to utilise and see the potential of the ICT services provided by USP. Records kept since March reveal that students using the computer lab for e-mail, research or assignment preparation are 51 per cent female and 49 per cent male. It appears, therefore, that there is no gender imbalance.

Examples of training

Very little is done in the way of training. Indeed, there is no ongoing training programme organised by the Education Department to develop computer literacy among teachers. However, some teachers, on their own initiative, have taken steps to improve their computer skills in three ways:

- By enrolling in basic computer courses at the USP Nauru Centre or through correspondence via Education Direct;
- By participating in short-term workshops/seminars on software applications whenever these are offered on the island;
- By self-learning.

It has only been two years since computer studies were first introduced at Nauru Secondary and Nauru College, and one year since lessons started at the Aiwo and Yaren primary schools.

There has not been any external assistance except UNESCO's contribution of some resource materials for the development of the inclusion of computer studies in the school curriculum. Each individual teacher has had to develop his or her own programme based on the resources available and the needs of the students.

The newly established Nauru Telecom Corporation has not undertaken any training as yet, but Cenpac has plans to provide training in the future.

Constraints on the use of ICT

Generally there is a serious financial problem in Nauru and this has halted major plans for training and upgrades. Efforts to improve the situation have led to the Nauru Telecom Corporation being established, but this is only recent and its budget is constrained by many old debts inherited from government. Cenpac's budget and funds are also limited.

The following are the notable constraints:

- The ICT infrastructure is substandard. There is one telecommunications centre on the island and it was only recently privatised.
- Telephone access/usage is very limited and cellular telephones are rare. Thus, a few businesses and individuals have invested in private satellite dishes.

- There is a lack of human resources. ICT professionals and computer technicians can rarely be found.
- There are no computer shops or computer repair centres and all units and parts have to be ordered and shipped from overseas.
- Power outages have affected access and limited training.
- Training programmes are minimal.

Analysis

The financial situation of the country has had a significant impact on ICT development and use and there is a great need for ICT training on Nauru.

There is a serious lack of ICT specialists to provide maintenance and training. For instance, at Kayser College, there is a need for a specialist to teach advanced computer usage, and the PCs donated by Taiwan are apparently under-utilised because there is no qualified tutor and no curriculum for teaching/learning about computers.

Broadcast technologies could be further developed for education and Nauru TV and Radio Nauru would like to get some training to do this.

New Zealand

ICT USE IN EDUCATION

Mr Tom Prebble, Ph.D

INTRODUCTION

In 1989 the governance of the New Zealand education system was radically reformed. From being a relatively centralised system, it became an extremely devolved one. Responsibility for the delivery of education at the institutional level was devolved to locally elected boards of trustees, in the case of schools, or each being responsible for just their local school. The Ministry of Education retreated from most of its former service delivery and quality assurance roles and restricted itself to policy formation and funding, devolving even quality assurance to an independent agency.

National policies, strategies and programmes

However, experiences of the 1990s indicated that there were certain issues requiring stronger "steerage" at the national level. Particularly, it became clear that the government needed to provide some leadership to encourage the developing use of ICT in the nation's school system.

This chapter explores the developing use of ICT by both the schools sector and the technical/vocational and teacher education sector against this context of the competing values of local governance on the one hand, and the national aspiration to participate in the international knowledge economy on the other. The experiences of the two sectors have been quite different, mostly because technical/vocational education and teacher education are both important parts of the tertiary system, which the government also recognised as needing support with respect to the uptake of ICT. For this reason, these two sectors are discussed separately.

ICT in the schools sector

National Policy, Strategy and Programmes

Whatever the reforms in institutional governance may have achieved in terms of institutional autonomy and responsiveness, they posed some serious challenges to the uptake of ICT in the education system, particularly by the schools sector. During the early 1990s, each school met the challenge of ICT in the best way it could and generally without much support or guidance from the ministry. Schools struggled to increase their ownership and use of computers, and there were a few research projects that brought small groups of schools together with their local university or college of education. But in an era when schools were realising that their survival depended on their ability to compete with neighbouring schools for pupils and for community support, there were few inducements for local or regional collaboration in the use of ICT.

There were some noteworthy exceptions. Some of these were in response to the challenge of distance. During the early 1990s, several regional clusters of schools began trials with teleconferencing and computer-based conferencing systems. Networks in the Canterbury region of the South Island and the central and east coast regions of the North Island enabled students to study subjects that could not be staffed from their own schools. In the case of the latter regions, schools with a large proportion of Maori students were able to form supportive learning communities with others wanting to strengthen their knowledge of Maori language and culture. These projects were funded by the Ministry of Education.[1]

In 1998 the Ministry of Education sought to draw on the lessons of these and other early leaders by developing a co-ordinated vision and strategy for the use of ICT in schools. This statement[2] proposed two focus areas: developing infrastructure and improving school capability. In the area of infrastructure, the strategy made commitments to develop an online resource centre to allow schools to access multimedia resources, to encourage businesses to recycle computers for use in schools at low cost and to encourage schools to access the Internet and regions to create local area networks. In the area of improving school capability, the strategy proposed three programmes: one for professional development for principals in the use of ICT, another whereby schools already making successful use of ICT would be contracted to work with clusters of schools and another whereby clusters of schools would be funded to organise their own training and development in ICT.

The ministry published a new strategic statement for the next four years.[3] The document proposed a three-way partnership between government, schools and business: the government's role is to provide strategic leadership, training and support for teachers, as well as a digital infrastructure; the schools are responsible for determining their own development priorities but are encouraged to do so by way of a whole-school approach and in collaboration with their community and neighbouring schools; and business is encouraged to share their experience and expertise and to provide links with the outside world.

Major Initiatives, Training and Development

- The 1998 strategic statement proposed the **ICT Schools Cluster Programme,** in which clusters of schools would support each other to incorporate the new technology both at a classroom and a whole-school level. Clusters are selected through a contestable process. The lead school in each cluster is contracted to take on this role for three years and receives NZ$120,000 a year payable on the completion of key milestones. In 2003 there were 71 clusters operating across New Zealand, and so far about one-third of New Zealand schools are either involved or have been involved in the programme. As the primary vehicle for training and supporting teachers and school administrators in the use of ICT in schools, the programme represents a creative departure from the traditional model of in-service training whereby teachers are taken out of the school for short periods of training and then expected to apply their new skills and knowledge on their return. The ICT Cluster Programme is being actively evaluated.[4]

- ICT professional development and support is also available from the **School Support Services,** a network providing a range of advisory, consultancy and training services. An ICT help desk is also available both by phone and web.[5]

- The Ministry of Education has also sponsored the development of several major online support resources for schools, students and staff. **Te Kete Ipurangi** – The Online Learning Centre[6] – delivers bilingual (Maori and English) access to all material. It is targeted at teachers, and curriculum materials are made available in all seven of the school system's "essential learning areas" as well as in cross-curriculum areas such as literacy, numeracy and ICT.

- The **Principals' LeadSpace**[7] is a portal directed at school principals, senior staff and boards of trustees. It provides ready access to a set of professional development materials, all the key policy documents affecting the management of schools, the online communications tools for reporting to the ministry and other oversight agencies, and a series of communication forums for school managers.

- While government policy commits state agencies to meet the needs of both Maori and *pakeha* (non-Maori), there have been a number of interventions targeting Maori. **Kaupapa Ara Whakawhiti M'tauranga** (KAWM)[8] brings a number of school improvement initiatives together under one umbrella. One is Te Kura Hiko, a videoconferencing network to broaden the range of specialist subjects available to senior students in predominantly Maori schools. Two others are **Project Rorohiko**, an initiative that has supplied nearly 2,000 recycled computers to predominantly Maori schools on the East Coast of the North Island, and the **Wharekura Expert Teacher Initiative**, which provides itinerant expert subject teachers to support both online and school-based teaching.

ICT in technical/vocational and teacher education

New Zealand does not have clearly differentiated sectors for either technical/vocational or teacher education. The Education Act of 1989 recognises polytechnics, colleges of education, universities, *whare wananga* and private training establishments as distinct categories, but none of them has a monopoly on the provision of any type of programme, and institutions are free to offer any qualification for which they meet the accreditation standard. In practice this means that many polytechnics offer postgraduate as well as undergraduate degrees, many universities deliver teacher education programmes and all colleges of education offer programmes targeting groups other than teachers.

Given the overlapping mandates of the various types of tertiary institutions, the government has chosen to address the ICT needs of the tertiary sector at large rather than the specific needs of any sub-sector. On the other hand, there have been some important developments in the use of ICT in technical/vocational and teacher education, which are discussed in their own right below.

National Policy, Strategy and Programmes

Until quite recently, New Zealand did not have a national strategy for the application of ICT in tertiary education, either vocational or non-vocational. In the newly devolved system of educational governance of the 1990s, each publicly funded tertiary institution was forced to compete with its neighbouring institutions for students and funding. Institutions developed their own ICT strategies, and these tended to reflect the scale of their own operations and their need to resource these within their annual budgeting cycle. There was a marked reluctance to embark on capital-intensive ICT projects, or on high-risk collaborations with other institutions or with industry.

The election of the current Labour Government in 1999 heralded an important shift in the governance and management of higher education. The incoming government announced that unfettered competition among education providers was not producing either the most efficient outcomes, or outcomes that were serving the wider public interest. Instead, it signalled an intention to exercise greater "steerage" over higher education. The various reports of the Tertiary Education Advisory Commission[9] indicated how this steerage might be exercised. In summary, a Tertiary Education Commission was to be established to make decisions about the kind and quantity of educational outputs required by the country, and institutions would be contracted and funded accordingly. (ICT is just one area of educational activity where the government indicated a wish to exercise greater steerage.)

In 2001 the Minister of Higher Education set up a group to advise him on the development of e-learning. The final report of the group[10] represents a balance between the need for clearer direction for the sector and the reality of New Zealand's highly competitive tertiary environment. The group was representative of the whole tertiary sector including the colleges of education, the polytechnic sector, industry training organisations (ITOs), and *whare wananga* as well as the universities. The report recommended the following:

- A strong role for the new Tertiary Education Commission in developing a national strategy for ICT in tertiary education;

- Targeted initiatives to use ICT to ensure Maori participation in higher education;
- Development of a national e-learning portal to begin to draw together the various e-learning opportunities available in New Zealand;
- Use of central funding to encourage the development of ICT through collaboration across the tertiary education sector and with industry; and
- Development of national "quality mark" in e-learning to which institutions could subscribe.

Since the publication of the report, the ministry has been drafting an e-learning strategy that draws equally from the reports of the Tertiary Education Advisory Commission (2000/2001) and the E-Learning Advisory Group (2002). It has also launched the Tertiary E-Learning Portal,[11] and at the time of writing it was seeking applications for the first round of grants from the ICT Collaborative Development Fund.

Major Initiatives

There are, as yet, relatively few programmes leading to full degrees that are delivered wholly online. It is noteworthy that several of these are in teacher education. Since the late 1990s, Massey University, Christchurch College of Education and Waikato University have developed online streams for their pre-service undergraduate teacher education degrees. In each case these were designed to meet the needs of mature-aged students living remotely from a college of education and prevented from studying on campus by family and work commitments.

The External Delivery Option (EDO) offered by Massey has placed greatest reliance on online media, setting up virtual groups for most of the study and assignment tasks, and making few if any requirements for students to come on campus. The Mixed Media stream at Waikato combines online communication and tuition with occasional block courses, while the Primary Open Learning Option (POLO) offered by Christchurch College of Education supports their online teaching and learning with regional study groups. In all three cases, the programmes are notable for the quality of the interaction that takes place between the tutorial staff and the students rather than for the sophistication of the online resource material. Students continue to express satisfaction with this mode of professional preparation, as do the schools employing the graduates of these programmes.[12]

Working in partnership with ITOs, many polytechnics and colleges of education are delivering vocational training programmes wholly or partially online. A quick scan of the Ministry of Education's new e-learning portal[11] found online programmes available in subjects as diverse as journalism, construction, graphic arts and design, and accounting,

Very few tertiary institutions have made extensive use of broadcast media. In part this has been because broadcasting has been unable to offer a flexible alternative to the more conventional media used by distance education institutions. But more importantly, New Zealand lacks the scale needed to make broadcasting economically viable. In the early 1990s, a series of trial courses were delivered by television broadcast in collaboration with a number of polytechnics and the New Zealand Broadcasting Corporation. None of these trials survived its first review.

Teleconferencing, both audio and video, has not been a lot more successful. The line costs, the challenge of maintaining regional centres, and the limitations of a real-time medium, have all kept teleconferencing as an auxiliary rather than a primary delivery or support medium for education.

There has been a less integrated approach to training in technical/vocational and teacher education. Individual polytechnics and colleges of education offer their own programmes of staff development and, for most institutions, the application of ICT to teaching and learning has become a significant emphasis of these programmes. Several of the larger institutions offer credit-earning programmes available to students beyond the employment of the host institutions. The E-Learning Advisory Group recommended that institutions collaborate to ensure more cost-effective training for their staff.

Current level of ICT access and use

Reading the professional literature on the development of ICT can sometimes leave the impression that the major determinants of progress are infrastructure and the availability of end-user interfaces. While there may be projects that have been delayed through shortcomings in one or other of these, for the most part infrastructure and access have kept up with the demands of students and the aspirations of institutions.

The Ministry of Education has actively worked to provide all schools with access to the Internet. By the end of 2002, all but a handful of New Zealand schools had Internet access and were on track to achieving broadband connection. There was at least one computer for student use in 81 per cent of classrooms, with secondary schools having an average of one computer for every six students and primary schools one computer for every 10 students.[13].In the general population, 75 per cent of New Zealanders had direct access to an Internet connection, and there were 3.5 million cell phone connections from a population of 4 million.

Institutions in technical/vocational teacher education tend to carry out their own surveys of access levels among staff and students. Almost without exception the access rates of their students from home or work equal or exceed national averages. Institutions delivering their programmes at a distance seldom encounter significant numbers of student who experience difficulty in securing access.

Access to computers has been assisted in recent years by the Laptops for Teachers Scheme, where teachers working with year 7–13 school students are reimbursed for approximately two-thirds of the costs of leasing a laptop. As part of the programme, teachers are expected to undertake professional development aligned to their school's ICT development plan. Laptops have also been provided to principals during 2002 and 2003.

Another initiative, Computer Access New Zealand, has been set up to provide cheap, warranted, recycled computers to schools. And yet another project has been set up to provide recycled computers, training, support and Internet access to students in low decile schools for the use of the students, their families and their community.[14] At the tertiary level, most tutors will have access to an individual work station and issues of access tend to focus on bandwidth or the capacity of their computers.

Maori are a group that has traditionally faced problems accessing high-quality education in their areas of concentration. Several *iwi* (tribal groups) and *runanga* (Maori tribal authorities) are using ICT both to enrich the educational offerings in their rural *rohe* (tribal region), but also to maintain links with their *iwi diaspora*, generally in New Zealand's northern cities. One example is a series of initiatives by Te Whanau a Apanui, an *iwi* whose *rohe* extends along a stretch of remote coast on the East Cape of the North Island.[15] Sixty-three per cent of its members are under thirty and 80 per cent lie outside the tribal *rohe*. The *iwi* is using e-learning programmes as a means of up-skilling its members and allowing them pathways into the ICT industry. Links have been forged with Cisco Systems, and academies have been established at several low-decile schools in urban areas with large concentrations of *iwi* members. The aim of the project is to deliver online training opportunities to *iwi* members wherever they are located.

Other groups that may have limited access and familiarity with ICT include senior citizens and those leaving school without a tertiary qualification. SeniorNet,[16] a community-based initiative that began in the USA in 1986, has been operating in New Zealand since 1992. There are now 77 SeniorNet Learning Centres throughout New Zealand offering a range of Internet-based learning and communications services. While the organisation was initiated by Telecom New Zealand, the Learning Centres are managed and largely funded by the local membership.

The needs of the younger group have begun to be met only more recently. Several regional polytechnics have begun offering entry-level programmes in computer and Internet literacy at no cost to the students. The institutions find that by scheduling these classes outside normal teaching hours they are able to take advantage of existing facilities and meet their costs from the government fee subsidy alone. They also hope that these courses will attract a proportion of young people back into tertiary education, and some institutions offer pre-employment and bridging courses through this means.[17]

At a national level, the government is committed to "closing the digital divide" through co-ordinating the activities of government and public agencies.[18] While many of these activities are initiated by education agencies pursuing educational objectives, others are providing an educational service in support of some other objective. For example, the Community Employment Group strategy combines the efforts of eight government departments to use ICT to support disadvantaged communities and build employment opportunities.[19]

Constraints on the use of ICT

Earlier it was claimed that infrastructure and end-user access have not been the most significant blocks to the developing use of ICT in the New Zealand education system. There are a set of challenges that pose a greater risk to this development if they are not managed successfully:

- The first challenge is posed by classroom teachers and their ability and willingness to embrace the new technology. If ICT is viewed as a technology to bypass the teacher and to "teacher-proof" the curriculum, it will be resisted by teachers and ultimately fail. In general, policy-makers are aware of this danger, and implementation strategies at both national and international levels recognise the central role of teachers as active managers of the e-learning experience.

- A second challenge is to encourage greater collaboration and sharing among educational providers at all levels of the system. This is necessary to take advantage of the economies of scale that are available through ICT and the shortage of specialised talent and resources in the area. It will not be easy to achieve in an educational system that has been developed in an environment of competition.

- A third challenge is to achieve an appropriate balance between central steerage and institutional autonomy in the exploitation of ICT. As with the previous factor, there are a number of opportunities that can best be addressed by a well-resourced central initiative. Government and other funding agencies need to be

careful that such unilateral initiatives do not compromise the level playing field that successive governments have insisted on.

- A fourth challenge will be to ensure that the efforts of the educational sector to make the best use of ICT are taking place in a context of supportive public policy and infrastructure. The deregulation of the economy, and the telecommunications industry in particular, that took place during the 1990s has provided an efficient infrastructure to support a growing ICT industry. A national ICT taskforce has been set up to encourage investment in ICT projects.[20] Another important contextual element is the government's e-government strategy.[21] The aim is to structure and deliver government services online wherever possible. The early work on system architecture, metadata standards, interoperability and security is proving important to the widening use of ICT within the education system.

Analysis

From the point of view of the ICT enthusiast, the telecommunications industry and sometimes even the New Zealand Government, the developing use of ICT by the New Zealand education sector may appear less than dramatic – even timid. The sector has used it adaptively and within the context of existing structures of institutional provision, rather than as a spur for revolutionary change in the ways in which educational services are structured and delivered. The technology has not displaced the classroom teacher as the key manager of the learning process. Teachers and institutions still retain control over when and how the technology is employed and frequently continue to play a major role in developing ICT courseware. The challenge for the next few years will be introducing a greater degree of steerage in the developing use of ICT, encouraging greater collaboration and resourcing a few projects at a national level without alienating the present very high level of commitment and sense of ownership of institutions and teachers.

NOTES

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Niue

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Niue is a raised coral atoll northwest of New Zealand. It has a land area of 260 square kilometres and a population of 2,113 (2002), which is mostly bilingual (English and Niuean). It is a self-governing nation that is part of the Commonwealth and is in free association with New Zealand. The main administrative centre is Alofi where the parliament sits and where the government ministries, shops, government secondary schools and the USP Centre are located. The Niue economy is based on fish, agriculture, some tourism and remittance from Niueans living overseas. The currency used is the New Zealand dollar. Niue is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

The Government of Niue states the following as its information and communication technology (ICT) policy vision:

The government envisages a Niue where every member of the community has affordable access to the information economy in order to enhance quality of life. Greater access and familiarity with the information and communication economy will contribute to economic development through the learning of relevant ICT skills, protocols and opportunities. Concomitant with government initiatives to up-skill Niue's workforce [is] Niue's growing ICT-related labour market [to] provide one of the prerequisites to the creation of an indigenous ICT industry. Over the medium term, an indigenous ICT industry will create a significant level of economic activity, as well as [provide] employment opportunities of the necessary profile to assist in retaining residents in Niue.[1]

The policy goals relevant to education are as follows:

- Structure educational policy to contribute to the creation of an ICT workforce
- Train and retrain the workforce to benefit from the opportunities presented by the ICT economy

Other policies relate to investment incentives for the ICT industry.[2]

A National Information Technology Committee was formed in June 1999 to advise the cabinet on strategies to create an ICT industry in Niue.

Current level of ICT access and use

Connectivity, Telephones, Fascimile

The Internet Users Society Niue (IUSN) was set up in 1997 to provide free Internet services to the people of Niue. It linked Niue to the World Wide Web through a server in New Zealand by a 64 MHz telephone connection leased from Telecom Niue. Over the years, usage has increased dramatically and there is at present a need for an increase in bandwidth to cater to the demand.

WiFi (Wireless Connection) was launched earlier this year by IUSN. This increased bandwidth to about 256 MHz, but at the time of writing, IUSN and the government were not in agreement over the legality of the operation and the Internet connection had been severed. (See also *www.wifination.nu.*)

Telephones and facsimile are widely used for both internal and external communications. However, the infrastructure is unable to fully support ICT. At present, Internet access in the outer villages is limited due to limited trunk lines made available by Telecom Niue for Internet access. Also, the outer villages are operating on a cell phone system that is not really compatible with Internet connection. Thus, upgrading of the existing services is an economic issue.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students only. Students of the distance and flexible learning courses of the university can communicate directly free of charge with their lecturers and other students by e-mail or through the two types of teleconferencing: video and audio. In addition to print courses, USP students can also enrol in the video broadcast courses and join in the lectures that are being delivered on Laucala campus. There are also Internet courses that are currently limited to the Law School and are taught from the USP Campus in Port Vila, Vanuatu.

Tapes of video broadcast sessions and audioconference tutorials are available on request by the Niue Centre to the Suva headquarters of the university.

Computer Use, Internet, E-mail

All schools, seven primary and one secondary, are government operated. Students have access to computer technology although it's more for the secondary students. Computer studies is a part of the syllabus at the secondary level from year 7 through to year 12 (forms 1 to 6). Internet access is still very limited, however, with only a few PCs connected, but a proposal has been submitted to enable all PCs in the school to be networked, which should at least improve connection capabilities.

With the inclusion of New Zealand form 7 studies in 2004 at the Niue High School, the need for Internet access is a priority to access materials from New Zealand Qualification Authority, and for general student research.

Broadcast Technologies

Radio and television stations operate daily services. Both radio and TV are operated by the state-owned Broadcasting Corporation of Niue.

Television licences are about US$ 40 every quarter. Programmes on TV are received via satellite from TVNZ and either broadcast live or recorded for later showing. Programmes are also received via satellite from the AsiaPacific Network in Australia. There are no specially made educational programmes, but there are two educational programmes from the AsiaPacific Network: the

"Y" which is science-oriented and looks at science concepts and theories through experiments, and a programme that looks at major historical events and explains what happened.

Satellite TV has just recently been offered in Niue by a private business that goes by the name of nuSatTV. There is talk that online learning will be made available to Niueans soon through the private sector, but as of the time of writing, that seems no more than rumour.

Major initiatives

USPNet

This partnership is between the university and Niue through the exemption made by the telecommunication organisation to allow the system to operate privately. USPNet is a 12-country satellite system and its current capacity has made it possible for Niue students to complete programmes while continuing to work and without leaving their families. Hence it offers economic advantages.

Satellite Link

In the 1980s to the early 1990s, some training courses were conducted using audio conferencing on a satellite link between Niue Agriculture/Fisheries Department with Samoa and Hawaii. This satellite system, however, is no longer in use.

Examples of training

In the non-formal education sector:

- Niue teachers are trained in New Zealand colleges where ICT training is incorporated into programmes.
- IUSN produces Internet training videos that are available to the public free of charge.
- Short-term courses are offered to the general public through the USP Centre. The courses include training in MS Word, MS Excel and PowerPoint. Other courses on databases are planned to be available soon.
- Government-run workshops on web design, as well as other software matters, are also usually available to the public.
- Continuous training and development needs were identified at a workshop held in July 2001 on National ICT Strategy. Staff development is a top priority, utilising existing institutions like the Niue High School, USP Centre, and government.
- Consultants and experts conduct workshops and training courses on ICT. They are usually sent to the island by aid agencies on the request of government.
- An IUSN volunteer is attached to the Information Systems Office of the Niue government to assist in developing software and databases. He is also responsible for training local staff in programming, website creation and maintenance of PCs.

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in Niue:

- The infrastructure is unable to fully support ICT.
- Limited trunk lines are made available by Telecom Niue for Internet access.
- Outer villages operate on a cell phone system that is not really compatible with Internet connection.
- People with ICT expertise are difficult to attract to Niue due to a lack of incentives in their work environments.
- There is a lack of government funding and other support and limited institutional capacity.
- ICT equipment and services are expensive.

Analysis

It appears that the desire to develop ICT, and the vision that "every member of the community has affordable access" are at odds with the infrastructure capacity and the costs involved in setting up computers and Internet access. While there can always be more emphasis on training, this does not appear to be as significant as many of the other constraints mentioned. Thus, if any assistance is to be given, there should be some emphasis on reducing those constraints regarding the availability of PCs and reducing the cost of Internet access.

NOTES

1 From the "National ICT Strategy Workshop Report, 2001". The official report on ICT in Niue is yet to be completed and most of the information in this paper is based on this report from the "Workshop for National ICT Strategy, 23-27 July 2001", held in Alofi, Niue. This workshop was facilitated by Taholo Kami, who is an IT consultant with Kami Communications. The participants were heads of department and senior management staff, cabinet ministers and members of the legislative assembly, representatives from the church and the private sector.

2 See note 1 above.

Palau

ICT USE IN EDUCATION

Mr Andrew Kerr

National policies, strategies and programmes

The Republic of Palau is an independent island nation located 500 miles southeast of the Philippines and 900 miles west of Guam. A former UN Trust Territory of the United States, Palau gained its independence in 1994, entering into a Compact of Free Association with the United States. As a result of the Compact, Palauan citizens use US currency and have unrestricted travel privileges throughout the United States and its territories.

Although Palau is a 400 mile-long archipelago with hundreds of islands (most uninhabited), the bulk of its 19,000 populace is located on the capital island of Koror. Because Palau has a dispersed population over several island groups, however, communication options can be limited for those living outside of Koror and the immediate area. While Palau is a young nation, it has a strong ICT infrastructure and several telecommunication options, although these are limited due to the remoteness of the island groups and lack of satellite availability. As part of the national technology plan of Palau, every person is to receive universal access to telecommunication, regardless of their location. The national telecom company, Palau National Communication Corporation (PNCC), has aggressively pursued this goal, resulting in the highest per capita penetration rates in the Pacific with services including phone (landline and cellular), Internet and television.

The two languages of Palau are Palauan and English. Japanese is widely spoken as well, as Japan administered Palau until the end of World War II and has a large tourism and fishing interest in the country. Public education is mandated from the age of six through 16. Grades are modeled after the American system with primary school consisting of grades 1 to 8, and high school consisting of grades 9 to 12.

Throughout the islands of Palau there are 22 public elementary schools, one public high school, two private elementary schools and five private high schools. There is also one institution of higher education, Palau Community College (PCC), which offers two-year associate's degrees and a variety of vocational education and adult education opportunities. PCC is also partnered with several universities, including San Diego State University (SDSU) and the University of Guam (UOG), which allows students to pursue bachelor's, master's and doctorate degrees without having to leave Palau (or leave for limited amounts of time during the summer).

Current level of ICT access and use

In 2001, Pacific Learning Services (PLS) reported that Palau has a high level of computer penetration in all of its 23 public schools with an average of 11 students per computer. Technology and technology literacy are considered high priorities of the Ministry of Education (MOE), and as a result every school has at least one computer lab and a computer lab manager. Teacher training in technology literacy has been ongoing and mandatory for all teachers. However, computer labs remain underutilised and many are limited to use for drill-and-practice programmes or games. In response, the MOE has been aggressively pursuing new training programmes for teachers and has drafted an educational technology plan designed to address teacher deficiencies in technology literacy and basic technology skills, as well as provide guidelines for technology programmes and integration into curriculum. These initiatives have resulted in increased usage of computers and technology integration across multiple disciplines, but low-bandwidth Internet access continues to pose a problem for schools.

The majority of computers in Palau schools use the Apple Macintosh platform. Windows platform computers are mostly limited to MOE administration staff, PCC and high school business classes. The MOE has videoconferencing capability and utilises the system to communicate with Hawaii and other US affiliates on a regular basis for professional development and administrative meetings. Two videoconferencing units are also in remote schools, but as they work through PNCC instead of the MOE's satellite-based system, operating costs are too prohibitive to warrant usage. To date the two units remain functional but not in operation.

Remote schools also have computer access. Most of the remote island groups have at the minimum semi-regular power that allows for the operation of computers labs. The very remote island groups rely on solar power for computer access. Internet and other telecommunication services, however, are limited or non-existent in these islands.

Major initiatives

Teaching, Learning, Technology Training Project

The Teaching, Learning, Technology Training Project was designed not only to bring technology to the students and teachers of Palau, but also to bring new strategies for teaching and learning. Building on the Palau 2000 Master Plan for Education Improvement, the project used a curriculum integration model that encourages student-to-student and student-to-teacher interactions, a model in which the mimetic approach to education gives way to a constructivist approach. The expectation was that through these changes a learning environment would be created that prepared students to deal with uncertainty, complexity, information resources, new technologies and different cultures.

The training was designed and conducted by a consultant from Guam and required a significant commitment from those who enrolled. Initially, participants took part in an intensive weeklong programme in Koror, followed by monthly day-long sessions over a period of six months or longer. Through the training teachers were exposed to a broad overview of computer operation, maintenance and use in the classroom. Content addressed included the operation of specific software products (e.g., Hyperstudio, Kidpix) and various strategies related to integration and use (e.g., lesson planning, co-operative learning).

Under the Teaching, Learning, Technology Training Project, a framework for professional development for teachers and school principals was developed as a process intended to improve skills, attitudes, understanding and performance. The process was structured around a series of courses/institutes designed for teachers to acquire identified skills and then apply and evaluate them using a problem-solving/sharing approach. The courses/institutes were used, and continue to be used, as opportunities for teachers to discuss, think about, try out and hone new practices. This form of professional development was key to the successful use of technology in education for improved student achievement.

The following technology competencies were identified as critical components of this professional development process: technology awareness, technology identification and operation, applications, academic skills development, cognitive skills development, acquisition of information (research), presentation/production skills, interpretation skills, ethics and technology in the community.

These technology competencies were aligned with five stages of technology application, derived from the Apple Classroom of Tomorrow (ACOT) research studies, through which it was hoped all of Palau's teachers would pass.

- **Entry stage:** Teachers struggle with the changes education technologies bring to the classroom environment. They are required to rethink teaching and learning styles, develop a new technology vocabulary and investigate new tools for learning. Initial experiences with technology characterise this first stage of technology awareness.

- **Adoption stage:** The struggle to accept new technologies is replaced by the struggle to master them at the most rudimentary levels. Fear is replaced by experimentation with electronic applications that closely imitate existing classroom activities, such as drill-and-practice and tutorial environments.

- **Adaptation stage:** Teachers recognise the potential and power of technology tools to the extent that they use them for personal productivity and begin to advance student usage of these same tools. Examples include the usage of word processing in writing assignments, database in social studies research and data collection and spreadsheet integration into the math and science curriculum.

- **Appropriation stage:** Teachers master specific technology applications and seamlessly integrate them into daily instructional and management activities within the school environment. Teachers at this stage are a valuable resource to their colleagues. They help implement the "teacher-training-teacher" and mentoring models for professional development activities.

- **Invention stage:** Teachers are technologically proficient and provide students with necessary technology skills and access to these powerful resources. Teachers at this stage can develop sharable courseware and materials that link technologies to current curriculum or education reform components while they teach technology to others.

Each of these stages was linked to curriculum integration so teachers could select appropriate instructional activities relative to their existing skill set and professional growth plans. As professional development took place and teachers began integrating technology, they were expected to progress through each stage over an extended period. The phasing-in of the professional development offerings at all stages of integration was expected to result in the majority of teachers reaching the invention stage. Structured teacher training programmes continue to be regularly offered by the MOE and teachers are encouraged to enroll.

PRELStar: US Federal Star Schools Project

Through PRELStar, the MOE and Emergency Management System were able to connect to the Peacesat satellite network with 128 MB videoconferencing capability. This allowed the MOE to connect (free of charge) to a multitude of other sites across the US-affiliated Pacific (including Hawaii, Guam, the Northern Mariana Islands and American Samoa). This system also allowed Palau to connect to any other videoconferencing system throughout the world via a relay system in Hawaii (at a cost). PRELStar also provided training.

*PR*TEC: US Federal Regional Technology Consortia Project*

PR*TEC provides technical training and support through PREL and assists the MOE in a variety of technical training. Major initiatives included providing support and guidance in the formalisation of a Palau Technology Education Plan to include technology standards and benchmarks for students, teachers and administrators, and creating a basic teaching credential that teachers can receive via distance technology. A current problem for the MOE is the lack of qualified teachers. This programme, a collaborative effort with PCC and other public institutions of higher learning in the US-affiliated Pacific, allows teachers to stay employed and on-island while taking courses towards certification.

Sasakawa Peace Foundation

The Sasakawa Peace Foundation of Japan has funded a number of technology and distance learning studies through the University of Hawaii and the University of Guam. Grant awards have allowed both universities to convene meetings for the former Trust Territories of the United States (Palau, Micronesia and the Marshall Islands). These meetings and

various reports have resulted in technical infrastructure data, needs assessments and distance learning plans for each island nation.

University of Guam: US Department of Agriculture Challenge Grant

Through a grant from the US Department of Agriculture, the Univeristy of Guam, in partnership with local institutions of higher learning and Florida A&M University, have created a series of distance learning programmes designed to assist agriculture teachers across the former Trust Territories of the United States. A series of modules were produced in both online and CD-ROM format and offered for university credit. The result is for participants to be trained in science and agriculture methods to improve both curriculums.

Examples of training

As part of its Compact of Free Association with the United States, Palau is entitled to participation in many US federal grants and programmes. These have allowed the MOE to vastly expand their services to teachers. Two major programmes are provided through Pacific Resources for Education and Learning (PREL), a Pacific-based, non-profit education corporation.

The first, PRELSTAR, is a distance learning programme designed to build telecommunication capacity in the US-affiliated Pacific. PRELSTAR has provided distance learning training to teachers, administrators, government and health workers for more than five years. Areas of training have included how to set up and maintain satellite earth stations, Internet usage for education and health purposes, videoconferencing training, educational and health distance learning programmes, and computer/media troubleshooting and repair. The result has been an increased capacity of education and health workers to access ICT services. PRELSTAR also funded a distance learning master's programme for the US-affiliated Pacific in instructional technology. The result was two professionally trained instructional designers to assist MOE and PCC teachers with technology integration.

The second programme provided through PREL is the Pacific Regional Technology in Education Consortium (PR*TEC). Like PRELSTAR, the PR*TEC offers distance learning training and support, but also provides technology literacy training for teachers and students, technology policy assistance and computer repair programmes. Work for the past three years of the PR*TEC in Palau has resulted in computer lab managers trained in integrating technology into the curriculum and repairing computers, a draft technology plan for the MOE and technology standards for teachers, students and administrators of the MOE.

Constraints on the use of ICT

Limited Access to Internet

The MOE's current telecommunications infrastructure is limited by the high cost of telecommunications within Palau and by the capacity of that infrastructure to support broadband services to schools. While schools have access to computers and other technology, only some have dial-up Internet access. They dial in to the MOE through a six-modem modem bank. From there, the MOE is connected via a 64 kbps dedicated connection to the PNCC. This level of service limits each school to no more than three concurrent users. As a result, technology use in schools is limited to those activities that do not require Internet access. According to Pacific Learning Services, these activities involve the preparation of lesson plans by teachers and papers and reports by students. Only a relatively small number of teachers are using computers, laser discs or projectors as part of their instruction. Thus, few teachers have integrated technology into their instructional practices and rely on the computer for drill-and-practice programmes or for classroom management activities, such as grade books and class lists.

Limited Bandwidth Capacity

PNCC is currently the only provider of telecommunications services in Palau. It has an Internet link that provides only 2 mbps downlink and 768 kbps uplink capacity. Although the company has installed a caching server, traffic on the link runs at 80 to 90 per cent capacity. At peak periods of the day, the link appears to be completely saturated, resulting in the inability to access services or very slow response times when service is available. Although a fibre ring connecting Koror with the largest island of Babeldaob provides increased service, it too is running near capacity.

To increase bandwidth capacity, Palau is currently pursuing funding for a fibre cable to link Palau with the state of Yap (in Micronesia) and the US territory of Guam. High-level agreements are in place and preliminary planning is being conducted by NTT, a Japanese telecommunications company. The estimated costs for laying the cable begin at between US$ 50–60 million. Cable maintenance costs are estimated at US$ 750,000 per year plus US$ 35,000 for each day the cable maintenance ship is at sea. In addition, there are considerable start-up costs. No funding for this project has been secured to date and PNCC estimates that operating costs alone would require a six-fold growth in the company's revenue base.

Bandwidth for Schools

The use of ICT to support education requires broadband Internet access. A full T1 access would best serve the needs of the MOE, but the cost of such access would require significant outside funding. The most cost-effective design for providing Internet access to schools involves the collaboration of the MOE with PNCC and/or other Internet service providers (ISPs) to establish a wide area network connecting schools with the MOE, a caching server at the MOE and dedicated Internet bandwidth of at least 512 kbps from the MOE to the ISP. The use of a caching server will lessen bandwidth demands and provide for higher speed response times for Internet sites accessed by multiple users. This architecture will allow for future upgrades in Internet connectivity as additional bandwidth becomes available.

Analysis

While Palau is far above the norm for computer access in education for the Pacific, the MOE would still like increased Internet access, a smaller computer-to-student ratio, higher technology literacy for teachers and students and technology integration into the curriculum. To accomplish these goals, the following recommendations may be considered.

ICT Access

Palau telecommunication infrastructure is currently under the monopoly of the PNCC. Under the current universal access plan, the high rates of the PNCC for subscribers actually subsidises the very high operating costs of providing services to remote areas of Palau. Because of this, a private company is considering offering ICT services with its own teleport to bring additional bandwidth to Palau and concentrate on the main population centre of Koror. This would provide lower-cost, high-speed Internet access to the largest portion of the populace. If this were to happen, the current model of universal access to Palau would be disrupted, as many customers would opt for the higher speed and cheaper cost of the private company.

A benefit for the MOE, however, would be better Internet access for the administration and schools. The lower costs would also allow them to purchase more computers under the same budget, as the money previously spent on Internet access could be redirected to equipment.

Technology Literacy for Teachers and Students

Under the current technology plan for the Palau MOE, technology literacy has been defined and categorised. However, to implement a plan that will ensure technology literacy for all students and teachers, time must be allocated for staff development and benchmarks must be assigned for students at each grade level. Technology literacy is a building process and should be consistent for students and teachers. Teachers must have a clear understanding of what is required to be technologically literate and be provided ample professional development opportunities to achieve it.

Technology Integration

Technology integration differs from technology literacy: the latter refers to specific skills, while the former refers to the application of those skills in different disciplines. Professional development opportunities for teachers should be provided on how to integrate technology into different subject areas, such as Math, Science, Palauan and English. Computer access should also be provided.

Papua New Guinea

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Papua New Guinea (PNG) lies north of Australia. It comprises the eastern half of the island New Guinea as well as many offshore islands, with the main ones being New Britain, New Ireland and Bougainville. It has a total land area of 461,690,33 square kilometres and a population of 5,100,000 (2002 figures).[1]

Politically, PNG is an independent state and a member of the Commonwealth of Nations. The administrative centre is Port Moresby,

located on the southern coast of the main island. Economically, the country produces copra, cocoa, coffee, vanilla, sugar, timber and fisheries as well as oil, copper, gold and natural gas. It has a small but growing tourism industry. The monetary currency is the Papua New Guinea Kina.

There are more than 800 known languages but English is the official language of government and business. Melanesian Pidgin and Police Motu are also used widely. Through recent legislation, all the 800 languages of Papua New Guinea have become official languages of instruction at the elementary school level.

National policies, strategies and programmes

The PNG government has a centralised information and communication technology (ICT) budget,[2] and there have been some attempts to develop and launch an ICT policy in the country. However, these have all been unsuccessful due, in part, to the ad hoc way of mounting projects which has resulted in incompatible appliances and applications being installed, as well as different ICT approaches on the part of many donors.[3] There has been a copyright law passed by Parliament that is now in effect, and there are plans to develop a government intranet and to put key dates and statistics and library material onto CD-ROM.

There are two government websites (see *www.gov.pg* and *www.pngonline.gov.pg*) as well as the prime minister's own website (see *www.pm.gov.pg*). Other government departments and statutory bodies also have their own websites.

Current level of ICT access and use

Telikom PNG is a government-owned organization and has a monopoly on telecommunication services, with 66,000 customers in 2002. As well, a high-capacity, 11-megabit private sector wireless telephone network has been introduced for government services.

A survey conducted in 2002 revealed that five organizations used telephones, facsimiles, and Internet on a daily basis as well as some audio conferencing at least once a month. Here are some of the views of the organizations surveyed:

- "ICT development is ad hoc and there needs to be a blueprint for ICT development so that change is uniform and not staggered."
- "In PNG we do not really have an ICT infrastructure."
- "PNG needs as much help as possible otherwise it will get lost."[4]

PNG has multiple Internet service providers (ISPs), which include Daltron Electronics, Datec, Global, Online South Pacific and High Tech Industries. There are 10,000 Internet subscribers and connectivity is affordable with excellent service in the urban areas.[5] There is still a monopoly over the licensing of ISPs by Telikom PNG.

The major centres of population, Port Moresby and Lae, have access to computers and the Internet either through work stations or through education institutions. There are over 10,000 public servants in PNG, a third of which are in Port Moresby, but with the exception of a few departments, the level of computer literacy is generally quite low.

PNG is home to the following educational institutions:[6]

- Over 3,000 primary schools (800,000 students);
- 170 high schools (56,000 students);
- Nine technical colleges (9,000 students);
- 124 vocational schools (7,000 students);
- Eight teachers' colleges (4,000 students);
- Six universities (10,000 students), comprising University of Papua New Guinea (UPNG) in Port Moresby, University of Technology in Lae, Pacific Adventist University in Port Moresby, Divine Word University in Madang, University of Vudal in Rabaul and University of Goroka in the highland town of Goroka; and
- The College of Distance Education (CODE), a large distance education institution for the school-age population.

UPNG and University of Technology both provide postsecondary and bridging-type programmes, and along with Divine Word, UNPG also offers tertiary programmes through the distance mode. UPNG is also partnering with Telikom PNG in a venture through which the university is moving into multimedia distance education through 14 regional centres. The demand for further education is high in regional areas where learners are unable to go beyond the grade 12.

In 2002, the education sector had 2,000 telephones, 50 mobile telephones, and the following breakdown of computers, of which 100 were over three years old and 30 were not functional:[7]

- 300 production computers;

- 160 administrative computers; and
- 80 Internet computers.

UPNG has computer labs in each of its five regional open campuses based in Mount Hagen, Madang, Kokopo, Buak and Port Moresby. Each lab has 20 computers networked to the UPNG intranet system. Furthermore, on the main campus at Waigani, the university has three computer labs with 200 networked computers in each lab. The labs are housed in the Michael Somare Library and the Mathematics Strand of the School of Natural and Physical Sciences. Almost all academic staff at UPNG have networked PCs. The Department of Education plans to increase its existing computer network systems, develop a website, provide specialist training for information technology staff and provide audio and video conferencing to some remote schools on a trial basis. There are also plans to develop a government-owned network on Education and Research Network (ERNET) that will encompass and link all of the universities and major tertiary education and research institutions throughout PNG.

Broadcast Technologies

Radio. Radio plays a major developmental role in Papua New Guinea with its difficult terrain. There are four types of radio services with the main one being the government-owned National Broadcasting Corporation (NBC). The NBC operates the two national services on the AM and FM bands with the FM service being its commercial arm, Kalang FM. The AM service is the government's public service station through which all basic education school programmes are broadcast every morning. For some of the remote students in the country, this is the only form of contact with the outside world.

The NBC also operates 19 provincial radio stations that air programmes ranging from news to government extension services and community awareness. They use the local dialects as well as Melanesian Pidgin. Most provincial radio stations are old and the equipment needs replacing. The Japanese government has assisted with the replacement of radio stations in some provinces.

There are also four private radio stations that broadcast on the FM band using a mix of the three main languages of Papua New Guinea. The latest addition is PNG Christian Broadcasting Network, a Christian radio station.

Television. Papua New Guinea has only one TV station, EMTV, which is a subsidiary of Channel 9, Australia. Most programmes are imported from Australia, although there is some local content with news and locally produced documentaries. Other overseas TV stations can be received by satellite with the proper satellite receiving dishes. Most urban centres have cable TV providers for people who can afford it. These include overseas channels as well as others.

The Papua New Guinea Education Department uses EMTV to broadcast primary and secondary school subjects during non-peak hours each day. The Department's Education Media Centre, funded by the Japanese funding agency (JICA), produces these programmes using actual class situations in schools. The Centre is currently supported by Japanese volunteers who work in a support role, providing training to local staff.

Major initiatives

Japan International Cooperation Agency (JICA) funded solar power for 350 schools that started in 1998 and are still operational. These came with lights, TV, VCR and a PC.

The Media Centre, described above, is another major initiative.

Examples of training

Telikom staff have received basic, intermediate and advanced computer training and 500 are now confident with ICT and computers.

In the Department of Education, 150 of 733 staff are confident in using ICT and computers. One hundred have been trained recently, and 300 are learning computer skills on the job.[8]

Constraints on the use of ICT

The following constraints were identified at the start of 2002:[9]

- High cost of equipment;
- High cost of domestic and international telecommunications;
- Unreliability of power supply, poor quality of Internet connections and the high cost of telecommunications for communications nationally and internationally;
- Poor access to telephone networks;
- Lack of skilled support services; and
- Lack of bandwidth.

Analysis

Obviously, the broadcast media are of vital importance for PNG education. Both radio and television are being used and the Media Centre, installed by the Japanese, is a significant resource that needs to be maintained appropriately along with adequate staffing resources.

Priority areas identified are introducing distance learning on a large scale at K-12, technical vocational and tertiary levels; accessible and affordable rural telecommunications services (which could be included under the new Community Services Trust Fund which is to address the provision of services to remote communities); and cross-cutting ICT policy for government. The last would be very helpful in the area of education as it would facilitate the development of the Education and Research Network as well as support telecommunications and ICT policy and regulatory development and overall capacity building.

The initiative by JICA that supplied schools with solar power along with other equipment could be considered as a model to increase connectivity and access for schools in the rural areas.

NOTES

1 "Internet Infrastructure and e-Governance in Pacific Islands countries" (UNESCO, 2002), Appendix 15. This information was obtained from a survey of the Department of Education, National Cultural Commission (NCC), Pacific Mobile Communications (PMC), South Pacific Post Ltd, and Telikom PNG.
2 See note 1 above.
3 "Information and Communication Technology in the Pacific," Report TA REG 5990 (Asia Development Bank, June 2002).
4 See note 1 above.
5 See note 3 above.
6 See note 3 above.
7 See note 1 above.
8 See note 1 above.
9 See note 1 above.

Samoa

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Samoa comprises seven islands of volcanic origin, with a land area of 2,860 square kilometres. The population of 179,466 (2002) is Polynesian and largely bilingual (Samoan and English). Five of the seven islands are inhabited. The main island of Upolu is where the capital Apia is located, as well as the parliament and government ministries. Apia, with a population of about 38,000, is also the commercial centre and the location of the campuses of two universities (University of the South Pacific (USP) and the National University of Samoa), Samoa Polytechnic and two theological colleges. Most of the country's schools are also on Upolu.

The other major island is Savaii which has a population of about 41,000. A number of secondary and primary schools are located on this island.

The Samoan economy is based primarily on fish, some manufactured goods, tourism and remittance from Samoans living overseas. The currency used is the Samoa Tala.

Samoa is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

Samoa National ICT Policy[1]

Samoa has a national information and communication technology (ICT) committee chaired by the CEO of the Ministry of Post and Telecommunications. Members of this committee include key ICT experts and representatives of educational institutions. The committee has established a website (see *www.e-samoa.ws*) which outlines policies and strategies for Samoa.

The Samoa ICT Policy Vision is "information and communication technologies for every Samoan." It follows the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan – a regional ICT strategy agreed and signed by the Ministers of Communication of each Forum member country. The Vision for Samoa includes statements of guiding principles in each of four areas of development. Policy statements have been developed within each area with respect to implementation. For example, the guiding principle statement and related policies in the area of human resources are as follows:

> *ICT will be used to inform and connect the population of Samoa and ensure that it benefits from flexible and appropriate education, training and experiences.*

- **Policy 1.1:** Awareness of ICT and the need for computer literacy at all community levels will be promoted and developed.
- **Policy 1.2:** Samoa will attract, develop and retain a knowledgeable ICT workforce that will be able to contribute to the maintenance and further development of ICT and in the process reduce professional isolation of Samoans at all educational levels.
- **Policy 1.3:** Everyone will have opportunities to access ICT [with special regard to women, the disadvantaged, the disabled, under-represented minorities and those in rural and remote areas].
- **Policy 1.4:** Samoa will promote and encourage its people to contribute to the global economy through ICT.

The other three statements of guiding principles are as follows:

Infrastructure Development: Appropriate ICT infrastructure [will be developed] to support development for Samoa.

Co-operation Between Stakeholders: Easy access to information through ICT will strengthen co-operation between stakeholders while advocating the Statement of Economic Strategy (SES) championed by the Government of Samoa to ensure good governance, development in the private sector and improvement in service delivery.

Appropriate Policy and Regulation: Easy access to information through ICT will strengthen co-operation between stakeholders while advocating the Statement of Economic Strategy (SES) championed by the Government of Samoa to ensure good governance, development in the private sector and improvement in service delivery.

Further, the Ministry of Education, Sports and Culture (MESC) has developed an Information Technology Strategic Plan 2000–2003[2] which looks at managing ICT to ensure the ministry properly meets the needs of stakeholders. This plan includes the management and operation of an ICT system, not only for ministry functions, but also for the schools system. It has been developed around 19 issues that include Internet access for both the ministry and the schools, hardware/software, an ICT steering committee and staff training. Thus there are strategies to implement the ICT policy that include promoting greater awareness of ICT; developing and retaining a knowledgeable workforce in ICT; developing and maintaining training policies and programmes to ensure ICT resources are properly managed; providing equal access to ICT, bearing in mind that there must be measures in place to reduce inappropriate use; developing ICT infrastructure to promote universal access; addressing affordability of ICT technology; and continually evaluating ICT plans and their impacts.

Current level of ICT access and use

Connectivity, telephones, facsimile

Since 2002, the telecommunications corporation has changed from Samoa Communications Ltd. (SCL) to Samoatel. The new management has made changes that have

increased the number of connections. The Samoa telephone infrastructure is extensive in the Apia urban area and fibre optic lines have begun to be laid to enhance connectivity for the national university and Samoa Polytechnic. Fax communication is extensive.

Wireless communication is provided by Telecom Samoa Cellular. In September 2003, their service was extended to Savaii. The prepaid mobile telephone is their latest development. This means of communication is very popular in Samoa and it was used in a trial by the Ministry of Education in 2002. The trial involved the provision of mobile telephones to School Review officers to allow communication during the times of national and external examinations. The trial revealed the need for telephone communications as confirmed by the officers, and proved to be of great use during this important time in the education cycle.

Computer Use, Internet/World Wide Web for Education, E-mail

There are 205 schools in Samoa, 166 of which are government operated. Of these, 141 are primary schools and 25 are secondary. The others are mission or private schools, both primary and secondary. Until 2002, most government schools had limited access to telephones and, consequently, very limited access to the Internet. However, as part of its ongoing institutional development programme, MESC recently assessed the use of mobile telephones for district School Review officers and has also been negotiating with Samoatel for more landlines. It is expected that schools will have telephones installed during 2004.

A few schools have acquired computer labs through which pupils have Internet access, but these are only on the main island of Upolu. In January 2003, there were 336 computers in all mission, private and government secondary schools. Another 160 PCs were received from the ANZ Bank and these are being distributed to government secondary schools and a mission school, Chanel College. The Asia Development Bank (ADB) is providing another 54 PCs that will also be distributed to secondary schools, making for an average of 12 computers per secondary school. Fifteen of 43 secondary schools are currently offering computer studies at various levels. One primary school has a computer lab donated by JICA.[3] However, the majority of Samoan school children have still to see a PC at their school.

The newly opened Teachers' Resource Centre in Savaii (in the Salelologa public library) is equipped with five PCs, a fax machine, telephone and other office equipment. This resource centre is open to teachers, USP Savaii students and the public at large. In the same complex, the USP Centre has established an office for its students in Savaii, and there are plans to install at least three more PCs for use by students for both preparation of assignments and Internet access once the connection is made, expected to be by the start of 2004.

Samoa Polytechnic, National University of Samoa, and USP Alafua Campus all have computer labs for formal courses and training programmes. Other computer labs that are not school-based are those of the South Pacific Regional Environment Programme (SPREP), and the recently completed training lab for the Ministry of Health (see "Major Initiatives" below). All have Internet access.

Three ISPs provide services: Computer Services Limited, I-Pasifika, and Le Samoa. E-mail has started to become a popular means of communication, particularly in urban Apia. Hotmail and Yahoo accounts are the most popular because of their ease of access, even for USP Centre students.

Samoa also has a vibrant Internet cafe industry. These cafes are very busy with clients ranging from students to tourists to the general public.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students on Upolu only. Students of the distance and flexible learning courses of the university can communicate free of charge directly with their lecturers and with other students using e-mail, or through the two types of teleconferencing: video and audio. In addition to print courses, distance and flexible learning students can also enrol in the video broadcast courses and join in the lectures that are being delivered on Laucala campus. There are also Internet courses which are currently limited to the Law School and that are taught from the USP Campus in Port Vila, Vanuatu.

The university has devised a strategy by which students who miss a satellite tutorial/lecture are able to request tapes of video broadcast sessions and audio conference tutorials through the Centre. Indeed, video broadcast lectures can be re-broadcast and video recordings are also available at the Centre.

Broadcast Technologies

Radio and television stations operate daily services. The government corporation, Samoa Broadcasting Corporation, runs the television station, SBC1, and the AM radio station, SBC2. There are several privately owned FM radio stations which offer music, news and programmes of general interest such as interviews with visiting high-profile people.

The SBC1 television station has non-formal education programmes and recently ran a series on the use of ICT to commemorate the 25th anniversary of Computer Services Limited (a government corporation). SBC2 radio station airs a schools broadcast programme that has been in operation since the 1950s. This is a one-hour programme, targeted mainly at the primary level, and covering all subject areas.

Teachers' Distance Learning Via Radio

In 2002, a Ministry of Education project on distance learning was mounted for primary (year 4 to 8) teachers on the national radio station. The duration of the programme was half an hour, after school, for one year. The course was on methodology of teaching the core subjects and focused on particular areas of difficulty that teachers had identified through a needs analysis. There has been very positive feedback on the programme's usefulness and funds are being sought for further programmes of this nature.

Major initiatives

National University of Samoa Videoconferencing

Through a PEACESAT link, the National University of Samoa (NUS) has been able to receive distance learning courses for its nursing faculty and has also been able to provide courses on teaching mathematics to students in American Samoa.

World Health Organization/Ministry of Health Project

This involved the establishment of a computer lab for the training of medical personnel, beginning with distance learning for nurses. Completed in September 2003, the lab has 10 state-of-the art PCs, a server, web filter, printer and has been set up to be compatible with the existing computing facilities of the ministry. Two training workshops have been built in as part of the project. The first one covered the basics of Windows 2000 and Office 2000. The second training workshop on Advanced Applications will be undertaken in the near future.

Teachers' Resource Centre

The newly opened (September 2003) teachers' resource centre in Savaii has increased opportunities for teachers to use computers, though not yet for Internet access. The centre is the initiative of the Ministry of Education, Sports and Culture with funding from NZAid. It is expected to provide support to teachers in their teaching preparations and the location in the same compound as the library and the USP sub-centre provides an integrated support service to all users.

USPNet

This partnership is between USP and Samoa through the exemption made by the telecommunication organization to allow the system to operate privately. This 12-country satellite system and its current capacity has made it possible for Samoan students to complete programmes while continuing to work and without leaving their families, by accessing the university programmes through the USP Centre in Samoa. As mentioned elsewhere, the multimodal facility of the network provides different modes of learning experiences for the students including text, videoconference and audio tutorials with the lecturers in Fiji or Vanuatu. There are also online courses for the law programme which is based in Port Vila, Vanuatu. A recent development of the USP Centre in Samoa has seen the establishment of a sub-centre in Savaii, the other main island. It is envisaged that Savaii students will receive access to USPNet if planned negotiations with Samoatel are successful. This will allow student access to e-mail and teleconferencing, as well as Internet and videobroadcast courses.

Examples of training

Formal training programmes include those offered at the Samoa Polytechnic, NUS and USP which offer a certificate and diploma in computing. There are also short-term courses on Microsoft applications at Samoa Polytechnic, running in the evenings over five weeks. In 2002, NUS commenced the offering of CISCO training on technical aspects of computing.

Some training on computer awareness and basic and advanced applications of Windows and Office programmes are offered by some computing companies at a fee comparable to that charged at the Samoa Polytechnic.

There are plans by the ministry to provide computer studies training for teachers given that a curriculum on Computer Studies is being developed. To date, teachers have received short-term workshops on computers and their use. Some government departments and commercial organizations also offer short training workshops when the need arises.

In March 2003, a small computer company was set up in the commercial centre of Savaii to offer training to the general public. Unfortunately it was moved to Apia in September due to dwindling business prospects.

Teacher training is being co-ordinated by the Ministry of Education, Sports and Culture, in line with the planned schoolnet. Other teacher training for ICT is provided by the NUS where two core groups of up to 15 teachers will be trained in the use of computers in the classroom and in interactive learning materials design.[4]

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in Samoa:

- **Limited institutional capacity:** Apart from the tertiary educational institutions and some secondary

schools in urban Apia, there is very limited computer and Internet access throughout the country's schools. The vast majority of students therefore have not had much exposure to computers and what is offered by way of communication – and the main reason is the lack of facilities.

- **Expensive ICT equipment and services:** PCs and accessories are still very costly in Samoa. Not only are institutions unable to afford teaching facilities, but ownership of PCs is limited to those who can afford them. It is also not a priority when compared to the other more pressing and basic needs of a family. In addition, labour costs are high.

- **Infrastructure:** Recently the telephone system has seen improvements in its service and infrastructure; however, access is still very limited. More landlines are being laid, providing the opportunity for telephone connections for rural schools. Until these are completed however, schools have no access despite a desire to be connected.

- **Cost of educational programmes for broadcast:** The USP Centre and other institutions could use both radio and television more to support students; however, the cost is a major constraint.

Analysis

While a computer culture has developed in leaps and bounds in Apia, this is not the case outside the town area. The cost of hardware remains one of the major constraints. Schools especially have not been able to catch up because of these costs, as well as because of the lack of telephone connectivity.

The development of a computer curriculum is a positive move forward but it needs to be accompanied by the provision of facilities in schools, more trained teachers and greater availability of maintenance service providers. Hence if ICT use is to be encouraged, there needs to be facilities to allow for exposure and regular practice by students.

Broadcast technologies are at present underutilised for education programmes. It is an opportunity that could be exploited particularly given the availability of educational programmes on video and audiotapes. There are local video producing companies that could record educational programmes for broadcast. However, cost is the major limitation.

Given the success of the radio-based teacher training programme described earlier, a particular priority should be given to raise the funds needed to allow it to continue.

NOTES

1 See Samoa Information and Communication Technologies (SICT) website, *www.e-samoa.ws/*.
2 "A Path for Change," Information Technology Strategic Plan 2000–2003 (Samoa Department of Educational Institutional Strengthening Program, December 2000).
3 Ministry of Education, Sports and Culture Report, IT Desk, "Computer Studies Stock-take in Secondary Schools" (2003).
4 "Technical Assistance for Samoa Schoolnet and Community Access Pilot Project" (Asian Development Report, 2002).

Solomon Islands

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

The Solomon Islands have been plagued by internal strife and unrest in the past few years. National governance and policy have been fragmented and inconsistently implemented as a result. Development efforts have been hindered by ongoing ethnic tensions. International development agencies, such as the UN and AusAid, have been involved in efforts to resolve conflict and restore peace to the nation.

There is currently no national ICT policy in place for the Solomon Islands for any sector, including education. To address this, a workshop was held in February 2003, bringing together stakeholders to discuss the development of a national policy. People from the Solomon Islands government, non-governmental organizations (NGOs), the private sector, donor agencies and civil service organizations came together and an ICT working group was formed as a result. The workshop report contains details on the strategies and plans mapped out at this meeting.[1]

A key body involved in the development efforts in the Solomon Islands is the People First Network (PFNet). It has spearheaded the most significant ICT effort in the country, an innovative e-mail–based communication network reaching rural areas of the islands. Initiated by the United Nations Development Programme/United Nations Office for Project Services (UNDP/UNOPS) Solomon Islands Development Administration Planning Programme (SIDAPP), PFNet is part of the Rural Development Division (RDD) of the Ministry of Provincial Government and Rural Development and has been operating since 2001. This initiative is detailed in the following sections of this report.

The Ministry of Education is currently operating under an Education Strategic Plan that was put together for 2001–2004. This plan has not been implemented due to a lack of financial resources. In an October 2003 strategic planning workshop, the Permanent Secretary of the Ministry of Education, Dr. Derek Sikua, assured participants that the plan is being reviewed and continues to be supported by the government and donors. Funding for education is slated to come from the European Union and the New Zealand Aid Program (NZAid). Bilateral donors such as the Republic of China and Japan are slated to continue supporting education efforts in the islands.

Current level of ICT access and use

"Applying Information and Communication Technology to Education in Rural Solomon Islands," co-authored by key players in the Solomon Islands ICT and education efforts, provides recent and up-to-date information.[2] It is a comprehensive and detailed overview, containing in-depth analysis and recommendations for future ICT planning.

The report states that not many statistics are available on the penetration of ICT in education in the Solomon Islands and identifies the need for baseline data collection. A few secondary schools in urban areas have computer labs and computer-related courses. The use of computers in these schools seems to be guided more by far-sighted administrators rather than an informed strategy for use and development of technology in education. Only three schools (one an elite international school in Honiara) were identified as having computer access and related curriculum.

The two institutes of higher education operating in the Solomon Islands are the University of South Pacific (USP) Centre and the Solomon Islands College of Higher Education (SICHE). There are plans to open a USP campus in Honiara and the university has identified the need to promote ICT usage and education for its students. The USP Centre is linked to a satellite system that offers Internet links, videoconferencing and other facilities, though a lack of available PCs for students renders these resources underutilised. SICHE currently has no computer lab and is in a challenging financial state since the economic collapse that followed the ethnic conflict of the past few years.

The greatest use of ICT for education has been in a distance learning project between USP and a rural community school (see below).

Major initiatives

PFNet is a unique project that includes a systematic evaluation effort that provides insight into the successes and challenges of bringing ICT to the Solomon Islands. The project was a finalist in the Stockholm Challenge 2002 and was entered in the InfoDev ICT Story Competition 2002, two competitions that seek out the most ingenious uses of technology for the development of human life. It is considered an exemplary effort to bring ICT to rural areas to empower, educate and provide access and information to people.

Conceived and implemented by the UNDP/UNOPS project, PFNet is maintained in partnership with SIDAPP and is part of the RDD in the Ministry of Provincial Government and Rural Development. PFNet has been established as a non-profit organization.

The PFNet project includes three main areas: the establishment of remote e-mail stations creating a rural communication network around the islands, a related pilot project to provide distance learning courses to rural areas and an Internet cafe in Honiara.

PFNet has set up a short wave (HF band) wireless e-mail system aimed at promoting equity and access to rural areas in the Solomon Islands. The system has successfully connected islanders in remote areas and provided economic opportunity. It has promoted communication between dispersed families, increased access to health and education resources and created the opportunity for rural islanders to conduct business and commerce with urban areas such as Honiara. The low cost to the end user of the system makes it more accessible to the average villager than radio telephones, which are more commonly used in remote Pacific islands. Research and evaluation conducted on the

usefulness and sustainability of these remote e-mail stations show a steady growth in usage and revenue.[3] Studies show an increasing demand and adoption by the rural islanders for this type of access to ICT resources.

From June to October 2002, PFNet piloted a distance learning project at one of the remote e-mail stations. The Rural Development Volunteers Association (RDVA) in conjunction with the USP Centre in Honiara implemented the project to train a small group to use distance learning and to evaluate the success and scope for distance education efforts in the future. The Sasamungga Community High School site was equipped with two laptops to conduct this trial. Nineteen students were trained in using the computers for basic productivity skills and for online communication purposes. RDVA assisted with training and supervision at the site and collected data on the project's effectiveness.

E-mail was the primary means of communication, allowing students to interact with tutors immediately rather than through the unreliable mail system. Students submitted assignments and sought assistance from tutors via e-mail and used Wavemail (an e-mail–based interface for searching for information on the World Wide Web) to conduct research. The overall results of the trial were positive, with students successfully completing their courses and feeling enabled to use computers for distance-based education. A detailed analysis of participants' experience can be found in "Applying Information and Communication Technology to Education in Rural Solomon Islands."[4]

A major goal of the project was to determine whether this model would indeed lead to better access to distance learning courses. The intention was to provide information that would allow the USP to develop courses designed towards delivery via e-mail. Researchers tracking the project to collect evaluation data on its effectiveness presented their results at a September 2003 National Education Conference. Overall, the project was judged successful and there are hopes of being able to broaden it to a national level if funding can be secured.

The third prong of PFNet is an Internet cafe based in Honiara. This cafe provides access to computers and the Internet as well as training classes for the general public (see below). Though the cafe generates a steady income, it is not yet self-sustaining, partly because of the high cost of overseas-sourced technical support. The operating costs are defrayed by donor funding, which has been inconsistent due to a lack of international confidence resulting from political instabilities in the nation.

Examples of training

Along with access to computers, the Internet cafe provides non-formal computer and Internet training courses to interested individuals and organizations. These classes are geared towards those who want to learn practical computer-skills and are open to people without previous computer experience. Classes include Introduction to Basic Computing, Introduction to Microsoft Word and E-mail and Internet Training.

Additionally, PFNet provides training to people in the rural areas where the e-mail stations are set up. Research studies have been conducted to see how these remote stations are used by communities. In a random sample of those surveyed, 64 per cent said someone in their families had used the station and 38 per cent had used the system themselves. Both men and women use the system, with the percentage breakdown being fairly balanced between genders in a society where women may traditionally have less access to these sorts of initiatives.

The ICT working group, formed as a result of the February 2003 ICT Strategy Building Workshop, has obtained funding for a Youth Focal Point and Computer Resource Center. Trainings at this centre will be targeted towards students who need access to computers and the Internet, especially those who need these resources to access tertiary education opportunities. The centre will provide affordable access and computing facilities where students can do research and complete assignments, learning computer and technology skills in the process.

Details on computer training for government ministry officials, RDVA volunteers, PFNet staff and rural operators of e-mail stations are available in a 2003 report.[5] Computer training was provided as appropriate on a range of skills from basic computer to e-mail usage to web page design and website maintenance.

Constraints on the use of ICT

The greatest challenges faced by the Solomon Islands are internal instability and unrest. The related economic crisis has left the islands in dire straits financially to proceed with development efforts in all sectors.

The lack of a national strategy is identified as one main challenge to the development of ICT in education. Without a national strategy for ICTs, the Solomon Islands have no means to systematically build the local capacity or human resources needed to lead, implement and support the growth of ICT. A vicious cycle of a lack of awareness of ICT in the development of the nation leads to a lack of policy and progress in this arena. In turn, this perpetuates a gap in understanding of how to create policies towards ICT infusion in educational curriculum at all levels.

Experts are disappointed that a recent draft of the National Economic Recovery and Development Plan (NERDP) does

not include a blueprint for a national information communication technology network. In a September 2003 interview for Radio Australia's *On Location Pacific* show, David Leeming, technical advisor to PFNet, discusses the need to see ICT more integrated in the existing draft of the NERDP, to make it a strong force in rural access and development.

Other constraints to setting up ICT are the isolated nature of villages scattered over large geographical distances. Much of the population is far from urban centres, where they might get access to and training on technologies. Utilities such as electricity and telephones are not to be taken for granted. In addition rural ICT requirements differ from urban ICT requirements. Providing and maintaining equipment to rural areas will require special attention.

Analysis

PFNet's extensive work, experience and evaluation of using ICT in rural areas for distance learning and practical training provide the best base on which to plan future ICT efforts in the Solomon Islands.

PFNet's reports on results of trials show an enthusiasm and desire on the part of participants in their various projects to use ICT to gain access to education and consequently to more opportunities. Distance education is both a practical and necessary means to build capacity in the Solomon Islands. Recent experience with PFNet's trial efforts shows that the outlook for using this means of education is positive and possible.

A study to keep track of in the upcoming year is the USP-led project that will conduct further in-depth research on the impact of the PFNet system. The project aims to study the existing five e-mail stations and identify the factors that affect the uptake of services and the appropriation of the system by the community. The result of the study is slated to be available in early 2004 and will likely inform future expansion of the ICT in rural areas of the Solomon Islands. This research and related developments will be key lessons to heed in extending ICT efforts for rural schools and for providing ICT training to school-aged youth in the Solomon Islands.

In September 2003, a workshop on distance education co-ordinated by a European Union consultant brought together all major stakeholders and funding sources that will have an impact on the development of ICT in education in the Solomon Islands. The aims of the workshop were to foster dialogue on distance education and develop co-ordination of distance learning initiatives for the nation. One recommendation of this workshop was the creation of the National Co-ordinating Committee for Distance Education to be established by the Ministry of Education.

While there are many challenges to creating a sustainable future for ICT in education in the Solomon Islands, there have been successes worth pursuing. ICT can support development efforts, providing income-generating opportunities to those who live in rural and poverty-stricken areas. The Solomon Islands will also benefit from building its local capacity and training youth to become future leaders and policy-makers in a globally connected marketplace.

Future efforts to develop ICT in education and training in the Solomon Islands will be well served by leveraging the lessons learned and consensus built by the ICT-related stakeholder groups already operating in the Solomon Islands. The PFNet and now the newly formed National Co-ordinating Committee for Distance Education are two important groups to collaborate with in bringing ICT into educational efforts for the Solomon Islands.

NOTES

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Democratic Republic of

Timor - Leste

ICT USE IN EDUCATION

PREL

National policies, strategies and programmes

Timor-Leste is the newest nation of the 21st century, formed when its people voted overwhelmingly for independence from Indonesia in 1999. In the months that followed the independence vote, the Indonesian-backed militia that had occupied East Timor left the country, destroying 90 per cent of the existing infrastructure.

This state, borne in conflict and torn apart by violence, is in the nascent stages of rebuilding. Development of national policy and

reconstruction are happening in all public and private sectors with the aid of international organizations. The United Nations Transitional Administration in East Timor (UNTAET) has played a lead role in the development of national policy and governance since the birth of this nation. The year 2002 was an important one for the country, as it adopted its first constitution, elected its first president and made the transition from United Nations rule to complete independence.

ICT in Timor-Leste - still in its infancy as a self-governing nation – is reflective of the emergent steps being taken towards building capacity and infrastructure in all sectors. Currently, Timor-Leste is operating under a National Development Plan, which emphasises poverty reduction and economic growth as its top priorities. In a May 2002 meeting of the transitional government, international financial institutions, non-governmental organizations (NGOs) and UN agencies, a three-year budget framework that included a 48 per cent allocation of funds towards health and education was discussed.[1]

The first Ministry of Education was re-established by the transitional government in 2001. One noted achievement of this government was the return to school of 240,000 students and 6,000 teachers in October 2001, a process aided and administered by the United Nations. While no policy on information and communication technologies (ICTs) is addressed by publications and press releases regarding Timor-Leste's education sector, investment in technical and vocational education for older students is listed as a high priority. The Ministry for Transport, Telecommunications, and Public Works has an information technology division that is responsible for national policy on communication and technology. Efforts being made by this agency are detailed in the section "Major Initiatives."

Current level of ICT access and use

In the destruction that took place in 1999, public institutions such as schools, hospitals and offices were destroyed; 90 per cent of primary and secondary schools and the entire higher education system were demolished. Rebuilding schools has been a priority of the Ministry of Education since its inception in 2001.

There is very little proliferation of ICTs in K-12 education in Timor-Leste. With pressing challenges such as a lack of pencils and textbooks and a shortage of people qualified to teach, technology is not seen as a priority.

The US-based non-profit Fund for East Timor, an organization involved in the rebuilding of Timor- Leste, states that while the school system is being rebuilt and re-established as compulsory for all students through grade 9, nothing is established to provide student training in information technology. However, the desire appears to be there, as evidenced by a struggling technical school in Dili that teaches English and computer skills and has 3,000 applicants per quarter for 150 openings.[2] The organization identifies how vital it is for East Timorese youth to be trained in ICT to compete in the world market.

An existing satellite radio network provided by Equal Access, a US NGO, does reach districts around Timor-Leste at community centres established in the schools. At the time of writing, no information was available on what, if anything, this is being used for.

Local universities and colleges in Timor-Leste provide a glimmer of ICT infrastructure and training in higher education. Details on these educational initiatives are outlined below.

Major initiatives

Government-related Initiatives

The Ministry for Transport, Telecommunications, and Public Works is spearheading the efforts to have ICT reach the people. Efforts are being made to set up a nationwide telecommunication infrastructure in the 13 districts that make up Timor-Leste. The website for the ministry describes the plans for setting up this satellite-based telecommunication infrastructure, noting that its main goal is to link schools and hospitals to the Internet to provide telemedicine and distance learning opportunities. Their website also mentions plans for an Internet Academy intended to train people in using such resources.

University-level initiatives

The National University of Timor Lorosa'e (UNTL) opened for classes in November 2000. When the university first opened "there was no accessible library, no administrative infrastructure, no phone network, no IT system, no Internet, no photocopiers, no fax machines, no audiovisual equipment or other basic teaching equipment; each faculty shared a bare classroom with a few old tables and chairs and a single secondhand computer."[3]

The university has plans to set up a computer lab with Internet access, so that students can learn some rudimentary computing skills that will help them get jobs and aid them in their research. Currently, UNTL does not offer coursework in the information technology field, but in their long-range plans they plan to offer media and communications courses.

UNTL is also building the nation's first library. The university and its library are seen as vital to the reconstruction of Timor-Leste, providing training to the nation's future teachers, public servants and leaders. The library houses 35 computers, two servers and other information technology equipment. Its one

uninterrupted power supply is inadequate to protect the equipment from power surges and electrical failures; thus, the UNTL is soliciting donations for various hardware and software. They are also seeking help from qualified ICT staff who may be willing to train local staff to maintain and manage the network.[4]

NGOs and Other Aid Organizations

Several international organizations are working on education efforts and partnering with local agencies in Timor-Leste, including UNTAET, the United Nations Children's Fund (UNICEF), Asia Pacific Development Information Programme (APDIP) and the previously mentioned Fund for Timor-Leste. UNICEF is looking at gender equity issues in addressing girls' education, trying to ensure that curriculum does not relegate girls to only have access to predetermined roles. APDIP and UNTAET are working with government ministries to set up educational infrastructures that include planning for ICTs.

The Fund for East Timor is exploring the most effective ways to create a core of experts who will be able to guide the efforts toward ICTs in education. The hope is that this core group will train others, see to the wiring of the schools and assist in the other ICT needs of the country.

Examples of training

Along with the UNTL, several international aid organizations, NGOs and universities are playing a role in training and developing Timor-Leste's teacher capacity and education system. Some of these initiatives include ICT facilities and intentions of building capacity in this area.

- ***Teachers College in Baucau.*** A Catholic teachers college in Baucau has been in formation since late 2000. This college is an initiative of the Marist Brothers in Australia. Australian Catholic University (ACU) is a part of this project, providing staff to assist in the development of the college and in onsite training. The teachers college houses a trilingual library and computer centre.

  A teacher trainer from ACU describes her experience working with teachers in each district to provide classes and work with local committees associated with the opening of the college. She describes the difficulties of reaching teachers in remote schools, the legwork necessary to bring teachers together (without the benefit of telephone and fax to reach them at their schools) and the adjustments she learned to make when she realised the irrelevance of some of her assumptions about teaching in this new cultural context. She concludes that there is definite enthusiasm amongst teachers to learn things that they may not immediately use, but that they may use in the future. For instance, along with teaching and classroom management skills, teachers requested lessons in computing skills.[5]

- ***Swineburne University of Technology.*** In 2002, a group from Swineburne University of Technology in Victoria travelled to East Timor to find out how to set up a communication project geared towards providing Internet access for students with the support of rotary organizations in Australia.[6]

  The group visited the teachers college in Baucau to get an understanding of the existing scenario. According to Amiguet, "the project may be delayed until communications in the country are properly established." While no follow-up information was available on the web about the progress of this effort, one person in the group planned to return to Timor-Leste to train nuns at the Catholic school to use computers so they could in turn teach students.

- ***Technical Colleges.*** According to the UNTAET Press Office, more than 700 primary schools, 100 junior secondary schools, 40 preschools and 10 technical colleges are currently functioning in Timor-Leste. [8] If the technical school in Dili that has 20 times as many applicants as it can accept is indicative of the country's interest in information technology, it seems these technical colleges are logical places to place ICT efforts geared towards training secondary-level students.

Constraints on the use of ICT

There are four categories to the constraints on the use of ICT in Timor-Leste: resource allocation issues, infrastructure issues, human resource issues and language issues.

The most obvious challenge of using ICT in Timor-Leste is that of resource allocation. In this poverty-stricken developing nation, just beginning to rebuild and recreate itself from the recent decimation that took place, the government's main focus is on addressing basic needs. Funding provided by international organizations and donors is most often focused on essential services and basic needs.

The ravaged infrastructure is the second issue. As in many developing nations, utilities cannot be taken for granted. The electric power system is unreliable and has caused many donated computers to break down, and few people know how to repair them.[9]

Another challenge is the difficulty of finding qualified teachers who can learn how to use ICT resources and infuse

them into education. Many teachers are under-qualified and not formally educated. The pressing need is to train teachers in basic teaching strategies and content. The difficulty is that teaching is not viewed as an honourable or lucrative career in Timor-Leste. People who do complete a high school education, and even those who attend college, do so only to find jobs abroad. The lack of a trained workforce in education adds challenges to training and retaining those who would have the language skills, technical skills, motivation and ability to use and integrate ICTs into education.

Finally, the existence of multiple languages creates challenges in teacher training efforts and materials development. Timor-Leste's national language, Tetum, has three different forms. Additionally, there are 17 indigenous languages and Portuguese is re-emerging after 25 years. UNICEF is advocating for local language instruction with the introduction of Portuguese and English as foreign languages later in a student's education.

Analysis

In reports on Timor-Leste and in narratives written by aid workers and volunteers who have travelled there, a common thread emerges: the East Timorese place much value on education and the enthusiasm of teachers to obtain training.

A visiting faculty member who spent a semester teaching at the teachers college in Baucau states, "Some [Timor-Leste teachers] have worked for many years in schools with hardly any training at all. But they have plenty of enthusiasm for learning and improving the quality of education in their newly restored country."[10] Another visiting teacher trainer writes of the engagement and enthusiasm of teachers who came to his workshops on science and math strategies, eager to absorb whatever information they could get. These anecdotes indicate that teachers will likely be eager to learn and use ICT resources, given the opportunity.

Some recommendations follow on where ICT development efforts in East Timor may be well placed.

- **Reaching teachers through existing centres of learning:** A logical place to focus ICT efforts is the centres where teachers are trained, such as the National University and the teachers' college. These places are a nexus – where funding, services, and infrastructure are currently more available or part of long-range plans. Bolstering existing infrastructure and providing training for staff who will in turn support educators will lend itself to more sustainability than diffuse efforts that are harder to follow up and support.

- **Training technical staff in key locations:** The UNTL Library Project identifies the need for training ICT staff to maintain and manage a network, establish a multimedia centre and train other local staff to create a sustainable network.[11] Its website is definitive on what skills and supports are needed to develop local ICT capacity.

- **Needs assessment on most useful areas for ICT in training:** A needs assessment on the key areas that educators could use ICTs in their skills development would inform planning. For example, teachers are apparently eager to develop English language skills in hopes of increasing their access to further education either at the university in Dili or at the teachers' college. Technology and telecommunication can be vehicles to provide these sorts of training, using interactive multimedia and distance learning resources/courses (when the communication and computing infrastructures allow).

- **Reaching East Timorese youth:** Schools in Timor-Leste seem to face many challenges, and introducing computers into schools will be a difficult task given the current realities. Providing exposure and access to computers for Timor-Leste's youth today will require creative strategies that extend beyond the school. Programmes that give students the opportunity to learn and use computing resources should not place the burden of maintenance and training on already overextended teachers who do not themselves have the adequate resources or training to properly introduce students to computing. After-school or community-based programmes using mobile labs and trained staff dedicated to the project may be a first step in exposing Timor-Leste's youth to the computing resources that they will one day be expected to use proficiently as part of their citizenship in the global society.

NOTES

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Tonga

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Situated north of New Zealand, Tonga comprises about 150 islands with a land area of 748 square kilometres. Only 36 of the islands are inhabited. The main islands are Tongatapu (location of the capital Nukualofa, seat of Parliament and main commercial centre), Vava'u, Haapai and Eua. The population of 102,321 (2002) speak Tongan and English. Politically the country is a monarchy with a Parliament that comprises nobles and representatives of the people. The currency unit is the Tonga Paanga.

Tonga has over 100 primary and secondary schools that provide compulsory education between the ages of 6 and14 years. Tertiary institutions include the Teachers' College, the University of the South Pacific (USP) Centre and Atenisi University. The Community Training Centre provides community vocational training programmes. Tonga is a member of the regional USP, and hence it is part of the privately owned satellite system called USPNet.

National policies, strategies and programmes

There does not seem to be an information and communication technology (ICT) policy in place, either for national purposes or for education, even though Tonga is a member of the Pacific Islands ICT Policy and Strategic Plan (PIIPS) accord signed by the ICT ministers of the region recently. However, there have been discussions on this issue between the Ministry of Education and the Central Planning Department. Under the Tonga Government Strategic Development Plan 2001–2004, the following ICT items relate to education:

- Development of ICT curriculum for secondary and tertiary education levels – a planned pilot ICT project at the primary level was not implemented due to a lack of funding;
- Computer training programmes – planned but not implemented due to lack of funding; and
- ICT strategic plan – implementation being undertaken with AusAID funding.

Current level of ICT access and use

Telecom Infrastructure and Connectivity

There are two telecommunication organizations in Tonga: Tonga Communications Corporation (TCC) and Shoreline Communications (Tonfon).

TCC consists of two components: terrestrial lines (copper) and wireless (U-call mobile). The copper wires cover Tongatapu and some parts of Vava'u, Ha'apai and 'Eua. U-call covers the whole of Tonga, mainly Tongatapu, Vava'u, Ha'apai and 'Eua. U-Call had about 4,000 subscribers in April 2003.

The local Internet service provider (ISP) is under TCC and at one stage was a monopoly (Kalianet). It covers mainly Tongatapu with a dial-up subscriber base of around 1,500 at present. The ratio of the number of dial-ups per modem is around 16:1.

Tonfon is a mobile service that competes with U-call. It has over 10,000 subscribers.

Internet Access

There are other Internet cafe services available in Nuku'alofa now, due to the cheap rates offered by TCC. However, local telephone call charges still apply. Tonfon competes for the service to businesses but is not competitive in the home market. The Internet cafes offer access at different rates depending on the ISP used. A few of the computer/office equipment suppliers/distributors also provide Internet access to the public at competitive charges.

Most of the high schools have Internet access for students and are connected via dial-up. One high school has a dedicated line to its Internet connection. Only one primary school is connected.

At the tertiary level, the USP Tonga Centre, which is part of the USPNet satellite network, is linked to other USP member countries. Through this link the distance and flexible learning programme of the university enables students to access courses by video broadcast and Internet, as well as being supported through audio conferencing and video conferencing sessions that use WebCT. Some of the programmes taught through USPNet are at the vocational level.

Many people, particularly expatriates, use privately owned satellite dishes to receive television signals.

Broadcast Technologies

Radio is probably the technology that has the most ubiquitous effect in the community as a whole. Nearly every household has a radio, and those that do not listen to the neighbour's. There are school programmes (at the primary level) that reach the rural areas. Target groups range from primary schools to churches, women's development groups, sports groups and some disadvantaged groups. However, these latter programmes (except the primary school programmes) are mostly non-formal.

Television is less available. There are three stations, Tonga TV, OBN and Tonfon TV (a religious station). In addition, Mormon churches receive satellite TV in their church centres throughout Tonga. There are no educational programmes broadcast via TV, as yet. However, t he UNITEC Royal Tonga Institute, scheduled to open in February 2004 as an affiliate of UNITEC Auckland, plans to broadcast tertiary education programmes via TV next year. (UNITEC is a tertiary institution in Auckland, New Zealand, that offers certificates, diplomas and degrees.)

Table 1: Internet access and use in education

	Primary	Secondary	Vocational	Teachers' College
Access	Very limited	Most schools have ICT access but to what extent needs further investigation	• Government-owned Community Development Centre has access • Tupou High School (THS) has a diploma programme in affiliation with a New Zealand tertiary education provider	Poor – no computer lab
Usage	Very limited	Most schools use ICT but the extent needs further investigation	• Usage is very limited at both THS and Community Development Centre	Usage is limited – probably due to lack of ICT training

Major initiatives

A major success is the founding of the National ICT Society (NICTS) – the first and only independent non-government ICT body in the Kingdom. NICTS has just received its certificate of registration with the Ministry of Labour, Commerce and Industries, as a non-governmental organization (NGO). This enables it to become operational along the lines of its constitution and should therefore be able to offer its services for the improvement of the ICT situation in the country.

NICTS aims to improve the use of ICT in education by brokering partnerships with government in terms of aligning ICT curriculum with local ICT needs and international trends, and by brokering partnerships with teachers so that they share their experience and resources and use the NICTS as a hub for accessing ICT resources they do not have. In fact, this project is being looked at and there are talks of forming a teachers' ICT association (perhaps under NICTS).

Currently, NICTS is seeking funding for conducting studies of ICT training gaps. One of NICTS projects for 2004 is the development of ICT resources based on the studies conducted. Also, NICTS plans to have participative partnerships with private businesses to provide employment through meeting local ICT requirements. In turn, NICTS intends to liaise with the Education Department and promote the alignment of current ICT curriculum with those needs.

It is also planned that NICTS will train people in the villages on how to run a telecentre and the technical side of maintaining computers and other electronic equipment. They would also get training in web surfing, e-mail, MS Word, Excel, etc., so they can teach villagers and help students in the village with their homework.

Other initiatives include the following:

- Radio is being used for non-formal educational programmes particularly in rural areas.
- Central Planning Department is pushing for Computer Science to be a compulsory subject in the national secondary school syllabus.
- In the past three years, the Peace Corps has established telecentres in Tongatapu and Vava'u, but sustainability is a major problem.
- The Tonga Royal School of Science is operating in its new location at the Touliki navy base. This provides Internet access as well as access to PCs for general use. Because of its distance from the vicinity of the town centre, the main users of that service are people in the military.

Examples of training

- ICT training on software usage is provided at Tupou High School. This involves para-professional training in computing (database, spreadsheet, information systems – software and web development).
- At the USP Centre, there are short courses (12-week duration) on Microsoft application packages.
- Teachers' College provides training for teachers to teach ICT at the secondary level.
- ICT in Teachers' College was only introduced in 2002. According to one ICT teacher there, the major constraint is the lack of facilities as there is no computer lab in place. There is also a great need for training. Despite these limitations, teachers have begun to teach ICT at form 4 and above.

Constraints on the use of ICT

- Policy-makers are not ICT experts and lack the knowledge and insights on ICT matters that should be considered in shaping ICT policy.
- The cost of access impedes ICT development.
- The lack of training is a further constraint, as are the unco-ordinated efforts of providers.
- Access to and usage of ICT in rural areas is low as indicated in the low usage of Peace Corps telecentres.
- There is a lack of information about the state of ICT access and usage not only in education but also at national level.

Analysis

Access and affordability on Tongatapu appears to be partly addressed by the ISPs now operating. However, in the schools, there appears to be a need to provide a guiding policy, and with that, an ICT curriculum for teaching throughout the different levels of education.

The cost of hardware in the first instance remains an inhibiting factor – thus the initiative of telecentres seems to be a positive move. The placing of some equipment in one location for the access of village dwellers will provide access. However, perhaps the low usage is due to the lack of skills so some training is certainly needed and NICTS seems to be moving along these lines.

With the establishment of the NICTS, there seems to be a conscious effort to address the ICT situation in Tonga. The lack of national and educational policies seems to be a drawback that the NICTS plans to address.

Tuvalu

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Tuvalu comprises nine coral atolls with a land area of 26 square kilometres. The islands are spread over 1.3 million square kilometres of sea. The population of 10,838 (2002 figure, growth rate of 1.41 per cent) is Polynesian, and largely bilingual (Tuvaluan and English).

Eight of the nine atolls are inhabited. The main atoll is Funafuti where Parliament sits, and which has the government department headquarters, the main primary school, the one hotel, the only

airstrip and the main commercial centre that comprises the bank, the co-operative wholesale society shop and a few other shops. The other major island is Vaitupu where the major secondary school, Motufoua, is located. The other secondary school, Fetuvalu, is owned by the Tuvalu church and located on Funafuti. There are 10 primary schools, two on Funafuti (one of which is operated by the Seventh Day Adventist church) and one on each of the other islands.

Tuvalu is an independent state and a member of the Commonwealth. The Tuvalu economy is based on licensing of fishing vessels, remittance from Tuvaluans living overseas and, recently, the selling of the domain name ".tv" to a US-based company. The currency used is the Australian dollar. Tuvalu is a member of the regional University of the South Pacific (USP), and hence it is part of the university's privately owned satellite system called USPNet.

National policies, strategies and programmes

The Tuvalu National information and communication technology (ICT) policy is in draft form. Negotiations with stakeholders are still underway. It is anticipated that when sufficient information has been collected, endorsement of the policy will be sought with implementation expected by 2004. The Tuvalu Policy Vision is "Information and Communication Technologies for every Tuvaluan Citizen." It follows the guiding principles outlined in the Pacific Islands Information and Communication Technologies Policy and Strategic Plan – a regional ICT strategy agreed and signed by the Communication Ministers of each respective Forum country member. For Tuvalu, these principles are:

- ICT will be used to inform and connect Tuvalu citizens and ensure that they benefit from flexible and appropriate education and training.
- Appropriate ICT infrastructure will support development for Tuvalu Islands.
- Easy access to information through ICT will strengthen co-operation between stakeholders to ensure good governance, to develop the private sector and to improve service delivery.
- ICT policies and regulations will be appropriate to the people and culture of Tuvalu.

Strategies to implement the aspects of the ICT policy which are relevant to education include promoting greater awareness of ICT, developing and retaining a knowledgeable workforce in ICT, developing and maintaining training policies and programmes to ensure ICT resources are properly managed, providing equal access to ICT, developing ICT infrastructure to promote universal access, addressing affordability of ICT technology and continually evaluating ICT plans and its impacts. Table 1 shows specific strategic plans relevant to education.

Other planned strategies include consultation with a wide range of stakeholders, developing exchange and vocational programmes by the education sector, incorporating gender issues and developing community awareness programmes to maximise benefits and minimise adverse social impacts. There are also plans to review communication tariff regulations to maximise benefits to communities.

Current level of ICT access and use

Connectivity, Telephones, Facsimile

The Tuvalu telephone infrastructure at the moment is a cable network. Subscribers with Internet accounts dial in for connection. Since there is a limited number of 32 lines available for home Internet connection, this system operates on a first-come, first-served basis. This is insufficient and thus most people go back to their offices after working hours to surf the Internet.

Table 1: ICT plans for education

Activities	Identifiable actors	Deadline
Build ICT into school curricula at all levels	Education Ministry	2004
Train teachers/trainers	Institutions	2003
Install ICT in schools	Education Ministry	2003
Create Internet cafés	Government and business	2003

Fax communication is available and very efficient for overseas services. However, within Tuvalu, there is a lengthy wait for connections to the outer islands because of the limited number of available lines (two to four per island). Vaitupu has the most lines available, but even these are not sufficient to meet the needs of the public.

Computer Use, Internet/World Wide Web for Education, E-mail

Except for the USP Tuvalu Centre, all schools at all levels have only a couple of computers for teachers to use in preparing their teaching materials. The Internet is available in Funafuti, but the two primary schools there have no access due to the high connecting fees. Most children have been exposed to computers and the Internet, but there are no facilities for hands-on experience on a daily basis. However, there is a general understanding that UNESCO will provide assistance to help connect schools throughout the country. USP students in Funafuti have access to e-mail and Internet facilities through USPNet.

Video Broadcast and Conferencing Technology

Video broadcast and conferencing technology is available to USP students in Funafuti only. Students who are enrolled in the distance and flexible learning courses of the university are able to take advantage of the USPNet system for communications with their lecturers and other students. Video broadcast courses enable Funafuti students to join in the lectures that are being delivered on Laucala campus. Tapes of video broadcast sessions and audio conference tutorials are available for Funafuti and outer island students on request to the Suva headquarters of the university.

Broadcast Technologies

Radio is the only broadcast technology in the country and there is only one educational programme that is aired once a week. This is mainly a lesson taken at the biggest primary school in Tuvalu (the Nauti Primary School on Funafuti), recorded and aired over Radio Tuvalu at the mentioned time.

There is also an awareness programme on the courses offered at the USP Centre that airs fortnightly.

Major initiatives

The main initiative is USPNet, the partnership between USP and Tuvalu through the exemption made by the telecommunication organization to allow the system to operate privately. This 12-country satellite system has made it possible for Tuvalu students to complete programmes while continuing to work and without leaving their families. The multimodal facility of the network provides different modes of learning experiences for the students including video conference tutorials and audio tutorials with the lecturer in Fiji or Vanuatu. There are also online courses from the Law programme which is based in Port Vila, Vanuatu. The next phase for Tuvalu is to make the technology work in the outer islands so that the USP students there will benefit from the same experience as the students in Funafuti.

Other initiatives include a survey of stakeholders by the government in 2001–2002 conducted to obtain information on public awareness and usage of computers and the Internet. Responses to the questionnaire were analysed and resulted in the formulation of the strategic plans outlined above.

In 2002, the IT Department set up two PCs with Internet access in their office for the public to use for a small fee. Government civil servants also use these since not all of them have access to the Internet in their own offices. As well, the IT Department has established an online information site for Tuvalu updates. Tuvalu citizens overseas have commended this initiative (see *www.tuvalu.tv*).

Examples of training

An ICT Expo Week was organised for the general public but attendance was not as high as anticipated. Again, being understaffed, the IT Department was unable to fulfil the objectives. At the moment, there are only two qualified ICT staff assisted by an expatriate expert and a local trainee. The department also conducts basic training programmes but their work revolves around installing and maintaining computers, faxes and printers.

The USP Centre offers courses on computing, which is another, albeit limited, avenue for training.

Constraints on the use of ICT

The following are some of the constraints on the use of ICT in education in Tuvalu:

- Limited human resources with ICT qualifications and limited training opportunities;
- ICT qualified Tuvaluans emigrate overseas due to the lack of incentives in their work environments;
- Lack of government funding and other support to develop ICT and broadcast technologies;
- Limited institutional ICT capacity;

- High costs of information management systems;
- Expensive ICT equipment and services in Tuvalu;
- Isolation and remoteness of the islands; and
- Understaffed IT Department.

Analysis

Only government departments and corporations on Funafuti have access to ICT services. The outer islands as well as the private sector cannot afford the expensive Internet connection fees. Even most government ministries utilise only one or two accounts for Internet access.

In education, the low level of access is a great concern. For a country that is spread over a large expanse of water, communication through modern technology must be a priority in order for the population to access information on the Internet.

It is apparent, also, that there is an urgent need for adequately trained and more experienced personnel, as well as for financial assistance in the form of facilities and equipment. There are high expectations, therefore, that UNESCO will assist in improving access; this must occur if the country is to benefit from ICT.

Given the scattered nature of the atolls, educational radio broadcasting from Funafuti could be explored further.

Vanuatu

ICT USE IN EDUCATION

Ms Ruby Vaa, Ph.D

INTRODUCTION

Vanuatu lies northeast of Sydney, Australia, and was known as New Hebrides until 1980 when it gained independence from France and Britain. It consists of a Y-shaped chain of some 80 islands spread over 848,000 square kilometres of sea and a total land area of 12,190 square kilometres. There are active volcanoes on Tanna, Ambrym, Lopevi, and Gaua. The indigenous people are known as ni-Vanuatu.

The total population of close to 200,000 (2003 estimate) speaks Bislama (the national language), as well as English and French

which are the official languages and also the languages of formal education. Vanuatu has around 113 indigenous vernacular languages in current usage and the government recently introduced a policy to teach the early stages of basic education in vernaculars, especially in rural Vanuatu.

The main island is Efate where the administrative centre Port Vila is located. Other large islands with population concentrations are Santo (the largest), Malekula (second largest), Tanna, Pentecost, Erromango and Ambrym. The country produces copra, fish, beef, cocoa, coffee, kava, timber and other wood products, and a limited number of manufactured goods. Tourism is a vibrant industry. However the subsistence sector continues to play an important role in the overall mechanics of the economy. The national currency is the Vatu.

Vanuatu is one of 12 member countries of the University of the South Pacific (USP), and therefore has access to the facilities of that institution including the USP Centre on the Emalus campus in Port Vila, Efate, and through it to the USPNet satellite system.

National policies, strategies and programmes

The 1999 Education Master Plan identifies, in broad terms, the need to integrate technology education with general secondary education. It further stipulates as Action 3 in Annex 3 the following:

> The government will introduce a comprehensive technology education programme in years 9 to 12 (grade 3 to 6) of general education. The technology programme should be holistic in its consideration of materials, processes and systems applied to technologies such as food, graphics, design, information and communications.

Furthermore, the plan makes reference to some previous expert consultations with New Zealand, and also to the possibility of seeking funding assistance for further information and communication technology (ICT) developments as follows:

> Because of New Zealand's experience with technology programmes in its general education system and its earlier involvement in technology issues in Vanuatu, the government will approach NZ to determine its interest in the programme.

It is nonetheless also generally acknowledged that other partners, including the European Union (EU), support the idea of assisting the introduction and use of ICT in the education sector. This is demonstrated by a recent study funded by the EU to develop an "Education: Information and Communication Technology Strategy Plan" (May 2003).

Up to March 2002 there was no clear national ICT policy, but there was legislation that covers access rights, copyright and ICT misuse. However, there was no centralised budget for ICT, and, according to a statement from the Vanuatu Broadcasting and Television Corporation (VBTC), the government is not promoting e-governance. Nevertheless, the government's Telecom development plans aim to "increase customer access and [the] number of customers." However, here too VBTC is skeptical stating that "the government is not organised at a fiscal level to produce a development plan for Internet services. Things may not develop in the next two years."

There is, however, some activity in government that includes building up computerised services, digitising government documents, providing subsidies for computer purchases, training government officials in ICT and reinforcing ICT training in schools, training institutes and universities.[1,2]

Current level of ICT access and use

The infrastructure in place supports telephone, facsimile, Internet access, e-mail and data transmission services. Telecom Vanuatu Ltd (TVL) (see *www.tvl.net.vu*), a private sector monopoly, had 4,500 customers in 2002 and 1,020 Internet customers. But with increased awareness of the need for technology for business and education, these customer numbers more than doubled in 2003.[3] TVL, jointly owned by government, Cable and Wireless, and France Cables et Radio, provides some regulatory services. It has excellent infrastructure, extensive use of solar power and provides very good and affordable Internet connectivity.[4] With its effective rural telecommunication development programme, TVL has so far equipped most major islands of Vanuatu with telephone facilities.

Wireless (mobile) telephony was introduced in 2002 and demand for it is expanding in urban Port-Vila and Luganville. It will soon extend to other outer island centres. The rural electrification programme of the French-owned private company, UNELCO, also plays a catalytic role in stimulating the expansion of telecommunication infrastructure and, hence, the ICT development.

Vanuatu has 405 primary schools, 65 secondary schools and a handful of tertiary institutions that include the Teachers' College, the Vanuatu Institute of Technology (VIT), the School of Nursing, the Maritime College and USP. A new College of Agriculture is currently being built on Santo, funded by the Peoples' Republic of China.

In 2002, between 25 per cent and 50 per cent of the population had access to the Internet at home or through telecentres, while more than 75 per cent had access through workplaces, Internet cafes and government institutions. However, access through schools and public libraries is

much lower. Again through its education-friendly programme, TVL is offering the "Lagoon School" Internet package to schools that request it. Internet access is free during specified official working hours where it is available.[5]

Primary Education

The major population centres of Port Vila in Efate island, Luganville on Espiritu Santos, Isangel on Tanna, Lakatoro on Malekula, and Longana on Ambae, have some computers available for administration. Primary schools are slowly introducing computers at the initiative of their school committees, as the meagre funding allows.

Secondary Education

To date, all government-owned and some other secondary schools have computer laboratories, and most schools (both primary and secondary) use ICT facilities for administration.

Post-secondary Education

The USPNet. A satellite service for distance education is provided through USP for students studying there. The university's Emalus campus in Port Vila comprises the USP Centre in Vanuatu, the School of Law, and the Pacific Languages Unit. University degree, diploma and vocational programmes, through both distance education and onsite courses, are available to all eligible students throughout Vanuatu. Distance education students have access to the tele-instruction in Port Vila and it is anticipated that the same facilities will be provided to the two subcentres in Luganville, Santo, and on Tanna, with instruction through USPNet (the communications network of the university). This will effectively enable Vanuatu students to complete a large proportion of the courses for the university programmes without having to attend classes on other campuses. Negotiations between the university and TVL are underway to enable this extension of USPNet to Santo and Tanna.

Meteo ICT project. A project is currently being developed for funding by the US authorities through the meteorology office to provide Internet facilities through schools and communities, with the aim of assisting the latter to monitor the weather and meteorological conditions, and to provide preparedness measures in times of natural disasters.

Police Crime and Disaster Management Project. A similar proposal, manned by the police authorities and designed to help maintain law and order, is in place in communities in provincial areas with access to schools, which assist with monitoring activities.

Broadcast technologies. Radio and television are widely used in Vanuatu, but there is currently very little in terms of distance education using these modes. This is an area needing further study and assistance for effective use of these technologies for education.

Major initiatives

One major initiative was the World Health Organization (WHO) project on training health workers. This involved establishing a computer lab to train medical personnel, beginning with distance learning for nurses. Completed in October 2003, the lab has 10 state-of-the art PCs, a server, web filter, and printer. Two training workshops have been built in as part of the project, the first one covering the basics of Windows XP and the second covering intermediate applications.

Other initiatives include the following:

- Satellite links through the USPNet;
- Internet cafe available in Vila, and Luganville (Santo); and
- USP Centre with its own computer labs in Vila and Luganville with Internet access. (A new lab is being developed on Tanna in collaboration with the TAFEA provincial government council.)

Examples of training

- Telecom staff have received basic, intermediate and advanced computer training while VBTC staff have attended journalism training workshops.
- The USP Centre has provided continuing education computer courses for the public at large. The courses offered range from basic computer awareness to the use of e-mail and Internet, PowerPoint and Publisher. More advanced professional training for programmers and systems administrators was also offered last year.
- The VIT also provides computer courses to the public as part of its adult education programme.

Constraints on the use of ICT

The following constraints were identified at the start of 2002:[6]

- Lack of locally qualified technicians and systems administrators;
- Limited technical support;

- Cost of equipment;
- Unreliability of power supply, poor quality of Internet connections, high cost of telecommunications, internally and externally;
- Lack of access to telephone networks;
- Lack of skilled support services;
- Limited bandwidth; and
- High access charges.

Analysis

Priority areas for Vanuatu have been identified as capacity-building in distance education, strategic planning for ICT in government and government-wide applications training in ICT.[7] A comprehensive training programme for local experts and technicians would be helpful, as well as assistance in the following areas:

- Community radio systems for basic skills and education for remote villages;
- Technical support for the government broadcasting system;
- Standardised technical training for government staff in applications and systems; and
- Capacity-building in distance education for the Ministry of Education.

NOTES

1 "Internet Infrastructure and e-Governance in Pacific Islands Countries" (UNESCO, March 2002), Appendix 15. This information was obtained from a survey of the VBTC, Telecom Vanuatu Ltd, and the Ministry of Lands and Natural Resources.
2 See the Asian Development Bank report TA REG 5990 "Information and Communication Technology in the Pacific", June 2002.
3 See note 1 above.
4 See note 2 above.
5 See note 1 above.
6 See note 1 above.
7 See note 1 above.

map of South Asia

South Asia

Bangladesh • Bhutan • India • Maldives • Nepal • Sri Lanka

Bangladesh

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph. D
Ms Vineeta Sinha

INTRODUCTION

Bangladesh is a country of deltas and rich alluvial plains in the eastern part of the Indian subcontinent. Farming, fisheries and other agro-based industries form the backbone of the economy. Among the poorest of the world's nations, Bangladesh is nevertheless growing steadily, and despite some instability in the political system, it has always provided a free environment for education and development.

Bangladesh receives support from a large number of donor agencies and non-governmental organizations (NGOs), some of which have pioneered the use of information and communication techonologies (ICTs) for poverty alleviation.

The first PCs were introduced in Bangladesh as early as 1983, but there was slow growth until the 1990s when the presence of a large number of computer dealers brought the technologies to mainstream society.[1]

ICT policies in Bangladesh

Bangladesh has an ICT policy formulated for human resource development (HRD) that states that the country must prepare itself to compete effectively in the global ICT market. As the demand for skilled manpower in ICT is growing worldwide, the country needs to produce a large number of ICT professionals.

Specifically, policy statements endorse the need for widespread introduction of ICT training in public and private educational institutions as a prerequisite for producing skilled ICT manpower. Facilities are to be built to promote ICT education and computer-aided education at all levels including primary schools and *madarsahs* (religious schools). Donor agencies, NGOs and other partners will be encouraged to help build the necessary capacity.

The policy envisages that universities, institutes of technology and colleges, both in the public and private sectors, shall be strengthened to produce ICT graduates from four-year Computer Science and/or Engineering courses. Necessary resources will be allocated to these institutions. Out of the three science and technology universities to be established in the fifth Five-Year Plan, one will be earmarked as a centre of excellence in ICT by giving it a higher allocation of resources.

The policy also proposes establishing multimedia institutes up to district level that will produce skilled human resources to exploit the opportunity offered by the growing multimedia market. Diploma and trade courses in ICT will be offered in both public and private institutes including polytechnics, while inservice training programmes will target the upgrading of professionals now employed in the public and private sectors.

The policy also identifies the shortage of trained and qualified teachers and trainers for ICT education and training as an impediment to the HRD plan. It proposes building capacity in teacher training institutions through special certification and inservice programmes to upgrade skills that will create a pool of skilled trainers.

Initiation of programmes that will develop quality ICT professionals and skilled personnel to ensure success in the global software and ICT-enabled services market are a part of the ICT policy too. The formal and informal sector will be encouraged to adopt internationally accepted standards for training programmes.

Distance education is recognised as an important methodology to extend the country's limited teaching resources and to ensure quality education. To achieve its goals, Bangladesh proposes to invite international faculty in fields where qualified local teachers are not available.

Current level of ICT access and use

There are currently 750,000 fixed lines operated by Bangladesh Telephone and Telegraph Board (BTTB), with a projected demand for fixed-line service over the next five years of about 3.5 million. There are now more mobile than fixed line telephones in Bangladesh. While there are four companies providing service in the mobile telephone industry, Grameen is the major player with a subscriber base of 730,000. The company expects to expand this number to 2 million by 2004.

Utilization of ICTs in education is related to access to ICT infrastructure and services. At present, ICT penetration is very limited in Bangladesh, with Internet use estimated at about 1.4 per thousand,[2] and restricted largely to the capital, Dhaka, and its surrounding suburbs. The potential for exploiting wireless-based technologies and the opportunities that exist with them are great, given the ever-increasing use of wireless telephones in the country.

Major initiatives

Bangladesh has a high level of international donor funding to support its developmental initiatives, with about US$ 1.1 billion secured in 2001.[3]There has been minimal use of broadcast media for education, other than the support provided for distance education programmes. Some of the following examples of ICT use are in partnership with external donors.

Grameen Bank [4]

A number of Grameen Bank (GB) members are poor women from the rural areas of Bangladesh. If they choose they are granted a revolving loan of BDT 15,000 (US$ 310) for a Village Phone (VP) package containing a cellular phone, battery, fast charger, sign board, calculator stopwatch, user guide in Bangla and a price list for calling different locations. The contract requires that the loan be repaid within two to three years through weekly payments while airtime charges are to be paid monthly. After being trained to use the equipment, the women are known as VP operators who begin their own business enterprise by renting out the mobile phones to anyone in the village who would like to make or receive a telephone call.

Nearly 50,000 Bangladeshi women make their living serving as Grameen "phone ladies." The income derived from the VP by the women was reported to be about 24 to 40 per cent of the household total. A VP operator earns an income of about BDT 14,400 (US$ 300) per year providing telephone services that exceeds Bangladesh's average per capita income of around US$ 286.[5]

Grameen Bank has targeted 39,346 villages to be recipients of the Village Phone initiative.

Grameen Telecom and Grameen Phone

Grameen Telecom (GTC), a non-profit organization, owns 35% of the shares of Grameen Phone Ltd. (GP), a private sector, urban cellular telephone company that was awarded a nationwide cellular licence in November 1996. GTC buys bulk airtime from Grameen Phone and passes on most of the savings to its Village Phone (VP) operators. GTC is using GSM (global system for mobile communication) cellular telephone technology at the village level, taking advantage of the GP-installed urban capacity. GP leases and operates a 1,800 kilometre fibre-optic cable from Bangladesh Railroad, effectively providing a parallel nationwide network to the one operated by the state monopoly, BTTB.

Grameen Cybernet Ltd.[6]

Grameen Cybernet Ltd. commenced operations in July 1996, and is currently the largest Internet service provider (ISP) in Bangladesh. It is a joint venture between the Grameen Fund and CITech Ltd., a well-known private computer and information technology distributor. The company boasts over 6,000 clients in various sectors, offering dial-up Internet access, technical support, web consulting and a help desk.

Grameen Communications

Grameen Communications is a not-for-profit organization that aims to increase awareness and use of the information available on the Internet for improving education, research, social welfare, health and sanitation in Bangladesh. To accomplish these goals, Grameen Communications organizes regular seminars, workshops, training programmes and projects utilising the Internet. Educational, research, social, non-governmental and governmental institutes are able to exchange academic, statistical and research information at affordable prices.

A pilot Village Computer and Internet Programme was launched by Grameen Communications on June 1, 1999, in Madhupur village, Tangail district. This project provides low-cost computer training to villagers in order to improve their skills and employment opportunities. Grameen Communications rents one room from the Grameen Bank branch and has equipped it with several computers, a modem and dial-up Internet connection using a Bangladesh Rural Telecommunications Authority (BRTA) phone line. Customers are able to send e-mail messages overseas and receive e-mail printouts. Using a scanner, customers may send original handwritten letters or documents, and a digital camera is available to send photographs. Farmers have become interested in how the technology could help them gain information about the market conditions. The major disadvantage at present is a very slow Internet connection.

The EMIN Project[7]

The ICT Development Group of RADARSAT International (RSI-Canada), Versatile Mobile Systems (VMS-Canada) and Bangladesh's Center for Environmental and Geographic Information Services (EGIS-Bangladesh) have designed and implemented the Environmental Monitoring Information Network (EMIN) project that aims to improve planning and management of water and land resources by strengthening two-way information flow between local and national stakeholders. Improving the linkages and tools within water sector organizations will enable delivery and exchange of relevant information to specific users, benefiting management of resources, especially at the local level.

Water is central to life in Bangladesh. There has not been a central communication channel to enable the multiple stakeholders in the water sector to be collectively involved in the management of the resource. The EMIN project provides a common platform to facilitate co-management of water resources helping to mitigate poverty through a better understanding of the complex relationships between water resources, flooding and erosion management.

Community Development Library[8]

The Community Development Library (CDL) strives to develop a knowledge network to facilitate the sustainable, effective, appropriate and affordable exchange of information at local, national, regional and global levels; to provide audiovisual services and training to NGO workers and other beneficiaries; to develop a video resource centre on development issues; and to bridge the communication gap that exists between policy-makers, social development activists, programme implementers and people working at the grassroots by providing information on ideas and experiences of innovative and sustainable development efforts.

CDL has been providing development information services at the grassroots level through 25 Rural Information Resource Centers (RIRCs). The RIRCs have library facilities and can organize seminars, workshops, study circles, discussion meetings and video shows to enrich people's knowledge on development issues. RIRCs maintain a news-clipping service and network with local NGOs and people in the community.

Each centre has an advisory committee comprised of representatives from NGOs and public bodies, as well as teachers, journalists, local government officials and cultural activists. The committee identifies the resource materials, policy matters, priorities, potential topics and organizations with which they would like to link. It meets monthly and provides management support on the basis of the guidelines to enable people in the community and NGOs to be involved in decision-making and programme implementation. As well it attempts to bring the centre towards self-reliance.

Center for Development Communication

A group of media activists established the Center for Development Communication to facilitate communication between the government and other development organizations. The objective of the organization is to raise awareness through radio, TV, printed publications, workshops, seminars, study circles and networking activities. To achieve their objective, the Center encourages production of innovative and creative films or TV programmes related to children's rights, social development, the environment and gender or development issues. The team is comprised of journalists, TV anchors, producers, professional photographers and graphic designers. The Center also provides consultancy services on public awareness programmes for print and audiovisual media.

Amader Gram[9]

Amader Gram is a model project of integrated rural development achieved through capacity-building of disadvantaged people, conservation of biodiversity, sustainable use and mobilisation of natural resources, and encouragement of environmentally sound income-generation activities.

The project was founded in 1996 by a group of development activists who believed that poverty could be eliminated through capacity-building of poor people and sustainable use of natural resources. Amader Gram originated out of this vision and is a project of the Bangladesh Friendship Education Society (BFES), an organization that provides technical know-how to poor grassroots people to assist in poverty reduction. Since 1996, Amader Gram has helped improve the lives of disadvantaged people in 20 villages of the Bagerhat (Rampal) and Khulna (Paikgacha) districts in Bangladesh.

Amader Gram's programme includes creation of a village information, communication and knowledge centre; a comprehensive database to preserve, update and ensure long-term use of village resources by the community; guidelines and simple village-level monitoring indicators for analysing data and information by the villagers; resource manpower through skills development training in ICT uses for youth groups and adolescent girls; behavioural and skills development training to underprivileged people through a rural training programme; micro-credit support for undertaking viable income-generating activities; provision of environmental education; homestead gardening training aimed at providing nutritional support; health education; and monitoring, research, publication, demonstration and replication of its projects in other parts of the country.

Examples of training

Network Learning of Bangladesh

Network Learning of Bangladesh was awarded a project funded by Pan Asia Networking (PANASIA). The approach was initially concentrated on a village network that had been established by The Learn Foundation. The Foundation's network, connected to the Shahjalal University, was comprised of 10 schools situated in the rural area around Sylhet, some 200 miles northeast of Dhaka. The first stage was a feasibility study that was conducted by a team led by Dr. Shahidul Alam (DRIK Multimedia, Bangladesh), and several international experts. As well as conducting the feasibility study, the team was asked to consider recommending up-to-date ICT tools and networking systems.

Private Sector Initiatives

There are a large number of private sector computer and ICT training institutes in Bangladesh, many of which are franchises of similar institutes in India. These institutes provide training in basic and advanced computing skills. Alumni seek employment in the industry at home or move abroad to enter the global ICT market. Market demand for trained personnel is great but the ability of governmental institutions to meet it lags behind. The amount of allocated public funds available does not match the actual costs of training. As well, the private sector does not find involvement in ICT projects an attractive investment opportunity.

Constraints on the use of ICT

Constraints affecting the use of ICTs in Bangladesh are partly technological, but to a larger extent they result from a lack of policy formation, implementation and inter-agency role definition and collaboration. Constraints also exist as a result of the variance between the need for access and the actual access, and between market demand for trained personnel and the actual courses being offered.

ICT penetration at primary, secondary and postsecondary levels is very limited, with only a limited number of urban

schools having ICT facilities available for education. Initiatives for increasing penetration are generally hampered by a paucity of funds, as are many initiatives for creating information networks in educational institutions. Take, for example, the case of the Bangladesh National Scientific and Library Information Network (BANSLINK), which is not working because of a shortage of funds.

There is a huge discrepancy between market demand and the ICT training courses being offered. On-the-job training is provided to a small extent, but given the limited presence of software companies in the country, long-term training is difficult to provide. Because of the many limitations in the system there is an alarming trend towards outward migration of ICT specialists and students.[10]

There is exponential growth in private ICT training institutions in Bangladesh. It would be an advantage to the country if these institutions could cater to the demand for ICT training, but instead they are concentrating their efforts on software development. Graduates from these institutions prefer to seek employment outside the country, largely in the Middle East.

Analysis

Interesting opportunities for development exist in Bangladesh as a result of the rapid advances in the ICT sector. For instance, if the GSM mobile phones of the "phone ladies" were replaced with a Global Packet Radio Service (GPRS) system, added to a low-end computer, linked through a partnership with an ISP where connectivity could be provided at a minimal rate, then the benefit of the convergence of wireless technologies with the power and potential of the Internet could be brought to villages for a fraction of the current price. Add the income-generation possibilities of e-governance or e-post activities, and an interesting model of applying ICT for all kinds of developmental activities emerges from simple e-mail to sophisticated mobile learning.

Similarly, if the technological and content development capacity of the Bangladesh Open University were combined with the distributed transmission capabilities of Bangladesh Television, equally innovative possibilities for using broadcast technologies for education could emerge.

To take advantage of the synergy of such possibilities, Bangladesh requires support at all level; assistance in the development of policy frameworks, plans and blueprints for deployment of ICTs in education; and demonstrated best practices and pilot projects within the country that can be scaled up (but with sustainability as a major factor built in to reduce dependence on donor funding and support).

ICT infrastructure needs to be built up or created to provide the springboard for further use. There is also need for a comprehensive regulatory, financial and environmental policy to support the use of ICTs. Currently, the lack of high-speed Internet access, the poor telecommunication infrastructure, the lack of a legal and financial environment to support e-commerce and the inexperience in catering to the global software market all limit use of ICTs in the country. At the same time, a clearer role definition of the public and private sectors in development, including public-private partnerships should be developed. Recognition of the importance of the private-sector role has to be given so that its contribution becomes greater. For example, private-sector representation is allowed on the Bangladesh Telecommunications Regulatory Commission (BTRC) as outlined in the original plan and intent, but somehow this has been overlooked. Currently, there are nine commissioners on the BTRC who are all retired BTTB employees or government officials.

There is also a critical need for intervention at the policy level through a series of policy dialogues among legislators and parliamentarians who are responsible for effective and proactive legislation. Bureaucrats and government officials need to become familiar with the potential of ICTs for serving educational needs through exposure to best practices in other similar countries. As important as exposure to the technologies is, exposure to governance practices in an ICT-enabled society is perhaps more so, so that there can be a better balance between the potential of technologies and their actual application and implementation.

NOTES

1 From UNDP Human Development Report, 2003.
2 See note 2 above.
3 See *www.telecommons.com/villagephone/gbfamily.html.*
4 See *www.grameenphone.com.*
5 See *www.citechco.net.*
6 See *www.ictdevgroup.com.*
7 See *www.cdlbangladesh.org.*
8 See *www.bfes.net/projects/projects.html.*
9 See *www.bfes.net/projects/projects.html.*
10 From Tech Bangla Survey 2000.

Bhutan

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph.D.
Ms Vineeta Sinha

INTRODUCTION

Bhutan has only recently emerged from a long self-imposed policy of isolation from the rest of the world. King Jigme Singye Wangchuk relinquished absolute power in 1998 to rule in tandem with the government, an assembly and a royal advisory council (including locally elected members). Now under a policy of limited modernisation, Bhutan is tentatively acquainting itself with outside influences in all areas of activity in general and information and communication technologies (ICTs) in particular.

Increased globalisation has been a double-edged sword for Bhutan as the government faces the problem of rising unemployment for Bhutan's well-educated and young population. Education has meant that the young Bhutanese are no longer satisfied with the traditional engagement with agriculture, and the need for new avenues of development has assumed importance.

Bhutanese radio broadcasting, begun in 1973, is owned and operated by the state-owned Bhutan Broadcasting Service (BBS). BBS radio broadcasts 12 hours per day and gives a daily news bulletin in four languages. First introduced in 1999, television is aired to the Bhutanese via BBS (two hours per day in Dzongkha and English) and through a number of competing cable operators. BBS television is currently limited to residents of Bhutan's capital Thimpu, but it has plans to become a national service. Bhutan has no private terrestrial television or radio services.

Internet came to Bhutan in 1999. Druknet, Bhutan's only Internet service provider (ISP), was initially conceived purely as a domestic e-mail service, keeping Bhutan sealed off from the rest of the world; but the king then decided to give Bhutanese citizens limited access to the World Wide Web.

Master plan

The ICT master plan for Bhutan was prepared soon after the introduction of Internet in 1999. The Department of Information and Technology (DIT) was set up under the Ministry of Communications. The master plan, known as BITS (Bhutan IT Strategy),[1] takes several key issues into consideration:

- **Infrastructure:** Infrastructure development to improve national telecommunications and establish data networks in all government departments is needed. A sound infrastructure is also necessary to enable ISPs to increase in number and improve services. Currently teledensity is only 2.2 per cent, lower than the average for low-income countries. A survey in 2001 reported that there were 2,550 computers in total, the majority of them owned by corporations.[2]

- **Institutional arrangements:** Government bodies must co-ordinate and regulate ICT-related activities. The DIT was established to promote ICT in the country, while the Bhutan Telecom Authority has responsibility for telecommunication services. The policy planning division of the ministry provides policy guidance and directions.

- **Human resources and training:** The Royal Government of Bhutan wishes to facilitate electronic communications for all citizens, and it recognises that trained people are needed to do that. The policy states that all the communication would be done electronically, and to provide e-governance services to the people, information management and content development is required. The plan therefore calls for capacity-building with a priority for employees, high school dropouts and unemployed youth. The ICT training centres and schools are the main providers for this type of training. The Royal Institute of Management (RIM) and Sherubtse College have been producing ICT graduates, but the number is still not sufficient to meet the public and the private demands.

- **Regulations, guidelines and legislation:** It is important to institute a system of e-government and to enact legislation to enable the necessary changes to the way the government operates.

- **Public access and awareness:** Public access points should be established throughout the country, accompanied by a promotional and awareness programme to inform the public about the benefits of ICT.

- **Private sector development:** The government should encourage the establishment of ICT companies, computerisation of private businesses, export of ICT services and the development of e-commerce.

Current level of ICT access and use

ICT access and use is still very limited in Bhutan. Both radio and television are limited to the capital and its surroundings. Teledensity figures show Internet access at a mere 7.4 per 1,000 in 2000,[3] showing that there is much to be done. Despite the aim of DrukNet (Bhutan's major ISP) to provide access to all of Bhutan's Internet users with the hope that more schools, businesses and government offices go online, access has been limited by the high cost of Internet usage. Consequently, the use of the Internet in the school system is negligible. Clearly, the primary challenge for ICT use in education is to create an enabling environment.

Major initiatives

Providing access and capacity-building among potential producers and users of content are the two areas in which initiatives and interventions in ICT can be categorised.

Building a Networked Nation

- **E-mail and e-post:** A project supported by the Universal Postal Union, International Telecommunications Union and Bhutan Post and Telecom is intended to bring e-mail and e-post services to post offices. The project envisages the establishment of simple kiosks in 38 postal outlets with about half of them in remote and isolated areas. Each household or individual will be issued a unique e-post address that will enable them to walk in to any of the 38 post offices to send and receive mail. Since printing of messages is done at the local post office near the point of delivery, e-post messages can be delivered quickly. Bhutan Telecom will provide the communication access from local exchanges.[4]

- **PAN Bhutan:** The main objective of this project is to build a national intranet infrastructure and provide international e-mail access. Both intranet and international e-mail will be provided as public services alongside the existing telephone services provided by the Division of Telecommunications. The project will develop a national intranet comprising a central server and gateway point in Thimphu with local points of access in initially two other locations in the country. Intranet services at the domestic level will include e-mail, computer conferencing and document-handling based on the World Wide Web technology. The international e-mail gateway will be accessible to users of the national intranet service. The project will build training capacities within the Division of Telecommunications on networking technologies to manage and expand the network. It will also build training capacities within the Royal Institute of Management to provide training in intranet and e-mail services to the wider community including government, research and business. It will provide direct assistance to certain research and development institutions to become connected with the network, and will establish a content-development function to serve the needs of those institutions in line with the Pan Asian Networking (PAN) Program of IDRC.[5]

- **Multipurpose Community Telecentre (MCT) at Jakar:** Bhutan Telecom established a telecentre at Jakar in central Bhutan with ITU and United Nations Development Programme (UNDP) assistance in 1998 as a pilot project. The telecentre has been particularly successful in providing basic information technology training to over 450 people. The second phase of operations envisages the support of UNESCO in converting the Jakar telecentre into a community multimedia centre where Internet access is coupled and integrated with broadcasting programme production to maximise the information services accessible to the local community. The media production centre will take advantage of telecommunication facilities available at the MCT to deliver locally produced content for daily radio and television broadcast offered by the Bhutan Broadcasting Service (BBS). Combining the media production centre and the MCT would enable BBS to offer more participatory programmes, besides using content based on the regular field visits conducted in central Bhutan. The media production centre is expected to eventually introduce local broadcasts through its own transmitter. Such broadcasts would include regular radio-browsing programmes to promote rural access to the Internet through the Jakar MCT.

- **Radio-browsing programmes:** Bhutan is served by the state-sponsored Bhutan Broadcasting System (BBS). Its main objective is to inform, educate and entertain the public. With low literacy and a small percentage of electrical grid coverage, radio is a very popular medium. Internet was introduced to Bhutan in 1999 but it has been restricted to urban areas. In 2000 UNESCO sparked the idea of radio-browsing programmes to provide information from the Internet to the disadvantaged and illiterate people and to increase awareness of new ICTs.

Building Capacities and Competencies

Several initiatives have been undertaken, with support from various donors, to increase the pool of people in Bhutan who have the requisite skills to bring the government's plan to reality. The following are examples of these initiatives:

- **UNITeS programme:** The United Nations Information Technology Service (UNITeS), in collaboration with the UN volunteer service, has been providing support for the integration of ICT within government, part of which involves the provision of information to the public. The volunteers are part of the UNITeS team and work in the context of an overall project sponsored by the Government of Japan, focused on institutional strengthening and training. In addition to the work they do in implementing systems, they also train master trainers who train others in ICT-related skills and knowledge.[6]

- **Building capacities in intranet and Internet technologies:** The long-term objective of this project is to capture the potential of modern ICTs for sustainable development and poverty alleviation by building capacities in information management and outreach capabilities in government, academic research and non-government organizations in Bhutan. The short-term objectives are to build the capacity of the Royal Institute of Management (RIM), Bhutan, to enable it to provide short courses in intranet and Internet technologies, train up to 10

trainers from RIM and elsewhere who will in turn train others and to create a modern computer laboratory at RIM that will serve as a resource centre and facility for training others.[7]

- **Training at schools and tertiary levels:** Given the severe lack of properly trained ICT specialists in Bhutan, the Division of Information Technology (DIT) has developed guidelines for ICT training institutes and ICT training courses at school and tertiary levels. These guidelines help the development of ICT specialists in the country by ensuring high and consistent training standards. Institutes have to fulfill minimum requirements to ensure quality instruction. Moreover, a number of standard courses are being developed to provide clients with the appropriate knowledge for their needs. These standard courses also make it easier for employers to gauge the knowledge of their (potential) employees.[8]

Constraints in the use of ICT

Shortage of ICT personnel is a big issue in the Royal Government departments. There are volunteers and consultants who are helping through different training activities. However, the local technical capacity needs to be built for establishing networks of MIS systems for e-governance issues.

Besides the lack of trained people, there are the predictable constraints faced by most developing countries. These include lack of adequate infrastructure, cost of accessing the infrastructure that is in place, lack of content, particularly in the local language and, perhaps most significantly, lack of capital to invest in the development of ICT.

Analysis

Given that both policy and political will seem to be in place, support for ICT initiatives in Bhutan could include capacity-building initiatives that would demonstrate and support the development of ICT professionals and computer literate employees. In the short term, capacity-building must take place for officials involved in governance and policy implementation processes. In the longer term, ICT needs to be included in the regular school curriculum with a parallel emphasis on teacher training initiatives. What appears to be essential for education is that ICT initiatives focus both on infrastructure development such as satellite and wireless technologies in order to make connectivity possible and on the development of content that is appropriate for Bhutanese learners.

NOTES

1 See *www.dit.gov.bt.*
2 See *www.undp.org.bt.*
3 From UNDP Human Development Report, 2003.
4 See *www.upu.int/coop_tech/bhutan_bridging_the_digital_divide.pdf.*
5 See *www.idrc.ca/pan/pr03398_e.htm.*
6 See *www.unites.org/html/projects/bhutan.htm.*
7 See *www.apdip.net/projects/cisco.asp.*
8 See *www.dit.gov.bt/training/index.htm*. This site lists the government and private ICT institutes in Bhutan and provides information on ICT workshops and training conducted by DIT.

India

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph.D
Ms Vineeta Sinha

National policies, strategies and programmes

India is a country of grand contradictions. While it is a global leader in the knowledge economy, it is also home to more than half the world's poor and illiterate people, most of whom are women. Urban India has problems of excess, while in the rural areas there is deprivation. The challenge that the country faces is to arrive at a policy that maintains its global position while also providing opportunities for access and services to the rural hinterland.

The confusing but rich picture of the Indian education system becomes clear when it is recognised that in the Indian federal system of governance, education is a subject addressed by both the central and state or provincial governments. The result is that there are both central government departments and state and district authorities, all working in tandem or independent of each other. There are also private sector educational initiatives in India.

India actively promotes the use of information and communication technologies (ICTs) in education in the formal education sector today, as it has in the non-formal sector for more than 40 years. From the use of radio to spearhead the green revolution, to satellite-based, one-way and interactive television for rural development in some of the most backward districts,[1] to today's thrust for the use of open and distance learning models to serve the larger populations, India has tried it all, with varying degrees of success. In fact, since the early 1950s, Indian policy documents have identified the need to use all media for promoting development and, implicitly, for education. The subsequent policy and plan documents on education, prepared from time to time, have chalked out a role for technology applications, especially in the non-formal education sector.[2]

Today, the country's decision-makers, at both the central and state levels, have chosen to explore the use of newer computer and Internet based ICTs for education, along with broadcast ICTs, and have been promoting the use of open and distance learning for both the formal and non-formal education sectors. The launch of a dedicated broadcast education satellite, EDUSAT, is scheduled for early 2004, with capacity for specialised educational channels and up to 5000 FM community broadcasting stations for use by educational institutions. This infrastructure will be available to all sectors of education, but primarily to publicly funded and implementing agencies that will be responsible for transmission and programming for their defined audiences. For instance, a state government will be able to use the channel capacity for governance, an open school for transmission of its own programmes, agricultural agencies for agricultural extension, etc.

As a result of a policy announcement made by the Prime Minister of India in the First National Conference of Information Technology Ministers, the Task Force on Human Resource Development in Information Technology was set up under the aegis of the Ministry for Human Resource Development. Through a process of consultation among different stakeholders and institutions, the task force report set out major recommendations to develop the core competencies and expertise of the country and to develop innovative technologies. This represents the master plan that India has in place for the use of ICTs in education, human resource development and in the capacity-building of institutions.

The task force made a number of recommendations designed to create a sustainable competitive advantage in order to maintain India's global leadership position in knowledge-led businesses.[3] A re-engineering of the technical education and training system of the country, with a focus on ICT education, was proposed under the umbrella of a National Program for Human Resource Development in IT (NP-HRDI*)*. Actions emerging from the policy include creating public awareness; documenting best practices through a clearinghouse; identifying and developing institutions of excellence; promoting technology-mediated learning; supporting capacity-building initiatives for faculty, curriculum and content development, research; and promoting private-public partnerships.

The interventions proposed focus on the most cost-effective options with short gestation periods and with an emphasis on critical infrastructure such as computer and networking facilities, faculty training, curriculum and courseware development, promotion of innovations and initiatives throughout the educational system by an open exchange of ideas and a system of recognition through awards and rewards for innovative practices among educators.

It is very difficult to accurately determine the government's funding allocations and expenditures for ICTs, since the money comes from both the overall educational allocation of 4.1 per cent of the GDP[4] in the national budget and from ministries dealing with different subjects. For instance, the investment for technology may come from the budget of the Indian Space Research Organization, allocations for the agricultural channel are likely to come from the Agriculture Ministry's budget and funding for content for the broadcast channels will come from the Ministry for Human Resource Development.

Overall, India's policy and strategies have been to build a self-reliant indigenous capacity. There has been a strategic shift from being a country seeking external assistance in its initiatives to one that is driven internally while still competing in the global marketplace and providing assistance to other countries.

Current level of ICT access and use

There has been a dramatic shift from the 1980s to the present day in terms of access to technology by the population in general. Deregulation of the airwaves and the telecommunication industry has spurred the revolution in basic telephony and Internet services. Technologies like Wireless in Local Loop (WLL) and Very Small Aperture Terminal (VSATs) are being used for Internet and intranet purposes. Data on teledensity reported in the UNDP Human Development Report, 2003[5] can no longer be considered accurate. The current annual rate of growth in the telephone sector is at 48 per cent for mobile telephony.[6] Radio has a

penetration of 100 per cent in the country while satellite and terrestrial television cover nearly 80 per cent of the country.[7]

Theoretically, availability of ICTs is widespread in large parts of the country, with pockets of saturation. In other areas, availability is lower due to terrain or extreme deprivation. With the availability of cyber cafes, people can get access to government documents (such as birth and death certificates, land registration and government schemes) for only INR 15 (US$ 0.3) each. Farmers can get daily updates on market prices of locally produced food grains and vegetable crops from around the district for INR 5 (US$ 0.1).

However, access to ICTs is still limited because of physical infrastructure constraints such as lack of electricity, poor maintenance of telephone lines and distance from the kiosk or cyber cafe; economic constraints such as extreme poverty; educational limitations such as illiteracy and the lack of relevant content in the local language; and social constraints of gender, class, community and caste. Data are not readily available to indicate the extent to which social constraints limit access to technology.

India has extensive experience in the use of broadcast technologies for both formal and non-formal education. This includes using radio and television for agriculture and rural development, for non-formal education and out-of-school children, and school telecasts from 1983 onwards in national and regional languages. Satellite-based teleconferencing (one-way video, two-way audio) for formal and non-formal education has been operational since 1992 at a national and regional level.

These efforts have culminated in the launch of Gyan Darshan,[9] a dedicated satellite-to-cable educational television channel, and Gyan Vani,[5] a dedicated educational radio project. The launch of EDUSAT will add a 70-channel capacity for use by all state governments and publicly funded educational institutions.

Although deregulation of the airwaves has taken place in the country, the Indian government retains its role as the major player in the use of broadcast technologies for education, holding control over allotment of frequencies. Thus, community radio is nascent and has not had any effect beyond a few localised interventions. Private sector broadcasting has not ventured into education.

Application and models of ICT use

There are many projects across the country that address the digital divide and gender issues. Other projects cater to the poor and try to reach the unreached. There are examples of audio-video conferencing and the use of multimedia instructional materials as well as examples of e-learning, e-governance and e-services. The projects also cover the country's geographical spread. There are a variety of applications, from an intranet e-governance portal to an online teacher's forum where teachers are able to plan their classroom sessions and share and learn through each other's experiences.[10]

Two aspects of these projects stand out, particularly in terms of assessing effectiveness. First, there is little or no data on the extent of use that enables any effective analysis of the situation on the ground. Second, there is the question of the extent to which such projects, which are often "one-off," are sustainable in the long term after donor funding is over.

The various projects and initiatives tend to cluster into two categories insofar as their use of ICT is concerned: broadcast technologies and digital technologies. Given the range of applications in India, it is impossible to discuss any of them in detail, but the examples provided in Tables 1 and 2 provide an overview of the kinds of activities that are underway.

Broadcast Technologies

Except in a very few instances, broadcast technologies are owned and operated either by the government directly or by publicly funded institutions established for the purpose. Table 1 provides some illustrations of the various ways the broadcast technologies are being applied across all sectors of education covered by this report. Note the importance of these technologies in the non-formal education sector.

Digital Technologies

Table 2 shows that some of the initiatives using digital technologies are spread across the country and not restricted to any one region:

- The Government of India's efforts in providing multipurpose community information centres in the northeast of the country has parallels to a similar joint effort by the Uttaranchal state government in co-operation with the Indian Institute of Technology. The Gyandoot Project is a district-level effort, which seeks to provide intranet services in one backward district, Dhar, of Madhya Pradesh.

- Madhya Pradesh is also home to the Headstart Programme, which provides computers along with multimedia learning kits for students and teachers in rural community schools that are set up under the Education Guarantee Scheme. The Government of Goa is also involved in an initiative to provide Goa schools with computers for use by students.

- Public-NGO (non-governmental organization) partnerships include the COLLIT, India project, a partnership of an international agency, the state

resource centres in Indore and Jaipur and an NGO in Tamil Nadu engaged in applying ICTs for livelihood.

- The Government of Andhra Pradesh is actively engaged in a partnership with Tataliteracy.com, a portal designed to provide literacy in some of the poorest districts of the state. Similar initiatives with MediaLab Asia, on the outskirts of Delhi, and in the interior of Tamil Nadu (Baatchit, Infothela, and Sari projects), seek to provide access and content to rural populations.

- Project Vidya, a partnership between the government of India and Intel, seeks to improve the quality of educational input in selected government schools throughout the country by providing both ICT access and training to students and teachers.

Table 1: Broadcast technologies in India

Project	Project Partners	Outcomes	Remarks	Contacts
Countrywide classroom	University Grants Commission (UGC), Consortium for Educational Communication (CEC) and 17 universities where media centres are located	10,000+ programmes produced and telecast on National Television from 1984 to date	A programme of UGC-CEC, which is involved in the educational programmes for telecast on Doordarshan, India' s national TV channel	*www.consortiumeducomm.org/Index.htm*
School Television in India	Central Institute of Educational Technology & 6 state Institutes of Educational Technology	Programmes produced and telecast on National Television from 1984 to date	General non-formal and curriculum-based programming for school children and school teachers	*www.ciet.nic.in/*
Gyan Darshan	Ministry of Human Resource Development, Information & Broadcasting, the Prasar Bharti and Indira Gandhi National Open University (IGNOU)	Also broadcasts the programmes of National Open School and Central Institute for Education Technology, National Council for Educational Research and Training	IGNOU had the nodal responsibility for transmission; today the programme runs 24 hours	*www.ignou.ac.in*
Gyan Vani		Reaching the backward rural communities by radio	Mixed content of programme, both non - formal and distance education curriculum-based programming and counselling	*www.ignou.ac.in*
Namma Dhwani (Voices)	Boodikote community in Kolar district, UNESCO	Brings the voices of the marginalised from the periphery of information and awareness and gives them the opportunity to make informed choices and decisions	Unique partnership because of the skill sets of each of the organisations; content is largely non-formal education and development oriented	*www.voicesforall.org/communityradio/namma_dhwani.htm*
Gujarat Community Radio	Kutch Mahila Vikas Sangathan, Bhuj and Drishti Media Collective, Ahmedabad	Non-formal education and social issues, especially those concerning women		*www.vub.ac.be/apps/board/koccc/messages/181.html*
Jhabua Development Communicati-on Program	Space Application Center (ISRO), Government of Madhya Pradesh	Five years of narrowcasting for NFE and capacity-building of district functionaries engaged in rural development through teleconferencing	Content consists of literacy, health, non-formal education, watershed management	*www.mcbsintl.com/booklet/drs/jdcp1.html*

- NGO initiatives include the TARAHaat, a project of Development Alternatives. Private foundations like the Azim Premji Foundation are undertaking similar efforts in Karnataka.

- Among the most successful of private industry initiatives is the Hole in the Wall project of the NIIT. This is an attempt to explore access to and use of Internet-based technologies in urban slums. The project, started in Delhi, has been scaled up to cover several locations in the country.

Despite all the activity, there are parts of India that are not participating in these initiatives. Orissa and Bihar, both backward states, and the interior of Maharashtra still lag behind. As well, Kashmir still has serious problems of access to telecommunications and its consequent benefits.

Table 2: Digital ICT applications in India

Project partners	Objectives	Outcomes
IIT-Roorkee	remarks:Project has just kicked off; for more information contact project through e-mail ID	
UNDP and IIT-Roorkee: *picaa@iitr.ernet.in*	E-services	Establishment of 1,000 Suchna Kutirs for information access.
COLLIT	remarks: Project ended in December 2002 but the partners are sustaining the project through their own efforts	
COL (Commonwealth of learning): *www.col.org,* and CEMCA (Commonwealth Educational Media Centre for Asia): *www.cemca.org*; implementing partner agencies in India were M.S. Swaminathan Research Foundation, and state resource centres of Rajasthan and Madya Pradesh	Literacy project integrating ICTs	Enhanced knowledge of appropriate and sustainable use of ICT in literacy education; a cadre of tutors who are knowledgeable in terms of using ICT in literacy education
TARAHaat	remarks:http://tarahaat.com/tara/home	
	Literacy through ICTs; quality education at affordable prices right at the learner' s doorstep; TARAHaat learners range from 8-35 years of age, school and college students, unemployed youth, professionals, women	ICT-enabled education has helped tremendously in learning, creating and maintaining interest
National Informatics Center-CLC	remarks: The programme is reaching the unreached; ICTs are becoming part of the daily lives in the northeast	
Department of Information Technology _ Ministry of Communications and Information Technology and state governments of northeastern states: *www.cic.nic.in; cic@cic.nic.in*	E-governance, e-services, e-learning, e-medicine, e-consulting, e-employment	ICT awareness, training, cadre-building, human capacity-building
Operation Headstart	remarks:The training of teachers under the Janshala programme – a joint UN-GOI programme that includes imparting quality teacher training through Headstart, including computer-based interactive training and development of TLM	
A joint UN-Government of India collaboration: www.*education.nic.in/ htmlweb/janshala/madhyapradesh.pdf*	Enhancing empowerment through computer literacy	The programme also aims to develop computer-enabled (CD-based) self-learning approach in a peer situation
Tata Literacy	remarks:The curriculum has been taken from the National Literacy Mission' s primers to develop the Computer-Based Functional Literacy programme (CBFL)	
Tata Group and Tata Consultancy Services, state government. of Andhra Pradesh, Maharashtra, UP and Madhya Pradesh: *http://tataliteracy.com/ contactus.htm; webmaster@tataliteracy.com*	Functional literacy	Literacy to be achieved in 40 hours

Project partners	Objectives	Outcomes
Sustainable Access in Rural India	remarks:Develops business models for economic upgrading of the communities.	
IIT-Madras, Massachusetts Institute of Technology (MIT) Media Lab Asia, Berkman Center for Internet and Society, Harvard University Law School, and the I-Gyan Foundation: *http://edevelopment.media.mit.edu/SARI/mainsari.html*	E-services for agriculture, education, micro-finance, health, market conditions	Telekiosks have been set up in rural areas of Tamil Nadu-for empowering the communities
Gyandoot Project	remarks:Online public grievances redressed in a unique system through soochnalayas	
National Informatics Center, Ministry of Communications and Information Technology and state government of Madhya Pradesh: *http://gyandoot.nic.in; gyandoot@rediffmail.com*	E-services, e-governance through establishment of soochanalayas.	Providing access to information such as land records, registration, mandi prices
Baatchit	remarks:E-governance is done through the Panchayats, the local level administration	
JIVA Institute, Media Lab Asia *www.jiva.org/outreach/baatchit/index.htm; www.jiva.org; www.jiva.org/baatchit*	E-services for information access, communication	Baatchit software has been developed and is being used for e-conversation, to address community needs, education purposes
Leveraging ICT through Market Centre for tribal communities	remarks:The Sawalmedha village of Betul District in Madhya Pradesh has a weekly market where 40 villages assemble to market their produce; reaching out to 10,000 people as the centre is operational during the market days	
Pan Asia Networking ICT R&D Grants Program-4D initiatives: *www.panasia.org.sg/grants/awards/0201a5.htm*	E-services for information access	Access to medical, education agri-forest produce markets
Infothela Mobile Centers	remarks:The pedal of the mobile unit generates energy to charge the battery; has facilities for diagnosing blood pressure and blood sugar levels	
Media Lab Asia, IIT Kanpur, UP: *www.iitk.ac.in/MLAsia/infothela.htm*	E-services through mobile unit-Internet, Telephony, weather conditions, education, health services	Mobile PCO with basic health services
Same language subtitling on TV for mass literacy	remarks:The replication of such projects can have enormous benefits	
Center for Educational Innovation, Indian Institute of Management in Ahmedabad, Indian Space Research Organisation, World Bank: *http://web.wprldbank.org/*	Increasing literacy levels through use of television through subtitling of programmes that are telecast.	The programme also caters to the deaf and hard-of-hearing people by making them exposed to print-literacy.
Karnataka CLC in Schools Initiative	remarks:Projects have been replicated to improve the retention rates and completion of primary education	
Azim Premji Foundation, Government of Karnataka:*www.azimpremjifoundation.org/index.htm*	To demonstrate that technology initiatives, such as the use of software to reinforce certain aspects of mathematics, geography, environmental sciences and Kannada, have a positive impact on the interest levels of children and increase their learning achievement levels	The project has been able to increase the retention of the children in schools; motivation levels have increased; community learning centres have been established
Project Shiksha-Computer Literacy	remarks:Quality of life of these children have improved	
Microsoft and State Education department: *www.vjti..edu/shiksha.htm*	Aims to accelerate computer literacy by providing an end-to-end solution, which includes software, comprehensive training for teachers and students, ICT curriculum development, and scholarships for teachers and students	Over 80,000 teachers and 3.5 million students in government schools have an opportunity to strengthen their ICT proficiency over the next five years

Project partners	Objectives	Outcomes
Goa Computers in Schools Project (GCSP)	remarks:	
Goa Government: *www.goasudharop.org/gcsp*	To improve the levels of computer literacy and computer access to students in Goa, while training teachers to use them to teach effectively	Helps all secondary schools obtain a lab of at least eight Internet-ready computers with the help of the government, industry and the community, relying on teamwork and networking among volunteers.
Project Vidya	remarks:Internet is having a profound impact on education worldwide; the project had three partners: Intel, Jiva and ERNET taking up this effort	
Ministry of Human Resource Development, GOI, and Intel Corporation: *www.ipan.com/press/97feb/1802in.htm*	To catalyse the use of leading edge computer technology in schools as a tool for education	Teachers and students in selected schools trained at specially developed cyber schools

Training

Training has been an important element of Indian efforts in deploying technologies for education. Implementation of all projects has involved training of trainers, producers of content, field level facilitators, etc. Generally, training has been provided either in-house or by other publicly funded training institutions, such as All India Radio and the Film and Television Institute of India; the Central Institute for Education Technology and the Development and Educational Communication Unit of the Indian Space Organization. Experts come from within the country, and training takes place on location.

A large percentage of the training is skill-oriented, helping existing staff to upgrade and acquire skills needed for the task at hand. Where large numbers of people have to be trained, such as in the District Primary Education Project, or in-service training of agricultural extension workers, teleconferencing (one-way video, two-way audio) is the preferred mode of delivery.

Broadcast technologies have been used extensively for teacher training. A massive effort in training primary school teachers through teleconferencing has been underway in the District Primary Education Project for more than five years, and agricultural extension workers and government officers have also been trained through teleconferencing. There have also been examples of teacher training and NGO staff capacity-building throughout the country through different ICT pilot projects.[11]

The capacity-building efforts have also percolated down to the grassroots through these catalysts. Training in the use and applications of ICT has been the major contribution from all the projects, as sustainability of donor-funded projects after the project life is seen as dependent upon the capacity-building of institutions and individuals involved.

Constraints on the use of ICTs

A variety of constraints dog India's efforts to deploy technology for education. Policy exists, as does government commitment. However, such policy and commitment is often lost on the road to implementation. Educational projects, set up by conventional governments as part of a broad educational agenda, tend to reflect the conventionalism of existing institutions with their hierarchical and bureaucratic systems of administration when the need is for creative and innovative management.

Access and availability of technology also becomes patchy since a piecemeal rather than a co-ordinated effort by different implementing agencies is followed. Lack of stable electric power, non-existent or unreliable telecommunication lines and a mismatch between funding allocation and actual needs all add to the problems. Sustainability is also a major obstacle, with many initiatives failing because donors have not anticipated the cost of maintenance and upgrading of technology and services.

Central models of management and development that are linguistically and culturally relevant to local communities are next to impossible when projects are being implemented nationally or from state capitals in ways that fail to take local needs into consideration. The result is a constant tussle between local requirements and the need to develop local materials with the economies of scale that are possible through more centralised models.

A very large number of local and regional initiatives have failed to increase the knowledge base regarding what works and what doesn't. There is not enough documentation and sharing of knowledge of interventions of ICT in education. Replication and up-scaling of efforts becomes difficult in the absence of such information. Institutional collaboration is also noticeable by its paucity. Thus, it is possible to have efforts in

the same region working independently and unwilling to collaborate or pool efforts for greater effectiveness.

Economies of scale make India an ideal location for large-scale experimentation. But given its size and cultural and linguistic diversity, solutions need to be specific to location, problem and time. The politics of monopoly and central control do not favour decentralisation and provide the autonomy needed by implementing agencies.

However, there are various dimensions to these issues. First, it is impossible in a country like India to address these challenges through centralised planning and decision-making. Second, central control makes for a cumbersome and slow process of hardware and software acquisition and production and response to problems and issues. Third, a decentralised educational system with multiple players cannot expect to continue to operate with a central monopoly over the control and operation of the delivery of education. Fourth, there is increasing evidence of local efforts succeeding, where nationwide efforts have failed, for the simple reason that local efforts have addressed local needs, local culture and local language. Initiatives such as GyanDoot and the Jhabua Development Communication Project are just two examples of local efforts succeeding. Finally, many local efforts cannot be up-scaled, for the simple reason they address local problems and succeed because they are local.

Analysis

There is a great potential to learn from India's experiments with the application of ICTs in education. There are few countries that can match India as a test bed for determining what works and what doesn't. The country has all the situations and conditions of developing countries.

The Indian government has, as a policy, decided to discourage international donor assistance, especially that of a bilateral nature, and to support development and education-related projects within the country. But there is room for supporting Indian efforts.

As a first step, there is a critical need to document Indian efforts for the benefit of its own decision-makers, institutions, NGOs and civil society. It is necessary to know what works and what does not, and what the implications are for policy-making, planning and implementation. A second step would be to inform the capacity-building and training provided to staff in Indian institutions. Specifically, it needs to be understood that any new technology comes not merely with hardware and software, but with a learning and teaching style and grammar of its own, and that management practices need to be adapted in order to use the technologies effectively. As an example, the use of ICTs in education calls for a fundamental shift in the way content is designed and delivered, as well as for teamwork and collaborative practices. New technologies cannot be imposed without enabling teachers and learners to understand these fundamental shifts. Ongoing training is necessary for the trainers in institutions and organizations who are engaged in the design of curriculum, teaching materials and delivery of ICT-enabled education. At the same time, middle-level managers, both in the public service and the NGO sector, need to understand the pedagogy of learning through ICT and the management models that are required.

India has the policy and technology to implement both small and large ICT interventions in education. What is missing and what fails is in the translation of policy and technology into good practice.

NOTES

1 Indian Space Research Organization. Jhabu Development Communications Project, ongoing. Ahmedabad: Space Application Center.
2 Government of India, "National Policy on Education 1986 with Modifications Undertaken in 1992," (New Delhi: GOI Press, 1992).
3 See: *www.education.nic.in*; *www.gipi.org.in/state_policy/action_plan_3.pdf*; and *www.mit.gov.in*.
4 From "UNDP Human Development Report, 2003," *www.undp.org/hdr/2003/indicators*.
5 Telephones at 38 per 1,000 and Internet usage at 6.8 per thousand do not reflect user patterns; where usage at a public kiosk or cyber cafe may be much higher as the mobile phone and WLL industry is growing at the rate of 48 per annum. See *www.indiachina.org/sectoral_info/pdf/report-telecom-cii.pdf*.
6 See *www.indiachina.org/sectoral_info/pdf/report-telecom-cii.pdf*.
7 See *www.indiantelevision.com*.
8 See *www.ignou.ac.in/gyan_sch.htm*.
9 See *www.ignou.ac.in/gyan_sch.htm*.
10 See, for instance, *www.vidyonline.net*, a portal designed to provide online support to teachers in India.
11 See *www.ignou.ac.in* and *www.depdpep.org*.

Maldives

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph.D
Ms Vineeta Sinha

INTRODUCTION

Southwest of the Indian subcontinent, the Republic of Maldives is one of the most attenuated countries in the world, with 1,196 islands in 26 distinct coral atolls spread over a total area of 90,000 square kilometres. Less than 0.5 per cent of this area is land, and some 200 of the islands are inhabited.

Until the arrival of tourism, fishing was the main occupation in this nation of seafarers, and the relaxed pace of life seems to have carried over into the 21st century. The graceful sailing dhoni (local boats) of old may have given way to motorised versions, but fishing with pole and line is still a common site throughout the islands.

The Republic of Maldives is today making rapid progress in national development. There is no doubt that significant gains have been secured in various fields, the result of giving priority to social development, education and health services. As an indicator, life expectancy has increased from 46 to 71, and functional literacy has increased to nearly 100 per cent. Yet the country faces many challenges unique to small island states with dispersed populations.

National policies, strategies and programmes

The Government of Maldives appreciates the potential benefits of information and communication technology (ICT) to a rapidly growing country. Hence the Ministry of Communication, Science and Technology (MCTS) has been mandated with issues such as ICT policy formulation, ICT management, strategic ICT planning, formulating ICT standards and improving public sector service delivery through ICT.

Accordingly, the ministry has developed a Science and Technology Master Plan[1] which gives priority to issues such as formulating a national ICT policy along with strategies and an action plan for the Government Network of Maldives (GNM) to connect all the public sector organizations in the capital Male', form a National Computer Center as a support structure for GNM, oversee the implementation of ICT policy, define ICT standards and establish community-owned telecentres.

The National Computer Center (NCC)[2] is to play a central role as it is expected to work with government agencies and the private sector to ensure that information technology policies, strategies and programmes are consistent with national development priorities and requirements. More specifically, the NCC is to:

- Promulgate policies, programmes and projects that will exploit ICT for economic and social development, especially in addressing the needs of the poor sectors of society;
- Carry out policy and technological reviews, studies, and research and development projects to accelerate the development of the local ICT and allied industries;
- Facilitate the development and implementation of a government information systems plan to accelerate the application of electronic governance;
- Develop and promulgate minimum standards and benchmarks for computerisation and other ICT-related activities in government;
- Review (and possibly approve) proposed information systems plans of national government agencies, government-owned and controlled corporations, and government financial institutions;
- Provide ICT advice and related services to other government agencies and institutions;
- Conduct periodic information systems surveys to foster integrated development, implementation and management of computer-based information systems and networks in government;
- Assist, as requested, government ministries and agencies concerned with the review and design of ICT education and training curricula; and
- Develop and implement a continuing national ICT promotion programme to improve public awareness and understanding of the national plan and vision.

Two NCC committees have been created: an Information Technology Advisory Committee to give guidance on policy issues relating to ICT and an Information Technology Standards Group to work on ICT standards.

Current level of ICT access and use

In Maldives, as elsewhere in the developing world, there is significant inequality in terms of access to ICT appliances and connectivity. But these island dwellers are particularly isolated because of the distances and sea between the many islands and atolls. Most islands are still economically dependent on the capital, Male' and islanders must travel by boat for many hours to get there. Currently, inhabitants physically travel to Male' to initiate transactions, which is an expensive undertaking. Further, as there is less travel between islands, local trade and small businesses have little information about the available resources, products, services and needs in other atolls and islands. Telephone calls between the islands are expensive. Internet connectivity is not readily available in the islands, and even in Male' Internet prices can reach up to US$ 3 an hour. Island dwellers have few avenues to advertise their small enterprises. The time schedule of transport can be problematic, as information about *dhoni* is often disseminated only by word of mouth. Information about other private sector services, education activities and events in the neighbouring islands and atolls is not readily available.

The availability of telephone lines is 121 per 1,000 inhabitants, reaching up to 293 per 1,000 in Male'. Waiting time for a line is nearly two years. Despite a fibre optic backbone, access to Internet remains at around 36 users

per thousand population. Patterns similar to other developing countries persist, with much of the usage concentrated in the capital city and at workplaces and institutions. While there are computers in schools provided for by the government, much of their use is restricted to limited office automation with very few schools providing computers for use by the students.

Integration of ICT use in education is stated in the policy, but there is very little that has been done. The country is in its infancy when it comes to ICT use and applications. The MCST, in co-operation with the Ministry of Education and UNESCO, has embarked on a programme to foster basic science concepts among the country's primary and secondary school children.[3] Under this programme, MCST has procured a wide range of science and technology programmes and materials designed and produced by professional organizations and institutions. The resource materials include video and audiotapes, interactive software and books. Priority will be given to atoll schools in the distribution of these resource materials.

Major initiatives

Digitally Empowered Development in the Island Communities of Maldives[4]

The purpose of this partnership project between MCST and the United Nations Development Programme (UNDP) is to empower island communities by sharing knowledge and information among islands through a community portal. It will provide information about products and services of the islands to a much wider audience by establishing a community portal and websites in the local language, Dhivehi, as well as English. The project will give national and international exposure to local businesses, enhance access to markets and create awareness of ICT to improve their social and economical life. The project is an add-on to the National ICT Policy Project.

Multipurpose Community Telecentre[5]

The multipurpose community telecentre (MCT) concept involves the creation of community telecentres where a variety of ICT services such as telephones, fax, voice mail, Internet (including e-mail), TV and radio for information and recreation can be provided. The ICT policy project will also formulate business models to ensure the sustainability of the telecentres and provide information packages. A more comprehensive content development initiative is to be carried out later on.

ICT Standards – Thaana[6]

Thaana has been included in Unicode 3 in close collaboration with MCST, NCHLR, Microsoft and the private sector. The result is that Windows XP is the first operating system to be released that supports Thaana.

E-governance – Information Technology Development Project[7]

The government views e-government as one of the initiatives to deliver a better quality of life to the people of the Maldives and to bring the services of the government closer to the people.

The Information Technology Development Project (ITDP) will establish a network that will connect government and parastatal agencies (including Vilingili and Hulhule islands) in Male' and 20 atolls. It will enable sharing of information electronically. Portals will be set up to enable public access to government information and services through the Internet. The project will also install Internet kiosks in Male' as well as on the atolls to provide public access to the government network and World Wide Web sites. Telecommunications sector reform, which will be implemented as part of the project, will lower the Internet tariff, making access more affordable.

Examples of training

The country has succeded in achieving near total literacy. There are primary schools up to seventh grade on all the inhabited islands, and primary education is both compulsory and universal. There are a few secondary schools of high quality, and existing secondary schools in the atolls have a boarding facility for students to come and learn.

To improve educational access and quality, the government is establishing learning hubs, called atoll education centres (AECs), in a phased manner. Three are being established immediately. These AECs, similar to multipurpose telelearning centres, will be fully equipped and connected through the use of ICTs.

Technology is seen as an essential support and supplement for improving the learning inputs for school education; however, teaching is likely to remain a face-to-face activity for some time to come. But improving the quality of teaching is a major priority and ways and means have to be found to provide professional development and capacity-building for the teachers, half of whom are currently untrained. It is here that ICTs are seen as being able to play a role in the educational process.

The UNDP Digitally Empowered Development in Island Communities project, described above, includes a substantial training component that is focused on the communities involved. It is recognised that such training is required if the people of the communities are to make use of the facilities and the technologies. However, there is no evidence of ICT training for staff in education per se.

Constraints on the use of ICT

Internet access is very expensive and access to telephones is not widespread. Few households have access to a telephone service even if they can afford it, and pay telephones are heavily used.

A means of easy transmission of written information could significantly streamline the operation of the atoll offices and provide more timely information to the various ministries. In some cases, such as with the collection of fines and fees, existing legislation requires that all information be kept in a physical account book.

Automation without procedural amendments to facilitate the use of information technology would serve only to increase the effective workload. The atoll offices are provided with personal computers, which are generally used for word processing, spreadsheets and, occasionally, graphics. The machines are used as standalone devices, however, as Internet access is prohibitively expensive.

No ministries have yet deployed applications that would enable the atoll offices to submit information online. In fact, current legislation often requires a written report, thus limiting the gains from the use of the technology. Better use of information technology, coupled with communication capability, would improve the abilities of the atoll health clinics to gather and report health information.

In education, one of the major constraints to the use of ICTs, once deployed, would be integration into the classroom. There is a distinct lack of awareness of the potential of either broadcast or computer-based technologies to assist the distant teacher in the school. Distribution of materials produced at the facility in the Educational Resources Centre of the Educational Development Centre of the ministry remains inadequate. At the same time, there is need to upgrade the skills and competencies of the teachers themselves, many of whom are matriculates and have come into teaching immediately after completion of their high school examinations. Tertiary education is limited, as are resources for education abroad. Thus, skills and knowledge upgrading among the teachers is limited.

Analysis

The needs are great in the Maldives in terms of policy, infrastructure development and institutional capacity-building. Inservice teacher training is critical, both in content and in the application of ICTs for education. The training of people to implement the e-governance projects is also critical.

Maldives is another example of a country with a national policy, but not enough resources to implement their policies and work plans. There is a need to work towards ICT penetration. The country requires intensive help in policy and master plan development, in strengthening infrastructure and connectivity and in teacher training and use of ICT in the classrooms. While the most common problems still relate to infrastructure and telecommunications development, further challenges include language difficulties (most ICT-related software and contents are in English), disparity in the accessibility of ICT between urban and rural areas, lack of motivation and technophobia among teachers, and a critical shortage of trained teachers.

NOTES

1 See *www.mcst.gov.mv/New/TTF%20project%20document.pdf.*
2 See *www.mcst.gov.mv/ITD/ncc.htm.*
3 See *www.mcst.gov.mv/New/resourcemat.htm.*
4 See *www.mv.undp.org/projects/propoor/internet.htm.*
5 See *www.mcst.gov.mv/ITD/mct.htm.*
6 See *www.mcst.gov.mv/ITD/itstandards.htm.*
7 See *www.mcst.gov.mv/ITD/egov.htm.*

Nepal

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph.D
Ms Vineeta Sinha

INTRODUCTION

Agriculture is the mainstay of Nepal, and this is evident east to west on the southern slopes of the Himalayan mountain range. Geographically, the country is landlocked, lying between the two Asian giants, China and India. The problems of poverty, deep gender divides, unemployment and underemployment are compounded by intermittent violence and strife by Maoist guerillas.

National policies, strategies and programmes

Nepal has recently accorded priority to the development of the information and communication technology (ICT) sector. Nepal's vision is to place this small Himalayan kingdom on the global map of information technology by 2005. With this vision in mind, a series of legislation has been enacted to regulate the ICT sector: the Telecommunications Act, 1997; Telecommunications Regulations, 1997; Communication Corporation Act, 1972; and the Intellectual Property Act.

The Information Technology Policy of Nepal, 2000, aims to build a knowledge-based society and establish knowledge-based industries. The plan is to make ICTs accessible to the general public and to provide employment in the ICT sector. The government has developed a strategy and action plan that includes private sector participation, infrastructure development, provision of technology to rural areas and the creation of an enabling environment for private sector investment in ICT-related service industries, such as e-commerce, e-education and e-health.

Current level of ICT access and use

Only 3.5 million out of 24 million Nepalese have access to electricity, and these people are mainly in urban areas. In the country as a whole there are three PCs per 1,000 people. There are16 Internet service providers (ISPs), 290 Internet hosts and 50,000 Internet and e-mail users.

The telecommunications infrastructure is good in urban areas, and because it has been installed recently, it is mostly digital. Though the use of ICTs in public administration and government is limited, its potential for driving development and economic growth has prompted the Ministry of Science and Technology to include strategies in its ICT policy of 2000 to further develop its use in the public sector.

Major initiatives

Although Nepal has lagged behind others in the use of computer-based ICTs, it is one of the countries in Asia where the concept and practice of community radio has been successfully tested and tried. Nepal's experience is quoted worldwide as an innovative and successful model, especially in countries with the similarities of a difficult terrain and a dispersed and isolated population.

Community Radio and Television[1]

Of the 22 independent radio stations operating in Nepal, four are community stations. One is in Kathmandu (Radio Sagarmatha) and the other three are in western Nepal (Radio Mananpokhara in Palpa district; Lumbini FM, close to the industrial and commercial town of Butwal; and Swargadwari FM in the town of Ghoral). Most of the commercial stations have a strong public service content in their programming.

While the community radio stations are largely self-financing, support is essential for specific programmes. The major block to continued growth of community radio is the lengthy licensing process. Currently, there are more than 25 licence applications waiting for approval before the government.

FM radio has increased the amount of "everyday life" information it broadcasts including information about special events, traffic reports in the city, weather forecasts, flight schedules, bus schedules, market prices for vegetables and fruits, air pollution readings, health tips and horoscopes. FM radio also provides live information on events such as elections, religious gatherings and national celebrations. It also interacts with government officials and politicians, which has added to the collective knowledge of urbanites regarding governance in Nepali society. Similarly, discussions with professional practitioners have helped to demystify specialist knowledge.

More and more radio programmes are becoming available on the Internet, and for those without access, radio hosts are bringing Internet content to listeners.

Radio Sagarmatha. Of the four community stations, Radio Sagarmatha is the most successful. An independent public community radio established in 1997 with a 100-watt transmitter in Nepal, it is the first of its kind in South Asia. It was initially financed through UNESCO grants, and is currently self-supporting but receiving donor assistance for specific projects.

Radio Sagarmatha started its FM broadcasting two hours daily to the Kathmandu Valley. The station's goal is to create awareness and involve the public in daily issues. The licence holder of the station is the Nepal Forum of Environmental Journalists (NEFEJ). A board of directors appointed by NEFEJ from its executive committee governs the station.

Radio Lumbini. Radio Lumbini, MS Nepal (Mellemfolkelight Samvirke, the Danish Association for International Cooperation) and the Danish International Cooperation Agency are collaborating to expand the radio station's programming. Under the agreement, Radio Lumbini will continue to cover local development and construction work, women's empowerment, ecology and good governance. MS Nepal will make available physical assistance, financial assistance and expertise for institutional

development and capacity enhancement. DANIDA (The Danish Development Agency) has provided a grant for establishing a second studio and to buy a new transmitter.

Radio Madanpokhara and Radio Swargadwari. Both of these stations are owned by villages or co-operative societies and have broadcasting committees to oversee their work. Start-up funding and donor support has been necessary for specific projects and activities. Advertising support has since taken care of the issue of sustainability and the stations are now doing well with expansion very likely in the future.

LI-BIRD Ko Chautari radio programme – Nepal. In October 2001, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) initiated a rural participatory radio programme that focused on biodiversity-related issues. The programme was meant to complement the government's agricultural radio programmes and form part of a wider package of efforts to increase local awareness about the importance of agro-biodiversity.

The programme used materials based on local knowledge and practices collected from farming communities. Technologies developed by the farming community and the research outputs of university and research stations were also used.

Digital Broadcast Initiative-Nepal.[2] Equal Access, an international non-governmental organization (NGO), is working in conjunction with the United Nations Development Programme (UNDP) on a comprehensive initiative to provide critical information on a range of development issues important to the people of Nepal. Out of this, the Digital Broadcast Initiative (DBI) was created. It is a broad partnership of several groups working with the continuing support of government through three project teams: Content Development, Outreach and Assessment. The teams work collaboratively on determining the information needs of underserved communities; writing and producing relevant and engaging audio and multimedia programmes to address these needs; broadcasting these programmes directly to communities via satellite and FM rebroadcast; integrating broadcast programming into existing outreach work being done by partner community organizations; collecting ongoing feedback and input directly from communities and including it in programming; and monitoring and assessing the overall impact and effectiveness of the initiative.

A wide range of programmes are broadcast, including a Nepali Language Service, a 136-episode serial drama addressing HIV/AIDS prevention, women's and girls' empowerment and related health and development issues, and "Chatting with My Best Friend," the first Nepali radio programme produced for young people involving issues such as sex, love, relationships, peer pressure and conflict with parents. Soon the Initiative plans to launch a new programme focusing on human rights, women's empowerment and sexual and reproductive health, as well as a programme designed to educate women of childbearing age about important issues in early childhood development.

The Initiative also involves capacity-building for local staff, including facilitator training, local radio digital production training and equipment training. The practical and inclusive approach of the project ensures that local needs are genuinely addressed, while Nepalese organizations and local staff are fully involved, creating a sense of local ownership.

Ratna (Srihagar) Cable Television.[3] Ratna Cable Television of Palpa is a local programming and broadcasting facility that arose from the efforts of Mahesh and Bouddha Shakya in their VCR and TV repair shop. The residents of Tansen, a town in the lower Himalayas, watch a two-hour long locally produced programme every Saturday. The service continues because of local volunteers. With some technical and financial support, this service could make a greater impact in promoting the flow of information in the community. Ratna Cable's experience could be replicated in other areas of the country.

ICT Interventions in Nepal

There are a few, but diverse, initiatives of the application of new ICTs in education. A brief description of some of the more innovative projects follow.

ICT Project 2000.[4] The objective of this project is to bridge the digital divide among the haves and the have-nots. It provides education on computer and Internet technology to students and youths wherever a dial-up Internet connection is available. Each participating school is given Internet access and one teacher from each school is provided training on software applications and computer hardware. The schools run free classes for students during school hours and for other community youths and interested people during non-school hours and on weekends. This project has enabled students and people in rural communities to benefit from Internet technology.

Nepal Internet Exchange.[5] This is a project of the Computer Association of Nepal. It is designed to address the problems associated with routing local computer traffic within Nepal. The exchange also provides a "looking glass" facility for researchers to ascertain the size of Internet infrastructure in Nepal.

Women Empowerment through ICT.[6] Having identified the root cause of social crime as poverty and lack of education, the group Advancing Girls and Women in Nepal (AGWN) initiated this project with the belief that by working with women as learners the family will ultimately benefit. In the first phase the goal was to achieve 10,000 computer literate women in Nepal. After one week of computer training, self-help groups were established to

enhance the women's learning with the hope they might design instructional materials or set up their own businesses.

Computer Association of Nepal.[7] Established by a diverse group of professionals and industries in the computer and information technology sector in December 1992, the main objective of the Computer Association of Nepal (CAN) has been to encourage and assist in the utilisation of computers and information technology by developing strategies to promote computer skills in the population.

Nangi Village School Project.[8] This project is a grassroots initiative by an individual educational pioneer, Mahabir Pun, to try to break the cycle of poverty in his mountain village of Nangi by taking it into the computer age. Having founded Himachal High School, he sees the Internet as the way to improve children's education.

To connect the village to the Internet, Pun installed two small hydro-generators in the stream near his village for a power supply to the school. Then he had computers donated from Australia, Singapore and Malaysia and used parts from the United States. From the parts, Pun assembled the first computer while the students and teachers assembled the remaining ones after his demonstration. At present there are 15 computers in the school for 300 students from six neighbouring villages.

The village got a telephone in 1998 with the intention of obtaining Internet access. However, it was found that the quality of the line was not good enough to carry the signal. Since then the villagers have been attempting to rectify the situation. In the interim the only option is to walk down for a full day to the nearest city where Internet service is available.

Training

While there have been some early initiatives of human capacity-building in ICTs in education, for NGOs around using ICTs for communication purposes and for the community radio's non-formal community education programmes, there has been little activity in training.

Constraints on the use of ICT

The fact that there is little demand for ICT in Nepal is not surprising considering the number of constraints existing in the country. These include the lack of infrastructure, high up-front costs, widespread illiteracy, language barriers, absence of local content, poverty and the lack of public awareness about the Internet and its use.

Other constraints, of lesser importance include inadequate human resource development and the brain drain of qualified specialists, lack of sufficient funds needed for the huge investment required to create a telecom infrastructure and inadequate numbers of computers in schools.

Analysis

Nepal's experience in community broadcasting, enhanced with the use of ICTs, could be leveraged so that convergent technologies could become the factors that are the critical input to telescope decades of change into a short span of time. Instead of proceeding with traditional ways of building line-of-sight and terrestrial systems, and high-cost media infrastructure, a combination of wireless and satellite-based telecommunications with low-cost Very Small Aperture Terminal (VSAT) apparatus for downlink of data and images could transform Nepal. However, all of this would need to be supported by a coherent and comprehensive policy, collaborative mechanisms between all stakeholders and local capacity-building by indigenous institutions.

NOTES

1 See *www.nepalmedia.org/radio/interview_bd_koirala.htm.*
2 See *www.equalaccess.org/programs/nepal/index.htm.*
3 See *www.nepalmedia.org/tv/community_tv.htm.*
4 See *www.interconnection.org/coppades Current_Projects.htm.*
5 See *www.can.org.np/.*
6 See *www.lbef.org/we.htm.*
7 See *www.can.org.np/.*

Sri Lanka

ICT USE IN EDUCATION

Ms Usha Vyasulu Reddi, Ph. D
Ms Vineeta Sinha

INTRODUCTION

The first country in South Asia to liberalise its economy, Sri Lanka stands out as an interesting example of a developing nation trying to incorporate information and communication technologies (ICTs) into an overall development and educational policy.

The country has faced formidable challenges. It has a powerful continental neighbour, India, and the society has been ravaged by civil war for nearly two decades. Despite these challenges, the country's literacy exceeds 90 per cent, and the gender divide is a non-issue, thanks to the country's consistent investment in health and education.

However, the war has retarded economic growth, resulting in high levels of poverty, unemployment, unrest, and crime. Thus, despite steady growth in educational indicators, problems of poverty, access and equity continue to dog this island nation. On the bright side, since the peace initiatives of 2002, there are definite signs of recovery and reconstruction in the island nation.

National policies, strategies and programmes

Policies, Strategies and Goals

In 1983, the first-ever Computer Policy for Sri Lanka (COMPOL) was formulated. The recommendations of the policy committee were accepted by the Government of Sri Lanka, and the Computer and Information Technology Council of Sri Lanka (CINTEC) was established by an Act of Parliament (Act No. 10 of 1984). The Act recognised policy recommendations and implementation as a major statutory function of CINTEC. The COMPOL recommendations, together with the recommendations made to the government by CINTEC from time to time, now form the current ICT policy.

In 1994, the Science and Technology Act was passed, and it became active in April 1998. This act repealed the CINTEC Act and replaced the Computer and Information Technology Council of Sri Lanka with the Council for Information Technology (although the well-known acronym, CINTEC, was retained). The 1994 Act provided for policy recommendations to be made by CINTEC to the government through the National Science and Technology Commission (NASTEC).

With the change of government in 1994, CINTEC began working on policy recommendations, and by 1996 it had completed most of the groundwork. It initiated a round table on ICT with the participation of all key agencies, which resulted in the formation of the National Working Group for the Exploitation of IT.

A draft of a national ICT policy was placed before the government for approval through NASTEC and the Ministry of Science and Technology.[1] The main objectives stated were to use ICTs for efficient administration and management, create a competitive advantage and attract a significant portion of the global software and ICT services market to Sri Lanka, provide information on the country to the world, and use ICT as a tool for the acquisition of information needed for the society.

In 2002, Sri Lanka went through yet another review and realignment of national policies related to ICT and telecommunications. The current policy envisions the growth of the country into a financial and service hub for the South Asian region with connectivity to the rest of the world. Colombo, under the vision, would become a multi-faceted service centre co-ordinating development at the provincial level.[2]

Key Action Plans

Key action plans include the development of physical infrastructure, deregulation of the telecommunication sector, mobilisation of private sector investment, introduction of measures to protect intellectual property, capacity-building and provision of e-governance services.

Current level of ICT access and use

Sri Lanka has near total literacy, and access to education for all Sri Lankans is free up to the secondary school level. Gender disparities are not an issue in this island country. However, teledensity in Sri Lanka is low, with about 44 telephones per 1,000 people in 2001 and Internet use estimated at eight per 1,000.[3] Judging by mushrooming computer vendors and training centres in Colombo and provincial capitals, computer usage seems to be spreading. Computers are used widely in the private sector for business applications with varying degrees of Internet connectivity and speed.

While a significant number of affluent upper- and middle-class families now own a computer, the cost remains prohibitive for most Sri Lankans. There is little access to computers in Sri Lankan schools and colleges and less in rural areas.

Internet access on a commercial basis became available for the first time in 1995. However, Internet use remains very low due to the high cost of computers, low bandwidth and low computer literacy. It is mainly the urban elite, businesses and private sector corporations who use the Internet. There is also an acute urban/rural disparity with respect to access to the Internet, and public Internet facilities are also limited.

Major initiatives

There are two dimensions to the use of ICTs in Sri Lanka: the extensive experience with community radio as a developmental tool and, more recently, the use of computer-based technologies and the integration of both kinds of applications in innovative ways.

Using Broadcast Technologies

Proactive government support and funds from international donor agencies enabled Sri Lanka to successfully experiment with community radio two decades ago. The

Mahaweli Community radio project from 1981 to 1989 served as the precursor for later applications of technologies coupled with participant communication techniques. Community radios were used as a means to mitigate the problems of relocation of local people into new areas of the country.[4]

Kothmale Community Radio Project.[5] The Kothmale Community Radio Project (KCR) was a UNESCO pilot programme put into place to assist people living in rural Sri Lanka to make the most of new communication technologies and to create avenues to reduce the digital divide at the national level.

The project combines radio and the Internet to address the problem of rural access to computers and connectivity. It was set up as a mini-ISP (Internet service provider) with leased line connection to the Internet. It uses a 300-watt transmitter for a listening area of a 20 kilometre radius that comprises 52 villages, two large towns and a total population of 230,000 people.

The broadcasters use the Internet in research and production and local people access the Internet from the facilities at KCR. Internet-browsing by a presenter on behalf of listeners, called radio-browsing, also uses a community database and hosted websites as additional sources of information. Resource people from the community (lawyers, doctors, etc.) interpret the information.

Initial training programmes were implemented with the assistance of foreign experts. Now local people have picked up the skills and pass them on to each other.

Computerised community radio operations in remote Sri Lanka. Riding the wave of the experience with the Kothmale Community Radio Project, the Government of Sri Lanka established Uva Community Radio in Badulla, one of the most underdeveloped districts in Sri Lanka, with support from UNESCO and the United Nations Development Programme (UNDP). The purpose of the community radio is to facilitate increased community participation in designing, implementing and evaluating an area-based growth and equity programme that has poverty reduction as a major focus.[6] As part of the project, rural broadcasters have been trained in using computer-aided programme production.

The Sri Lanka Environmental Television Project.[7] The Sri Lanka Environmental Television Project (SLETP) offers the country's television broadcasters and video users a broad range of factual programmes on subjects such as the environment, development, health, social justice and science. As the Sri Lanka Video Resource Centre affiliated with the International Television Trust for the Environment (TVE), SLETP has had access to some of the best factual programmes produced around the world.

SLETP was started in 1995 by TVE and the Open University of Sri Lanka as a non-profit service to use the audiovisual and electronic media to raise awareness on environmental and development issues. As a non-formal educational effort, all SLETP programmes are scientifically accurate, journalistically produced and use engaging, non-technical formats.

The project's strength has been in forming partnerships with television stations, universities, government agencies, training institutes and non-governmental organizations (NGOs). Television producers and programme managers turn to the SLETP for complete programmes as well as video footage that is not easily or commonly found elsewhere in Sri Lanka.

The Science and Environment Video Library provides non-broadcast users with access to nearly 500 video films that have come from TVE along with a multitude of other sources. The videos are regularly borrowed for screenings in schools and universities, community gatherings, public seminars, training programmes and for private viewing. For those interested in buying videos, SLETP sells high-quality tapes containing those programmes for which copyright and distribution rights have been cleared (usually SLETP's own productions and all TVE titles).

Using Computer and Internet-Based ICTs

Secondary Education Modernization Project.[8] The first initiative has come from the World Bank and the Asian Development Bank, which recently launched two separate plans to introduce computers to schools and teach computer skills to high school students. Together the plans will provide computer centres each with 10 to 20 computers for 2,300 schools during 2001–2006. The project will improve access for an additional 5,000 poor students annually by upgrading 100 existing schools.

The project is comprised of three components. The first is the modernisation of secondary schools through modern teaching methods coupled with evaluation to improve quality. The focus is also on developing computer literacy to narrow the digital divide. The second component will expand educational opportunity for poor students by increasing the number of full-time schools in the rural areas, and the third component will improve the delivery of educational services by providing training for relevant agencies.

International Childcare Trust.[9] The International Childcare Trust is working in Sri Lanka to enhance the capacity of partner organizations through information-sharing and training opportunities. Its objective is to help partners in designing, implementing and managing projects in co-ordination with local people. In Sri Lanka, the projects include supporting children in local schools.

Knowledge and Information Systems of the Urban Poor.[10] The aim of this research project, Knowledge and Information Systems of the Urban Poor (KIS), is to investigate how the urban poor access the information and technologies they need to improve their livelihoods, and to strengthen their knowledge and information systems.

Poor men and women living in urban informal settlements need knowledge and information to cope with risks and to improve their livelihood. Not knowing about their rights, the services they could access, plans for their areas or what options there are for tackling certain problems puts them at a disadvantage and increases their vulnerability

The Pan Asia Networking Program Initiative.[11] The Pan Asia Networking Program Initiative (PAN), a project of the International Development Research Centre (IDRC), has been designed to provide the physical electronic infrastructure for networking in the Asian region. A joint venture company was set up to operate Internet-related services in the country. It is registered with the Board of Investments in Sri Lanka and is jointly owned by several partners including IDRC. The joint venture company provides competitive and affordable Internet services in the country. It promotes networking between research and educational institutions, government bodies, the private sector and national government and international programmes that are concerned with economic and social development.

Training

There is evidence of utilisation of ICT in various sectors of the economy in Sri Lanka, but not much for instructional purposes. One project, the Training of Teachers in Information Technology, co-ordinated by the Ministry of Education and supported by UNESCO and the National Open School of India, seeks to bring together students, teachers, ICT professionals, research and development institutions and private sector organizations to upgrade the knowledge and skills of teachers and facilitators and to integrate educational technologies in their work. More broadly, it also aims at tapping the potential of new ICTs (including distance education methods) to provide more easily accessible and better teacher education and professional development.[12]

Constraints on the use of ICT

Lack of awareness, resistance to using ICTs, inadequate communications infrastructure and limited collaboration between different regulatory and educational organizations are some of the constraints on the greater use of ICTs for education.

There is an urgent need to establish a government intranet and to provide Internet access to it. At present the Lankan Educational, Academic & Research Network (LEARN) provides an Internet and e-mail service to universities and a few research institutes, but does so with much difficulty owing to the lack of funds and the difficulties in obtaining stable communication links.

Appropriate changes to the existing legislation, introduction of new legislation and the development of the necessary infrastructure are urgently needed to obtain maximum benefits from technology. For international players to enter the Sri Lankan market, it is also necessary to enact laws for the protection of personal privacy and intellectual property.

Analysis

There are two dimensions to the use of ICTs in Sri Lanka. One is that small individual projects, such as the Kothmale Internet Radio in Sri Lanka project have serious bottlenecks that hamper sustainability. Initial funding for infrastructure development has to be sustained by a parallel investment for the upgrading of capital equipment and for operating costs. Thus, initiatives enabling local partners to develop private-public partnerships and business models to ensure sustainability are essential.

Capacity-building of teachers is critical if the current initiative to upgrade secondary school education through the use of ICT is to succeed. Faculties in the universities are computer-literate and are capable of providing the leadership for a sustained effort for the rest of the country. But often they are working in isolation from each other because of inter-institutional competition. Thus, any initiative undertaken should be spearheaded by a nationwide collaborative effort of several partners and should focus largely on providing teacher education to improve awareness, access and use of ICT by teachers.

NOTES

1 See *www.esrilanka.lk/eg-policy-prel-draft-may06-03.pdf.*
2 Malaka Gunawardene and Chanuka Wattegama, "Sri Lanka" (2003) *Digital Review of the Asia Pacific 2003/2004* (Orbicom, 2203), *www.digitalreview.org.*
3 From UNDP Human Development Report, 2003, *www.undp.org/hdr/2003/indicators*.
4 M.J.R. David, "Mahaweli Community Radio" in *A Passion for Radio: Radio Waves and Community* (Bruce Girard and Communica, 2001), *www.comunica.org/passion/pdf/*.
5 See *www.cbonline.org.au index.cfm?pageId= 12,39,3461.*
6 See *www.apnic.net/mailing-lists/s-s-asia-it/archive/2003/03/msg00008.html.*
7 See *www.sletp.org.*
8 See *www.adb.org/Documents/News/2000 nr2000.*
9 See *www.ict-uk.org/srilanka.html.*
10 See *www.itdg.org/html/shelter/kis_research.htm*
11 See *www.idrc.ca/research/index_e.html.*

Integrating Information and Communication Technologies in Education in Asia and the Pacific: Trends and Observations

Mr Glen Farrell, Ph.D
and
Cédric Wachholz

Context

The socio-economic diversity among the countries of the Asia-Pacific region is extreme. The region includes countries such as Australia, Japan and the Republic of Korea, all with comparatively mature economies, competitive ICT infrastructure and solid human resource bases, as well as countries in Central and South-East Asia that are at hugely differing stages in their development, and are facing far more daunting challenges. These variances are reflected in the country reports on the status of ICT applications in education that collectively form the main body of this report. The purpose of this concluding chapter is to provide the reader with an overview of those differences, as well as a summation of the challenges and opportunities that confront educational policy makers, managers and teachers who are striving to use these technologies in ways that will add value to the current state of practice.

The picture that emerges from the reports is one of a continuing process of change. In the first instance, it is apparent that leaders in all countries recognize the growing impact of ICTs on their societies and economies. Most are aware of the need for a labour force that has the skills and knowledge to enable their country to function in a global "e-economy". Differences become apparent when one examines the actions different countries have taken in terms of applying and integrating ICTs into their education systems to help achieve this target. For example, countries are at different stages of both development and implementation in the areas of policy formulation, ICT infrastructure development and access to it, content development, programme initiatives and the training provided for education personnel. While many factors account for these differences, few will be surprised to learn that, primarily, they are related to the available fiscal and human resources. However, they also result from differences in the perception of the role of ICTs in the teaching-learning process. On one hand, it is obvious that if a country is to have a technically skilled workforce, it is essential that students in schools and post-secondary institutions are taught to use ICTs as part of their course of study. On the other hand, however, the role of ICTs in enhancing pedagogy in all parts of the curriculum is less obvious, and therefore

less frequently embedded in policy frameworks and implementation strategies.

Policy frameworks

Policies are an important ingredient of any leadership and management process. If properly developed, a policy framework provides a vision of desired end outcomes, it defines the results that need to be achieved in order to reach those ends, and it provides guidelines for how the results are to be achieved. As such, a policy framework has multiple levels, ranging from general "vision" statements defining outcomes, to specific results, with timelines and measurable outputs[1]. In practice, the process of policy development is usually iterative and often described in cycles. For example, a policy may be developed and promulgated only to find that there are constraints which make it difficult to implement, making it necessary to revise the policy, or to add another phase. This can be seen in the case of the Republic of Korea. This country is in its second policy plan stage, which includes standardising ICT skills, revising curricula, closer monitoring and other dimensions. Yet the country report shows that not enough software is available to meet the excellent hardware provision in schools, and that there is a lack of standardisation of existing materials. Other countries can learn from this and might be able to leapfrog this stage by planning and earmarking early funds for a standardized content development. This lesson will also apply to experiences at much lower scale, for less privileged countries which are exploring the integration of ICTs into teaching and learning.

Suffice it to say that there is no "best" way to go about the process of policy development – a point that is underscored by the variety of approaches that have been described in the foregoing country reports.

The following observations, distilled from the reports, provide an overview of the differences among the countries of the Asia-Pacific region in terms of their progress to date regarding development of policies to guide implementation of ICTs into their education systems:

- All countries have given some thought to the present and future impact of ICTs on their economies and cultures and accordingly have promulgated, as a minimum, some statement of vision regarding development goals. These might remain general, IT centred and not specifically relating to the education system.

- There are remarkable differences among countries in their "visions" for the role of ICTs in economic development. For example, Sri Lanka has developed a comprehensive strategy to position the country as a "hub" for ICT development in the sub-Asian region, including for open source software[2]; the Democratic Republic of Korea has committed to the development of excellence in science and technology and is focusing on the training of gifted students in order to develop the necessary expertise; and others, such as Mongolia, have a vision for a "knowledge-based" society in which people have access to ICT infrastructure, and the skills to use it, to enhance all aspects of their lives.

- Countries are at differing stages in terms of having a policy framework that goes beyond the "vision" level. Some, like Nepal, have a national vision but no detailed policies. Malaysia and the Philippines, on the other hand, have developed comprehensive policy frameworks for the application of ICT in education that are nested within an overall national ICT development policy.

- Those countries that have the most mature policy development processes in place are, not surprisingly, those with more mature and robust economies such as Australia, the Republic of Korea and Japan. These countries not only have comprehensive policy frameworks, but also implementation strategies and mechanisms, measurement indicators, and have committed resources to such matters as infrastructure access and connectivity, training and learning software development.

- Countries also differ in the processes used for developing policy. For example, several of the Pacific island countries are participants in a regional ICT policy development initiative called the Pacific Islands Policy and Strategic Plan. Others are developing policy with assistance from various agencies such as UNESCO and UNDP. Others, such as India, have quite adequate internal resources to manage the task.

- The forces that influence policy also differ among countries. For example, the ICT policy in the Democratic People's Republic of Korea was decreed by the national leader. In contrast, the process in the Republic of Korea is iterative in that it is informed along the way with information from formative evaluation and research, with adjustments made in the policy as necessary.

- One of the most striking differences among the policies of countries relates to differing perceptions regarding the role of ICT in education. These fall into three categories – one is that ICT must be taught in upper-secondary institutions as a subject, in order for the country to have a labour force with essential skills; another is that ICT must be part of specific areas of the curriculum to improve subject teaching, e.g. to simulate experiments in physics; the third category aims at creating knowledge societies with

ICT-savvy citizens and skilled workers, in which, potentially, anyone can learn anytime, anywhere.

- As is being realized in most of the countries, writing policy is the easy task! Implementing it is what is difficult and costly. As Green describes in the paper on gender issues, policy needs to be developed in tandem at multiple levels. For example, policies regarding access to infrastructure, connectivity, content development, training, etc. need to be developed and implemented concurrently for initiatives to be successful. Furthermore, it is not sufficient for policies to exist only at the national level. They need to be articulated with those at state/province and school levels to ensure that ICT adoption is encouraged and supported.

In summary, the countries are arrayed along a continuum of stages with regard to policies pertaining to the integration of ICT into their education systems. While all of them have stated that the development of ICT capacity is important to the future of their countries, fewer have grappled with the policy questions as they relate to ICT applications in education – and many of those that have lack the resources to implement their strategies, a recurrent theme throughout the reports. This "lack of resources" reflects, however, weaknesses of existing policies and the need to improve them.

The first and most overlooked aspect in many policies is the question of scope: realistically, what can and what can not be achieved? Secondly, there is little alignment with educational goals; ICTs remain an add on. Thirdly, there seems to be little planning for educational change. Successfully integrating ICTs into education systems means often radical shifts in teaching and learning, shifts that are little acknowledged or planned for. Lastly, we learnt that policies were developed by outside consultants or individuals/units in the Ministry of Education, often without stakeholder participation. Nevertheless, broad consultation and ownership are crucial to sustaining momentum during the often difficult implementation stage.

From vision to reality – the state of access

As mentioned previously, there is a great deal of variance among the countries regarding ICT applications in education. In some countries, such as Australia, New Zealand, the Republic of Korea and Japan, the available resources have enabled a degree of ICT integration in education that is exemplary in world terms. Others, of which Malaysia, the Philippines and China are examples, have comprehensive policy frameworks in place and are devoting considerable resources to implement their plans by increasing the availability of ICTs, including computers, connectivity and training at the institutional level. Mongolia, Viet Nam, and many of the Pacific Island Countries are examples of countries that have articulated policies for the use of ICT in education, but where implementation is occurring primarily through projects that are donor-sponsored. In addition, there is a sizable group of countries still at the stage of dealing with ICT development at a macro level and have not yet defined application goals for the education sector. Yet even here there are typically some donor-sponsored projects that are attempting to provide demonstrable evidence of how ICTs can be applied to benefit education in that country.

The following points illustrate the various ICTs being used, the level of access to them among different user groups, and the factors that appear to be influencing levels of access:

- In general terms, the adoption of ICTs in education is following the chronology of their development. In other words, the use of broadcast technologies, such as radio and television has been followed by the introduction and use of computers as stand-alone appliances, followed by networks that enable e-mail and file sharing, which then leads to Internet connectivity. Now we have the emergence of wireless networks and the advent of mobile or "m-learning". The examples of ICT use described in the country reports reflect this evolutionary pattern, with the rate of adoption in a country being primarily influenced by the level of ICT infrastructure development in that particular country. The education sector generally follows the private and communication sector in their degrees of ICT integration; it seems that anything else would not be sustainable.

- There is a degree of "appropriateness" in the pattern of ICT usage in the Asia-Pacific region that stands in contrast to that seen in North America and western Europe where the tendency to adopt the "latest and greatest" of the newer ICTs has been rampant, with the old being discarded in favour of the new. In contrast, radio and TV are widely used in countries such as Mongolia, Nepal, Pakistan, China, and parts of Central Asia, to reach large numbers of people with non-formal education programmes. Even in countries like Japan and the Republic of Korea, with world class ICT infrastructure, both radio and TV are used extensively. The lesson here is not to "throw the baby out with the bathwater" when it comes to making decisions about appropriate use of ICTs in education.

- We also see a creative "mixing and matching" of the old and new technologies in countries such as Nepal, the Philippines, Sri Lanka and Bhutan where radio is being combined with information retrieval using the Internet. This is referred to as "radio browsing" and is being used to provide both non-formal education, as well as support for classroom teachers.

- Examples of dedicated networks strictly for educational purposes are also emerging. The paper on India describes the imminent launch of a satellite that will enable the provision of several television channels and dozens of radio channels for educational use. Many of the Pacific Island Countries are members of the University of the South Pacific consortium that uses a satellite-based communication network (USPNet) to deliver university courses and some non-formal education, using teleconferencing, e-mail and the web. Indeed, USPNet provides a good example of successful regional cooperation.

- Wireless networks are starting to appear. Bangladesh is arguably one of the world's more active examples in using wireless technology to support the many facets of development education. The Philippines is the site of an innovative mobile m-learning project that incorporates wireless technology.

- There are also examples of web portals, such as those in Mongolia and the Maldives that have been developed as a means of sharing teaching resources.

- But in spite of these burgeoning, and often innovative, developments, access to ICT appliances such as computers, communication networks, and Internet connectivity remains low or nonexistent for the vast majority of educators in all but the most developed of the Asia-Pacific countries. Even when access is available, the staff of educational institutions typically lack the skills, knowledge and comfort level to make use of them. A Pacific Island Country report shows that the little existing infrastructure is actually being underutilized. Research has shown in other cases that access could be tripled, just by using existing resources to their full capacity.

- The issues of the "digital divide" are more complex than a simple comparison between the so-called "developed" and "developing" countries. There are many intra-country factors creating barriers. In many countries, with the exception of Japan and the Republic of Korea, access to ICTs by girls and women is a major concern. While there are programmes in some countries that are vigorously addressing the issue of lower ICT-related participation by girls and women, equity issues remain an important concern. Intra-country digital divides are also rooted in socio-economic issues such as: differences between rural and urban areas, differences within urban areas and age groups, language barriers, caste differences, lack of access to electricity and lack of access to ICT infrastructure.

The authors' analyses of country realities are sometimes measured with an implicit hierarchy of the best set-up: from a fully Internet-connected classroom, down to the radio use in community learning centres. Despite this fact, the main question remains, which is the most (cost-) effective solution for the educational purpose, and which is not: how can we get our school online and what will it cost? In many countries, one can find a strong focus on technologies and on connectivity, e.g. giving benchmarks on what the pupil - (connected) computer ratio should be by 2005, etc. The Republic of Korea requests their teachers to use ICTs for teaching and learning for 10% of total classroom time. Yet specifying the degree of curriculum integration, as well as making explicit indications and training on how exactly the computers and online information/communication possibilities should be integrated effectively remains the exception. In addition, many claimed "online experiences" in learning environments can be had with only a minimal (or no) connection to the Internet[3], with the same learning outcomes. Some learners are therefore much better served by a systematically integrated Interactive Radio Instruction programme, than by a rarely or badly used Internet-connected computer set-up.

Current initiatives

There appears to be a common pattern of development among the countries regarding the adoption of ICT applications. It is sequential and somewhat linear, necessitating that each phase be completed to some minimal level before the next can be undertaken successfully.

- The first phase of this adoption process typically involves ICT applications in the area of administrative functions such as finance, student records, and personnel. While these types of applications are not the focus of this report, it is interesting to speculate about the necessity of accomplishing this phase in order to get administrators "on side", and to have the support systems in place when applications that are more directly related to the teaching/learning process come to fruition.

- The next adoption phase involves teaching about ICT. Here we see a wide variety of initiatives that range from setting up computer labs to developing ICT curricula. In turn, these curricula include subjects ranging from how to operate a computer, to how to use software, to learning programming languages. Indeed, if one examines the content of the policy statements extant in many of the countries, it is clear that the development of ICT skills and competencies in the labour force is the top priority for many governments.

- The "teaching about ICTs" phase has two effects that provide the platform for the next phase: the use of ICTs by teachers to develop and acquire materials

that support their teaching in other subjects. The first of these effects is that the school or institution becomes equipped with some ICT appliances and networks along with some level of Internet connectivity. The second is that one or more teachers with ICT skills become available to colleagues for support and collaboration. Thus teachers can begin to visualize how they can use the technology to support their teaching, and they have access to the means to do it. While it is often the case that this phase begins through the innovative efforts of a few teachers, it must, in the end, be championed and supported by governments and donor agencies. The reports are rife with examples of this. The "Smart Schools" programme in Malaysia, the emergence of portals for sharing materials among teachers as in Mongolia, and the growing emphasis on teacher training are examples of wider initiatives to help educators use ICTs as part of the pedagogy in all parts of the curriculum. Countries such as the Republic of Korea, Australia, Japan and New Zealand are much further along in their development of this phase.

- The next phase is more opaque because there are very few examples mentioned in the reports. Nevertheless, the initiatives that are underway are transforming the traditional role of "teachers" who are becoming facilitators of learning. As ICTs are employed to enable learners to access information on their own, the teacher's role shifts from being primarily an information provider to that of helping learners manage and interpret information. Many authors of country reports have identified this type of teacher training as being of crucial importance in the continuing evolution of ICT applications in formal education. Little space was left in the reports to analyse the important "teaching culture" changes this implies and the challenges this represents, even for technologically advanced countries[4]. The imminent changes of teacher roles re-emphasises the need for the participation of all stakeholders, including teachers, in the planning and policy process, to find feasible solutions and applications.

The area of non-formal education presents a totally different picture. First of all, the target learners in non-formal education are different from those in the formal system. They are often out-of-school youth and adults whose learning needs are the development of functional skills in basic literacy, health education, food production or human rights, and they live in communities where applications of the digital ICTs are difficult to implement in a sustainable way. Meeting these needs requires technologies that can reach mass audiences, while not increasing existing disparities by ever-increasing the "digital divide". Here too, there is a pattern of ICT applications that emerges from the country reports:

- The country reports on Nepal, Pakistan, India and Afghanistan document a wide variety of radio programme initiatives covering topics such as health, food production, literacy, and human rights. A particularly interesting and seemingly effective example, begun by the BBC some years ago in Afghanistan, continues today. It is called "New Home, New Life" and uses a "soap opera" format to deal with such topics as repatriation, reintegration of returnees to the country, awareness of land mines, health, hygiene and sanitation, and conflict resolution.

- Television also plays an important role in many countries. Pakistan uses television extensively in non-formal education, as does Mongolia.

- While the traditional broadcast technologies will certainly continue to be used on their own as the main means to reach large numbers of learners, such technologies present a one-way form of communication, lacking the interactive capacity that enriches any learning experience. This, however, is changing with the trend to use the broadcast technologies in conjunction with telephone, e-mail, the web and the Internet. For example, in Bhutan, Nepal, and Sri Lanka listeners can use whatever means are available to inform the broadcaster of information they are interested in, and the broadcaster then "surfs the web" and broadcasts the information over the radio. This is referred to as "radio browsing".

- Certainly the most ubiquitous innovation regarding the use of ICTs in non-formal education has been the development of telecentres at the community level where people can access ICT appliances as well as learning opportunities – both formal and non-formal. While this is well documented in many of the papers, two are particularly noteworthy. Viet Nam has established a network of such centres with support from the Coca-Cola Company – a somehow astonishing example of what can be accomplished through partnerships, which would be interesting to study in more depth at a future date. Meanwhile, the Swaminathan Foundation has established partnerships with dozens of villages in the south of India to empower people to manage ICTs for their own purposes. That may vary from obtaining market information, health education, marketing locally produced products, or literacy training.

Many of the initiatives described in the reports involve development of new organisational arrangements that are designed to foster and support the use of ICTs in education.

- One example is the growing number of SchoolNets throughout the region that are providing support for teachers, facilitating the development and sharing of

learning materials, and helping to create and sustain e-mail and Internet access for schools.

- Another is the emergence of research and development bodies with mandates to undertake formative evaluation projects, establish benchmarks and standards, and monitor policy achievements. Examples of such bodies are described in the papers on Australia and Republic of Korea.

- Much more recent is the work of organisations such as EdNA in Australia that works across all education sectors to support the use of ICTs. As a result, Australia is at the vanguard of countries working on the development of online learning object repositories.

While there are a great many initiatives underway in the countries of the Asia-Pacific region, the majority of them in developing countries are made possible by support from donor agencies. This raises the question about their sustainability when the donor- funded stage is completed. Much more troubling, however, is the apparent lack of attention paid to assessing and sharing results from these projects. There are some cases of evaluation assessments currently being undertaken. In Sri Lanka, for example, research is underway on how urban poor access ICTs, while in the Solomon Islands, factors that affect the use of facilities by rural populations are being explored. However, the country papers are notably silent about initiatives of this sort, not because the authors have ignored the question, but because examples of the kind mentioned above are so rare. This may, of course, be due to the fact that so many of the initiatives are new, but it does underscore the importance of initiatives such as the portal on the use of ICT in education that has been created by UNESCO. This is one of the few "one stop shopping centres" for information about the use of ICTs in education (www.unesco.org/bangkok/education/ict/).

Constraints and challenges

The factors that constrain the adoption of ICTs in education can be grouped as follows:

National Priorities

Many countries in the Asia-Pacific region, among them those in Central Asia, the Pacific Islands, Myanmar, Cambodia, and Lao PDR, face difficult choices when it comes to making policy decisions regarding the increased use of ICTs in their education systems. On one hand, there is the reality that there are too few teachers with even basic teaching qualifications, too few schools for the numbers of students, and insufficient teaching materials to support the most conventional of learning environments. It seems that in many countries, ICTs have not been explored enough to face the severe Education for All (EFA) challenges. ICTs are often immediately linked to expensive high-tech solutions and low-tech but effective open and distance learning options, opportunities for effective multi-class teaching; to include those with special needs etc. remains unexplored. On the other hand, governments are acutely aware of the importance that the new ICTs play in the global economy and are therefore driven to acknowledge this importance in some way too. Thus, we have the situation described in so many of the country reports, where a national vision, sometimes along with a detailed policy framework, promulgates the importance of, but does not implement the use of, computers in schools, except in the context of donor-sponsored demonstration projects.

ICT Infrastructure

Obviously there must be access opportunities if educators are to make use of ICTs. This is highly variable among countries in terms of such issues as access to ICT appliances, Internet connectivity, connectivity speed, reliability of electricity, and cost of service. These are the ingredients of the "digital divide" that is manifest most profoundly between countries such as the Republic of Korea, Japan and Australia on one hand, and those that are less affluent on the other. However, the gaps in access to ICTs are also intra-national. They exist between rural and urban areas, between the wealthy and poor areas, and among social strata based on gender and, sometimes, on caste.

Policy Goals

As noted earlier, policy statements regarding the role of ICTs in education vary widely in terms of goals that have been set. For instance, the policy goals of the Democratic People's Republic of Korea have resulted in a focus on training gifted students in specialised institutions. In contrast, the policies and practices in the Republic of Korea encourage all citizens to become ICT literate, with the result that there is ready access to ICT infrastructure as well as opportunities to learn about applications. Between these polar examples are national policies that define ICTs as an essential subject in the curriculum, in contrast to others that call for the integration of ICTs into pedagogical practice across the curriculum – a difference that clearly influences both the numbers of teachers being trained, as well as the content of the training itself.

The reports identify a number of language-related problems, which stem in part from a lack of appropriate policies or strategies. Difficulties displaying local-language scripts on a screen persist, for example in Afghanistan, Cambodia and Laos. There is also a lack of quality, local-language content in many countries, both in terms of software/learning materials, as well as training manuals. This is, in part, a knock-on effect of the script issue, but it also extends to many other countries in the region: Bhutan, India, Indonesia,

Laos, Maldives, Mongolia, Thailand and Viet Nam, to name but a few.

Teaching Practice

The reports showed the multiple dimensions necessary for a successful ICT integration in the classroom, to which teachers remain the key. Teachers are more likely to incorporate ICTs into their teaching if they feel confident in using the technology, and if they perceive that doing so will be of some benefit as opposed to just adding more work to an already busy schedule. They need a supportive environment and general guidance, individual incentives, clear policies, curricula, instruction and training, and they benefit from peer support and interaction in networks. The lack of ICT-based instructional materials, and more specifically, the lack of such materials in the local languages is one reason mentioned why teachers are sceptical about the value of ICTs in their classrooms. Even those that do have access to the Internet are constrained in terms of making use of it because so much of the content is in English. Some country reports mention, however, that more than half of the teaching workforce has never benefited from any pre- or in-service training. Some examples show how ICTs can well be used to do both, familiarize teachers with ICTs and to offer training in content, pedagogy and a broad range of skills.

Money and People

The lack of funding and the dearth of trained staff are the two most cited constraints to ICT application in education. The lack of funding for the development of infrastructure and the purchasing of hardware and software are the most obvious. Public-private partnerships (PPPs) could be promoted to address this problem, but remain an under-explored option in the region. While several examples of PPPs are mentioned in the country reports, few are at scale, and many remain at the pilot project stage. Some reports, specifically those on Cambodia, Laos and Myanmar, mention the need to create a more amenable climate for promoting and attracting greater private-sector involvement in all areas of ICT development, from upgrading infrastructure, to NFE and TVE, to establishing more training institutes and Internet cafes.

However, the lack of human expertise is equally constraining in that it impacts on everything from policy development, to infrastructure servicing, to the provision of training for teachers and the development of instructional products.

The constraints and challenges teachers and pupils face of course differ from the above described development stages. Yet one report shows that even a perfect infrastructure and ICT literate teachers and students do not guarantee that these technologies are really being used to help pupils to think, to analyse critically, to learn how to solve problems, to interact and communicate, evaluate information resources, synthesize etc. New challenges have arisen, such as the "Internet addiction" of pupils who spend their lives playing games, visiting porn-sites, chatting, breaking copyright laws etc. The country reports also rarely mention the ongoing challenge of working in line with EFA goals towards gender equality, and of using ICTs systematically for this purpose. Few projects promote the active enrolment of girls in ICT programmes, provide incentives in the form of, say, scholarships, or include awareness-raising activities. One example of an NGO actively involved in promoting ICT education to girls, however, can be found in Pakistan. Since November 2000, the Ma'arif Education Society (MES) has been aiming to promote access to, and quality of, ICT education for women. MES also works to increase female participation in ICT education, in particular through the Ma'arif Institute of Information Technology, as well as by educating young girls, especially, about the appropriateness of women working in ICT-related fields.[6]

Again countries exploring a higher degree of ICT integration can learn from these experiences, addressing early ethical questions in an effective way, also stressing the need for other social interaction in real life.

Most importantly these experiences show that even fully equipped classrooms and technically skilled teachers are not a solution in themselves. The main questions on learning remain: what should the pupils know, be, be able to do - and how exactly can technologies assist in this individual and social development?

Strategies and opportunities

The country reports describe a wide variety of strategies that are being employed to introduce ICT applications into educational systems. The authors also offer their own analysis of the lessons learned and new approaches that might be tried. The following summary provides an overview of the points made:

- All authors identified training as a critical determinant of successful ICT applications. While training for teachers is an obvious need, many authors also stressed the importance of training for administrators and support staff.

- The content of training programmes needs to cover much more than simply how to operate a computer. Teachers also need to learn how to incorporate ICTs into the teaching of all subjects in curriculum, and to develop appropriate instructional materials.

- Some innovative models for providing training and support for teachers have been developed. For example, New Zealand has introduced the idea of "cluster schools" with a "lead" school in each cluster

that has the resources to provide training for staff at other schools in the cluster. Thailand uses the strategy of "peer-to-peer" training, and others are accessing online courses. Strategies such as these are more conducive to the provision of training on a "just-in-time" basis, and are therefore more likely to help teachers feel supported in their efforts to change how they practise as teachers.

- Palau, a country that is well above the norm in terms of ICT integration in education, has initiated the "Teaching, Learning, Technology Training Project". This uses a professional development framework based on a number of critical ICT competencies such as being able to operate ICT appliances, use software applications and develop academic skills. These are then aligned within five developmental stages ranging from entry-level teaching skills to ones at more advanced levels.

- The reports describe a variety of strategies for introducing ICTs into education systems, ranging from ones that are initiated from the top down to those that begin at the grassroots level. While there is no "right way" to do this, one of the lessons learned is the importance of multi-level policies and supports – from national to school levels – if the innovation is to succeed.

- The important role that partnerships can play in facilitating the use of ICTs in education is clearly evident in many of the reports. Partnerships that might include non-government organisations, government, private sector companies, donor agencies and/or international institutions can help schools solve infrastructure access problems, train staff, produce materials, and pilot test innovations. The "adopt-a-school" project in the Philippines, the learning centre development programme in Viet Nam, the BBC-produced radio soap operas broadcast in Afghanistan, and the US-China collaboration to teach English online, are but a few of the examples described in the country reports.

- Within countries, more collaboration among schools is needed in terms of resource sharing. Training, materials development and infrastructure maintenance are costly and therefore difficult for educational institutions to afford. Finding models through which to share investments, risk and expertise is therefore of critical importance.

- While the rapidly emerging use of wireless networks and mobile learning in countries like Bangladesh and the Philippines may create the impression that the broadcast technologies are giving way to the Internet, the evidence is contrary. Indeed, the use of radio and television remains important, and in the case of radio, it is used in ways that expand access to the Internet.

In summary, the vast majority of countries in the Asia Pacific region are still at an early stage in the process of adopting ICTs into their education systems. For most students and teachers, using a computer to send an e-mail or surf the web is still in the future. However, this situation is changing rapidly, and as it does, policy makers and education leaders need assistance as they make investment decisions. They need to know more about what is being learned from the many projects currently underway in the region and around the world. They need valid indicators by which to measure progress and better models for evaluating ICT options that are available in order to maximise the benefits for their country. Unfortunately, the state of development of these decision tools is still quite primitive. In 2003 UNESCO launched, however, twelve ICT in education projects[5] financed by Japanese Funds-in-Trust, to assist Member States in Asia and the Pacific in meeting key challenges described and analysed in this survey.

NOTES

1 The authors used the UNESCO terminology of Results-Based Programming, Management and Monitoring (RBM), as defined by UNESCO's Bureau of Strategic Planning in the RBM guide 2001.
2 See the Digital Review of Asia Pacific 2003/2004 by Chin Saik Yoon (Ed.), p. 13, published in Nov. 2003, also with more information on e-commerce, e-health, e-government etc. in the region at: www.digitalreview.org.
3 Local web servers, CD-ROMs, proxy cashing servers, e-mail server on the local network can also save often downplayed operating costs. For more information see http://www.unescobkk.org/education/ict/technologies or read the Planning for Technologies section in the TechKnowLogia Jan-March 2002 publication at www.techknowlogia.org.
4 See for example the Japan country report.
5 Please visit www.unescobkk.org/education/ict for more information.
6 'www.123freehost.co.uk/sites/maarif/; Also, see: ICT Education for Women in Pakistan: A Political or Economic Issue?, Ahsiya Posner, research paper: www.gse.harvard.edu/~views/VIEWS_posner.pdf

Asia-Pacific Regional Bureau for Education
UNESCO Bangkok

This Meta-Survey on the Use of Technologies in Education in Asia and the Pacific is the first such survey to map the use of ICTs in the education systems of an entire region. The project, conducted by UNESCO with the support of Japanese Funds-in-Trust, gathers information on 44 UNESCO Member States, and provides an up-to-date overview of the state of ICT use in primary and secondary, non-formal, technical and vocational education across Asia and the Pacific. With a special focus on using ICTs to achieve Education for All goals, the report also includes a chapter discussing issues relating to ICT use and gender equality, which identifies areas for further efforts to ensure girls and women are not excluded from the educational benefits that ICTs are seen to offer.

The 24 authors describe and analyse regional developments and trends in the country reports, and address the following themes:

- National policies for ICT in education
- Current levels of ICT infrastructure
- Teacher training initiatives
- Access to and use of ICTs in different learning environments
- Constraints on the use of ICTs in education, and opportunities for UNESCO assistance

The survey analyses regional trends, describes innovative projects reflecting the diversity within the Asia and the Pacific region, and provides the reader with a snapshot of the state of ICT use in education in each of the 44 UNESCO Member States.

www.unescobkk.org/education/ict/metasurvey

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