

The following representatives presented reports of their country's experiences on the use of ICT in education and their efforts to assess its impact:

Australia	Ms Paula Christophersen, Manager of the VCE Information Technology, Victorian Curriculum and Assessment Authority
India	Mr Shri Vivek Bhardwaj, Deputy Secretary (SE), Department of Secondary and Higher Education, Ministry of Human Resource Development
Indonesia	Mr Lambas Lambas of the Curriculum Centre
Malaysia	Zainal Abidin Bin Ismail, Co-ordinator of the Teachers' Activity Center, Port Dickson
The Philippines	Ms Marivic Abcede, Department of Education
Korea	Mr Seung-Ku Woo, Director of Division of Information Technology Policy, Ministry of Education and Human Resources Development, and Mr Jung-Woo Cho, Research Fellow of the Korea Education and Research Information Service (KERIS)
Thailand	Mr Narongsak Boonyamalik of the Monitoring and Evaluation Division, Bureau of Policy and Planning, Ministry of Education
Uzbekistan	Mr Ziyovuddin Jaloliddinov
Viet Nam	Mr Nguyen Anh Tuan of the Education Management Information Centre of the Ministry of Education and Training in Viet Nam

Below is a synthesis of these countries experiences in the use of ICT in education.

All of the countries have developed their policies on ICT in education. The objectives of these polices range from promoting connectivity and access to ICT in schools, upgrading teacher competencies, integrating ICT into curriculum, to improving the quality of teaching and learning. A number of countries go so far as aiming to develop a cadre of citizens who can contribute to the workforce and economy of the country.

At the federal level in **Australia**, the Commonwealth Government seeks to achieve two overarching school education goals, that is all students will leave school as 'confident, creative and productive users of new technologies, particularly information and communications technologies, and understand the impact of those technologies on society', while all

Policy on the use of ICT in education

schools will seek to integrate ICT into their operations, to improve student learning, to offer flexible learning opportunities and to improve the efficiency of their business applications.

At the state level, specifically Victoria, schools implementing a Learning Technologies Plan should result in schools':

- » Having access to ICT and curriculum products as part of the school's educational programme;
- » Being routine, competent and discriminate users of ICT in the daily programmes of the school;
- » Developing skills in the use of ICT; and
- » Showing leadership and innovation the use of ICT.

Goals and objectives of the ICT for education programmes in **India** are even more ambitious, being to:

- » Equip all students with basic computer skills;
- » Facilitate IT as a career option for secondary school students;
- » Enhance learning effectiveness through Technology Aided Learning;
- » Promote critical thinking, a spirit of enquiry, make learning joyful and empower teachers; and
- » Address problems of children with special needs.

Similarly, **Indonesia** seeks to ingrain students with the ability to harness new technologies for accessing and disseminating information and knowledge, and to harness these as tools for decision-making. The Curriculum Centre believes that this is an important competency in the era of knowledge and information technology.

It is intended that students will learn to understand when and what kind of knowledge are needed; find and access information from various sources; and evaluate, use and share information with others. The Centre defined ICT in relation to students as "...in ICT students learn to get information, process and use it to communicate effectively through various media."

The government of Indonesia set the following goals and objectives for the integration of ICT in education:

- » Information and Communication Technology in Society: The student understands the benefits and disadvantages, as well as the challenges in information technology;
- » Information and Communication: Students put their knowledge, skills and attitudes into practice relating to Information Technology in getting, processing, arranging, distributing, and keeping information; and

- ▶ System and Design: Students apply their knowledge, skills and attitudes in designing information technology systems, solving problems relating to ICT.

Along the same lines, **Malaysia's** national programme for ICT for education develops the whole individual. Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious.

A crucial component of Malaysia's integration of ICT in education is the *Malaysian Smart School* programme, which intends to "systematically reinvent" learning institutions in terms of teaching practices and school management in order to prepare children for the Information Age. The Smart School System has been pilot tested in 90 schools throughout the country.

Other than working towards these objectives, further specific objectives include to provide opportunities to improve individual strengths and abilities, to produce a thinking and technology-literate workforce and to increase participation of stakeholders.

Meanwhile, **the Philippines'** Department of Education (DepEd) policies on the use of ICT are:

- ▶ Technology must be studied first as a separate subject then applied in other learning areas as a tool for learning how to learn;
- ▶ The application of computer skills to the other learning areas is a curriculum policy that stems from the principle that teaching-learning must not be textbook-driven and educational processes should take advantage of technological developments, including the application of ICT in teaching and learning, where appropriate; and
- ▶ An education modernisation programme will equip schools with facilities, equipment, materials and skills and to introduce new learning and delivery systems necessary to capitalise on recent technological developments.

The goal of the Philippine Education Technology Master Plan is to deliver quality education that is accessible to all through the use of IT and other innovative technologies.

Under this framework, the DepEd is implementing an ICT Plan for Basic Education, which has the following objectives:

- » To provide the physical infrastructure and necessary technical support to make ICT accessible and useful to students, teachers, administrators and school support staff;
- » To develop teacher competence in the use of ICT and in the design, production and use of ICT-based instructional materials;
- » To ensure access to the latest developments in ICT and to support research and development;
- » To undertake a curriculum improvement that would integrate technology with the different learning areas; and
- » To promote the use of appropriate and innovative technologies in education and training.

The Philippine Education Technology Master Plan has the following operational targets by the year 2009:

- » All public secondary schools shall be provided with an appropriate educational technology package,
- » 75 per cent of public secondary schools shall have a computer laboratory equipped with basic multimedia equipment,
- » All public secondary schools shall have an electronic library system,
- » 75 per cent of public secondary schools teachers shall have been trained in basic computer skills and the use of the Internet and computer-aided instruction,
- » All learning areas of the curriculum shall be able to integrate the application of ICT, where appropriate.

In **South Korea**, the project for adapting education to the information age was started in July 1970 as a plan for computer education. In the early 90s, state level policy was outlined by the Framework Act for the promotion of ICT, and in July 1996, the Enforcement Plan for Adapting Education to the Information Age was formulated.

The general objectives in using ICT for education are to:

- » To stimulate students to actively participate;
- » Enhance students' ability to carry out self-directed learning;
- » Use ICT as a tool for learning; and
- » Use ICT to provide quality education inexpensively to everyone.

The Ministry of Education prepared the Second Stage Comprehensive Plan for Developing ICT Use in Education to address new challenges by 2005. The Second Stage Comprehensive Plan promotes educational reform and human resources development. The vision includes:

1. The general teaching and learning environment will be enhanced by the upgraded ICT infrastructure. The use of ICT in classrooms will increase greatly, allowing students to use multimedia educational materials in the classroom. Student-PC ratios will drop to 1:5 and communication will become much faster. Students will access the Internet and retrieve information easily from the digital library. Teachers will get a wide variety of multimedia teaching-learning materials and guidelines from EDUNET.
2. The Integrated Human Resources Information Network will be completed in 2005. The network will connect those who want to develop their skills for jobs, the institutions that provide educational and training services and the industries that need skilled manpower. This integrated network will create a database on job opportunities and current training services.
3. The quality of education administration will be greatly improved by the year 2003. The online network of the Nationwide Educational Administration Information System will be completed in 2002.

The National Education Act 1999, **Thailand's** first of its kind, forms the core of the education reform movement. For the first time, the direction points toward the philosophy of education provision for the purpose of lifelong learning and societal participation.

Three categories of education management are identified including the formal education, non-formal education, and informal education. Under the principle of equality, people are guaranteed of their rights and opportunities in education.

The goals and objectives of the ICT for Education Programme are to:

- ▶▶ Give all teachers, college lecturers and professors, school children and college students opportunities to learn to use ICT. Employ ICT 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; and
- ▶▶ Make full use of ICT and distance education to meet the needs and aspirations of all citizens for continuous education and skills upgrading without regards to age, profession, distance, or geography.

Specifically, the Educational ICT Programme aims to:

- ▶ Introduce at least one computer per 40 primary school students and one computer per 20 secondary school students by the year 2006;
- ▶ Allocate, on a continuous basis, an annual budget of 1,000 million baht to acquire ICT equipment such as PCs, communication modems and, where appropriate, satellite receivers, and multimedia equipment. The amount should be sufficient to equip state schools with up to 30,000 PCs a year; and
- ▶ Connect all universities, colleges, and later on, secondary schools to the UniNet, EdNet/Internet.

Thailand goes as far as to specify 3 sets of strategies towards implementation. The “value-added” policy proposes the following actions:

- ▶ Prioritise the provision of useful software, content and necessary supporting IT curriculum via searching, localizing, producing to make better use of existing hardware in schools;
- ▶ Train teachers to gain literacy in computer and internet uses;
- ▶ Establish maintenance programme for the existing hardware;
- ▶ Enhance the capabilities of organisations that can provide support and services to schools by forming network of agencies and individuals; and
- ▶ Continuously monitor and evaluate the use of technology for education and collect data for planning purpose.

Even though there have been huge investments in IT at school level, statistics show that such investments are not evenly distributed. In fact, a relatively large number of schools and communities are left behind. In dealing with this “digital divide”, the following “equity strategy” attempts to remedy the situation taking into consideration the financial difficulties the country is facing.

- ▶ Provide a set of minimum requirement equipment and facilities to needy schools including electricity, 3 telephone lines, 5 computer sets, 1 printer, 3 sets of televisions, 5 sets of radio, 3 internet accounts of 100 hours per month via the SchoolNet programme;
- ▶ Provide a “Digital Learning Centre” (DLC) to the community; and
- ▶ Train teachers and trainers in IT & Internet literacy.

Information and Communications Technologies and the Internet in particular provide vast opportunities for a country like Thailand. In this light, ICT provide opportunity for a nation to leap-frog the development in general and in the education sector in particular. Some of the measures to accomplish the quantum-jump strategy include:

- » Set a target for all teachers and students to be IT and Internet-literate by the year 2002;
- » Centrally produce 250 titles of academic software and contents annually and provide funding worth 500 million baht per annum to various communities for content development as well as provide budget for localizing 2,000 titles of useful foreign content;
- » Set PC density target by the year 2006 as follows:
 - 1:20 for Secondary School level
 - 1:40 for Primary School level
- » Investment in the production of IT and network equipment for use in the education sector including software and multimedia;
- » Provide IT for education and professional development to the underprivileged, the disabled, and common people seeking lifelong education;
- » Provide adequate radio frequencies for the education sector;
- » Invest in research and development in IT for education at least 400 million baht per year;
- » Establish monitoring and evaluating procedures and protocols; and
- » Establish a National Institute of Technology for Education.

In 1992, the government of **Uzbekistan** adapted the Law on Education, which was amended in 1997 to meet the demands of the National Programme on Personnel Training. This programme introduces reforms in the education system and part of these reforms is the integration of ICT in education.

The national policy stresses the need to achieve computer literacy among all students, promote the use of ICT in schools and everyday life and the integration of ICT in education and other industries.

The goals and objectives of the ICT for education programmes focus more on infrastructure:

- » Establish regional and national networks with global access;
- » Change teaching practices and methods;
- » Reduce education gap between regions;
- » Access to global network for the use of additional materials;
- » Increase of software supply; and
- » Use ICT in management and monitoring of education system.

Financial resources and partners

Viet Nam conducted a campaign to “universalise” primary education from the year 1990 to 2000. Now, it is set to universalise secondary education by 2010. For the centralised planning and administration of education and training, the Education and Training Management Information System (EMIS) was designed.

Meanwhile, the goals and objectives of ICT for education programme for the year 2010, similar to Uzbekistan, focus on implementing the technology:

- ▶ Establish ICT departments in universities to train teachers for schools;
- ▶ Make ICT a subject in general education;
- ▶ Train teachers to make them qualified;
- ▶ Provide computer labs in all schools; and
- ▶ Promote collaboration in international training about ICT; and apply ICT in school management.

It was found that some countries have realised the importance of allocating funds to support their ICT for Education projects if they are to achieve their objectives.

In **Australia**, the Queensland government committed A\$ 59.4 million to ICT in education for 2003 to 2004, and an additional A\$ 35 million to improve ICT access and the ICT skills of students and teachers. Meanwhile, in Victoria, A\$ 20 million was made available through 1:3 subsidies, there is state-wide licensing of products and software, SOFNet, a satellite television network to meet the needs of students and school communities and VicOne (wide area network) was established so schools will have access to a minimum of 64 kbps ISDN line at no cost. Furthermore, an e-mail account was set up for every principal and school council president (up to 3 million messages sent each month at no cost to schools), while seven navigator schools provide accessible working models of educational environments incorporating ICT. In the same state, Net Day uses corporate sponsorship to network classrooms so that students can obtain enhanced access to the Internet.

In **the Philippines**, since 1996, an annual appropriation has been provided for the procurement of computer hardware, software and courseware for teacher-training. In 2002, this allocation amounted to P 155 millions (US\$ 3.1 million), mostly from government funding. However, the DepEd involves other government agencies, local governments, and the private sector to finance various components of building up a programme in ICT in education.

To fast-track the connectivity of schools, DepEd is undertaking Project LINK, which will upgrade computer resources in schools to allow access to the Internet, and give training to teachers on the use of the Internet for research and distance learning. The government will finance a large part of the cost for this project. The costs of connectivity will be carried out by the local businesses, and the operation and maintenance costs shouldered by city and municipality governments.

On the whole, the countries introduce ICT in the elementary (primary) level and in subjects such as Maths and Technology. Yet some do not start introducing ICT until the secondary level, while South Korea covers all levels, including university.

Education systems in **Australia** are expected to organise their curriculum around these eight key learning areas:

- English
- Mathematics
- Science
- Technology
- The Arts
- Health and Physical Education
- Languages other than English
- Studies of Society and the Environment

ICT in **the Philippines** is introduced in the elementary level as a subject called *Home Economics and Livelihood Education (HELE)* and in the secondary as *Technology and Home Economics (THE)*.

In **India**, the ICT for education programmes target all secondary schools and all subjects where ICT is applicable.

ICT in **Indonesia** begins earlier, being introduced to students in primary school. However, most innovatively, schools introduce ICT according to student needs. ICT subjects are taught 4 hours a week. Schools are likewise encouraged to upload their ICT curriculum on the Internet. ICT is also used for school management. In the non-formal education sector, private computer courses are offered or sometimes, ICT is offered as an extra-curricular subject.

In **Korea**, the scope of ICT application is wide, with the specific tasks to adapt education for the information age are carried out in four levels:

1. The elementary and secondary level;
2. Research and universities;
3. Educational administration; and
4. Life-long education.

Scope of ICT use in education

Manner of introducing ICT in schools and non-formal education

To date, there are 9,668 schools in **Uzbekistan**. Out of these schools 4,597 have computer classes of different models. ICT is a required subject in schools and computers are used for subjects like Physics, Chemistry and Biology. ICT is a compulsory core subject in Grades 8, 9, 10 and 11 which covers one and half million students every year. ICT as a subject is taught 2 hours a week.

Meanwhile, ICT in **Viet Nam** is offered only as an optional subject in schools. In schools where there are computer laboratories, students are able to practice their computer skills. In lower secondary schools, students study Winword and Excel; in upper secondary schools, students study basic programming.

The way in which countries are focusing on developing ICT use in schools varies greatly, depending on how established ICTs are already in the countries education systems. All countries already offer Computers as a separate subject. Most are now beginning to focus on integration of ICTs into other subjects, a process in varying stages of development. While in the Philippines and Uzbekistan, ICT is used to supplement instruction, India is beginning to integrate ICT within the textbooks of technical subjects. Others have developed complex systems of integration, such as in Malaysia and Thailand, including ICT within pedagogy and management systems.

The EdNA website (<http://www.edna.edu.au>) provides an electronic community for sharing information and resources on ICT in education in **Australia**, providing an invaluable resource for all working in the field. Other supporting organisations include The Department of Education and Training in Education and Training in Victoria, which supports the successful use of ICT in education through a range of initiatives, including the IdeaBank, a database of teaching and learning strategies to help students achieve CSF (Curriculum Standards Framework) learning outcomes.

The Victoria government has a *Curriculum and Standards Framework (CSF)*, developed by the Victorian Curriculum and Assessment Authority (www.vcaa.vic.edu.au) which identifies what students should know and be able to do in the eight key learning areas from Preparatory Year to Year 10. Within these key learning areas, the major knowledge and skills are arranged into strands, within the Technology Key Learning Area are three strands: Information, Materials, and Systems, for which indicators are provided to inform teachers of the evidence they should look for in student performance.

India is seeking to introduce ICT in Education through a multi-layered approach, with ICT first being integrated in textbooks for computer subjects like Introduction to Computer Science, Informatic Practices, and ICT Systems. ICT is likewise used in face-to-face learning.

The primary teaching and learning components of the Smart School in **Malaysia** are Curriculum; Pedagogy; Assessment; and Materials. Each of these components has unique features. The key features of the Smart School curriculum are:

- » Overall development;
- » Knowledge, skills values and language across curriculum;
- » Explicit learning outcomes for different levels of ability; and
- » Integration of knowledge, skills and values for the information age.

The key features of the pedagogy followed for the Smart schools are:

- » Varied learning strategies to ensure basic competencies and overall development;
- » Teaching that responds to different learning styles; and
- » Classroom environment that is conducive for a variety of teaching and learning strategies.

The materials used in Smart Schools are intended to fulfill curriculum teaching and learning needs and challenge thinking, motivate learning, encourage active participation. There are also a variety of materials for networking between teachers and students. Conventional materials are complemented by electronic materials.

The Smart Schools' management system is comprised of:

- » Technology (system implementation, system maintenance etc.)
- » Financial management (budgeting, reporting, accounting, purchasing etc.)
- » Human resources (teacher scheduling, hiring, staff training management etc.)
- » Facilities (maintenance, asset management etc.)
- » External resources (database management, liaison with external resources etc.)
- » Educational resources (resource database management, input to curriculum management etc.)
- » Student affairs (student profiles, performance evaluation etc.)
- » School governance (communications, public relations, curriculum management etc.)
- » Security (Physical security, IT security etc.)

In the Smart School System, technology is used as an information processing and productivity tool; to enhance professional development; and to automate instruction.

In the majority of cases in **the Philippines**, ICT materials (software, multimedia) are used to supplement instruction. These materials may be produced by teachers themselves (as in the case of animated PowerPoint presentations) or ready-to-use courseware either purchased from abroad or leased to the school as part of the hardware. Currently, there is no integration of the application of ICT with textbooks.

In **South Korea**, the focus is on:

- » Restructuring the curriculum to integrate the application of ICT to teaching and learning;
- » Improving the delivery support system of basic education so that it includes the use of ICT as a component of multi-channel learning;
- » Generating funds through non-traditional financing schemes; and
- » Retooling human resources at different levels involving sub-systems (Central office, field offices, and schools) and focusing on the different components of basic education.

In **Thailand**, most schools adopted ICT in their curriculums. ICT is used in formal and non-formal education in a number of ways.

- » Word processors to write and present their work;
- » Using a spreadsheet to enter data collected in investigations, creating charts, and interpreting the results;
- » Creating databases as part of investigations, interrogating the database by searching and sorting for problems-solving;
- » Using hypermedia to write, lay out and present work for publication on the Internet; and
- » Using the Internet and CD-ROMs in research and investigation.

The teachers also use ICT in a variety of ways:

- » Using word processors to publish their text book, and test-book;
- » Using spreadsheet for data processing and statistics;
- » Using PCs to prepare teaching materials; and
- » Using the Internet and CD-ROM in teaching and assignment.

In the non-formal education sector, the Center for Educational Technology (CET), a unit of the Non-formal Educational Department in the Ministry of Education, is responsible for the production and promotion of educational media for the formal, non-formal, and informal education sectors.

The Center is also responsible for the production and broadcasting of educational radio and television programmes, educational computer

media, media for the disabled, printed materials, as well as video and audio tapes to supplement existing materials in the formal, non-formal and life-long education sectors.

An easy-to-use tool was also developed for teachers to create their own content or teaching materials to add to the digital library.

The SchoolNet Project achieved a “universal access” status since 1997. The project was cited in UNDP’s Human Development Report of 2001.

UniNet (Inter-University Network), established in 1997, is a national network administered by the Office of Information Technology Administration for Educational Development, Ministry of University Affairs, providing national and international education network services to enable research and development technologies to support all universities and institutions of higher education in Thailand. Self-study centres are being developed with electronic library databases, Internet, multimedia, video on demand, to be connected to the high performance network.

In **Uzbekistan**, ICT is a required subject, while computers are also used during teaching other subjects (Physics, Chemistry, Biology and others). Methodological support to ICT education programmes is given by the Republican Education Centre. Developed educational materials are analysed thoroughly by experts before being recommended to schools.

Most countries are now recognising the importance of effective teacher training. Both pre-service and in-service training in ICT is offered on the whole, while a few countries offer more advanced training in integration of ICT within key subjects, curriculum development and classroom management. With most courses being offered by the relevant governmental agencies in each country, policy frameworks for training are generally established.

The Federal Government of **Australia** has a tradition of supporting the professional development of its educators, and provides continuous training through a range of programmes. The local government of Victoria conducts professional development opportunities for teachers through which to develop confidence and competence in the use of ICT in education. These teacher-training programmes span three key areas: computer software skills, curriculum development, and classroom management (curriculum delivery, assessment, and reporting).

While schools conduct their own programmes, which include: Navigator School Programmes and Leading Practice Programmes, teachers may also use self-paced learning materials in the CD-ROM format. There are also programmes for school leaders: Using Basic Computer Applications, Learning Technology Planning for School Leaders, and Computer and Technology Skills for Leaders.

Professional development

The various education department agencies provide their on-line activities for teachers. The *Victorian Information Technology Teachers Association* (www.vitta.org.au) and the *Information and Communication Technology in Education* (www.ictv.vic.edu.au) are among these agencies.

In-service training of teachers is conducted in State Councils for Education Research and Training. Meanwhile, the National Council of Teacher Education provides the framework for pre-service training of teachers. In addition to these, the government works hand-in-hand with private organisations for other ICT related training for teachers.

In **Indonesia**, teachers' courses are provided by the education board as well as by non-government organisations.

Since 2000, it has been the policy of the DepEd in **the Philippines** to give preference to the hiring of teachers who are computer literate; most teacher-training institutions offer computer education as a required course. Usually, public schools send a few teachers to computer literacy training, who would then pass on the training to peer teachers. Private schools usually hire ICT service providers to give training to their teachers. Public school teachers handling **THE** classes receive training on ICT. Since 1997, the DepEd has intensified the provision of ICT training to teachers of English, Science, Mathematics and **THE**.

There has been some private sector support for teacher training. Intel and Microsoft have a current programme – “*Intel Teach to the Future*” – which aims to teach 1,000 teachers on the condition that each teacher would train 20 others. Other training programmes for teachers are funded by other private organisations.

In **Thailand**, training of teachers and related personnel in ICT is a critical step in any effort to promote the use of ICT in the classrooms, since teachers determine how ICT will be used in instruction. Thailand viewed the ICT personnel skill training as an important project, and allocated a large budget for training programmes. To date, 71,442 out of the country's total of 358,781 teachers and education personnel in the primary education level have already been trained. And 25,000 out of 125,983 in the secondary education level have also been trained. Only 21 per cent of teachers/personnel have been trained in ICT. Meanwhile the total number of PCs used is nearly 200,000 and more than 150,000 were used in the learning/instruction process.

Uzbekistan, like Thailand, includes both pre-service and in-service training. The former is conducted through five pedagogical higher education institutions and as special courses in other high education institutions. Meanwhile, in-service training is conducted through the provision of special courses and training in 14 provincial institutes of in-service training and the Central Institute for In-service Training for Public

Education Managers. The Ministry of Public Education launched a Basic Education Staff Development Programme that uses distance learning in teacher training. It is planned to establish 70 Professional Development Centres in selected schools to promote the professional development of teachers and the use of new technology and methods in teaching.

Few teachers in **Viet Nam** have graduated from ICT-related courses. One of the things being done about this is to train Maths and Physics teachers in ICT.

Connectivity is a complex issue, with countries again varying in approach, whether improving bandwidth, providing teachers with notebooks or setting up LANs. While all countries have provided schools with computers to some extent, student/computer ratios vary from 80-1 to 3.9 to one. Some are also making distribution of computers to teachers of importance. Internet connectivity also varies greatly, with 19 per cent connectivity in the Philippines, but 100 per cent through LANs in Korean schools.

In 1998, Victoria in **Australia** started the programme *Notebooks for Teachers and Principals* to encourage teachers integrate the use ICT into teaching and administrative tasks, providing notebook computers to these educators through an affordable lease scheme (A\$ 150 year for three years) and on the condition that they take courses in professional development (40 hours in the first year) and to use the notebook in their teaching.

By November 1998, 29 per cent of Australia's teachers had a notebook computer. By November 2000, the number grew to 80 per cent, and by July 2001, 91.7 per cent of teachers. Evaluations eventually showed that the number of teachers using a computer at home and at school grew (from 52 per cent to 77 per cent of teachers). Classroom use of computers by teachers grew by half, from 36 per cent to 50 per cent of the programme participants. Also, teachers with notebooks routinely used computers 20 per cent more than their counterparts who had none. A year 2000 report showed that 37 percent of school computers were in laboratories and 31 percent were in classrooms. Laptops comprised 16 percent of all school computers, and secondary schools had lower student:computer ratios than primary schools.

A February 2002 study shows that in Victoria, the average computer: student ratio was 1:3.9 (the highest in Australia). This study also indicated that 88 percent of schools had a computer:student ratio of 1:5. Presently, Australia's schools have a total of 136,000 computer units.

Connectivity

The bandwidth available to schools varies from state to state, and the type of connections to the Internet ranges from ISDN (the most common) to ADSL, and some schools even have cable and satellite Internet. The majority of schools have either a 64 kbps or a 128 kbps ISDN line. In Western Australia, the majority of schools have 64kbps dial on-demand connections, and in the Northern Territories, schools have 400 kbps satellite connections. Some states, specifically Western Australia, will soon implement a rollout programme to provide 10 Mbps bandwidth connections to metropolitan schools, 2 Mbps to regional high schools, and 512 kbps to regional primary schools.

Meanwhile, schools in **India** are provided with computer, networking facilities, printers and scanners. Computer software is also provided such as MS Windows, MS Office, CorelDraw, MS Encarta, and Educational CDs. Internet connection however is limited to Types A and B Cities.

Use of the Internet in **South Korea** is seen as an indispensable part of ICT use in education and is promoted by the mandatory provision of LAN in the construction in all schools. LAN construction started in 1997 and was completed in 10,064 elementary and secondary schools by 2000. The school LANs help teachers and students use ICT and access the Internet.

Efforts have been made to distribute PCs to computer labs, the foundation for ICT use in education. It also supports the increase of computer use in elementary school education and the emphasis on ICT use in the Seventh Educational Curriculum. A total of 431,981 units were distributed among more than 10,000 schools in the year 2000. Part of the goals of the Plan is to provide a PC for each teacher in elementary and secondary schools in the year 2000. A total of 340,854 units were distributed to teachers by the end-2000.

The main goal of the advancement of teaching facilities is to provide multimedia equipment to 200,000 classrooms (elementary, middle and high school). The equipment is classified as essential and optional. Essential equipment includes 586 or upper level CPU computers and one image device, including a projection TV, a monitor, and an LCD projector depending on the school level, grade and the number of students per school. Optional equipment comprises visual presenters, scanners and or digital cameras.

Eighty-one percent of schools in **the Philippines** have no access to the Internet. The schools in Metro Manila, the Philippines' capital, have the greatest access to the Internet, but the incidence of connectivity decreases as one goes northwards and southwards throughout the archipelago.

At the higher education level, all universities in **Thailand** are connected to the Internet, but only 22.50 per cent of secondary schools and 1.19 per cent of primary schools. Plans target that by the year 2002, the student-to-computers ratio in secondary schools should be 40:1, and in primary schools 80:1 (compared to 114:1 in year 2000). The use of PCs for learning and instruction versus the use in office administration at the primary school is 29:1, and in the secondary school 3:1. Plans indicate that in the primary level, PCs are used mainly for learning and instruction. The country aims for 100 per cent connectivity for secondary schools by the year 2002, and for primary schools by 2004; but figures show these targets may not be met.

Another use of ICT via Internet is the schoolnet Thailand programme, (<http://school.net.th>). Presently, SchoolNet Thailand connects over 4,300 schools to the Internet. The network has been designed to serve the goal of universal access for every school nationwide. More specifically, a school only pays the telephone charge at the local-call rate per connection (at 8 US cents 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, digital library and digital archive, which contains digitised materials in various forms with proper indexing and a search engine for ease of use.

Thailand set up the ICT infrastructure connecting all universities, institutions, and campuses in the country, called 'UniNet', by establishing ATM network via 155 Mbps bandwidth fiber optics; the infrastructure will connect the networks in Bangkok to the rural provinces through digital leased lines with 2 Mbps (E1) bandwidth.

Annually, the Government of **Uzbekistan** funds to procure 100-150 computer classroom sets (each set includes 10 computers). PCs are supplied with Microsoft Office and other software. Less than 2 per cent of schools have access to Internet or modern hardware to establish local networking. One of the main issues with Internet access is the cost of communication, as most school budgets cannot afford the Internet. Local computer networks (Intranet) have been set up within educational institutes, which will introduce local distance learning.

Most countries have started to evaluate but few indicators have been set up yet. South Korea has become systematic, having developed its set of indicators, collected data and maintained a database. Australia has developed its set of indicators but they have to be tried out in the coming years. While generally research, surveys and indicators are still at the infancy stage in other countries, some are increasing their efforts to evaluate and assess.

Evaluation and indicators

The Ministerial Council of Education, Employment, Training and Youth Affairs (MCEETYA) in **Australia** is looking into the use of performance measures for student achievement relating to new technologies. MCEETYA also conducted a survey on students' IT skills in information processing and computing.

The University of Sydney conducted research investigating the changes in student performances after integrating ICT into education. Key findings include:

- » ICT increased student engagement, enthusiasm and motivation;
- » More student-centred learning took place;
- » Students' higher-order thinking skills improved;
- » Changes occurred in the teaching practice; and
- » Ability to use emerging technologies improved.

To evaluate all the efforts being made in **India**, a Management Information System (MIS) is being developed. This MIS includes:

- » Student Information Module
- » Assessment Tracking Module
- » Collaborative Module
- » Administration Module
- » Content Updating Module

Since assessment is an important component of the Smart schools, it consists of an on-line assessment system, a database and training and certification for assessors.

The Department of Science and Technology (DOST) in **Malaysia** conducted a survey of schools that gathered baseline data on schools' Mathematics and Science teachers and the extent of the schools' use of ICT for instruction and other purposes. The survey, which covered 4,310 public schools, used the following indicators:

- » The percentage of computers used for instruction and the percentage of computers used for administrative work;
- » The percentage of classes (by subject types) that use computers in instruction;
- » The percentage of schools that engage an outside technician to maintain the computer system;
- » Percentage of schools with telephone line;
- » Observation of teacher and student practices; and

- ▶ Interviews of innovative teachers on practices (teacher and student) related to innovation, problems, solutions and prospects for sustaining and continuing innovation.

ICT indicators in **South Korea** include:

- ▶ Percentage of schools connected to a network (currently 100 per cent);
- ▶ Budget source (currently 25 per cent from the central government and 75 per cent from the regional government);
- ▶ Speed of network;
- ▶ Accessibility to PC (includes number of students per PC which is currently at 1 PC: 8.13 students, number of teachers per PC/ Notebook which is currently at 1:0.9); and
- ▶ Accessibility to equipment.

While **Thailand** has an educational ICT policy and has set up targets for monitoring and evaluation in 1995, the actual monitoring and evaluation activities are lagging behind schedule. Formative evaluation has been done to improve project implementation, but only on a small scale. Summative evaluations have been done, but only with a few projects and with inadequate standards, due to constraints in time, knowledge, financial support and expertise. The Ministry of Education set up a committee to monitor and evaluate the use of ICT in education project recently, but the committee is only beginning its process and will require time to achieve its task.

The Ministry of Public Education in **Uzbekistan** conducts monitoring and evaluation through its 14 Provincial Departments of Education and 15 In-service Training Institutes. School computers are assessed in terms of availability of computers in school and the number of students using PCs. These computers are used to exchange information with the Ministry on regular basis and to receive test results on the knowledge of a) students lower secondary level (7-9 grades) and b) school graduates to access their abilities before applying to higher education institutions.

As mentioned previously, infrastructure still provides a major problem for most countries, as well as integration of ICT within the curriculum, while India and Australia also identify teachers' attitudes as a hurdle.

Some of the problems encountered by schools in **Australia** regarding the implementation of ICT in education were: the cost of infrastructure, unreliability of hardware, lack of management support, teacher reluctance to embrace change, lack of graded professional

Problems and issues

development and lack of strategies and criteria for assessment of non-cognitive outcomes (such as social and affective development, workplace competencies). On the more basic level, connectivity and broadband connection are also issues, specifically relating to price, availability, management issues, and technical support problems.

Similarly, in **India** there are still many challenges and obstacles to hurdle. Among these are software content, infrastructure, lack of trained teachers and lack of motivation in all concerned.

In **Indonesia**, challenges focus more on the integration of ICT in the curriculum, the decentralisation of the educational system and the high cost of Internet connections.

In **the Philippines**, the following were identified as key problem areas for implementing ICT in basic education:

- » Teachers' fear of the technology;
- » School principals' closed mindset to and non-appreciation of the value of ICT to transform and improve education;
- » Constraints of the annual Education Budget;
- » Maintenance of ICT resources and lack of technical staff;
- » Sustainability; and
- » Limited availability of education software and courseware.

In **Thailand**, major issues include:

- » **Accessibility and affordability.** Radio frequency for education is now a major issue facing the education community during this transition period of the commercial liberalisation of the telecoms market.
- » **Networking.** In this area, investment and utilisation are piecemeal, redundant, and cost-ineffective.
- » **Curriculum and content.** The inadequacy of ICT curriculum still impedes technology literacy, while quality contents for on-line and off-line learning remain minimal.
- » **Manpower.** Shortages - in the numbers of computer teacher, qualified IT graduates, researchers, and IT technicians - are impacting on the quality of computer literacy attained.
- » **Investment.** Most investment in-flows were for the hardware end, and little for improving teachers' literacy and content production.

In summary, the problem of the used of ICT for education in Thailand can be classified into three groups: (i) Accessibility and Affordability (ii) Need for appropriate content, and (iii) Need for ICT literate teachers.

The problems in **Viet Nam** remain more fundamental:

- » Price of computers;
- » English language skills are low; and
- » The disparity in living conditions between urban and rural areas.

Statistics from studies reveal that only 2.59 per cent of lower secondary school students and 11.52 per cent of upper secondary school students are trained in ICT.

In Uzbekistan, less than 2 per cent of schools have access to the internet or modern hardware to establish local networking. Most schools cannot afford Internet, as the connection is so costly. Equipment is old and outmoded, while programme support and other office programming is not yet available in all languages of instruction in schools. Teacher training is also scant as yet. The Government is currently employing a range of initiatives to solve these issues.

