TEACHER TRAINING ON ICT USE IN EDUCATION IN ASIA AND THE PACIFIC:

OVERVIEW FROM SELECTED COUNTRIES

By

Information Programmes and Services

Contents

Annexes

Introduction and Summary

There is now an irreversible trend among countries in Asia and the Pacific to transform their teaching force and educational staff into technology literate and skilled workers. In almost all countries in the region, including emerging countries, teachers in primary, secondary and tertiary levels are being trained in the use of information and communication technologies (ICTs) in education with varying degree and scope. In summary, these teacher training programmes on ICT are being initiated:

- with a wide variety of objectives, ranging from supporting broader development goals of creating a workforce equipped for the knowledge society and knowledge economy, to promoting educational reforms and revolutionizing the teaching and learning process;

- through the sponsorship of multiple parties, with many emerging/developing countries largely funded by outside donor agencies, while the more developed nations are receiving substantial Government allocations;

- through ready-made prototype training models, contents and modalities provided by sponsoring agencies, but modified and adapted by the countries;

- with the apparent tendency for curriculum contents to be more oriented towards basic computer literacy for the emerging/developing countries, while the more advanced countries are following a more integrated ICT and pedagogical approach (although this can also depend on the donor agency mandates and thrusts, no matter what the development level of a country is);

- with priority attention being given to training secondary level teachers in charge of selected subjects and with gradual inclusion of principals and administrators in the training scheme - with pre-service teacher training gaining ground as well;

- through a nationwide approach for the more advanced countries and those receiving substantial outside funding; and for less developed countries, through a limited number of pilot schools, but in various parts of the country;

- mostly using face-to-face and limited online modes of delivery; and

- with a few projects sharing their training contents and resources through the Internet.

Objectives of Inventory

To learn from these experiences as well as benefit from existing training resources, UNESCO undertook an initial inventory of professional development and teacher training programmes on ICT from selected countries in Asia and the Pacific (see list below). The inventory looked into the implementing bodies, sponsorship, objectives, recipients of training, geographical coverage, scope and level of training, curriculum course contents, modules and training materials developed, methodologies, and mode of delivery. Data and information culled and analytically synthesized from this inventory will hopefully:

- provide policy-makers and administrators/managers with information to help formulate their teacher training programmes involving ICTs for education;

- assist the trainers in selecting and trying out/adapting existing training curriculum and existing materials, rather than trying to reinvent the wheel;

- help to avoid pitfalls and weaknesses in existing programmes and replicate strengths; and

- assist teachers in identifying and accessing the wealth of training resources that are already available and ready to use.

The inventory is still, at best in the embryonic phase - the initial information will be used to launch a database of teacher training programmes on ICT in the region, to be made searchable online. This is an ongoing project which will see a continuous expansion and updating of the database as all countries in the region begin to perceive the importance of contributing to its updating. The end goal

is to benefit countries in the region in improving their teacher training activities in ICT.

Sources of Information

The main sources of information in this inventory are the administered questionnaires submitted by selected countries through personal contacts and correspondence, as well as limited Internet searches followed up by correspondence to complete missing information. To extract information that was more or less common to all teacher training programmes for purposes of comparison, an inventory form was developed.

While most, if not all, of the items in the administered questionnaires were completed, the Internet searches had many gaps in the information required. Therefore, to reconcile the different degrees of information provided from the two sources, the analysis below focused on those common items which received substantive responses from both sources, and left out items which had scant or uneven information. For example, the initial wish to compile the actual training modules was abandoned simply because they were not readily available and accessible on the Internet and many of them were in the national languages.

The owners were also reluctant to share the information because of policy limitations and copyright issues. Instead, the analysis focused on reviewing the training contents based on the topical outlines derived from the training curricula, which were easier to access. It was also found that such outlines provided enough adequate information to indicate what teachers are being trained on, and thus provide useful directions to policy-makers, managers and practitioners.

More thorough searching on the Internet may unearth further websites that carry descriptions of teacher training programmes in the region, but for the initial analysis, large teacher training projects funded by corporations such as Intel, Coca-Cola, IBM, Nokia and international organizations like World Bank, World Links, Bellanet, UNDP, Japanese Funds, and a few U.S.-based institutions were selected owing to their dominant and accessible presence on the Internet, and because the information given is in English.

Additional effort will also be made to gather information from other countries not included in the inventory directly from governmental officials responsible for training teachers. This information will then be translated in order to draw more concise details about the programmes.

So while the analysis provided here may not be complete and exhaustive, it nevertheless provides a sound basis in understanding what initiatives already exist in the region.

Geographic Range of the Inventory

The information provided and synthesized here is from:

A) Individual countries

Afghanistan
- UNESCO Computer Training Centre for MOE (questionnaire)

Australia
- Victorian Department of Education and Training and IBM (Internet)
- South Eastern Regional Computer Training Centre, Victoria, Australia (Internet - http://www.serct.vic.edu.au)

Indonesia
- State University of Jakarta and other provincial universities (questionnaire)

Korea, South
- KERIS (questionnaire)

Mongolia
- Ministry of Science Technology Education and Culture and JICA (questionnaire)
- Education Research Institute (questionnaire)

Pakistan
- National Institute Planning and Administration, Quetta (questionnaire)
- Ministry of Education and Intel (questionnaire)

Philippines
- Coca-Cola Edventure (Internet)

Singapore
- Instructional Science Academic Group, National Institute of Education, Nanyang Technological University (Internet - http://eduweb.nie.edu.sg/is/)
  - http://eduweb.nie.edu.sg/is/Inservice/AD_ITE.htm - provides the objectives of the in-service teacher training courses, training contents and modules

- http://eduweb.nie.edu.sg/is/ITT/ITT.htm - contents for pre-service teacher training on ICT
- http://eduweb.nie.edu.sg/is/Postgraduate/MAIDT.htm - course contents for postgraduate on ICT

Viet Nam
- Center of information Technology and MOE (questionnaire)
- National Institute of Educational Sciences (questionnaire)

B. Regional or inter-country teacher training projects on ICT

1. SEAMEO INNOTECH (http://www.seameo-innotech.org)

- Cambodia, China, Fiji, Lao PDR, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Viet Nam

2. Intel Teach to the Future (http://www97.intel.com/education/teach/index.htm)

- China (http://www.teachfuture.com/)
- India (http://www.educationinindia.net/)
- Japan
- South Korea
- Malaysia (http://www.i-eduweb.com/teachtothefuture.asp)
- Pakistan
- Philippines
- Taiwan (http://itf.ice.ntnu.edu.tw/)
- Thailand

3. Coca-Cola (http://www2.coca-cola.com/citizenship/education_asia_digital_divid.html)

- Australia
- China
- Malaysia eLearning for Life, Malaysia - (http://www.elearningforlife.org/)
- Philippines - Department of Education, Culture and Sports and Foundation for IT Educational Development - (http://www2.coca-cola.com/citizenship/education_philippines_latest_edventure.html)

4. UNDP

- Ministry of Education, China (Western provinces, Gansu, Sichuan and Yunnan)

5. World Links http://www.world-links.org/english/html/countries.html

- Cambodia
- China
- India
- Indonesia
- Lao PDR
- Philippines
- Viet Nam
- Sri Lanka

C. A few online teacher training programmes from the United States and Canada were also looked into in terms of their training curriculum only as they provide good models either in delivery mode or in a more integrated ICT-pedagogy approach (see Annex for the profile).

Analytical Synthesis of Training Programmes

A. Objectives

1. *To support government ICT policy*

This is presumed here since most of the teacher training on ICT programmes reviewed are being implemented directly under the government or quasi government auspices; government partnership suggests that one of the objectives of the training programme is to support the ICT for education policy and overall ICT master plan of the government. This is supported and confirmed by the fact that most of the administered questionnaires indicated that the countries concerned do indeed have a policy and master plan on teacher training in ICT.

There could be just a few of these training programmes which may operate on their own and conduct training programmes on an ad-hoc basis but are not necessarily linked to the government's policy initiatives and master plan. This could occur if an external donor directly approaches NGOs whose teacher training programmes on ICT may not have any links to the government's efforts.

A good example of an explicit goal in this area is provided by the Malaysian Coca-Cola eLearning for Life initiative, which very clearly states its support of the Malaysian Government in efforts to expand the K-Society and the K-Economy and to revamp the educational system to respond to the knowledge-driven demands of the new economy.

2. *To develop/upgrade knowledge and skills in basic computer literacy and integrated use of ICT in teaching - yet specific/concrete competencies to be improved among teachers and other professionals seldom articulated*

Most of the training programmes carry general objectives aimed at developing awareness, knowledge and skills in either the use

of computers per se, or the integration of computers into teaching. As to what specific competencies are being developed or strengthened in the various uses of ICT in teaching, these are most often not well articulated.

Most of the countries in the region lack official standards/benchmarks concerning teaching/learning competencies of the teachers and students; standards which can guide in formulating objectives and expected outcomes in ICT training programmes. The inventory has found a few exceptions to this – the more advanced countries like Australia, South Korea and Singapore, for example, have formulated the ICT competencies required of teachers. Donor-funded training programmes, such as those run by Intel or Coca-Cola, among others tend to provide more concrete objectives and expected outcomes. A few examples of these are:

- To develop skills in using ICT to support student-centred, inquiry - driven teaching and learning activities
- To undertake extensive research on differential learning experiences which will provide the appropriate pedagogy for ICT-based learning
- To encourage teachers to work in teams, problem-solve, and participate in peer review of their lesson plans
- To design ICT-based constructivist activities
- To develop skills in telecollaboration and working in teams for project-based lessons
- To engage teachers in hands-on learning and the creation of lesson plans and evaluation tools
- To develop models of learning using electronic performance support systems and knowledge management
- To develop skills in the use of productivity and communication tools

3. Training content thrusts generally support three major objectives as far as competency development is concerned

Teacher and staff training programmes usually aim at achieving any or a combination of three general objectives as far as competencies are concerned. These include developing knowledge and skills on:

a) basic computer literacy per se, not necessarily linked to teaching;

b) on the use of ICT hardware and software but linked to teaching and learning; and

c) the effective use of ICT for improving pedagogy in teaching different subject areas, classroom management and in telecollaboration and online school activities.

Most of the countries in the region have learned from the mistakes of the past where teachers were first trained just on basic computer literacy, after which the knowledge and skills learned were never or rarely applied in the schools.

It was observed that an increasing number of countries are now undertaking training to develop skills in the use of ICT in teaching and other school activities, including classroom management, to ensure that teachers bring their skills to actual classroom teaching. For example, South Korea's teacher training objectives are all directed towards developing the skills of teachers to use ICT in teaching Korean, English, Social Studies and Science in 2002-2003 and Ethics, Mathematics, Music, Art, Gymnastics, and Technical/Home economics in 2003-2004.

Higher level teaching pedagogy is offered by Singapore's teacher training programmes, while Intel-funded countries start their training programmes from planning an ICT-based lesson to be integrated into a subject.

The differences in training objectives or thrusts are not only found between countries but also within a country itself. For example, while the cascade type of training usually starts in a holistic and more comprehensive manner during the training of trainers, the second level ends up with diluted objectives and contents aimed at just training teachers in basic computer functions and operations. The original training strategy gets watered down due to the huge numbers of teachers to be trained and lack of time and resources.

4. *The importance of developing teachers' skills in computer configuration and troubleshooting is beginning to be realized by only a few programmes*

Only in very few programmes one finds training objectives that go beyond developing teacher competencies in the use of ICT, into ICT management and technical support, including troubleshooting. This is an aspect which a programme on ICT use in schools cannot exist without, considering that frequent unresolved computer

breakdowns are experienced in many countries (very often with donated, second-hand computers) which result in dampening teachers' enthusiasm.

Philippines' Coca-Cola Edventure and Malaysia's eLearning for Life, for example, have objectives that focus on developing skills in managing ICT facilities, strategies in resolving technical problems or troubleshooting, as well as touching on financial and resources issues.

5. *Skills to undertake online collaboration are gaining ground but require strong connectivity*

More and more countries, especially those funded by World Links and Intel, include in their training programmes a strong emphasis on the use of online tools for collaborative activities, telecollaboration, chatting, discussion groups and building and maintaining online learning communities. World Links also provides opportunities for online learning for the professional development of teachers in the use of ICTs, apart from its face-to-face professional development.

The issue of increasing bandwidth is intertwined with online collaboration, a problem expressed by Australia, among others, as a major need to be met.

Many developing countries may experience frustration over the type of skills to be developed if they lack adequate online facilities to support e-learning.

6. *Reaching the community*

A few training programmes also go beyond school-based training by offering training to the community through school hubs, as in progammes from World Links, Malaysia and Intel-India. Here, the aim is to build ICT hubs and ICT community centres in selected schools to provide access to ICT training to other schools, as well as to the communities in the vicinity. The World Links training programme is also aimed at encouraging the development of school-based telecentres.

7. *Providing technical advice and support*

While some of the training programmes are one-shot activities, a few programmes, as in Australia and World Links countries, provide continuing follow-up support through in-country technical advice and consultancies after the trainees return to their countries. Some organizations run school-based initiatives or centre-based

programmes meant to provide instant response to requests for technical assistance. Follow-up services also include providing consultation in feasibility, connectivity, policy and strategy development, e-learning, curriculum development and others.

This objective is very rare but most practical in further enhancing teachers' mastery of skills, while promoting sustainability in ICT use in schools.

B. Training Recipients and Scope

1. *Type of trainees*

Courses are most frequently oriented toward in-service teachers, perhaps because pre-service teachers are gaining access to ICT curricula during their university or college studies. Countries either train all in-service teachers in all subject areas, or only those teachers teaching selected priority subjects. South Korea, India, Mongolia and Viet Nam all concentrate on training in a few subject areas first and then expand training to other subjects as the project progresses.

While teachers are the main target audience, many of the inventoried programmes also address the critical need for administrators to understand the management issues of technology well enough to make sound decisions for ICT policy and programme implementation. Afghanistan, Mongolia, Pakistan, World Links-funded countries and Coca-Cola and Intel projects include principals, headmasters, supervisors and administrators in their training courses.

The number of countries providing ICT training at both pre-service and in-service levels is growing. Four inventoried countries, namely, India, South Korea, Singapore and Indonesia, have reported that both in-service and pre-service teachers have been trained and in massive numbers. Singapore and South Korea have integrated pre-service teacher training on ICT in various undergraduate and graduate studies, while an increasing number of universities/ colleges in India are just starting to integrate ICTs into their teacher training colleges. The more advanced countries usually cover both in-service and pre-service K-12 teachers (South Korea, Australia, and the U.S.). Intel-funded countries (China, India, Japan, Pakistan,

Malaysia, Philippines, South Korea, Taiwan and Thailand) also cover both in-service and pre-service teachers.

The public at large and communities are also being reached. A few online training courses are open to the general public. Some projects, such as Malaysia's eLearning for Life, World Links-sponsored countries and IBM, include community participation in various forms as a means to broaden the scope of their programme and provide ICT access to the community. IBM addresses the learning community and encourages parental participation, while World Links employs a more direct community role through the development of community learning telecentres based in the schools.

2. School level of trainees

Teachers are being trained at primary, secondary and collegiate levels. However, due to funding constraints and the massive infrastructure and facilities required, secondary level training is initiated first in many developing countries. The more advanced countries cover all three school levels simultaneously, as in Australia, South Korea and Singapore, among others. Most of the World Links-funded countries cover the in-service secondary level only. Malaysia's eLearning for Life and Philippines' Coca-Cola Edventure cover in-service training for the secondary level.

3. Number of teachers being trained and already trained

The number of teachers being trained varies greatly from country to country. Inventoried programmes have reported having trained huge number of teachers, especially in those countries which have had a long history of training, are more financially endowed, and are more advanced in their ICT development. South Korea, for example, reported of having trained all teachers in selected subjects, or a total of 3,897 in-service teachers per year. Intel India has reported of training 230,540 in-service teachers across 35 cities in India and a total of 29,702 pre-service teachers. Intel Malaysia has trained over 15,000 teachers to date, while the World Links-sponsored training programme in India has trained 130,000 teachers.

Some countries start with small numbers of teachers per school, such as three to four teachers per school in several schools or ten teachers from a few pilot schools. The number of teachers to be covered also depends on the scheme being followed. Malaysia's eLearning for life and Intel's Teach to the Future train a specific number

of teacher trainers in each school who, in turn, are instructed to train the other teachers in their respective schools. This cascade type of echo training ensures that more teachers will have the opportunity to be trained on ICT simultaneously nationwide.

A number of the projects start with selected pilot schools spread all over the country, a selection of sample schools representing the urban, semi-urban and remote areas, as in the Philippines, or a concentration within a single region of the country, as in the Western provinces of China.

Most of the projects inventoried are undertaking the training on a selective basis - pilot testing on a few schools first reaching not more than 1,000 trainees per year, while many are training nationwide.

4. *Geographical coverage, location, duration*

Most of the more advanced countries - in terms of length of ICT use and presence of donors like Intel - cover wide areas in their training. The location of training is generally in the country capitals, if not major cities and often covers selected provinces or regions of the country, as in China, Malaysia, South Korea, the Philippines and so on. If training runs nationwide, the training courses are usually organized or coordinated by the provincial or regional education offices.

It should also be noted that different donor-funded teacher training projects select various parts of the country to avoid overlap, and consequently result in covering many different places nationwide. China, the Philippines, Viet Nam, Malaysia, Coca-Cola, Intel and IBM sponsor various teacher training programmes on ICT in different places in the country. Meanwhile, emerging countries like Afghanistan, Cambodia, Lao PDR, Mongolia, Myanmar, and Viet Nam are going slowly in extending their coverage by just pilot testing the activities in a few provinces or schools.

The duration of training varies from country to country - 5, 10, 14, 21 days (Mongolia); 10-15 weeks (Afghanistan); one week and 20 days (Pakistan); 14 days (Korea and Viet Nam); or as short as 2 days on specific training on the use of Internet for university teachers in Indonesia. South Korea uses 60 hours/30 hours/15 hours to measure the length of teacher training programmes. Malaysia's Intel-sponsored training programmes require 40 hours of in-class

training for 10 modules (at 4 hours each) and 20 hours of take-home activities. The length of training is critical in planning a teacher training programme on ICT, as if a course is too short, how can teachers be expected to have developed the knowledge and skills sufficient for confident classroom appilcation?

5. Trainers

Who are the trainers? One will note that most of the trainers were sourced from outside the organizations. These include trainers from funding agencies (in Afghanistan and Mongolia among others); from universities of technology (in Mongolia); from training centres (in Mongolia, Pakistan, Viet Nam); and experts invited from various organizations (in Mongolia, Viet Nam).

Four countries inventoried reported of running training courses by in-house trainers (Indonesia, Singapore, South Korea and Viet Nam). Countries sponsored by Intel in their Teach to the Future Project rely on the peer approach type of training and thus mobilize local skills across the country in spreading ICT skills among teachers. The same holds true for Coca-Cola's eLearning for Life Programme in Malaysia.

Key issues that arise in this area are the lack of trainers who are pedagogy-based; the need to form a training team that will comprise subject specialists, pedagogy specialists, and ICT experts to ensure developing pedagogy-based ICT skills; the need to develop a critical mass of trainers who are skilled in the pedagogy-based integrated use of ICT; and the effectiveness of the peer approach in cascade training.

C. Programme Sponsorship

The inventory presents programmes that have been developed through a variety of means. International organizations like the World Bank and individual national development agencies have pioneered some of these programmes. Technology industry leaders have also championed the development of programmes, often engaging the governments of the specific nation within which they work. Examples of these donors which pioneered teacher training on ICT include Intel with Microsoft, Coca-Cola, IBM, World Links, World Bank, Bellanet, UNDP, Japanese Funds and JICA, among others.

The more advanced countries like South Korea, Australia, Singapore and Malaysia receive a large portion of funds for teacher training from

Government allocations. In summary, sponsorship has been an important aspect for providing training and pedagogy in emerging nations. The costs of technology and the continued expansion of training programmes to a large body of in-service and pre-service educators are enormous, explaining why it was not possible for the Governments of some countries to do it alone. Outside help at the beginning of the programme on ICT for Education has been necessary.

Some agencies, like Bellanet iTrain have provided enormous assistance by making materials available in a variety of languages. Other organizations, like Intel, World Links, and Japanese Funds have provided assistance by provision of programme sponsorship around the world. Some of these programmes also provide the hardware and software like Microsoft products.

Many programmes have worked directly with governments, bringing curriculum to the professional development communities working in government schools. Together they build the capacities of staff and encourage the spread of ICT teaching to places where otherwise resources may not yet be available.

Issues in sponsorship

1. Cost in developing modules

Some argument could be made as to the cost effectiveness of emerging nations developing their own modules, rather than localizing content that already exists. Pilot training projects which were sponsored by external funding institutions have developed such modules in many countries. These could be revised and adapted for either initiating or for further expansion of existing professional development programmes in the region.

2. Training scheme

There seems to be a trend to employ the peer training approach, especially with Intel-sponsored programmes, where teachers from schools are trained first and when they go back to their respective schools are instructed to train the rest of the teachers.

On the one hand, such an approach has the advantage of skipping the pilot testing phase while promoting the immediate spread of technology skills development on a nationwide basis, as well as allowing native language peer-to-peer instruction of the content.

Yet the main disadvantage of this approach is the dilution of the quality of the training, especially if the trainer has not mastered enough knowledge and skills to share with other teachers.

A spot check in one school in the Philippines following this approach has shown that although a teacher had been trained as a peer trainer in various aspects of ICT use, including the integration of ICT in teaching, the peer training they conducted in their school only covered basic computer literacy, neglecting integrating technology within the teaching/learning process. Another weakness may be that the teacher trained is not able to transfer the knowledge in the time limits given and in the midst of inadequate support.

3. Access to online facilities and infrastructure

In terms of access, language, programme coverage, infrastructure, and copyright must be considered, amongst other issues.

Infrastructure is a key issue that is sometimes overshadowed. The cost associated with the provision of adequate access to the Internet is prohibitive for the educational systems in many emerging nations. In order for countries to use materials that may be online, they need infrastructure that can support rich media, because even the most simple of demonstration programmes (ActDen) uses a high graphic representation in its more accessible version without Flash.

A few of the teacher training projects covered in the inventory in fact promote online collaborative projects and telecollaboration, use of Internet resources to develop lessons and lesson plans, chatting and engaging in discussion forums, etc. which require a reliable connection, i.e. broadband, which is costly.

The issue of language is another significant factor to consider, as most of the resources are in English and are not easily understood by many in the region.

D. Training Contents

Most of the countries inventoried indicated that they have produced modules and materials for use in training teachers and other education professionals. Some general trends can be seen from a review of these contents.

Within a country where varying kinds of teacher training programmes on ICT sponsored by various donor agencies simultaneously take place, the content focus tends to differ. The content focus can range

from being hardware and software applications-oriented with no link to teaching/learning; to a combination of basic computer literacy and the use of hardware and software in teaching/learning; to a more pedagogy-based and integrated use of ICT in the schools, not only in teaching but also in management, online collaboration and communications. The content thrusts are also dictated by the purposes and mandates of the donor agencies.

The Intel Teach to the Future programme provides a flexible, modular curriculum delivered by teachers for teachers. The curriculum is based on MS Office 2000 Professional as a teaching and learning tool. The training incorporates the use of the Internet, web page design and multimedia software. Countries have the prerogative to modify the modules and training offerings based on specific country needs and context.

It is interesting to note that most of the administered questionnaires submitted by emerging countries focus on basic computer literacy – hardware and software applications. Basic computer literacy refers to developing knowledge and skills on PC structure and functions; operation systems; MS Office applications like Word, Excel and PowerPoint; e-mail; and the Internet, as has been the focus in Mongolia, Pakistan and Afghanistan, among other countries. Training programmes given by JICA as seen in Mongolia and Thailand tend to focus on Linux applications and installing and configuring Linux – too complicated and technical for primary school teachers.

Training programmes that go beyond the basics and cover the integrated use of ICT and pedagogy, as well as applications of teaching/learning principles on instructional design and development are run by Singapore, Australia, Malaysia and South Korea. Many training programmes sponsored by Intel, IBM, Coca-Cola and World Links also place a high premium on online telecollaboration and networking, as well as classroom management, even including sessions on troubleshooting.

Synthesis of training contents

This synthesis is offered by various countries and sponsors in their training programmes on ICT, categorized into common groupings:

Three main trends in content focus

- **basic computer literacy, dealing with hardware and software/ applications without necessarily being connected to teaching and learning** (ActDen; iTrain of Bellanet). In some countries, the content just deals with developing skills on the basic operations and functions of a computer with no software applications included in the training.

- **basic computer literacy** also as the main focus, but this time in relation with or **in support of teaching and learning activities** as shown in their practicum and exercises.

- **contents that integrate the use of ICT and pedagogy;** use of ICT in teaching specific subjects in the classrooms; the Internet as a pedagogical innovation and used for collaborative activities; school and classroom management with troubleshooting techniques thrown in for a few of the programmes.

1. Under basic computer literacy, the following course contents are offered:

    a. Basic computer parts and functions (opening, closing and saving files, optimizing the hard disk, managing files, opening and renaming files, viruses, zipping and unzipping, etc.)

    b. Operating systems (Windows Operating System and others)

    c. Software applications – MS Office (not necessarily linked to teaching/learning)

    - Word processing (MS Word)
    - Spreadsheets (Excel)
    - Presentations (PowerPoint)
    - Website navigation and Internet searching (Internet Explorer, Netscape)
    - E-mailing (MS Outlook, Eudora, Pegasus), Website development/designing (FrontPage, Dreamweaver)
    - Graphics and drawing (Paint Shop Pro, PhotoDraw, Adobe Illustrator, Inspiration)
    - Databases, data entry, and programming (Access, Pascal, Coldfusion)
    - Desktop publishing (Publisher, PageMaker, etc.)
    - Designing print materials (elements of design and layout, using fonts, graphics and colours)

- Scanning text and graphics
- Video – video production and editing (script writing, shooting, video graphics, sound recording, editing)
- Chatting, discussion groups (ICQ)

2. Under the second trend – use of ICT hardware and software for teaching/learning activities, the same topics under category one are also given, but are more linked to teaching and learning, where samples and practicum exercises demonstrate how such software and applications can be used for various teaching and learning activities. Below are examples of these course contents:

   a. Creating student reports in Word, Access, and others

   b. Using Excel to create class lists and for assessment record-keeping in the classroom, alarms, split screens, assessment and print worksheets and spreadsheets etc.

   c. Creating animations for integration into art studies

   d. Using WebQuests - online problem solving tasks to support a thinking-oriented and student-oriented curriculum and to collaboratively develop their own online curriculum resources

   e. Using PowerPoint for presentations in the classroom for a variety of curriculum areas

   f. Using NetMeeting in the classroom, including the use of chat, whiteboard sharing, files, cameras and microphones

   g. File management for teachers for creating folders, moving files, renaming files, etc. for their assignments and documents

   h. Using Publisher software to create a class newsletter or teachers' newsletter and students' publications

   i. Using FrontPage/Dreamweaver for creating a classroom webpage

   j. The Internet for teaching/learning

- Effective searching strategies and techniques
- Online research
- Evaluating websites
- Online ethics and Netiquette

- Intellectual property and Copyright laws
- Creating an Acceptable Use Policy

- Internet access and safety issues
- Using the Internet for teacher-led instruction, student-directed learning and project-based learning
- Creating an Internet-based lesson plan
- Meeting academic standards with the Internet
- Publishing on the Web

k. Creating a website or web page for teaching/learning

- Website as a pedagogical communications tool
- Website as a container of curricular materials
- Web publishing in the classroom

    - Tools and fundamentals for web page creation and publishing

    - Building a Web-based project or activity that integrates the Web into the classroom

- Building a telecollaborative library

l. Using e-mail for telecollaboration

m. Developing productivity tools like templates, tests, mark sheets

n. Creating multimedia presentations for teaching a lesson

- Instructional media design and multimedia design
- Various basics, tools, software, multimedia applications to create a multimedia project for the classroom (HyperStudio, KidPix, PowerPoint, etc.)
- Searching the Internet for good multimedia lessons, activities and resources as well as pedagogical issues
- Creating a standards-based lesson, unit or project that integrates multimedia
- Using and producing video for classroom teaching
- Instructional photography
- Visualising the thinking process with IT Tools
- Facilitating the creation of hypermedia

3. The third type and the more advanced level focuses on pedagogy-based ICT use; the integrated use of ICT in subject curricula and classroom teaching and management, online collaboration and networking.

    Singapore is the best example of both in-service and pre-service training curricula that incorporates pedagogy, i.e. teaching/learning principles and effectiveness into ICT design and development. The pre-service training focuses on technology integration in the school curriculum, and developing different approaches in teaching with technology, such as the use of ICT in constructivist learning, problem-solving and project-based learning. The in-service teacher training covers three levels: a) the basic, which uses learning resources in the virtual world, e-learning, multimedia presentations; b) the intermediate, which covers integrating ICT into curriculum, ICT tools in thinking, learning and visualizing, developing ICT-based activities; c) the advanced, including designing ICT-based constructivist activities, project-based ICT class/lesson and cutting-edge technologies in education.

    South Korea's training contents begin with the use of ICT in teaching specific subjects where the trainees select and analyse a subject into which ICT will be integrated; apply ICT models into these subjects and require teachers to develop and evaluate their own ICT-based class.

    The approach employed by Coca-Cola's eLearning for Life initiative in Malaysia begins by revisiting a specific lesson plan, improving, building and enriching it not only with ICT, but with appropriate pedagogy/teaching and learning principles, after which the developed lesson is integrated into the subject curriculum. The strategy or principle usually followed is to empower the lesson plans with multimedia technologies and ICT.

    The Intel Corporation follows the same strategy in their training contents in various Asian countries. The main goal of the training is for teachers to develop a unit plan template on a particular subject, a portfolio rubric and a sample unit portfolio of ICT-based lessons. All of the tools and software learned, as well as outcomes (multimedia presentations, publications, websites, assessment tool, handouts, templates, worksheets,

and classroom management documents) developed during the training are integrated into the teaching of a unit plan of a specific subject.

Below is a synthesis of these contents offered by various countries at the more advanced stage:

a. **ICT and pedagogy integration (Instructional technology and use in various models of teaching/learning as well as design and principles for integration into subject curriculum and classrooms)**

■ Technology and instructional concept and design and application to teaching/learning principles/models

- Instructional strategies and learning effectiveness

- ICT-based tools for designing constructivist activities; project-based work; building critical thinking skills; collaborative activities; interdisciplinary project work; other interactive multimedia-based activities to empower the learners as a whole

- ICT-based activities to support differing learning styles and those with special needs

- Instructional media design and multimedia design based on various learning principles

- The Internet as a pedagogical innovation

■ Principles for integrating ICT into the classroom

■ Curriculum mapping

■ ICT use in creating problem-based curriculum

■ Planning and developing a technology integrated lesson (curriculum enrichment)

- Analysing a subject and/or reviewing a lesson plan of a specific subject and planning to incorporate effective teaching/learning principles and the use of ICT

- Improving or creating an ICT-based lesson plan (empowering subject/lesson plan with ICT); or preparing unit lesson plan template, portfolio rubric and sample unit portfolios of lessons

- Locating resources from the Internet; CD, etc. for the sample unit/lesson plan

- Creating subject unit/lesson plan support materials (spreadsheets, multimedia presentations, publications, student and teacher's support materials, grade book worksheet, creating student database; websites, videos, PowerPoint, etc.)
  - Putting a lesson plan together
  - Assessing lesson plans
  - Planning on how to integrate the improved lesson into the teaching of a specific subject
- Best practices and ICT models of technology integration
- Integrating telecollaboration and online discussion forums into existing curriculum
- Teaching and classroom management
- Introduction to a One-Computer classroom
- The Next Wave: Cutting-edge Technologies in Education

b. Integrating ICT into teaching specific subjects

- Use of ICT in science
  - How ICT improves the teaching/learning of science or how to improve science teaching through intelligent and informed use of technology
  - Searching and using Internet resources for science materials and lessons
  - Science education on the Internet
  - Use of computers software and calculators for science teaching
  - Use of computer to simulate scientific phenomena and use of graphic calculators to collect and analyse data
  - Constructing technology-enhanced lessons or lesson plans within a science curriculum
- Use of ICT in mathematics
  - How ICT improves the teaching/learning of mathematics or how to improve mathematics teaching through intelligent and informed use of technology
  - Searching and using Internet resources for mathematics materials and lessons

- Use of computer software and calculators for mathematics teaching
- Use of computers and graphic calculators to collect and analyse data and to build and test mathematical models of the real-world
- Constructing technology-enhanced lessons or lesson plans within a mathematics curriculum

■ Use of ICT in language arts

- How ICT improves the teaching/learning of language or how to improve language teaching through intelligent and informed use of technology
- Searching and using Internet resources for language materials and lessons
- Searching literature-based, creative writing, problem-solving Internet projects with the option of using interpersonal exchanges, virtual gatherings, peer feedback or mentoring to support student learning.
- Constructing technology-enhanced lessons or lesson plans within a language art curriculum

■ Use of ICT in social studies

- How ICT improves the teaching/learning of social studies or how to improve social studies teaching through intelligent and informed use of technology
- Searching and using Internet resources for social studies materials and lessons
- Searching problem-solving, enquiry and creative thinking materials with the option of using interpersonal exchanges, virtual gatherings, peer feedback or mentoring to support student learning
- Constructing technology-enhanced lessons or lesson plans within a social studies art curriculum
- WebQuests

■ Use of ICT in health education and PE

■ Use of ICT in chemistry

■ ICT and multicultural education

- Integrating technology into K-12 classrooms
  - Reviewing available instructional technologies and models of technology use in the classroom
  - Understanding the benefits of incorporating technology into education
  - Technology integration – planning and implementing technology use in the classroom
  - Classroom management
  - Evaluating lesson plans that integrate technology
  - Understanding classroom management issues
  - Integrating the Internet and other resources into elementary classrooms (search techniques, safety, ethical/legal issues, evaluating websites, teacher and student Internet resources)
  - Software evaluation and integration in classrooms
  - Creating a technology-enhanced lesson or a teacher/ student project
  - Web page development for teachers
- Teaching with educational software and other applications
  - Teaching with WebQuests
  - Logo
  - Science software such as Redshift, Eco Ranger, Dynamic Rain Forest, Thinking Science, etc
- Use of software that employs simulators to simulate experiments for interactive activities in physics, science, etc
- Assessment and evaluation - Understanding and evaluating students' learning in an ICT environment and measuring ICT impact and effectiveness

c. Use of online communication tools

- Information literacy
- Online learning environment
- Online communication tools – the website as a pedagogical communications tool

- The Internet

  - Introduction to telecommunications, primer on the Internet and the World Wide Web

  - Useful Internet resources

  - Using Internet tools, search engines, e-mail, etc.

  - Dealing with Internet information (safe access and Acceptable Use Policies; copyright issues; evaluating and citingonline resources)

- Collaborating online (telecollaboration)

  - Joining a collaborative project online

  - Online search for telecollaborative projects

  - Schools online project updates

  - Designing telecollaborative projects - steps in designing and implementing; analyzing a telecollaborative project; creating a telecollaborative project website; publicizing telecollaborative projects

  - Project-based learning

  - Creating a pilot e-mail project

  - List server simulation

  - Creating an electronic mailing list

  - Using online experts to enhance student interest and learning

d. Technology management and installation

- Troubleshooting

  - Approaches and techniques/tips for troubleshooting (peripherals, networks, backups)
  - Operating system configuration
  - Hardware and software basics
  - Computer maintenance and preventive measures (utilities, viruses)
  - Technology resources and repairs (Internet resources for troubleshooting)
  - Installation of memory chips
  - Preventive maintenance and repair strategies
  - Report of a troubleshooting experience

- Essentials of networks (LAN)
- Setting up an Intranet
- Setting up, installing and using Linux
- Zipping and unzipping

e. Linking schools with the community

- The schools and the community: challenges and opportunities for linking through technology
- What are telecentres?
- Setting up telecentres in schools (needs assessment, designing and setting up, disseminating)

Other trends

4. Introduction sessions to motivate - Some training courses have gone directly to training on basic computer literacy and software without first introducing the teachers and other staff to the rationale and justifications for the use of ICT to improve teaching/learning or situating ICT use in their own classroom environment. Thus, after the training sessions, teachers go back without being convinced and motivated enough to use the new knowledge and skills that they have learned. Ideally, training courses should have the following introductory sessions, as a number of countries, such as Singapore, have included in their training courses:

- Introduction to ICT and its application in education
  - Role of ICT in teaching methodology renovation (ICT and pedagogy)
  - New roles of teachers in the ICT environment
  - Selecting strategies/technologies for teacher training
- ICT and pedagogy
  - Pedagogical principles for integrating ICT into classrooms
  - Curriculum mapping
  - Utilizing technology in creating problem-based curriculum
  - Building critical thinking skills in the classroom
  - Constructivism in the classroom

- Creating units to support differing learning styles – multiple intelligences
- The Internet as a pedagogical innovation

5. Training of administrators - An increasing number of countries are starting to include administrators like principals and supervisors in their training courses, since their role is pivotal to the success of a school ICT endeavour in terms of support, especially to teachers. Examples of training course contents offered by the Coca-Cola-sponsored training course in the Philippines, with some additions from other programmes include:

- An overview of ICT use in education and introduction to instructional technology
- Drivers of and barriers to use of ICT in education
- Strategic planning, developing an ICT in education vision
- The need for a technology plan in schools – architecture and infrastructure, functions, services and capabilities
- Role of school administrators
- Issues in teacher training and professional development
- Technical sustainability
- Identifying opportunities to apply ICT and designing ICT strategies
- Policy on appropriate ICT use
- Creation of Acceptable Use Policy
- Information literacy and telecollaborative learning
- Financing centre operations
- Partnerships, community mobilization and strategies for resource generation
- Monitoring and evaluation
- Basics of WWW, e-mail, distance learning, etc.

6. A few programmes (Edventure in the Philippines and World Links) tend to place emphasis on teaching the teachers with online communication tools and project-based learning and telecollaboration, optimizing the value of e-mail and the Internet for discussions and collaborative activities.

7. One programme (World Links) went beyond the use of ICT in schools and included a session on how telecentres can be built and maintained in schools for community use. This shows how the schools which are more equipped with trained personnel and facilities can help communities harness the use of ICT in order to improve their lives and daily activities.

8. A training course on ICT does not necessarily have to be entirely computer-based. Some training programmes (SEAMEO INNOTECH) do not only develop skills in producing computer-based products but still include print, video and multimedia production focusing on media design and techniques, development and production presentation, as well as various digital tools for teaching.

E. Mode of Delivery

Almost all countries in the region and the majority of the training programmes reviewed provide training on a face-to-face mode. Clearly, the value of face-to-face training is still highly acknowledged in the region. Also, running online courses can be costly and difficult to manage in countries where little experience and skills in this area are still the rule rather than the exception.

Only two countries reported of a combination of face-to-face and online modes – the IBM-sponsored training course in Viet Nam and South Korea, where the evaluation of learning is done online, while the rest of the training is face-to-face.

Purely online courses are run by commercial companies and educational foundations on the Internet. Examples of these are Microsoft's ActDen, PBS, Bellanet iTrain – whose modules can be accessed on the Internet and are either open source or one needs to register and enroll. PBS provides online, informal self-paced lessons and online formal professional development within supervised learning communities

F. Methodologies Used

Countries usually employ a combination of teaching methodologies. The more common ones that are usually used together include lectures/presentations, discussions, group work/activities, computer hands-on and practicum.

Other methodologies employed are:

- Project-based learning with teachers working in teams
- Constructivist learning approaches where learners are encouraged to participate in a generative learning experience by participating in small group discussions, paired projects, peer review activities
- Simulations
- Hands on experience with technologies
- Demonstration
- Peer discussion
- Brainstorming
- Collaboration
- Joint planning

One curious questionnaire completed by Mongolia reported of a teacher training session on using PCs in teaching (includes PC structure, operating systems, word processing, spreadsheets) where the methodologies used include lectures/presentations only.

Conclusions and Implications

1. Many countries in the region reported of having developed a policy and master plan on teacher training on ICT. Yet these plans still need to be looked into more carefully to link them to the broader ICT for development and education goals – they need to be updated, encouraging a movement from developing basic computer literacy competencies to ICT-integrated teaching/learning. Many countries are realizing that they have developed their ICT in education policy from the technology perspective and understand the need to revise and overhaul the policy from the pedagogy-based perspective.

2. There is a clear need for countries to formulate their basic standards/benchmarks and ICT competencies for teachers, managers and students that can serve as a basis for developing teacher training programmes on ICT.

3. While basic computer literacy and software applications need to be taught to teachers and other professionals, they should be offered as an integral part of the teaching and learning process or as pedagogical tools rather than as applications per se. Countries should now start moving forward in developing their training courses to focus on the development of skills in the pedagogy-based and integrated use of ICT into the subject curricula and classroom teaching.

4. Intertwined with the need for training programmes to focus on the development of skills in the pedagogy-based and integrated use of ICT into teaching is the corresponding need to build a critical mass of trainers in the countries that have a mastery of knowledge and skills in this area.

5. Training programmes should always start with an introduction of the rationale and purpose of using ICT in teaching/learning, the role of teachers in the new ICT environment and how they can benefit from the use of ICT, even before the technical aspect is given. Experience in certain countries has shown that without the motivational push, teachers do not bring back what they have learned into classroom application.

6. The issue of whether troubleshooting and technical maintenance should be included in the training of all teachers or only given to selected key teachers needs to be considered more carefully.

7. The value of training principals and headmasters together with the teachers (but on a different stream) is beginning to be recognized in many countries in the region and practiced by a few. This trend should be replicated and expanded to other countries as well.

8. Similarly, extending the training facilities and programmes to the community, such as to the parents, can benefit school-based programmes in terms of support to both teachers and students. This approach also provides access to resources that can help improve community life.

9. There is now a growing body of tested training modules and materials that can be replicated or adapted by countries planning to implement new training programmes. The issues of sharing, copyright and open source need to be addressed to break the barriers that prevent the poorer countries or marginalized areas from tapping into this wealth of resources.

10. The inventory of teacher training on ICT programmes initiated by UNESCO should go beyond profiling into serving a clearing house and depository of actual copies of training modules and materials on ICT.

11. Best practices and lessons learned in teacher training/ professional development on ICT should be documented in a more in-depth manner, as it is more cost-effective and wiser to learn from other countries' experiences which have pioneered in this area and have accumulated lessons learned, rather than starting from zero.

12. The huge amounts of resources invested in teacher training programmes will only pay off if teachers go back to their schools with continuing support in terms of facilities/equipment, connectivity, appropriate software installed, materials and technical and help-desk support.

13. Countries should now start venturing out into gradual use of online learning combined with the face-to-face mode of delivery – selecting parts of the training programme that can easily be implemented online.

14. To enable countries to learn from each other, especially those less advanced countries learning from the more developed ones, attachments and study visits should be considered.

15. To enable countries to have equal access to the wealth of training resources that are beginning to grow, digital/electronic copies of these should be made available on the Internet as open source, gathered by UNESCO through a Web-based clearing house.

Annexes

1. *Synthesis of Contents/Topics of Curricula for Training Teachers and Others on ICT*

2. *Summaries of the Training Contents of Various Organizations*

Synthesis of Contents/Topics of Curricula for Training Teachers and Others on ICT

A. Introduction to ICT and its application in education

- Role of ICT in teaching methodology renovation (ICT and pedagogy)
- New roles of teachers in the ICT environment
- Selecting strategies/technologies for teacher training

B. Optimizing the use of ICT in schools (for administrators and policy-makers)

- Overview of ICT use in education and introduction to instructional technology
- Drivers and barriers to the use of ICT in education
- Strategic planning, developing the ICT in education vision
- The need for a technology plan in schools – architecture and infrastructure, functions, services and capabilities
- Role of school administrators
- Issues in teacher training and professional development
- Technical sustainability
- Identifying opportunities to apply ICT and designing ICT strategies
- Creation of Acceptable Use Policy
- Information literacy and telecollaborative learning
- Financing centre operations
- Partnerships, community mobilization and strategies for resource generation

- Monitoring and evaluation
- Basics of WWW, e-mail, distance learning, etc.

C. ICT and pedagogy

- Pedagogical principles for integrating ICT into classrooms
- Building critical thinking skills in the classroom
- Constructivism in the classroom
- Creating units to support differing learning styles – multiple intelligences
- Curriculum mapping
- Utilizing technology in creating problem-based curriculum
- The Internet as a pedagogical innovation

D. Basic hardware/software/applications per se (not necessarily linked to teaching/learning)

- Basic computer parts and functions (opening, closing and saving files, optimizing the hard disk, managing files, opening and renaming files, viruses, zipping and unzipping, etc.)
- Operating systems (Windows Operating System, others)
- Software applications – MS Office (specify – not necessarily linked to teaching/learning)
- Word processing (MS Word)
- Spreadsheets (Excel)
- Presentations (PowerPoint)
- Website navigation and Internet searching (Internet Explorer, Netscape)
- E-mailing (MS Outlook, Eudora, Pegasus)
- Website development/designing (FrontPage, Dreamweaver)
- Graphics and drawing (Paint Shop Pro, PhotoDraw, Adobe Illustrator, Inspiration)
- Database, data entry, and programming (Access, Pascal, Coldfusion)
- Desktop publishing (Publisher, PageMaker, etc.)
- Designing print materials (elements of design and layout, using fonts, graphics and colours)

- Scanning text and graphics
- Video – video production and editing (script writing, shooting, video graphics, sound recording, editing)
- Chatting, discussing (ICQ)

E. Use of basic software/applications in teaching and learning

- Creating students report in Word, Access, others
- Using Excel to create class lists, for assessment record-keeping in the classroom, alarms, split screens, assessment, and print worksheets and spreadsheets etc.
- Creating animations for integration into art studies
- Using WebQuests (online problem solving tasks and to support a thinking-oriented and student-oriented curriculum) to collaboratively develop online curriculum resources
- Using PowerPoint for presentations in the classroom for a variety of curriculum areas
- Using NetMeeting in the classroom, including the use of chat, whiteboard sharing, files, cameras and microphones
- File management for teachers for creating folders, moving files, renaming files, etc. for their assignments and documents
- Using Publisher to create a class newsletter or teachers' newsletter and students' publications
- Using FrontPage/Dreamweaver to create a classroom webpage
- The Internet for teaching/learning
  - Effective searching strategies and techniques
  - Evaluating websites
  - Online ethics and Netiquette
  - Intellectual property and copyright laws
  - Creating an Acceptable Use Policy
  - Internet access and safety issues
  - Using the Internet for teacher-led instruction, student-directed learning and project-based learning
  - Creating an Internet-based lesson plan
  - Meeting academic standards with the Internet
  - Publishing on the Web

- Creating a website or web page for teaching/learning
  - Website as a pedagogical communications tool
  - Website as a container of curricular materials
  - Web publishing in the classroom
  - Tools and fundamentals for web page creation and publishing
  - Building a Web-based project or activity that integrates the Web into the classroom
- Building a telecollaborative library
- Using e-mail for telecollaboration
- Developing productivity tools like templates, tests, mark sheets
- Creating multimedia presentations for teaching a lesson
  - Various basics, tools, software, multimedia applications to create a multimedia project for the classroom (HyperStudio, KidPix, PowerPoint, etc.)
  - Search from the Internet for good multimedia lessons, activities and resources as well as pedagogical issues
  - Creating a standards-based lesson, unit or project that integrates multimedia

F. Integrating ICT into classrooms and subjects

1. ICT and pedagogy integration (instructional technology and use in various models of teaching/learning, as well as design and principles for integration into subject curriculum and classrooms)

- Technology and instructional concept, design and application to teaching/learning principles/models
  - Instructional strategies and learning effectiveness
  - ICT-based tools for designing constructivist activities; project-based work; building critical thinking skills; collaborative activities; interdisciplinary project work; other interactive multimedia-based activities to empower the learners as a whole
  - ICT-based activities to support differing learning styles and those with special needs

- Instructional media design and multimedia design based on various learning principles
- The Internet as a pedagogical innovation
- Principles for integrating ICT into the classroom
- Curriculum mapping
- ICT use in creating problem-based curriculum
- Planning and developing a technology-integrated lesson (curriculum enrichment)
  - Analysing a subject and/or reviewing a lesson plan of a specific subject and planning to incorporate effective teaching/learning principles and use of ICT
  - Improving or creating an ICT-based lesson plan (empowering subject/lesson plan with ICT); or preparing a unit lesson plan template, portfolio rubric and sample unit portfolios of lessons
  - Locating resources from the Internet; CDs, etc. for the sample unit/lesson plan
  - Creating subject unit/lesson plan support materials (spreadsheets, multimedia presentations, publications, student and teacher's support materials, grade book worksheet, creating student database, websites, videos, PowerPoint, etc.)
  - Putting a lesson plan together
  - Assessing lesson plans
  - Planning on how to integrate the improved lesson into the teaching of a specific subject
- Best practices and ICT models of technology integration
- Integrating telecollaboration and online discussion forums into existing curriculum
- Teaching and classroom management
- Introduction to the One-Computer classroom
- The Next Wave: Cutting-edge Technologies in Education

2. Integrating ICT into teaching specific subjects

- Use of ICT in science

- How ICT improves the teaching/learning of science or how to improve science teaching through intelligent and informed use of technology
- Searching and using Internet resources for science materials and lessons
- Science education on the Internet
- Use of computers software and calculators for science teaching
- Use of computers to simulate scientific phenomena and use of graphic calculators to collect and analyse data
- Constructing a technology-enhanced lesson or a lesson plan within a science curriculum

- **Use of ICT in mathematics**

- How ICT improves the teaching/learning of mathematics or how to improve mathematics teaching through intelligent and informed use of technology
- Searching and using Internet resources for mathematics materials and lessons
- Use of computers software and calculators for mathematics teaching
- Use of computers and graphic calculators to collect and analyse data and to build and test mathematical models of the real-world
- Constructing technology-enhanced lessons or lesson plans within a mathematics curriculum

- **Use of ICT in language arts**

- How ICT improves the teaching/learning of language or how to improve language teaching through intelligent and informed use of technology
- Searching and using Internet resources for language materials and lessons
- Searching literature-based, creative writing, problem-solving Internet projects with the option of using interpersonal exchanges, virtual gatherings, peer feedback or mentoring to support student learning
- Constructing a technology-enhanced lesson or a lesson plan within a language arts curriculum

- Use of ICT in social studies
  - How ICT improves the teaching/learning of social studies or how to improve social studies teaching through intelligent and informed use of technology
  - Searching and using Internet resources for social studies materials and lessons
  - Searching problem-solving, enquiry and creative thinking materials with the option of using interpersonal exchanges, virtual gatherings, peer feedback or mentoring to support student learning
  - Constructing a technology-enhanced lesson or a lesson plan within a social studies curriculum
  - Web Quests
- Use of ICT in health-education and PE
- Use of ICT in chemistry
- ICT and multicultural education
- Integrating technology into K-12 classrooms
  - Reviewing available instructional technologies and models of technology use in the classroom
  - Understanding the benefits of incorporating technology into education
  - Technology integration – planning and implementing technology use in the classroom
  - Classroom management
  - Evaluating lesson plans that integrate technology
  - Understanding classroom management issues
  - Integrating the Internet and other resources into elementary classrooms (search techniques, safety, ethical/legal issues, evaluating websites, teacher and student Internet resources)
  - Software evaluation and integration in classrooms
  - Creating a technology-enhanced lesson or a teacher/student project
  - Web page development for teachers

- Teaching with educational software and other applications
  - Teaching with WebQuests
  - Logo
  - Science software, such as Redshift, Eco Ranger, Dynamic Rain Forest, Thinking Science, etc.
- Use of software that employs a simulator to simulate experiments and that can create interactive activities in physics, science, etc.
- Assessment and evaluation (understanding and evaluating students' learning in an ICT environment and measuring ICT impact and effectiveness)

G. Use of online communication tools

- Information literacy
- Online learning environment
- Online communication tools – the website as a pedagogical communications tool
- The Internet
  - Introduction to telecommunications, primer on the Internet and the World Wide Web
  - Useful Internet resources
  - Using Internet tools, search engines, e-mail, etc.
  - Dealing with Internet information (safe access and Acceptable Use Policies; copyright issues; evaluating and citing online resources)
- Collaborating online (telecollaboration)
  - Joining a collaborative project online
  - Online search for telecollaborative projects
  - Schools online project updates
  - Designing telecollaborative projects (steps in designing and implementing; analyzing a telecollaborative project; creating a telecollaborative project website; publicizing telecollaborative projects)
  - Project-based learning
  - Creating a pilot e-mail project

- List server simulation
- Creating an electronic mailing list
- Using online experts to enhance student interest and learning

H. Technology management and installation

- Troubleshooting
  - Approaches and techniques/tips for troubleshooting (peripherals, networks, backups)
  - Operating system configuration
  - Hardware and software basics
  - Computer maintenance and preventive measures (utilities, viruses)
  - Technology resources and repairs (Internet resources for troubleshooting
  - Installation of memory chips
  - Preventive maintenance and repair strategies
  - Report of a troubleshooting experience
- Essentials of networks (LAN)
- Setting up an Intranet
- Setting up, installing and using Linux
- Zipping and unzipping

I. Linking schools and the community

- Schools and the community: challenges and opportunities for linking through technology
- What are telecentres?
- Setting up telecentres in schools (needs assessment, designing and setting up, disseminating)

Summaries of the Training Contents of Various Organizations

ActDen

ActDEN is an interactive website with multiple purposes – It is a very software-oriented with no clear links to teaching/learning. The entire website targets teachers and students. ActDEN is sponsored by Microsoft and the content for teachers is predominantly a "point and click" animated demonstration of how Microsoft products are used in the classroom. Indeed, while the website is weak on curriculum content for skills development, the site does help people envision the future and what may be possible if they develop computer literacy for use in the classroom and apply their skills toward use of Microsoft's products in their teaching and learning environments. The website is available as an open source tool, requiring no log on password or fees. The content is in English. A user can choose to view the content with or without Flash media − the time it takes to access the site as a result can be minimized to a certain degree. The viability of this website for higher end skills development or pedagogy study is quite limited. As a tool toward creativity and motivation the website has some use. When you can connect to the Internet, the site is free, but the products discussed are not and may not be affordable to people who want to learn more. ActDEN is one of the sites inventoried that have online modules.

South Eastern Regional Computer Training (SERCT) Centre

The Australian government, through the Colombo Plan, and further through Learning Technologies Teachers Capabilities has set in place a plan to build the capacities of teachers and students. Part of that effort has involved the development of centres for training of which SERCT is one. The centre provides face-to-face instruction to people who contract their services. The curriculum is comprehensive, including technical literacy and pedagogy. In the training programme,

teachers are first taught the various software and then the use of such software in teaching. The curriculum appears to be largely oriented towards technology and software – focusing on Word, Excel, Access, PowerPoint, e-mail, Dreamweaver, FrontPage, scanning text and graphics, etc. with sessions on how to use ICT in classrooms; how to create student reports using Word; how to search the Internet for teaching/learning; how to publish a newsletter for classrooms, using software for science and physics, preparing a webpage for classroom use, developing a digital portfolio etc. The training provided through the centre is not free, but rather, schools hire SERCT to provide professional development to parts of the faculty or individuals pay to learn through the centre as part of in-service professional development or pre-service credits.

iTrain Bellanet

The iTrain Bellanet programme is an effort on behalf of several international aid agencies to create content for training in technology literacy. The effort provides curriculum content in five languages for over 20 courses, consisting of basic computer software: e-mailing using Eudora, MS Outlook and Pegasus Mail; MS Access; Coldfusion; Netscape; the Internet and ICQ. It is software oriented training, rather poor in pedagogy. iTrain Bellanet encourages anyone to use and adapt the content to suit the needs of their own organization. All training curriculum modules for instructors and students are available by download over the Internet or by request through the mail. The open access of this resource and wide applicability because of the variety of languages available make it a very good resource for basic technical literacy curriculum materials.

Philippines Edventure

Philippines Edventure is being implemented in partnership with a combination of organizations, including a quasi-governmental foundation, corporate funding and support and universities. The strategy to develop a quasi-governmental foundation has been used several times, including with the Government of the Philippines and Australia's Curriculum Corporation. This strategic organizational development gives implementing agencies greater freedom to achieve policy goals, while not being constricted by governmental regulations that sometimes inhibit reform or change. Currently,

Philippines Edventure is providing three courses, including information for administrators and teachers. They blend technical learning with pedagogy, which promotes motivation as learners begin to understand why learning technical skills has relevance in the development of their teaching skills. Distinctively, the teachers are taught using online communication tools, and project-based learning and tele-collaboration. The content for administrators includes knowledge, strategies and tools to set up a school technology plan; sustainability; policies on use; community mobilization and; resource generation, monitoring and evaluation. The teachers are given background/motivational information, such as using computers for teaching/learning, as well as the basic computer fundamentals and software (word processing, spreadsheets, presentations, the Internet for use in teaching). Teachers are also taught how to use online communication tools, project-based learning and telecollaboration, as well as how to design a school website. This is a true professional development model, with in-service high school teachers taught by university faculty members.

Coca-Cola E-Learning for Life, Malaysia

The objectives of the E-Learning for Life programme in Malaysia directly correspond to the national and educational policy initiatives of the government. A collaboration between the government, a corporate foundation and technology industry leaders, the programme is a secondary initiative to the Malaysian Smart Schools project which stressed the development of educational software for classroom use. The distinction between the Smart Schools programme and the Coca-Cola Malaysia E-Learning for Life programme is the education of teachers who will in turn promote the use of technology as a means of learning rather than the end. The training is delivered face-to-face. The curriculum is skills and pedagogy based. Teachers work in teams and are grouped by subject matter. Guidelines and techniques for building lesson plans are taught, as well as structuring thematic and topical lesson plans, building templates, and enriching the lesson plans through incorporating effective learning principles. This is followed by enhancing the lesson plans with multimedia technologies (PowerPoint, video, computer products, etc) and finally planning how this lesson can be integrated into a teaching unit for a specific subject.

As a train-the-trainer programme, the effort is meant to engage teachers from multiple subjects and regions. Those teachers will be responsible for training other teachers. The content for this programme

is not in English and not widely available, as the face-to-face mode is preferred.

Intel Teach to the Future

Intel Teach to the Future is a worldwide effort to help both experienced teachers and pre-service teachers integrate technology into instruction and enhance student learning. Participating teachers receive extensive training and resources to promote effective technology use in the classroom. Teachers learn from other teachers how, when and where to incorporate technological tools and resources into their lesson plans. In addition, they are instructed on how best to create assessment tools and align lessons with educational learning goals and standards. The programme incorporates use of the Internet, web page design, and student projects.

Intel approaches ICT skills development in an integrated manner. The main goal of the training is for teachers to develop a unit plan template on a particular subject, a portfolio rubric and a sample unit portfolio of ICT-based lessons. To build on this, the teachers are then taught the various software and applications like Internet searching; developing multimedia presentations, publications, support materials; creating a website; and developing and showcasing the portfolios. In this way, all of these tools and outcomes (multimedia presentations, publications, websites, assessment tools, handouts, templates, worksheets, classroom management documents) developed are integrated into the teaching of a unit plan of a specific subject.

Teach to the Future works with governments. Both those governments who want to provide in-service training and educational institutions that want to provide pre-service training must apply to become active partners. As a result, programme delivery assures coordination with governmental policies for the training of educators in core pedagogical issues related to technology in the classroom. Intel has a set of core programme components, including the development of a train-the-trainer model where teachers rather than technologists become the future trainers. Also, they demand 40 hours of face-to-face hands-on training with an additional 20 hours of homework. Finally, they work with the governmental offices to develop the curriculum content to be localized for the country in which it is being implemented.

A key issue for Intel Teach to the Future is their focus toward improving the teaching of in-service teachers who use technology, rather than the development of their technical literacy skills. The Intel Teach to the Future worldwide leadership was most forth-coming with UNESCO, sharing much information, including the curriculum and also spreadsheet files related to the actual numbers of teachers trained in each country they serve. They have a worldwide goal of training over 1,000,000 teachers by the end of 2003.

World Links

The World Links training course, previously funded by World Bank, is strongly geared towards the use of the Internet for teaching/learning, as well as for tele-collaborative learning projects, both within schools and globally. The course also links pedagogy and ICT use, focusing on the integration of telecollaboration and online discussion forums into existing curriculum. The training goes beyond the classroom by providing school-based telecentres and covering the training of policy-makers to provide them with skills on planning and technical support. World Links is currently updating their training modules. This analysis is based on their old training contents which were accessed in outline form only.

SEAMEO INNOTECH

SEAMEO INNOTECH Technology Applications in Education for teachers and trainers involves media design, development and production to develop a package of both print and non-print materials that can be used for teacher training. The training design is strong on creativity, elements of design and layout, fonts, graphics and other production techniques in developing both print and non-print materials, including computer-based presentations and video production. The training develops skills in the use of various software and tools for production such as Desktop publishing, presentations (PowerPoint) and interactive multimedia software. It also deals with the appropriate selection of technologies for teacher training and various digital tools for teaching (the Internet, electronic discussion groups, creating a web page); integrating technology into instructional design and catering to special learning needs.

The Institute of Computer Technology (ICT)

The Institute of Computer Technology or ICT is a non-profit organization which provides technology training and planning services.

The institute is quite unique for several reasons. First, they have produced online learning modules of accredited courses for university study within a degree-seeking programme in the California state university system. Second, they are working with industry partners, such as Intel, to gain intellectual capital so as to develop innovative, effective programmes. The institute developed the curriculum for Intel's Teach to the Future Programme. The curriculum developed by leaders at the institute is being implemented in the education departments of nine Asian nations, and will soon be used in many more.

Only an outline of the content was available for review. The training directly develops the skills of teachers in integrating ICT in teaching specific subjects such as languages, mathematics, science, social studies, and elementary grades. The course also develops teachers' skills in tools that will enable them to teach these subjects, including skills such as word-processing, desktop publishing, spreadsheets, multimedia presentations, using the Internet, creating a webpage for teachers, and creating multimedia presentations. Here is a good balanced combination of learning the various tools and software, and using these tools for integrating ICT into various subject teaching.

PBS Teacher Line

PBS TeacherLine is a direct collaboration between the Department of Education in the U.S.A. and the Corporation for Public Broadcasting to provide educational materials for teachers related to pedagogy for applying technology in the classroom. Curriculum for this project is online and available to people in the United States who register through their local public broadcasting affiliate television station. International access is not currently available, but PBS TeacherLine representatives indicated they would like to expand a pilot beyond the borders of the nation at some point in the future. The curriculum titles and expanded outlines provided by PBS TeacherLine representatives show the most advanced pedagogical approach reviewed in this inventory, offering both

pedagogy and integrated ICT approaches in two parts – teaching practices and technology integration. The teaching practices/pedagogy sessions focus on building critical thinking; constructivism in the classroom; creating units to support differing learning styles; curriculum mapping; assessment and evaluation and utilizing technology in creating problem-based curriculum. Meanwhile, the technology integration sessions deal with communicating and collaborating online; use of computers for personal productivity; enhancing multicultural education with technology; searching, evaluating and organizing Internet resources and content; integrating the Internet into the K-12 language arts curriculum; Acceptable Use Policy of the Web; publishing on the Web; how to start putting computers in the classroom; teaching with WebQuests, etc.

IBM Reinventing Education: Victoria, Australia

IBM has partnered with the Department of Education in Australia to assist in the implementation of technology in underprivileged communities in Melbourne. They are working to build of teacher capacities towards proficiency in student performance along key areas of development called "strands". They approach change in teaching holistically and encourage transformation throughout the learning community, including teachers, administrators, students and parents. The change is encouraged through an action research model, based more on a process of consideration and evaluation conducted through teamwork, rather than on classes for professional development in ICT. If training modules exist, they were not made available. IBM uses a network system to provide ongoing structure and support through computers to learning communites. Furthermore, if teachers decide they need specific functional literacy related to computer operation or programmes, they indicate what they need and the skills development they require is provided. All subjects are approached and the whole school is involved. No specific programme participant numbers were provided by the project contact.

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