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ICT in Teacher Education

Case Studies from the Asia-Pacific Region

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ICT in Teacher Education:

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Introduction

From studies conducted in recent years, it is evident that information and communication technologies (ICT) can help to broaden access to education and improve learning outcomes. Research has also shown, however, that success in the use of ICT in education depends largely on teachers and their level of skill in integrating ICT into the teaching process and in utilizing ICT to provide learner-centred, interactive education. Therefore, training teachers to be able to use ICT and to integrate ICT into teaching is crucial for achieving improved educational outcomes with ICT.

In recent years, various programmes have been implemented in the Asia-Pacific region that seek to raise the capacity of teachers to utilize ICT effectively in teaching or that seek to utilize ICT tools to improve teacher education, or both. Many of these programmes are innovative in that they have pioneered this type of training in their country or they have introduced new techniques and training procedures.

This publication contains a collection of examples of "ICT in Teacher Education" programmes from the Asia-Pacific region. While these programmes may not always have been successful and are not necessarily examples of "best practice", an examination of such programmes offers insights into the process of educating teachers to integrate ICT into teaching and the process of utilizing ICT tools for training teachers. In addition, these programmes provide information about the issues that are often faced in ICT-enhanced teacher education in the region and the lessons that have been learned through past experience. This information will be useful to education planners, teachers, educators and researchers, particularly those in the Asia-Pacific region.

The case studies were compiled within the framework of the "Training and Professional Development of Teachers and Other Facilitators for Effective Use of ICT in Improving Teaching and Learning" project, which was implemented between 2003 and 2007 by the UNESCO Asia-Pacific Programme of Educational Innovation for Development (APEID), with the support of Japanese Funds-in-Trust (JFIT).

1. Bhutan "Support for Teacher Education" Project

Philip Wong [1]

Introduction

This case study describes an innovative project to assist Bhutanese teacher education institutions to provide trainee teachers with skills in ICT and with the ability to utilize ICT in the classroom to enhance the quality of teaching and learning. This paper begins with background information about the situation in the Royal Kingdom of Bhutan and the need for the project. The two phases of the project are then described and the process of developing an "ICT in Education" curriculum is explained. Following this, other aspects of the project are outlined, including equipment supply, professional development and the evaluation process.

Background

The Royal Kingdom of Bhutan's education system covers Kindergarten to Grade 12. The medium of instruction is English with additional lessons for teaching their national language, Dzongkha. Based on 2006 statistics, there are about 190,000 students enrolled in about 512 schools.[2] School enrolment is 95 percent and the national literacy rate is 60 percent.

Information Technology (IT) courses are offered in Grades 9 and 10. Computer classes are offered in Grades 11 and 12 but they are theoretical courses in C++ programming and follow the Indian syllabus. A local IT curriculum has recently been developed for Grades 11 and 12, however, and this will be implemented in 2008.

In Bhutan there are two teacher education institutions, namely, Paro College of Education (formerly known as the Teacher Training College and later as the National Institute of Education) and Samtse College of Education. Both colleges are member institutes of the Royal University of Bhutan and they offer a three year undergraduate Bachelor of Education qualification for primary and secondary school teaching. Trainee teachers spend eight months as an apprentice teacher at a school before embarking on the Bachelor of Education programme. Postgraduate teacher training (PostGraduate Certificate in Education) is offered at Samtse College of Education for those who already have a bachelor's degree. Similarly, Paro College of Education offers postgraduate courses such as a Master in Education and a Diploma in Management and Leadership.

Prior to 2000, no "ICT in Education" modules were offered at either of the colleges. At that time there were not enough trained lecturers nor was there sufficient computer equipment to be able to teach computer skills to all the trainees.

Recognizing the need to introduce ICT to trainee-teachers so as to enable them to acquire ICT skills and use ICT in teaching, an approach was made to the Singapore International Foundation (SIF), a non-profit foundation, for assistance in developing an ICT-enhanced curriculum for teacher education and

[1] Philip Wong is an Associate Professor at the National Institute of Education, Singapore.
[2] Bhutan Government website.

for assistance in building capacity so that the colleges would be able to provide ICT training. The teacher education institutes were also interested in introducing an ICT track for their Bachelor of Education programme so as to train teachers who could teach ICT skills and use ICT in teaching in schools.

SIF ICT in education project

The SIF ICT in Education project, initiated in 2000, aimed to assist Bhutan's Ministry of Health and Education (MoHE) to introduce ICT into its education system to help bridge the gap between the low ICT-skills among pupils (the future workforce) and the growing adoption of ICT technology in the workplace. The project, conducted by the SIF Specialist information technology (IT) team, also trained teacher educators and curriculum design specialists to utilize ICT in their work and to integrate computer-based training materials into the school curriculum. Funding for the project was obtained from the Singapore Government and philanthropic foundations in Singapore.

In May 2000, a technical feasibility visit was made by a team of specialist volunteers from one of Singapore's polytechnic colleges to assess the parameters of a project with the Paro College of Education

The project was conducted in two phases. Phase One was implemented in 2001 and 2002, and Phase Two was implemented over the period from 2002 to 2007.

Phase One (2001 – 2002)– ICT-literacy training and course development

An SIF IT Specialist Team, comprising volunteers from Temasek Polytechnic in Singapore, conducted the first training workshop in ICT-literacy in December 2001. Attended by 25 Bhutanese high school teachers, the workshop was held at the request of the Bhutan Ministry of Health and Education, to kick off a three-year Post-Graduate Certificate in Teaching Information Systems that the Ministry had initiated.

A second activity conducted by the Specialist Team in 2001 was to assist the Bhutan Education Department to develop a three-module course (called Functional IT) within the pre-service teacher training programme. This course was designed to equip all Bhutanese teachers with ICT skills and to help them to prepare instructional materials. This course was subsequently introduced at the Paro College of Education.and Samste College of Education and was offered to all trainee teachers at these colleges.

Phase Two (2002 – 2007) – Curriculum developed for a Bachelor of Education in IT

The key objective of the second phase of the project was to develop and launch a new elective ICT subject within the Bachelor of Education (B.Ed) programme. To achieve this objective, another Specialist Team from Singapore expanded the ICT resources available at the Paro College of Education, provided training for lecturers at both colleges, and provided assistance in conducting the new elective subject.

The Specialist team worked with the lecturers from the Paro College of Education to design and develop an IT curriculum which would achieve two goals. First, equip the trainees who opt for this elective with sufficient skills to teach computer studies in middle and high schools. Second, provide trainees with the skills required to design and develop teaching materials and to teach using ICT.

The ten-module curriculum that was developed, known as "Enhanced IT" (EIT), is similar in terms of coursework demands to other courses offered in the Bachelor of Education programme, requiring a period of three years to complete. In addition to taking the EIT modules, trainee teachers also specialize in another discipline.

The curriculum development process took approximately one year. It began with an initial face-to-face meeting which was followed up on through a series of e-mail exchanges. When the curriculum was complete, it was submitted to the Paro College academic board for approval, which was obtained in late 2002. The first batch of six trainees started the course in February 2004. Initially, the curriculum will only be offered at the Paro College but in time it will also be available at the Samtse College.

Aside from developing the curriculum, the project involved providing various training courses to lecturers at the Bhutan colleges in order to develop human capacity and ensure lecturers have the expertise required to teach the EIT curriculum. Training was provided by Singapore volunteers in Bhutan. Lecturers from both colleges also attended training courses in Singapore.

The use of computer technology in education can be classified into three categories.[3]

- Computers can be considered as an "object" which students learn about (hardware and software).
- Computer technologies can be an "aspect", which means using them as tools in subjects, such as computer-aided design courses, or as general tools in educational settings, such as the use of graphic design software to create web pages for a school.
- Computer technologies are a "medium" for instruction. In this category, computer technologies can be used for teaching and learning.

The curriculum that was developed for the Bhutan teacher education institutes incorporated all of these categories, with a good balance between the categories.

A number of competencies and skills are required of a 21st century learners,[4] including digital-age literacy. A 21st century student needs to be aware of various tools for digital communication and be able to use them. Recognizing this, the concept of digital-age literacy was taken into consideration when developing the information and communication technologies (ICT) curriculum for Bhutan.

Conventionally, teachers are trained to use a teacher-centred approach, however, in developing the new curriculum for teacher training institutions in Bhutan there was a conscious shift towards approaches that lead to constructivist and independent learning. This shift was made in recognition of the fact that through the use of computers and the Internet new forms of learning can take place, including problem-based learning, project-based learning, and authentic learning using real-life scenarios.

Curriculum development process

The EIT curriculum was designed with the following goals in mind.

- To equip trainees with skills in using the computer and related applications for improving productivity, for preparing teaching materials (lesson plans and multimedia instructional materials) and for integrating technology into their teaching.
- To prepare trainee teachers to be able to teach computer studies to students in grades 9 and 10.

[3] Plomp, ten Brummelhuis, and Pelgrum, 1997
[4] NCREL, 2003

During the development of the curriculum,[5] it was speculated that many of the trainees who would take the Enhanced IT course would not have any previous ICT experience. Thus the modules would need to start from basic computing technology and move on to more advanced content later. This assumption was subsequently justified by results from an annual survey conducted at the beginning of the academic year: nearly all trainees entering the EIT programme said that they had little or no IT experience.

The curriculum developers realized that the curriculum had to strike a balance between methods and content. In terms of methods, the curriculum covered teaching methodology for computer studies, developing and preparing teaching resources and integrating technology into teaching. The content covered multimedia design, instructional design, programming, and scripting languages. These courses were designed to build IT skills and also equip teachers with the knowledge required to teach computer studies in grades 9 and 10.

The curriculum developers were also aware that the curriculum must be relevant in terms of the Bhutan context and yet must be up to date in terms of international standards. When designing the curriculum it was therefore necessary to take into consideration the resources available in the colleges and the schools so that the courses would be in accordance with existing computer resources. It was observed that sometimes the resources available in the training colleges did not match those in schools. For example, Internet access was available in the Paro College but schools (where trained teachers would be working) did not have any Internet access. It was also observed that although certain software programs were required for the training of some modules, funds were not available to purchase them. It was therefore decided to use as many freeware options as possible so that cost of software would not be a problem. Some of the freeware options selected included: Hot Potatoes (software for producing online tests), Gimp (image manipulation software) www.gimp.org; and Picassa (image sharing and storage software) www.picassa.google.com.

Since the trainee teachers needed to become qualified to teach computer studies in schools, the curriculum development process included a concerted effort to match the curriculum to the schools' computer studies syllabus. However, at the time the curriculum was being developed there was a move to revamp the old computer studies syllabus for Grades 9 to 12. Because of the uncertainty of the school syllabus, it was therefore difficult to develop the curriculum. Consequently, it was agreed that the curriculum would be based on the existing syllabus and the relevant modules would be altered in future to match the revised school syllabus.

Each of the 10 modules were classified as either "M", which stands for teaching methods, or "C" which stands for content. In total there are three Method modules and seven Content Modules.

The greater emphasis on content than method was necessary because when the curriculum was designed in 2002 it was anticipated that most trainees joining the programme would not have any computer skills or any prior ICT knowledge. However the emphasis will change, as necessary, in future.

Supply of ICT equipment

It was recognized from the beginning that for the B.Ed programme to be successful, adequate computer resources, teaching resources, reference materials and textbooks were required. When Phase Two of the project began in 2002, Internet access was slow, with dial-up access to the country's Internet

[5] The curriculum-design approach outlined by Posner and Rudnitsky (2005) was adopted in the curriculum development process.

service provider. There was only one computer lab and it was open to all trainee teachers, not only those enrolled in the EIT programme. Relevant software was not available and funds were limited. To help out, various software titles were donated to the college. One approach was to donate older versions of software. For example, when the university in Singapore bought a newer version of a program, it donated the old version to the teacher education college in Bhutan so that trainee teachers could have access to a legal version of proprietary software. In addition, desktop and laptop computers were donated for student use. The college also received funding form an international source to construct a block to house computer labs, and for professional development of the lecturers and purchase of resources. Recently, three computer labs were built in the new block, along with a server room, and one of the computer labs is reserved for use only by trainees in the EIT programme. The Paro College has slowly built up its resources and now has fast Internet, with satellite connection.

Professional development of lecturers

When Phase Two of the project began in 2002, it was anticipated that the lecturers teaching the course would need help to build their capacity. As such, a professional development programme was developed. Due to time and resource constraints, professional development was carried out in phases and aligned with the module schedule. There were three phases of training activities.

In the first phase, volunteers visited Bhutan and conducted a week-long training course based on the module that the lecturers would be teaching in the following semester. For example, if a module was going to be offered in Semester 2, then a professional development course to prepare the lecturers to teach that module was conducted in Semester 1.

A number of academic volunteers from the Singapore National Institute of Education and Temasek Polytechnic were involved in conducting these training courses. Each volunteer was selected based on their expertise and on the content of the modules. During the training in Bhutan, the content was introduced to the lecturers at the college, and lecturers developed teaching materials that they would be using, designed assignments and exercises, and participated in discussions about the sequence of content. Also, the lecturers experienced working as a team, which had the advantage of enabling teaching resources to be developed faster.

In the second phase of the project, a volunteer was attached to the Paro college for one year. Previously the head of the IT department in a school in Singapore, the volunteer helped the lecturers to develop training materials for Modules 1, 2, and 3. The volunteer also taught some of these modules and she helped the lecturers to mark the assignments.

In the third phase of the project, seven lecturers from Paro and Samtse college went to Singapore for three months, December 2005 until February 2006, for professional development training at the National Institute of Education (NIE) in Singapore. While in Singapore, the lecturers also visited educational institutions and interacted with staff from e-learning companies.

The lecturers received training in the following areas:

Content:

- Preparing multimedia materials with Authorware™
- Using Macromedia Flash™ to create animations

- Editing pictures with Adobe Photoshop™
- Creating webpages with Dreamweaver™
- Principles of programming - Java Script Language

Curriculum:
- Development of e-portfolios
- Instructional Design

These modules were specially designed to enable the lecturers to conduct the teaching of modules EIT 7, EIT 9 and EIT 10.

Review and evaluation of the curriculum

I. Mid-project review

In May 2005, one and half years after the programme of study began, a review was conducted to evaluate the curriculum and to make any necessary modifications. By the time of the review, Modules 1 to 4 had been completed by the first batch of trainees and a second batch of trainees had completed Modules 1 and 2. During the review process, trainees from both batches were interviewed to obtain feedback about the content, methodology of delivery, assignments and adequacy of resources.

Based on the feedback, no changes were made to EIT Module 1 since this was a basic course. All trainees were required to attend FIT modules and the trainees from the EIT programme attended EIT 1 and this is equivalent of two FIT modules. However, since many trainees were first time users of ICT, the trainees requested more time to practice and to allow them to go at a slower pace. Trainees taking EIT modules were given more access to computers and extra disk space on the network drive.

For Module EIT 2, a method module, the use of an instructional CD ROM was discontinued as this kind of media was no longer easily available. Instead, learning objects based on Java or Flash were used, as many of these are available on the Internet and it would be easy for trainees to incorporate them into their school lessons.

II. End of project review

In March 2007, the volunteer team from Singapore visited Bhutan again to undertake a final evaluation at the end of the five-year project. The review involved conducting a survey to obtain feedback from the trainee teachers, graduate teachers, lecturers and the Director of the Institute on the effectiveness of the curriculum and the project. Classroom observations were also conducted to determine how teachers were using the new skills they had gained.

Feedback from trainee teaches and graduate teachers indicated that many were concerned that the principals of their schools expected them to be "experts" in computers and to solve hardware and network problems. Since schools do not have technicians, teachers attempt to solve minor computer problems but are unable to go beyond this.

Based on the feedback and observations, some modifications to the curriculum were made. The most notable changes were the addition of hardware maintenance training, instruction in basic networking and in setting up simple networks, and training in the use of *Flash* software rather than *Authorware* as a developmental tool.

As technology is constantly changing, the curriculum will need to adapt accordingly, so further changes and updates to the curriculum will be conducted at regular intervals in future.

Conclusion

The project succeeded in bringing about changes in teacher training in the area of ICT. The survey data indicate that teacher educators' skills and knowledge increased tremendously as a result of the project. Lecturers went from not knowing anything about computers to being able to design web pages – a tremendous jump in skill acquisition. In terms of pedagogy, teacher educators moved from the conventional teacher-centred approach to more collaborative modes. There was also an increase in group work activities, use of project-based teaching, exploratory methods of learning, and constructivist approaches.

The five-year project can therefore be considered a success. One of the success factors was the support given to the project by all parties, including the Ministry of Education of Bhutan, the teacher education colleges in Bhutan, the Singapore International Foundation and volunteers, and the donors and sponsors from Singapore and Switzerland. All participating organizations had a role to play in the project and their combined efforts resulted in a successful outcome.

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2. Malaysia's Experience in Training Teachers to Use ICT

Bismillah Khatoon Binti Abdul Kader[6]

Introduction

This case study begins by describing the Malaysian "Smart School" project and goes on to explain the teacher education component of the project. This paper examines the key areas in which teachers require training and discusses the issues that have been experienced in Malaysia in training teachers to utilize information and communication technologies (ICT) effectively to improve learning outcomes.

Background

At the turn of the century, educationists and policy makers in Malaysia debated about the challenges of the new millennium. In particular, policy makers were keen to know how to make the best use of information and communication technologies (ICT) to deliver knowledge and information to all; to facilitate communication; to provide greater interaction; and to encourage innovation and creativity to improve national productivity and competitiveness.

In its Seventh National Plan (1996-2000), Malaysia outlined its strategy to develop the labour needs of the nation, particularly in the fields of science and technology. The Plan identified one of the objectives of education and training as to produce an adequate number of highly skilled workers and gave high priority to reorienting the education and training system so that by 2020 Malaysia would have workers with the knowledge, skills and expertise necessary to support a knowledge-based society and economy. Malaysia saw innovations in ICT as an opportunity to review the country's public education system. Schools were identified as having a key role to increase the number of ICT-skilled people to meet the demands of industries that would be integrating ICT into their processes.

The purpose of this paper is to introduce readers to the Smart School initiative and a range of related activities that Malaysia has undertaken. A major government initiative, the Smart School initiative has focused on preparing a pilot group of selected schools for the changes that are taking place as a result of the advances being made in ICT. This initiative provides selected schools with ICT tools and manages change towards integrating ICT into teaching and learning. As a result of this project, which has been underway for ten years, Malaysia has accumulated considerable understanding of the potential and the pitfalls of introducing ICT into education. The work is continuing and other projects are now being rolled out across the country, designed in the light of the experiences gained through the Smart School initiative.

The Malaysian Smart School Project

Since 1996, the Government of Malaysia has targeted education as one of the main vehicles to bring about the planned accelerated development of Malaysia. Knowledge and information were identified as important prime movers of the nation's economy for growth, wealth creation and competitiveness.[7]

[6] Bismillah Khatoon Binti Abdul Kader is the Managing Director of Internexia Sdn. Bhd.

[7] The Malaysian government set aside RM105.6 billion for education in the 8th Malaysia Plan. This represented an increase of 50.4 percent of the budget for education in the 7th Malaysia Plan.

In 1997, the Smart School initiative was launched as one of the flagship applications of the Multimedia Super Corridor, under the management of the Multimedia Development Corporation[8] (formerly MDC, now MDeC). The Smart School concept came out of a brainstorming session held at the Ministry of Education. Officials from the MDeC, the Ministry of Education and industry representatives produced a Conceptual Blueprint of Smart Schools, then appointed Telekom Smart School Sdn Bhd (TSS), a consortium of seven Malaysian companies and three multinational companies, in a project management role. TSS became a partner of the Ministry of Education, and was responsible for implementing the Smart School Integrated Solutions (SSIS) in cooperation with the Ministry. It was the first partnership of its kind for a national education project. In support of this initiative, the Government invested in the development of Malaysia's ICT infrastructure, to enable new technology to be used in the selected schools. The arrangement was for TSS to complete a pilot programme for a group of selected schools by December 2002. On completion, the programme would be rolled out to all of Malaysia's 9,000 schools by 2010. The project involves 87 schools nationwide.

Malaysia's Smart School project involves a wide range of inter-related initiatives. These include schemes to improve Malaysia's ICT infrastructure, training in change management for teachers and school managers, a national school management system to link schools and the communities they serve, integration of software, and a help desk facility. The result is the incorporation of ICT into schools at a rate not far behind the rates of more developed nations.[9]

The first step in the Smart School initiative was the introduction of computers, related applications, software and courseware into schools, classrooms and the teaching and learning processes. The 87 participating schools were divided into three types or "models". There are four "Model A" schools and four "Model B Plus" schools.[10] "Model A" schools , all of which are situated in the Klang Valley (which includes Kuala Lumpur), are equipped with computers in every classroom and with video conference facilities. In these schools, the ratio of students to computers is 5 to 1. "Model B Plus" schools[11] are equipped with computers in selected classrooms and in the science laboratories. The other 79 schools are Model B schools.[12] These schools are equipped with a single computer laboratory.

Smart School Integrated Solution

The Telekom Smart School and its consortium members developed the components of the "Smart School Integrated Solution" (SSIS). This comprehensive approach to integrating ICT into education encompasses five main elements:

» Teaching-Learning Materials.

Materials include 1,494 items of courseware and printed matter for four subject areas: Bahasa Melayu (Malay language), English, Science, and Mathematics.[13]

» Smart School Management System (SSMS).

This is software for managing and administering student enrolment, educational resources, school finances, human resources, external resources, facilities, technology, and hostel facilities.

[8] MSC Malaysia, formerly known as the Multimedia Super Corridor (MSC) is a national initiative spearheaded by the Malaysian Government to promote the national ICT industry and to provide a test-bed for the global ICT industry.
[9] Frost and Sullivan, 2004, Benchmarking of the Smart School Integrated Solution (Strive for Knowledge), Smart School Development, Educational Technology Division, Ministry of Education, Malaysia. p.11.
[10] Model A provides schools with 520 computers, five notebooks, six servers and video conferencing equipment and COINS leased line (512/256 kbps).
[11] Model B Plus provides schools with 81 computers, two notebooks and three servers and COINS leased line (128/64 kbps).
[12] Model B provides schools with a computer lab comprising 37 computers, two notebooks and three servers and COINS leased line (128/64kbps).
[13] Courseware is being developed for other subject areas, such as Physics, Biology and Chemistry.

» Technology Infrastructure.

The infrastructure provided to schools included hardware, software and other equipment.

» Systems Integration.

This was implemented to ensure integration between the various components and processes of the SSIS, between the Smart School System and other flagship applications, and to ensure data integrity and security.

» Support Services.

The support services include Help Desk services, maintenance and support. The Help Desk is located at the Educational Technology Division of the Ministry of Education.

The SSIS was implemented in the 87 pilot schools at a cost of about RM300 million (USD78 million).

Malaysia's innovative approach

In a study comparing Malaysia's approach to introducing ICT into schools with the approaches taken by eight other countries, researchers found that Malaysia's approach is radically different from the others.[14] In Australia, Britain, Canada, Ireland, Japan, New Zealand, Singapore and the USA, initiatives for incorporating ICT into education have tended to be initiated by schools rather than by the national governments. The schools set the goals themselves, with the governments providing funds.

These ICT initiatives usually began as small-scale projects. Many started with installing ICT tools in schools and then providing professional development for teachers. This was normally followed by the development of a communications network and provision of access to on-line content. In the other countries studied, the schools aimed to integrate ICT into education and teaching and learning materials were usually produced as a result of the professional training and development of teachers.[15] Often, projects began at school level and moved on to a cluster of schools and then to the national level.

The SSIS is innovative because it is government-led and is multi-faceted in its approach. An advantage of the leadership role of the government is that relevant policies are in place to support the necessary changes in theory and practice in education.

Another innovative aspect of the SSIS is the partnership between the Malaysian Government and the private sector in development, testing, installation and implementation of the SSIS. The Government sets the vision and provides the budget. For example, the building of schools and computer laboratories and the setting up of networking systems in the Smart Schools have been entirely funded by the Government. The private sector provides their expertise in their particular area of interest.

A further innovative aspect of the project is its focus on developing locally-relevant courseware. The courseware was created in recognition of the fact that teachers require digital content that is compatible with the curriculum. The quantity of courseware created has been impressive. By 2003, 1,494 courseware titles had been created at an approximate cost of RM1 million (approximately USD285,000). Each title

[14] Frost and Sullivan, 2004, Benchmarking of the Smart School Integrated Solution (Strive for Knowledge), Smart School Development, Educational Technology Division, Ministry of Education, Malaysia.

[15] Ibid, p.10. The comparative study shows that this works well in developed countries where expenditure per student as a percentage of per capita GDP is relatively high compared to developing nations. Malaysia spends 10.7 percent of GDP per capita on education. The US for example spends a high 18 percent of its GDP per capita on education. The US GDP is more than eight times that of Malaysia.

required about nine months to develop. The courseware were created in four subject areas: Bahasa Melayu, English language, Science and Mathematics, for students from Year 1 to Form 5 (Grades 1-11). They are web-based and run on all platforms, including open source. They also conform to the Shareable Content Object Reference Model (SCORM) standard for web-based e-learning. The subject matter incorporates Malaysia's education philosophy, which includes knowledge, competency, moral values, and personal well-being of an individual and the need for each citizen to contribute to the harmony and betterment of family and Malaysia's multicultural society and nation.[16] The courseware was distributed to all the schools participating in the project.

The Smart School initiative emphasizes the constructivist approach to learning, taking the focus off "teaching" and placing it on "learning". This approach recognizes that students will construct knowledge for themselves if teachers create the right learning environment.

In Malaysia today there is nationwide awareness of the Smart School initiative. The launch of the project sparked new ICT training initiatives, schemes for parents to buy computers for the home and initiatives to establish learning centres, colleges and universities which specialise in ICT and multimedia development.

Obstacles and Challenges

The initial phase of the SSIS exposed a range of obstacles and challenges. Achieving a consistent level of ICT infrastructure in schools has been one of the biggest challenges facing this project. There continues to be enormous disparity in the level of ICT availability and in the level of ICT use in schools, especially between schools in rural areas and schools in urban areas.[17] The issue of lack of Internet connectivity is a particular challenge. At the current rate of development of connectivity, it is unlikely that the infrastructure will be in place in time to connect all schools to the Internet by 2010.

The lack, or low quality, of connectivity in rural schools threatens to amplify the disadvantages of rural learners. Without infrastructure and connectivity, the integrated system (encompassing web-based courseware, on-line management tools, and technical support) provided by the Smart Schools project is not accessible to rural schools. This poses a big challenge for the Ministry of Education. To address this issue, the Ministry provides schools in remote areas with special training programmes and provides teachers with notebook computers and with CD-ROMs containing teaching materials. In addition, the Ministry has launched special schemes for the schools and communities which are located on remote islands and in mountainous districts. For example, in Bario, an isolated community on the island of Borneo in the Malaysian state of Sarawak, there is no road access and poor telecommunications infrastructure. For Bario, the Smart School project was divided into two Phases. Phase I involved conducting a baseline survey to gain an understanding of the information needs of the local Kelabit people. Phase II involved the establishment of a telecentre in a secondary school. Internet access was provided to this school via a VSAT satellite link. Another initiative implemented in remote areas is the Demonstrator Application Grant Scheme.[18]

[16] Quoted from the Malaysian National Philosophy of Education.

[17] Zaitun Abu Bakar, University of Malaya, Malaysia, The utilization and integration of ICT tools in promoting English language teaching and learning: Reflections from English option teachers in Kuala Langat District, Malaysia, 2005.

[18] The Demonstrator Application Grant Scheme (DAGS) was launched by Ministry of Science, Technology and Innovation on 21st April 1998. DAGS is a key initiative for the realization of objectives set out in the National IT Agenda. The grant scheme is a platform for building human capacity and capability through ICT applications.

The integration between the Smart School System and other flagship applications is another challenge. Developing the courseware through a single vendor (though the vendor is a consortium) led to over-reliance on a single source of supply. Some companies within the consortium could not produce the work on time and to the quality specified. Beset with internal administrative problems and issues relating to evolving needs, and suffering from a lack of insight into developments in new technology and changes in national education policies,[19] TSS lost the monopoly on the production of courseware. Government tenders for courseware development are now open to all companies. This involves lengthy procedures for tendering and evaluating and selecting companies but has seen an increase in the standard of courseware.

Currently, courseware developers for the Ministry of Education assign their intellectual property rights and copyright to the Government. The contract for developing courseware includes minimal service levels, mostly restricted to meeting specifications and satisfying user acceptance tests and other technical criteria. Advanced services for updating and corrections post-delivery have not been sought so far.

Providing teachers with courseware has its advantages but this system also has disadvantages. Under this system, teachers are not trained to create and implement teaching materials themselves. There is no requirement for teachers to experiment with the particulars of using ICT in the classroom or to explore the vast resources available on the Internet. In addition, some teachers see the courseware as a replacement for pedagogy. A common misconception among teachers is that using the courseware simply means assigning a topic for students to learn or search. Thus, the teacher merely projects the courseware on the screen and the students use the courseware without any guidelines or teacher supervision. At the other extreme, some teachers claim that teaching with the provided courseware requires more preparation time and creates more work, requiring them to structure the learning by providing a framework, formulating guide questions, recommending websites and facilitating discussions. Some teachers feel they can teach more content and make students understand better by using traditional chalk and talk methods.[20] The courseware remains in its boxes for these teachers.

To make the best use of new ideas and tools, teachers must understand the relevance, usefulness and usability of those ideas or tools. Teachers need to be computer literate themselves and be confident in the use of ICT in order to understand what ICT can do to enhance their own development and to enrich the learning experience of their students.[21]

Teachers also need help and support when things go wrong or technology does not function. While technical support is a component of the SSIS, it is perceived by some as being inadequate. In a review of the SSIS carried out by the Ministry of Education, an important recommendation was in the area of technical maintenance and the need for more suitable and adequate technical support for teachers in schools.

Opportunities

Positive unintended consequences have arisen from the decision to provide courseware to the 87 Smart Schools. This major investment of Ministry officers' time and Government funds has resulted in the development of a vibrant e-learning and creative content industry with over 100 companies. Malaysia is becoming noted for its capability in content development for on-line learning and its expertise in areas

[19] Between 1999 and 2005 significant changes were made to the school curriculum and there was a major change in teaching of science and math ematics.
[20] Integrating Courseware for Teaching and Learning in Classroom Setting, Mathematics, MSC and Ministry of Education Malaysia.
[21] The Smart School Roadmap *(A consultative paper on the expansion of the Smart School initiative)* 2005-2020: An Educational Odyssey, October 2005.

such as interactive multimedia courseware development. Phase One, which covered the launch in 1996 through to 2003, saw small and medium sized enterprises and multi-national corporations working together, generating over 5,000 jobs.

Alongside the growth of companies which specialize in developing on-line learning content, and the software and related technology for delivery of on-line learning, a growing number of teachers and officers are developing skills in mapping curricula and using progressive checks on learners' achievements. Involvement in courseware development and evaluation has enhanced the professional development of teachers and officers at a much faster rate and in more depth than traditional training would provide. Teachers with subject specialization were seconded to companies in the TSS consortium as subject matter experts and evaluators.

Training Teachers to Use ICT

Training teachers in computer skills and the incorporation of ICT into lessons to improve students' achievement were not major focus areas of the SSIS. This was an obvious omission in the Smart School project.

TSS and other vendors saw this as an opportunity to propose ICT training for teachers as an additional element to the SSIS. Fujitsu Systems Business (Malaysia) Berhad (FSBM), submitted a proposal to the Ministry offering their on-line teacher training software, the Malaysian Teacher Training Program (MTTP). FSBM's on-line teacher training software was designed by Internexia, using as a guide the United Kingdom's Teacher Training Agency (TTA) specification,[22] to equip teachers with ICT skills and with the knowledge and understanding to make decisions about when and how to use ICT in their teaching and to improve students' learning achievement.

The teacher training software that Internexia designed for FSBM is an on-line learning tool, enabling teachers to learn at their own pace, place and time. The software incorporates tracking of learning and a self-assessment system, and also maps the learning pathway for each teacher. Teachers are expected to complete the training in nine to 12 months at their own pace. On successful completion, teachers are awarded an internationally recognised certificate of competency.

In 2004 FSBM and partner organization Prestariang Technology Sdn Bhd were awarded a contract by the Malaysian Ministry of Education to train 100,000 practising teachers to use the FSBM program, MTTP. The software was given a new title: BPPT *(Bimbingan Perguruan Profesional dalam Teknologi Maklumat dan Komunikasi)* or Teachers' Continuing Professional Development in ICT.

The aim remained the same: to equip teachers with the knowledge, understanding and skills about when and how to use ICT in their teaching. Most of the original objectives were also retained:

- To raise the standard of students' achievement by increasing the use of ICT in their learning.
- To create a national resource data bank of high quality, technology-enhanced teaching and learning materials created by teachers for teachers.

[22] The specification listing expected outcomes for teachers was provided by the UK Government's DfEE for training teachers in the use of information and communications technology in subject teaching under UK's New Opportunities Fund (NOF) Training. NOF is the £230m. of lottery funds set aside for the purpose of helping teachers use the potential of ICT to raise pupils' standards of achievement in the NC core subjects at primary level and NC core, and non-core, subjects at secondary level. Every maintained school in the UK benefit from the NOF training, a big initiative in the professional development of teachers and school librarians. The money is to be spent on training in the use of ICT, not basic computer skills.

- To enable teachers to make sound judgements about when and how to integrate ICT in the classroom.

- To enable teachers to acquire the confidence and skills to make use of and to integrate ICT into their lesson plans and teaching of the subjects in the classroom.

- To provide teachers with access to the national resource data bank: an ever-growing pool of teaching materials.

The Malaysian Ministry of Education required the training to be implemented through face-to-face instruction to accommodate the style of learning preferred by teachers. Prestariang Technology re-worked the on-line program into a full-time,10-day, face-to-face training course. Internexia was appointed by Prestariang Technology to train a group of first-level Master Trainers who would undertake the nation-wide training of 100,000 teachers. The BPPT was launched in 2004 and the first phase was to be completed in mid-2007.

The adaptation from an on-line, part-time self-study programme to a two-week face-to-face course had advantages and disadvantages. Among the advantages were: concentration on training without being distracted by day-to-day teaching activities; immediate tutorial support from the trainer; opportunities for collaborative work with fellow teachers; and a quick evaluation of progress. The disadvantages were that ICT skills and new pedagogy require time to be absorbed and adopted into classroom practice. The intensive face-to-face training did not allow time for teachers to absorb the lessons and teachers returned to the classroom and tried to implement what they had learned without continuing support from the trainer. Another disadvantage of the face-to-face course, from the schools' perspective, was the need to replace teachers for two weeks while they attended the training programme. This caused disruption and detracted from the motivation of teachers to participate in the training course.

Using ICT in Teaching

Broadly speaking, ICT can be used in education in two ways: as a subject (learning to use ICT) and as a tool (using ICT to learn). Using ICT to learn requires first learning to use ICT.

The BPPT course focuses on using ICT to enhance learning rather than on teaching strategies. The course covers four main areas: informatics; independent learning skills; goal-oriented, resource-based subject learning; and assessing achievement.

- Informatics

The BPPT provides training in informatics (how to use computer-related technologies). The core of informatics competence training include enabling teachers to: use standard office applications; understand the components and structure of computers and networks; and utilize relevant educational software. The BPPT also ensures that Master Trainers were in a position to develop and incorporate optional modules to suit particular national needs and student aspirations. Such options covered competences for language learning, mathematics, science, engineering, software development, multimedia production, and software applications, among others.

- Independent learning skills

Many studies have shown that learners are motivated to learn and learn best when what they learn is relevant to their needs at the time of learning and how they learn is consistent with their individual

learning styles. Conventional curricula and approaches to formal education tend to neglect both these aspects of learning. An emphasis on students as learners, rather than as recipients of teaching, demands significant shifts in teachers' behaviour and attitude. ICT offer opportunities to bring education closer to the needs of the individual learner. The BPPT course encourages teachers to become familiar with ICT tools for accessing learning resources and information, solving problems and presenting results. The course also enables teachers to learn to support their students in adopting learning skills that would enable them to learn independently in the future.

- Goal oriented, resource-based subject learning

The BPPT course explains that using technology to develop new skills is a means of re-balancing the curriculum, but does not imply abandoning subject-based learning. The course demonstrates that most subjects can be explained and enhanced through using ICT applications. The course also promotes a shift from interpreting the curriculum as a list of facts to be learnt towards treating a subject as content with a set of competences to be acquired. This is most obvious in subjects such as language, informatics and mathematics, which are already both learned and tested as skills. But relevance and a focus on individual learning styles, as well as the need for communicative and collaborative skills, require that even knowledge-based subjects, such as history, science and geography, should be learned in the context of problems to be solved and challenges to be undertaken. The challenge for teachers, and the trainers of teachers, is to restructure subject learning as a series of increasingly demanding goals to be achieved, with technology tools giving access and structure to the resources needed to stretch the students' capabilities and to measure their success in rising to the challenges posed by the curriculum.

- Assessing Value Added and Achievement

Assessment is conventionally seen as something that schools and teachers do to students, through tests and examinations. ICT tools provide an opportunity to enable the student to participate more actively in the process.

Various aspects of assessment lend themselves well to technological enhancement and to the closer integration of assessment into the learning process. Diagnostic assessment can be used by students and teachers to identify gaps between present knowledge and skills and the required knowledge and skills. This helps to focus on the progress to be made in learning and in achievement. Furthermore, with a curriculum expressed as measurable learning outcomes (as is the case now in Malaysia), the distinction between learning and assessment blurs. Formative learning, at the early stages of a subject or level of difficulty, can be closely guided and monitored with the support of ICT tools. Technology-enriched developmental learning activities enable the student to attain knowledge and skills beyond the basics, and help the student to identify the subjects most closely suited to his or her needs, desires and talents. Problem-based learning is particularly well suited to provide learning activities that develop competencies, and to measure the outcomes of such learning.

What skills should teachers have?

Teachers are the key to the successful integration of ICT into education. They manage the processes of teaching and learning. Without the active, enthusiastic and skilled participation of teachers, innovations to enrich education with the advantages offered by technology are doomed to fail. The full participation of teachers in adopting new technologies to enhance education requires a commitment to ongoing professional development of teachers.

Two broad questions stand out for attention:

- What are the competences that can reasonably be expected of a teacher engaging in ICT-enriched education?
- What are the methods by which the expected levels of competence in the teaching profession can be achieved?

All teachers who use ICT to enrich their teaching and their students' learning need to develop specific educational competences to do so effectively. Teachers should be volunteer learners, motivated to learn to use ICT based on their interest in seeking out learning opportunities and in managing the changes taking place among their students, and in their classrooms, schools and profession. Teachers are motivated to learn when the new knowledge or skills can be used to better their position or to make improvements. They are not always interested in knowledge for its own sake. For many teachers, learning is a means to an end, not an end in itself.

In any ICT in Education professional development programme, teachers first need to gain the knowledge and judgement to be able to select and evaluate ICT resources that are suitable for teaching and learning in their own subjects. In particular, teachers need to be able to use the internet to search and select, with a critical eye, information and resources that are relevant for their subject and their students.

Secondly, teachers need to be able to judge when and how to integrate ICT into their lessons. Many aspects of education can be enriched with the judicial use of technology while some topics and aspects cannot. A teacher needs to be able to distinguish between these, and finer, distinctions.

Thirdly, teachers need to able to evaluate the effects of ICT on their teaching and on their students' learning. If the curriculum is defined in terms of learning outcomes, and standards for ICT-enriched teaching and learning are clearly defined in measurable terms, then the teacher would be able to apply the outcome measures, both to their own teaching and to students' results.

The training course offers the following: competence in the use of relevant technologies; competence to apply these technologies appropriately to teaching; competence in the development of resource materials and content for teaching; and competence in working collaboratively to improve the quality of ICT-enriched resources.

The course begins with providing training in basic ICT applications – Introduction to Computers and Applications (ICA). ICA is an on-line self-learning course with eight modules. The course comes with a set of instructions which include text, audio and images. Practical exercises can be followed by teachers to learn how to utilize ICT to develop lesson plans and teaching materials. Teachers have access to the on-line programme 24 hours a day, seven days a week.

Beyond the computer skills, the course extends teachers' competence in ICT to a level that enables them to produce teaching and learning materials for their own use and to share them with subject colleagues. In particular, the course gives instruction in how to access and utilize a resource bank which contains examples of lessons, and how to share their resources with others.

The training model is flexible and can be adapted to meet the needs of individual schools. The training co-ordinator is a key element in the organization and delivery of the course. Action planning is

addressed throughout the training and there are opportunities for teachers to meet ongoing needs as they are identified. The provider has rigorous procedures in place for quality assurance, which confirms its commitment to a programme of ongoing monitoring and improvement.

Following participation in the training course, most teachers responded positively in their feedback form and on the BPPT website.[23] Teachers reported that the training had a positive impact on their professional practice and that they were increasingly confident in the use and application of ICT in their teaching.

The BPPT website provides examples of (unedited) responses from teachers who have participated in the training course. Some of the teachers' comments are reproduced below.

- "This course has enabled me to use ICT in teaching and learning in line with the current developments in the education system."
- "After the course I became aware of the importance of ICT for the future and learned that it is very important to use ICT in Teaching and Learning. The use of ICT enables the process of teaching and learning to be more enhanced and complete."
- "This program has enabled me to increase my knowledge and skills in ICT. In particular it is a great help for me in lesson planning. I received a great deal of understanding and knowledge from my friends and peers from other schools."
- "This is an eye opening to a new way of teaching."
- "It's a great course, a useful tool; opening doors to learning, to turn children on to lifelong interest."
- "A very beneficial course to all teachers regardless of what subject we teach. For sure this is one of the best ways to educate and guide our pupils/students."
- "To all teachers, grab this opportunity to attend this BPPT course because it has many benefits for teaching and learning."
- "This course is very significant for me where I where I was able to learn many things about ICT. It also helps me in my area of teaching and learning."

In 2007, consultants from the International Islamic University of Malaysia began evaluating the BPPT programme. When complete, the evaluation report will be published on the BPPT website.

Malaysian Grid for Learning

In response to feedback from teachers, a decision was made to upload to the Malaysian Grid for Learning portal the best lessons developed by teachers.

The Malaysian Grid for Learning (MyGfL) is a strategic initiative and a vital part of the Malaysian Government's commitment to the creation of a knowledge-based society. MyGfL is managed by the Malaysian Government through the Ministry of Education (MOE) and aims to cater to the educational needs of learners and educators of every age, in both formal and informal learning environments, towards achieving national excellence in education. The MyGfL Formal Learning portal offers all schools in Malaysia a one-stop gateway to useful educational resources from Malaysia and other countries.

[23] BPPT website: http://www2.bppt.com.my/index.php

Assessment of the SSIS

In 2005, the Ministry of Education and MDeC published a report which documented an study of the changes brought about by SSIS and the impact the SSIS had on teachers, students and school administrators. The study also assessed the "first-of-its-kind" partnership between the Government and the private sector in the development, testing, installation and implementation of the SSIS.

The study focused on initiatives undertaken between 1999 and 2002. It surveyed 33 of the 88[24] Smart Schools and found that around 90 percent of students in the schools were ICT literate and could use ICT facilities for learning. Although teamwork, peer learning and independent learning are valued by more than 50 percent of the students in the survey, the study report noted that there was reluctance among students to work in teams because this was seen as an obstacle to completing assigned exercises during lessons.

The study also found that a high percentage (83 percent) of teachers were ICT literate. Furthermore, around 90 percent of teachers were using the computer laboratory for lessons and preparation of materials and most teachers (73 percent) found their productivity improved by using ICT facilities.

The report noted, however, that there was a need to establish a minimum ICT competency level for teachers, particularly in terms of competency in the innovative and creative use of ICT in teaching. The report recommended further provision of training in teaching methods and recommended that the teacher training curriculum should incorporate competence in the use of specific ICT tools, competence in integrating ICT into subject teaching, and competence in utilizing ICT for planning, preparing, teaching, assessing and evaluating lessons.

The report also recommended updating courseware to incorporate changes in the curriculum and in technology. The report noted that there was a need to implement the Smart School initiative in a more defined, structured and balanced manner and to improve the management of the various projects. A key recommendation was to enhance the classification standards for what qualifies a school to be "Smart".

Smart School Qualification Standards

In June 2006 MDeC published the Smart School Qualification Standards (SSQS).[25] The SSQS – a five star ranking system – provides the criteria for achieving Smart School recognition. The SSQS also provides a set of indicators for measuring progress.

The objectives of the SSQS are to:

- Develop a system to measure ICT use in education
- Provide a basis for policy planning and programme improvements
- Raise standards in education
- Serve as a catalyst for educational change
- Empower teachers and learners

[24] Thirty-three of the 88 pilot schools were selected for the purpose of impact assessment study, which was undertaken in October 2005. Students, teachers of Bahasa Melayu, English, Science and Mathematics and administrators provided insights and feedback on their experience of the SSIS implementation. Frost and Sullivan, 2006.

[25] Smart School Qualification Standards (SSQS), MSC Malaysia Client Contact Centre (CliC), Multimedia Development Corporation Sdn Bhd, 2007.

The SSQS has four focus areas for assessing Smart Schools: utilization of resources, human capital, applications, and technology infrastructure. The schools must achieve the minimum conditions (1 star) for each of the four focus areas to qualify as a Smart School. An essential criterion is the ability of teachers to utilize the schools' resources (such as ICT-enabled tools), to bring about an increase in pupils' learning and achievement.

Ministry reports state that the initiatives and implementation of the SSIS are heading in the right direction. Teachers are adopting new roles in the changing school environment, developing their ICT skills. Teacher training has brought about several significant effects. ICT training programmes have improved teachers' ICT skills, enabling them to incorporate ICT in their lesson plans. Teachers are able to produce digital materials and to integrate ICT in teaching and learning.

The Ministry has also provided a programme to train trainers to meet the demand for the large number of courses conducted by MOE. Encouraged by the improvement in teachers' skills and knowledge, the Ministry has recently identified 30 schools as "centres of excellence".

The Ministry continues to monitor strengths and weaknesses of the SSIS to enable appropriate intervention and support for schools. In a recent paper, Dr Masnah binti Ali Muda[26] wrote that the viability of the SSIS depends on ensuring that its management modules are scalable, web enabled and flexible for integration with on-going ICT initiatives. He also recommended that the student-to-computer ratio should be reduced, with better connectivity and broadband access; that schools should create champions who will lead change; that schools should take a holistic approach to change management issues; and that the Ministry should continue to provide guided training. Echoing the findings of the impact assessment study, Dr Masnah concluded that there should be alignment of policy objectives at all levels within the Ministry of Education, between Ministries and among agencies.

Conclusion

Through the Malaysian Smart School project the Malaysian Government has: made a strong commitment in policy, created a blueprint and guidelines, provided funds and resources to develop the necessary infrastructure, identified experienced and qualified teachers and officers, allocated a large budget for the development of teaching and learning materials and initiated a national thrust to bring about accelerated improvement in the application of ICT in education.

Teachers at Malaysian Smart Schools are perhaps some of the most advantaged professionals in the region. Their schools are well equipped and they are well supported in terms of access to ICT tools and to teaching materials and resources. Impact studies, government monitoring and evaluation reports of developments[27] and reports of visits to schools show that there is widespread use of ICT in the 87 Smart Schools by teachers, students and administration staff. Nevertheless, what is missing are the ingredients that make teachers innovative and creative in their role as facilitators to promote learning. There remains a need for teachers to develop confidence in new methods of promoting learning. The BPPT programme seeks to address this issue by providing training for teachers, giving them competence in the use of specific ICT tools, competence in integrating ICT into subject teaching and competence in utilizing ICT in planning, preparing, teaching, assessing and evaluating lessons. This training enables teachers to

[26] Dr Masnah binti Ali Muda is a senior officer in The Educational Technology Division of the Ministry of Education Malaysia.

[27] Laporan Ujian Diagnostik, Pengajaran-Pembelajaran Sains Dan Matematik Dalam Bahasa Inggeris (PPSMI), Lembaga Peperiksaan Malaysia, Kemen terian Pelajaran Malaysia, Ogos 2005

develop confidence and encourages teachers to introduce more innovative methods in teaching. While the training has been warmly received by teachers, conventional didactic methods are deeply ingrained into educational practices and will not be overcome easily.

The 87 Smart Schools are poised to be graded according to the SSQS five star ranking system. This ranking system aims to encourage teachers to be innovative and creative in using the large collection of educational aids available to them, including ICT tools, courseware and other materials, to bring about an increase in students' learning and achievement.

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3. Microsoft Partners in Learning Programme in Five ASEAN Countries

Vincent Quah [28]

Introduction

This case study describes the Microsoft Partners in Learning (PiL) initiatives in the area of training teachers to utilize information and communication technologies (ICT), in five Association of South East Asian Nations (ASEAN) countries: Indonesia, Malaysia, the Philippines, Thailand and Viet Nam. The case study also examines the impact of the PiL programme on education communities, and its contributions in driving the integration of ICT into education in these five countries. The study further illustrates the value of sustainable corporate-community partnerships in enhancing ICT in Education initiatives.

Background

The difference between communities with and without access to the latest technology (the "digital divide") is both significant and troubling, manifested in both quality of life and economic development. In an attempt to narrow this digital divide, Microsoft has devoted US$253 million to its Partners in Learning (PiL) initiative. Under this initiative, Microsoft establishes partnerships with Ministries of Education, national and local Government bodies, and other stakeholders to develop ICT capacity among educators around the world. This multi-faceted approach aims to increase access to information and improve digital literacy.

This case study presents examples from the PiL Learning Grants teacher training schemes in five ASEAN countries, illustrating successes as well as areas for improvement – information potentially applicable to other teacher training initiatives in the Asia-Pacific region.

PiL goals are two-fold: skills development and pedagogical transformation. In each of the countries it has been implemented in, the PiL Learning Grants framework is adapted to suit specific needs.

PiL Teacher Development Project

The focus of this study is the "teacher development" project of the PiL Learning Grants framework, the most popular of the projects developed in each country. Basic Skills and Advanced Skills training courses for teachers have been held in each of the five ASEAN countries. In addition, online community portals, designed to facilitate sharing of lesson plans and teaching materials among teachers and school leaders have been set up in each country. Furthermore, because professional development for school leaders is a significant component of effective integration of ICT into education, PiL "Leadership in the 21st Century" modules have been offered in four of the five countries.

The implementation of PiL in the ASEAN countries is relatively recent; most countries officially launched their initiatives from late 2003 to mid 2005. PiL has nevertheless made significant inroads in improving teaching and learning using ICT in schools. Its areas ofimpact include curricula, professional development of school staff, improved school ICT culture, teacher use of ICT for teaching, and student use of ICT for learning.

[28] Director, Public Sector Programs, Microsoft Asia-Pacific

PiL has been notably successful in improving Basic ICT Skills, reaching large numbers of teachers who then teach others. Peer Coaching has also been effective in every country in this study. The impact of PiL is also evident in changing pedagogical methods, but will require a long-term commitment to effect lasting transformation in education.

Although the approaches for implementing the PiL initiative vary among the five countries, and the levels of ICT use in teaching and learning differ, there are similarities in the experiences of implementation. The areas in common are as listed below.

- ICT integration is a key component of national education goals in most countries. However, in many cases, there is little availability of instruction in ICT skills for students.

- Lack of funding continues to be an obstacle in every country, and rural and remote communities continue to be plagued by weak infrastructure.

- In many countries, there remains an ongoing need for ICT learning resources in local languages.

- In many public school classrooms, the prevailing pedagogical practice is best characterized by rote learning and a teacher-centred approach. ICT learning is student-centric and community-based; thus conventional, ingrained pedagogical habits need to be dislodged—with cultural sensitivity—for ICT training to be effective.

The country-specific sections of this study identify the unique features of the PiL programme in that country and the impact of the teacher training programmes, and offer lessons that are potentially applicable to others.

There is growing recognition of the importance of public-private partnerships for sustainable development. Governments increasingly recognize the need to engage local and multinational companies in their efforts to transform the daily lives of their citizens. Yet if such engagements are to have long-term sustainability, long-term partnerships, rather than patchwork solutions, are called for.

Innovation is the central theme that governs the PiL programme in terms of scope and implementation. Firstly, although the Partners in Learning initiative is a global programme, it has been designed to incorporate local requirements and needs in the way projects are designed and in terms of scope. This is a critical step to ensuring that the projects are relevant to local community needs. Secondly, there is evidence from the various country implementations that suggest that the Partners in Learning initiative facilitates important cross-group collaboration, not only between different divisions of the Ministry of Education in each country, but also between other stakeholders in each country's education communities. Thirdly, while we believe that the provision of teacher training is an essential component of the initiative, nevertheless, it is important to move beyond a "training mentality" and embrace a longer term professional development approach through the establishment of a coaching/mentoring environment in schools, or even at the district or national levels.

The concluding section of the study identifies successful elements shared by the various country programmes, as well as weaknesses, and discusses obstacles and challenges. The hope is that this case study, illustrating a series of innovative corporate-community partnerships toward productive educational change through the integration of ICT in the teaching and learning process, will be useful

for the many stakeholders in community development and education in the Asia-Pacific region who can learn from the PiL projects and implement similar initiatives.

Indonesia

Background

The Government of Indonesia is concerned about the low use of ICT in teaching and learning in schools. Although ICT is an essential component of the 2004 national curriculum, not all schools are able to use ICT. This is because of the lack of sufficient hardware and software in Indonesian schools. Furthermore, schools lack ICT-literate teachers and the ability to develop ICT-based learning materials.[29]

In the financial year of 2005, the projected and achieved targets of four key projects were as follows:

- 75,075 teachers and school leaders were trained;
- 574,000 students were reached by the curriculum;
- 37,580 (far exceeding the proposed 20,000) assessments and certifications were completed;
- 5,000 schools implemented a student help desk programme.

The PiL Indonesia programme

On 1 November 2003, Microsoft signed a memorandum of understanding (MOU) with the Indonesian Ministry of Education (MoE), valid for a period of five years. The PiL partnership with the MoE focuses on increasing ICT proficiency throughout Indonesia, and narrowing the technological gap between Indonesia and its neighbours.

Goals and practices focus on working with and supporting the Government of Indonesia, as well as industries, communities, NGOs, policy makers, partners and media to:

- develop the nation's ICT capacity;
- provide schools with affordable PCs equipped with licensed software;
- formulate strategies for achieving higher levels of ICT proficiency;
- accelerate the process of improving ICT proficiency;
- assist teachers by developing course materials that use ICT in the classroom.

PiL works closely with the national government with respect to its ICT Masterplan in Education, and from this close working relationship, significant goals have emerged. These include:

- Professional development of teachers, from basic ICT competency to advanced competency;
- Design of a national curriculum of ICT-literacy for K-12 students.

In order to ensure that the MoE was not favouring any one product, Microsoft products were not mentioned in the curriculum and standards. To support the delivery of the curriculum, PiL also co-developed (with the MoE, teachers, teacher educators and private sector) a set of materials to be used to meet curriculum objectives. All these activities were initiated and overseen by the working group in the MoE.

Microsoft Indonesia has created strong and sustainable partnerships with universities and teacher education institutions in Indonesia. Microsoft Indonesia also has valuable partnerships with non-governmental organizations (NGOs).

[29] Lim, 2006, p.5

Overview of pedagogical issues

In many public school classrooms, rote learning and deference to the teacher's authority best describe the prevailing pedagogical practices. Also, a tendency persists to teach ICT as a separate course, rather than as an integrated feature of education.

Further, the country's diverse ethnic mix necessitates localized curricula to supplement the national curriculum. Most of the teaching and learning resources were translated from English, and the materials were localized to make them more familiar to Indonesian students.

Issues and challenges

Problems identified locally, but which have widespread application include:

- Lack of access to computers in schools or at home for many teachers, therefore computers are not yet part of their lifestyle;
- Difficulty in encouraging informal dialogue among teachers to teach one another; and in devising means of making ICT-use routine, such as requiring lesson plan submission via email;
- Many of the older teachers tend to shy away from ICT (the average age of the teachers in some schools is about 50 years).

Additional issues raised by teachers include the lack of a physical office or virtual space to meet, suggesting that Microsoft Indonesia may need to provide a common meeting place. Finally, the lack of a big picture of the PiL project and knowledge of the activities of other agencies hampers planning. Better coordination is needed between agencies to exchange information and to avoid wasting resources.

Innovative practices used in the PiL programme

The Peer Coaching programme trains master teachers to integrate ICT into the curricula and to train and mentor other teachers at their school. Described by one participant as a "bottom-up" approach, teachers are empowered to participate in their school's education policy. The programme acknowledges that teachers are best-qualified to tailor ICT planning in terms of their specific school needs.

The success of Peer Coaching is partly attributable to the selection of subject-area specialists, as teachers are "more likely to buy into the use of ICT in teaching and learning when they can see the use of ICT within their own subject areas". Peer Coaching can be credited with generating the "cascade effect" of ICT use in schools in Indonesia.

Examples of best practice

Despite his extensive subject-area knowledge and pedagogical skills, Teacher A, a high school biology teacher, was nevertheless almost completely lacking in ICT skills. He was identified by a Microsoft PiL Advisory Committee member to attend the Peer Coaching programme. There, he was completely won over by the concept of Peer Coaching and the need for ICT use in the classroom. When he returned to his school after the training programme he immediately set about transforming the science curriculum, training fellow teachers and students, and integrating ICT into all facets of the school culture.

A best practice example of the cascade effect can be found in School A. In this school, peer teaching is prominent; ICT is used for school work and after-school activities, administration, and in daily life. The ICT team has constant dialogue with the teachers to shape the ICT vision of the school. The increasing use of ICT by the students has also changed the learning culture of the school, as teachers are no longer viewed as the sole source of knowledge and expertise.

Conclusion

PiL Indonesia has been most effective in three areas:

- Promoting the development of an ICT curriculum in the schools;
- Professional development of staff;
- Increasing presence of ICT in school culture – including collegial exchanges of knowledge and active student learning.

The findings in this country study suggest the positive impact of the PiL initiative and the lessons that can be applied elsewhere. However, challenges remain. PiL should continue to facilitate dialogue among major stakeholders; should undertake tracking and monitoring of teachers who have undergone the professional development programme, to measure success; and should provide post-training support, as teachers need on-going technical, administrative, and pedagogical support.

Malaysia

Background

No official ICT Integration Masterplan exists for Malaysian schools. However, a 1997 Smart Schools blueprint is regarded by some as a de facto ICT Integration Plan, as it emphasizes the centrality of ICT in future learning environments.[30]

The Ministry of Education (MoE) of Malaysia reports that 50 percent of schools are equipped with computer labs (99,000 computers and 4,600 servers) and 95 percent have broadband connection. In addition, the MoE has provided selected schools with 97,000 laptops and 70,000 LCD projectors, and have provided English-language courseware in the subjects of Science and Mathematics, for Forms 1 to 4, in all schools throughout Malaysia. Eighty-eight schools in Malaysia are taking part, as pilot schools, in the "Smart Schools" initiative, which seeks to promote ICT use in schools. Many Chinese primary schools have acquired their own hardware and software through the financial support of their Parent-Teacher Associations and the community...

In 2005, the PiL project had achieved the following:

- 6,324 teachers and school leaders were trained;
- 950 students were "reached" by the curriculum;
- five partners were engaged;
- 100 assessments were completed;
- 18 Innovative Teachers were registered.

But these numbers do not tell the whole story. Since August 2004, 46,000 teachers have been trained under the Bimbingan Perguruan Profesional dalam Teknologi (BPPT) partnership programme.

[30] Gan, 2006, p.3

Furthermore, 18,000 teachers have been trained to use laptops as part of the Teaching of Mathematics and Science in English (PPSMI) Laptop Roll-Out project.

The PiL Malaysia programme

On 20 June 2004 an MOU was signed with the Malaysia MoE, outlining ten broad project areas. The PiL activities in Malaysia focus on programmes endorsed by the Government of Malaysia.

The PiL programme works with the national education authorities to provide software to schools at a discount, and collaborates with ministry officials to organize training programmes for teachers. PiL provides training curricula and materials, while the MoE identifies participating schools and teachers, and organizes workshops. PiL facilitates meetings between the Curriculum Development Centre, MoE and international organizations.

Several types of professional development programmes for teachers are available, including the Student ICT Help Desk programme, the Peer Coaching programme, MyGuru Portal, and the Laptop Roll-out programmes. Problem-Based Learning (PBL) and *empowerICT* are programmes designed to promote new pedagogical practices using ICT (30).

PiL has contributed significantly to the success of several MoE projects. Successful programmes include Student ICT Help Desk Project, ICT Innovation Program for Chinese schools, BPPT Partnership Project and the PPSMI Roll-out Project. The impact of other projects, while not apparent now, will be tested in the near future. These include: the Curriculum Project, the Peer Coaching Project, Smart Education Partnership Project (MyGuru Portal) and the impending Leadership Development Project.

Issues and challenges

No ICT curricula are available, nor are national standards for student's ICT competency available. However, despite the lack of policy changes, pedagogical changes are taking place; student self-assessment, for example, has been introduced in the Chinese schools, whose teachers are being trained in PBL.

Examples of best practice

Teacher B, winner of the 2005 Microsoft Innovative Teachers Competition, attended a Problem-Based Learning (PBL) training workshop. Following the workshop, Teacher B helped to integrate PBL experiences into co-curricular activities for students in her school. Her award-winning project involved a team of six teachers and 400 students in a PBL activity. Press coverage of her award helped generate positive buy-in from other teachers for a PBL training workshop.

School B, an overcrowded Chinese school in suburban Kuala Lumpur offers two best practices examples. The school is a self-made Smart School. It engaged the services of a private company to set up computer labs (each with 27 computers, LCD projector and Internet access) and equipped each of its 25 classrooms with a PC and a TV or an LCD projector. The community and the Parent-Teacher Association contributed funds for this purpose. Each family pays a nominal monthly fee for purchases and services. The school provides fee-waivers for students whose parents cannot afford to pay to help ensure that no student is denied the opportunity to use ICT in school. Other schools have sent teams to visit and learn from School B, which acts as a catalyst in the community for ICT-enhanced teaching and learning.

However, in spite of its success in obtaining equipment, School B is not entirely successful in integrating ICT use into teaching and learning. In particular, while both the principal and the teachers in this school recognize the value of PBL, and the school consistently sends its teachers to training workshops, parents do not recognize the value of PBL and generally perceive it as a time-consuming activity that detracts from the more important goal of "completing the syllabus. Teachers are under pressure from parents to deliver good examination scores, and therefore most teachers rarely integrate PBL into their teaching.

A suggested solution to this issue is to make PBL a part of the weekly compulsory after school co-curricular activity. In this way, all students in the school will have a chance to benefit. These co-curricular classes are team-taught, thus permitting teachers who have not had formal PBL training have the opportunity to learn from their peers who have received training.

Conclusion

The PiL project in Malaysia has found that:

- Good leadership is vital for developing and sustaining a positive and supportive ICT culture in schools, and leadership development is urgently needed for many school leaders.
- Support from all stakeholders is an important factor in sustaining an ICT culture in schools.
- Sound planning, timing, and sequencing for professional development programmes will make training more effective.
- PiL should make available the software, quality courseware, and other resources that support and meet curriculum needs.

The Philippines

Background

Integrating ICT into basic education is a stated national education goal of the Government of the Philippines. An ICT Integration Masterplan in basic education lays the groundwork for shifting to learner-centered pedagogy. In the Philippines, PiL objectives are to assist the Government in building a 21st-century education system, featuring a systematic, sustainable ICT-based learning environment.[31]

In 2005, the PiL project had achieved the following:

- PiL has partnerships with 164 universities and colleges;
- 3,051 teachers and school leaders have been trained;
- an estimated 347,000 students and 13 of 17 regions have been reached through the cascade effect;
- Ten teacher training and support programmes have been created.

The PiL Philippines programme

In 2003 an MOU was signed with the Department of Education (DepEd). PiL Philippines projects involve dynamic, productive partnerships with the national and local governments, and PiL works closely with DepEd in implementing most of its projects. In addition, Microsoft Philippines has productive relationships with several private organizations and NGOs.

[31] Quimbo, 2006, p.5

The DepEd permits teachers to use their official time to participate in PiL projects, thereby encouraging professional development. The DepEd also permits travel expenses to be charged, and local community groups such as PTAs often pay for meals and supplies and materials, indicating an important dimension of community involvement in teacher training.

Stakeholders have recommended more systematic involvement from the DepEd, including formal recognition for teachers who attend ICT-related courses. Furthermore, it was recommended that the DepEd should introduce ICT systematically into school curricula, and appoint full-time ICT coordinators in schools.

Issues and challenges

As in other countries, older teachers showed some reluctant to "leave their comfort zones". To compound this problem, younger teachers are often uncomfortable mentoring their elders.

Innovative ICT practices used in the PiL programme

"Tech-mentors" train fellow teachers in ICT basics, as well as in the effective use of ICT in teaching. Of the projects conducted in the Philippines, the most successful have been those planning and implementing ICT-related activities involving tech-mentoring.

In many cases, both teachers and students find technology-enhanced education more stimulating than conventional education. Teachers observe that technology enhances their work, re-kindling their interest in engaging their students. Teachers also observe that ICT enhances the learning process for students, increases student-interest in lessons, and encourages self-directed learning. Students may acquire greater satisfaction from experiential learning, and enjoy their technology-enhanced projects more.

As a result of receiving training in ICT skills, teachers and students have become animated about learning, citing an open-minded outlook as one of the by-products of the training. Learning is no longer thought of as confined to classroom. Sharing information with other students, researching on the Internet, and taking part in ICT–based collaborative projects with students from other countries allows students to broaden their academic horizons and learn from other cultures. Use of ICT in the classroom also promotes creativity, critical thinking, and ownership of the learning process.

Examples of best practice

Teacher C, the ICT Coordinator at her school and recipient of an Innovative Teachers Leadership Award, attended a Peer Coaching seminar. Following the seminar, in her capacity as the tech-mentor for her school, she designed a curriculum to help train ten colleagues in ICT-integration, generating a great deal of enthusiasm for ICT among fellow teachers.

Teacher D, teaching in mountain province general comprehensive high school, assisted her students in creating a website showcasing the local Igorot cultural achievements. She reports feeling humbled by what the students achieved in utilizing ICT to help spread knowledge about this dwindling ethnic group.

Conclusion

These are the recommendations for the PiL programme in the Philippines:

- The PiL programme should continue beyond the five-year commitment. Five years is believed to be too short to create a lasting impact in the education system.
- To sustain ICT use in schools, PiL recipient schools could serve as flagship schools for nearby schools with zero or limited use of ICT in teaching and learning. Trained teachers could train or mentor teachers in the other schools.
- Greater exposure of master trainers to information about how other countries are implementing the PiL programme can help them in performing their training roles. A conference in which master trainers can come together to share their experiences of PiL implementation would be a useful experience for teachers.
- Longitudinal studies into the use of ICT in classroom practice in relation to student performance are needed. Tools are also needed to assess application of ICT in subject areas.
- There may be a need to foster closer working collaborations between PiL and DepEd at the school division level for greater recognition of PiL initiatives and how these activities create an impact on the teachers and the schools.

Thailand

Background

The first National ICT Masterplan for Thailand was implemented in 2000. The second, IT-2010, focuses on sustaining the first Masterplan's achievements. The Ministry of Education (MOE) has a number of programmes in place designed to support the Masterplan, which calls for the networking of all education institutions by 2010, and for ICT integration to have increased by 30 percent over current levels.[32]

PiL's efforts in Thailand have focused on skills-building for teachers and students, in particular in advancing teachers' ICT knowledge so that they can teach ICT skills more effectively; using education opportunities to stimulate development of a local software economy; and building awareness of intellectual property rights.

Since December 2003 the PiL project had achieved the following:

- 22,682 teachers and school leaders have been trained in various aspects of ICT literacy, from basic skills (16,575) to training in Peer Coaching (820); as master teachers (336) and in the school leadership programme (18).
- The PiL programme provides participants with the necessary hardware, software, trainers, and documents, and operates in 84 training centres in five regions of the country.
- The Peer Coaching programme, implemented in 2004, has over 800 teachers (64).

The PiL Thailand programme

On 17 September 2003 an MOU was signed with the Thai Ministry of Education for a five-year programme to impart ICT skills in schools nationwide. PiL Thailand works closely with the national and local education authorities to identify training needs, localize curricula, and identify teachers for training. PiL also works closely with several intergovernmental and non-governmental organizations (NGOs) in

[32] Lertchalolarn and Suwannatthachote, 2006, pp. 5-6

Thailand. With UNESCO, PiL collaborates on several ICT activities, including the successful *SchoolNet* and *Next Generation of Teachers* projects. PiL worked with ECPAT International to add the topic of "Child Online Safety" to the training programme for the annual Microsoft IT Youth Challenge Camp. PiL also supports Her Royal Highness Princess Maha Chakri Sirindhorn's IT projects, including "IT for education in rural areas". PiL has also collaborated with the Southeast Asian Ministers of Education Organisation (SEAMEO); and works with the Intel Teach to the Future programme. In April 2006, the joint programme trained 600 teachers in Peer Coaching.

Issues and challenges

The two key areas of concern identified by the MOE and PiL are teacher computer literacy, and the failure to go beyond computer classes and integrate ICT into subject areas.

While basic computer literacy is required for all teachers, including the ability to develop new instructional media and integrate it into teaching and learning, many teachers lack such skills. Furthermore, teachers who possess basic skills need training in ICT integration.

A bureaucratic top-down approach is ineffective in the Thai context. Instead, working directly with each education service area and with teachers has proven effective (35 offices have participated thus far). For example, in 2004, problems were identified with the training sites. By working directly with local authorities, PiL solved the problems, and over 16,000 teachers were trained..

Schools with an average teacher age of over 40 years found it hard to train teachers in advanced ICT skills, in part because heavy teaching loads leave teachers with little time to practice new skills.

Cultural factors must be accounted for when designing training activities. The following issues were frequently encountered:

- The emphasis in Thai culture on harmonious relationships and on elders instructing younger people complicates ICT training. While younger teachers tend to be more open to learning new technologies and practices, they are uncomfortable in coaching teachers who are older than they are.
- Peer Coaching has proved useful in the Thai context, building on an established cultural practice of sharing among friends and families, but a "soft approach" is needed to convey training and feedback.

Examples of best practice

Teacher E, a primary school science teacher whose use of ICT in teaching had been limited to assigning students to search for information or images on the Internet, attended a basic computer training programme. The pedagogical shift was rapid. Following the training, the teacher integrated ICT into two-thirds of his science lessons. His students now request additional computer lab time during lunch and before school in order to work on their projects. So impressive are the learning benefits for students that the school opened a second computer lab, and Teacher E has been asked to train other teachers.

ICT is well-established at School C, a large secondary school in central Bangkok, which was selected as a pilot school in the *empowerICT* project. One teacher at this school became a trainer for Peer Coaching, was selected as a 2004 "Innovative Teacher" and has been trained in several projects under the PiL programme. Teachers at this school are now encouraged to increase their use of ICT in their administrative work and in classroom teaching.

School C has focused on generating group ICT projects by students, to build the school's electronic library. Student groups, with the assistance of teachers, worked on projects which, when finalized, were uploaded to the school's website. Through such collaborative projects, the students, already computer-literate, have cultivated new ICT skills, and are highly motivated to participate in ICT competitions. The school wins many awards and has national recognition, and has been selected for the APEC programme: ICT Model School,.

Conclusion

The key points to consider regarding PiL's activities in Thailand are as follows:

- PiL offers training at three levels, but large numbers of teachers still require training. Many teachers who are computer literate are still weak in ICT integration. PiL should address these needs.
- PiL training programmes have positively affected schools by promoting ICT culture. Students are enthusiastic about ICT, and one of the IT Youth Challenges received more than 1,000 submissions. More teachers are using ICT in their teaching, which has led to the development of higher order thinking skills for students.
- New strategies are needed for the public relations of the PiL programme. Teachers commented that the image of the PiL programme is not recognized as much as it should be. Media exposure is helpful, as teachers recognize the brand, generating buy-in.
- The PiL online portal functions as a static bulletin board, rather than as a dynamic community. More publicity for the portal is needed and more resources should be directed to it.
- PiL Thailand needs to work towards sustainability. It has been pointed out that the PiL programme has started many pilot projects. Rather than continuing to initiate new projects, it has been recommened that PiL should consolidate and continue to support its existing programmes.

Viet Nam

Background

The ICT Masterplan 2001-1005 developed by the Government of Viet Nam focuses on infrastructural needs and on developing technical expertise for computer-related activities (Wong, 2006, 5). As a developing country with limited ICT school resources, Viet Nam's PiL objectives are centered on the professional development of teachers and principals, including Basic Skills training for teachers, Peer Coaching, ICT integration, and leadership skills for school leaders (7). Since 2005, 100 teachers and school leaders have been trained in various aspects of ICT literacy; 60 teachers have been registered as innovative teachers, and five advisories have been established (3).

Though 90 percent of high schools have PC access, in the lower secondary levels, only 30 percent of schools have computers. This figure is even lower in primary schools.

A PiL MOU was signed in June 2005 with the Ministry of Education and Training (MoET) for a five-year programme to organize training course for teachers, imparting ICT skills and teaching methods in 15 cities and provinces (8).

The PiL programme in Viet Nam

As the MoET lacks a professional ICT training programme, PiL fills this gap, offering Basic Skills training for teachers (21) and working closely with the MoET. The MoET identifies teachers for training, and recommended five teachers from each school, instead of the one as PiL requested. Targeting fewer schools more effectively has proven the better strategy as five teachers can provide one another peer support (21).

PiL works successfully with Hanoi National University of Education, the main teacher training university in the country, developing courses on new teacher training and incorporating ICT training into teacher training modules (22-24). This productive partnership positions PiL well for teacher buy-in. PiL Viet Nam has a strong and helpful Advisory Council that offers sound advice and strong leadership to the programme (45). No direct partnerships with NGOs currently exist in Viet Nam (22).

One of the first and most productive tasks accomplished by PiL Viet Nam was to translate all training materials from English, making the materials widely available. Though a young programme, PiL Viet Nam has been successful in getting schools to start using technology. Teachers who have attended the various training courses have applied what they have learned to their teaching, and schools have shown interest in the use of ICT. Principals are increasingly aware of the power of technology to help students and are more willing to support the teachers in this area. At the national level, officials are motivated to commit more funding and support the use of technology in schools.

An ICT culture is developing in Viet Nam's urban areas. Students learn computer skills outside of school, and are comfortable with various applications, including email messaging, chat, and games. Use of ICT is more active in high schools (where it is compulsory) than in primary schools.

Many teachers in Viet Nam have been enthusiastic about learning ICT skills. For example, 200 teachers attended a Basic Skills training session, even though the session was held during summer vacation. At the training session, they learned Internet skills, PowerPoint, and were introduced to the PiL Portal. Teachers with good aptitude were selected for Peer Coaching and ICT integration modules.

Issues and challenges

- As MoET controls the national curriculum, PiL materials cannot be used in schools; thus the PiL work in Viet Nam is exclusively focused on teachers.
- Many teachers remain unfamiliar with computers and the Internet. Lack of Internet access at schools is believed to be a major factor restricting teachers from gaining Internet skills.
- It is believed that use of ICT in primary school is unnecessary.
- Budgetary constraints limit ICT availability in the lower grades.
- Teachers use ICT for administrative purposes, but seldom for teaching. When ICT is used in teaching, it tends to support frontal teaching. However, there are signs that PiL is affecting pedagogy, as some project-based learning has been taking place.
- With only one computer per classroom in some schools, many teachers feel that ICT is not useful in teaching.
- As the language of instruction is Vietnamese, the training materials need to be customized accordingly.

- Working at the district level rather than at the national level proved easier to garner support from teachers and schools for training.
- The PiL Portal is a useful first step toward developing a teaching community. The portal was developed to support the e-Learning initiatives in Viet Nam and supports teachers by providing electronic content, best practice examples, and access to the Innovative Teachers' Network. However, difficulties remain:
  - the site remains unstable, and the network tends to be slow;
  - worldwide examples on the site are in English.

Examples of best practice

Teacher F, who attended ICT integration training and Peer Coaching training, is now a Master Trainer, and has peer coached other teachers in project-based teaching. She assists other teachers in Basic Skills training and her students are able to confidently prepare lively PowerPoint presentations.

Teacher G, a biology teacher, gave a lecture using the PowerPoint program and Flash animation to show transpiration in plants. Though the mode of instruction was teacher-directed and frontal, nevertheless the teacher was able to utilize ICT to present a lesson in an engaging way.

School D in Hanoi, is well-equipped with computers and projection systems. Its students are high-achievers, many of whom are preparing for foreign university exams. All students receive ICT instruction.

Conclusion

The PiL project in Viet Nam recommends that:

- Although there is an ongoing need for Basic Skills training for teachers, PiL Viet Nam should shift from offering Basic Skills training to ICT integration training, as many teachers now have basic skills but are ill-equipped for applying their skills to teaching.
- PiL should better utilize available computing facilities in high schools, conducting in-house training using peer-coaching approaches.
- PiL should also offer regular short training courses during the term, rather than once-yearly training during the summer vacation.
- PiL should provide resources and assistance for schools for developing ICT strategic, implementation and training plans for schools.
- PiL should assist teachers in developing simple ICT-based learning materials in Vietnamese.

Summary and Conclusions

The impact of the PiL programme in the five ASEAN countries has been both positive and widespread, driving integration of ICT into education. Teachers in each of the five countries felt that the training was useful and officials, noting the success of these projects, are committing more funding and support for technology in schools. Feedback from most countries indicates that the PiL initiative has helped to achieve wider use of ICT in teaching and learning, and has encouraged other educational initiatives as well. Other positive outcomes of the PiL programmes include enhanced cooperation between businesses, government, NGOs, universities, and other local stakeholders.

For programmes to be sustainable, attention needs to be paid to the cultural context and teachers and parents should be recognized as key stakeholders. The flexible framework of the PiL Learning Grants initiative has served each country well in adapting to local needs and stakeholder concerns.

The importance of training teachers in integrating ICT into teaching cannot be over-emphasized. It is necessary to recognize teachers require skills and knowledge in a range of areas. Teacher training programmes therefore need to be developed accordingly.

For teachers who are new or just beginning to use ICT in their teaching, attention should be paid to assisting these teachers to acquire skills which enable them to explore and discover new ways of utilizing ICT in their classes. Although these teachers need to acquire certain fundamental ICT skills, the emphasis needs to be placed on how these skills can be applied in teaching. It is necessary to assist teachers to utilize their ICT skills to enhance education. Training programmes should therefore show teachers how to achieve specific educational objectives through the use of ICT.

In addition to the imparting skills and information to students, teachers often play a leadership role. This means that it is important to select the right teachers for peer-coaching workshops. The teachers who attend these training courses will serve as models for others.

ICT can transform both the learning and the teaching processes and facilitate autonomous learning. In general, ICT are most useful when they are used to support educational goals. It is therefore best to avoid isolating ICT as a separate subject.

Peer Coaching has proven to be an effective means of gaining acceptance of ICT among educators. However resistance to new technologies is pervasive. Factors contributing to resistance include – preconceptions about new technologies. For example, older teachers tend to be less accepting of new technologies, less willing to move out of their comfort zones and try new things, and less willing to take on extra work. Such obstacles can be overcome by demonstrating how simple it can be to use new technologies and assisting teachers to make the transition gradually.

Similarly, because the use of ICT requires teachers to give up a measure of control over information, some teachers may be unwilling to utilize it in the classroom. Likewise, cultural views can serve as obstacles to the uptake of ICT in education. For example, older teachers may resist learning from younger teachers, and younger teachers may be unwilling to teach older people for fear of showing disrespect. Care must be taken to take cultural views into consideration when planning ICT training, so as to find ways of overcoming obstacles.

Ongoing challenges include:

- The use of ICT remains low in many classrooms despite the increase in availability of hardware and software, because of insufficient teacher training. It is clear that additional forms of teacher training are required in order to integrate the use of ICT into classrooms. Professional development for teachers and school leaders must be ongoing and must cover a range of areas, including pedagogy.
- Rural and remote schools continue to function at a material disadvantage to their urban counterparts.
- Lack of sufficient learning resources in local languages serves as a disincentive to learn to utilize ICT.

The following are some recommended means of addressing such challenges:

- Design and develop a change management process, starting with policy and decision makers, to facilitate the connection between policies, practice and the people who are needed to make it happen.
- Facilitate the development of schools and school principals as change agents and provide the relevant professional development to the senior leadership of schools.
- Adopt new policies and award-programmes that recognize and reward teachers who excel in using ICT to enhance the quality of education.

While some of the above suggestions may take time to be implemented, optimism is nevertheless warranted, based on the enthusiasm of teacher and students in the five ASEAN countries studied. It is clear that while challenges remain, the Microsoft PiL initiative is helping ASEAN nations to bridge the digital divide.

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4. Utilizing a Pedagogical Support System to Develop Intel Teach Communities of Learning in the Philippines

Monalisa Sasing, Celia Balbin and Cecilia Ubarra [33]

Introduction

Studies have shown that the effective integration of information and communication technologies (ICT) into formal and community education classrooms can accelerate the development of skills such as communication, critical thinking, collaboration and problem solving. These findings have bolstered the demand for effective integration of ICT into educational settings and into teacher training. Furthermore, this has led to calls for changes to curricula to reflect the use of ICT in education.

In the Philippines, the Department of Education (DepED) is striving to implement reforms towards appropriate and effective use of ICT to broaden access to and improve the quality of education and to improve the efficiency of basic education service delivery. In 2000, the DepED implemented a system-wide computerization programme for public secondary schools, which includes initiatives such as the Personal Computers for Public Schools project and the Adopt-a-School programme. The DepED computerization programme is supported by ICT-related initiatives of other national government agencies, local government units, non-governmental organizations (NGOs), private firms, foreign governments, and international aid donor agencies. These initiatives include infrastructure projects and projects which train teachers in basic ICT literacy and in technology-integration pedagogy.

Among these initiatives is the "Intel® Teach" programme, a global initiative of Intel Corporation, which aims to train teachers in how to effectively integrate the use of computers into their existing curriculum in order to motivate students and increase their learning and achievement. In particular, the programme aims to enable teachers to implement inquiry and project-based learning.

The Intel® Teach Programme

Intel® Teach employs a teacher-led training system. The training course emphasizes the use of teaching strategies and practices which integrate technology into the existing school curriculum. The course aims to enhance teacher productivity and enable them to create technology-enhanced learning activities and to utilize the Internet as an information resource and a communication tool.

Designed for both pre-service and in-service K-12 teachers, including ICT lab teachers, programme participants learn optimal ways to integrate technology tools and resources into their own lessons and promote student-centred learning. The programme also supports the implementation of peer review and collaborative problem solving.

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The programme has trained over 4 million teachers in more than 40 countries to create learning environments in which students work collaboratively to develop skills that can be used to address real-world concerns. In the Philippines to date, over 74,000 secondary school (in-service) in-service teachers and pre-service teachers have benefited from the programme.

Intel® Teach Programme in the Philippines

The implementation of the Intel® Teach programme in the Philippines is a joint endeavour by the Philippines Government and Intel Technology Philippines Incorporated. It is implemented in co-operation with partner agencies from the government and private sectors.

The goal of the programme in the Philippines is to foster the building of communities of learning (CoL), defined as effective networks of productive exchange among a broad range of education stakeholders, including teachers, learners, education policy makers and managers, subject matter experts and education researchers, technicians and technologists, parents, government, the private sector, and civil society groups, in support of technology integration and within the framework of providing high quality education for all.

In 2001, the Intel® Teach Essentials Course was launched by Intel in co-operation with its programme partners, including the DepED, Department of Science and Technology-Science Education Institute (DOST-SEI), the University of the Philippines National Institute for Science and Mathematics Education Development (UP NISMED), and EduQuest Inc. In 2005, the Foundation for Information Technology Education and Development (FIT-ED) joined the partnership. Through concerted efforts, this programme has become a major teacher-training component of the government's computerization programme.

The Essentials Course is a 10-day hands-on training programme employing the "train the trainer" model of delivery. The training is composed of 10 adaptable modules focusing on the development of a unit portfolio containing student learning activities with special emphasis on the inquiry approach, project-based learning and authentic assessment. The training is offered to both in-service teachers and pre-service students. Participants are taught how, when and where to incorporate technology tools and resources to achieve maximum student learning.

Training is conducted by a small pool of senior trainers from the UP-NISMED, selected in-service teachers and selected faculty from pre-service institutions. Each batch has a maximum of 25 participants from carefully selected schools, divisions and pre-service universities. In turn, these participants share what they have learned with other in-service teachers or pre-service teachers near to their location.

The programme enhances the learning process by:

- Using curriculum-framing questions (CFQs) to connect real life and content.
- Emphasizing learning objectives that develop higher-order thinking skills.
- Emphasizing students' creation of products to demonstrate learning.
- Promoting authentic assessment and increased student participation in assessment.

Since the start of the 2005-2006 Philippines school year (SY), the programme has implemented a systems approach to ensure sustainability of efforts around ICT integration. The systems approach points to the recognition of all stakeholders within "communities" (e.g. principals, teachers, ICT

division co-ordinators, etc.) and has introduced innovations to link and promote ownership of the identified stakeholders. Innovations introduced to foster the formation of sustainable communities of learning (CoL) include competitive selection of schools and teacher education institutions (TEIs), introduction of planning and management strategic workshops within schools and divisions and provision of pedagogical support which created the links between many different players within and among the schools, divisions and TEIs.

This paper will focus on one of the innovative strategies that the programme employed in the Philippines: the implementation of a Pedagogical Support System (PSS). The discussion will describe the PSS, its rationale and objectives, and the challenges encountered and lessons learned.

Piloting the Pedagogical Support System

Since 2001, more than 50,000 high school teachers in the Philippines have been trained in how to integrate technology into the subject they teach. Results of end-of-training evaluations show that a significant number of these teachers greatly appreciated the new strategies and skills they gained from the 10-day course. An evaluation of the impact of the programme on student learning and teaching practices showed, however, that out of 1,271 respondents surveyed, only 16.6% fully implemented the technology-enhanced unit plan they developed during the course (SEAMEO Innotech, 2004). Periodic programme evaluation revealed that the achievement of programme goals were hampered by several inter-related factors topmost of which were the following:

- Poor content and pedagogical knowledge of many public high school teachers.
- Poor technology skills of teachers.
- Lack of post-training pedagogical support for teachers as they strived to master new teaching practices (FIT-ED, 2006).

To address this gap, a Pedagogical Support System (PSS) was set up in July 2005 as one of the programme's post training activities. Its overall goal was to help teachers, teacher educators, content supervisors, and department heads integrate into their own "Communities of Learning" to dynamically sustain the use of technology in school curricula to maximize student outcomes.

As a pilot project, it aimed to provide instructional support to new Master Trainers (MT) during unit implementation to help overcome challenges in Unit plan implementation as well as to help MTs prepare for the conduct of their own school-based Participant Teacher (PT) Training. Specifically, it sought to enable new MTs to:

- Enhance the Unit plan they developed during training.
- Implement the Unit plan.
- Reflect on and evaluate Unit plan implementation.
- Revise the Unit plan for future implementation.
- Prepare for the school-based Participant Teacher Training.

Provision of support in the pilot PSS had two components: the Instructional Support and the Participant Teachers' Training Support. The ***Instructional Support*** aimed at helping MTs implement their technology-enhanced Unit plan in class. The ***Participant Teachers' Training Support*** prepared MTs to deliver the Essentials Course in their school or division. Each component included a reflection and evaluation session that enabled all Support Providers and the new Master Trainers to recommend changes aimed at improving the PSS processes and tools.

Scope

As a pilot project, the PSS was intended for the new 68 MTs trained under the programme the previous May (10 to 20 May and 23 May to 3 June 2005). These MTs were DepED secondary school teachers selected by the implementing agency, the Foundation for Information Technology Education and Development (FIT-ED). They came from 10 selected divisions all over the country; specifically Bulacan and Tarlac (Region III), Batangas, Laguna, and Cavite (Region IV-A), Davao City (Region XI), Lanao del Sur II (ARMM), Makati City, Quezon City, and Pasig-San Juan (NCR).

The Support Providers (SPs) were selected from the programme's pool of practitioners in the MT's division, nearby division, or region and had received enhancement training on the latest curriculum. Members of the PSS Development Team from UP NISMED also served as SPs for MTs from the divisions of Makati City, Quezon City, Pasig-San Juan, Batangas, and Cavite since there were no available and qualified Intel® Teach practitioners near the area. The support scheme was limited to instructional support in unit plan enhancement and implementation, and PT Training preparation.

The Project was piloted in the 2005-2006 school year and covered a unit plan implementation that took place between October 2005 and March 2006, while PT Training support included training activities conducted from October 2005 to May 2006. Support was likewise extended to MTs who implemented their Unit plans before the PSS started and was matched to the stage of implementation the MTs were, at the time the SPs reached them.

The instruments used to gather data in the delivery of the PSS were intended mainly for use by SPs and MTs. Hence, learning' derived from this project were largely based on the written accounts provided by these two key players.

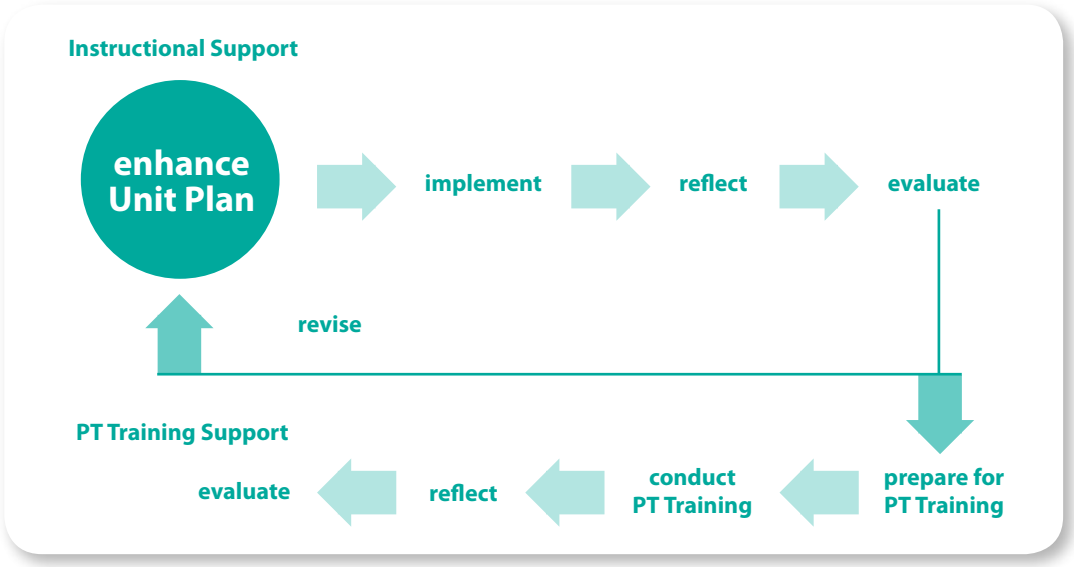
Project Duration

The Project was undertaken over 12 months, from July 2005 until June 2006, and was carried out in three phases. The first phase comprised of the pre-implementation activities. Activities in this phase included assessment of support needs, profiling of Unit plans, identifying an SP for each MT, developing the PSS tools, and conducting orientation sessions for SPs. The second phase was the pilot run and included validation of the instruments developed in Phase 1. The pilot began in October 2005 and ended in May 2006. The activities were grouped into two components and are described in detail in the next section. The third phase was the reflection and reporting phase which started in February and ended in May 2006. This included debriefing sessions with SPs, gathering of completed instruments and SP reports, project reflection and reporting.

The Pedagogical Support Process

The Pilot PSS had two components: the Instructional Support and the Participant Teacher Training Support. Figure 1 illustrates the process.

Figure 1: Major Pedagogical Support Activities



The ***Instructional Support*** consisted of an array of activities, resources, and services carried out in three stages namely:

Stage 1: Unit plan Enhancement
Stage 2: Unit plan Implementation
Stage 3: Reflection and Evaluation

Each stage included a reflection and evaluation component that enabled all Support Providers and new Master Trainers to recommend proposed changes to the tools and processes in the PSS.

Stage 1: Unit Plan Enhancement consisted of unit plan clinics, provision of access to supplementary resources, and face-to-face, telephone and email consultations.

The bulk of support was provided during this stage. During the unit plan clinic, the assigned SP reviewed and gave feedback on the following aspects of the MT's unit plan:

- Curriculum-framing questions
- Emphasis on higher order thinking skills in learning objectives
- Incorporation of Project-Based Learning ideas or inquiry approach
- Appropriateness of selected technology (i.e. ability to maximize learning)
- Appropriateness of assessment strategy (e.g. authentic, increased student participation)
- Ability of learning activities and student support materials to scaffold and maximize student learning
- Implementation plan.

Support providers likewise reviewed the accuracy and currency of content of all sample technology-based student outputs, teacher support and student support materials. They identified areas for improvement and assisted in the revision.

In case the SP's subject area specialization is different from that of the MT, the SP sought assistance from the MT's department head, or subject area supervisor, or a university professor whose subject expertise is the same as that of the MT. Where UP NISMED staff was the SP, the content and instructional design reviewers were drawn from the Institute's pool of Intel® Teach Senior Trainers and subject area specialists.

After the Unit plan clinic, MTs normally consulted with SPs and reviewers to discuss suggestions and obtain guidance in enhancing their unit plans and other components of their unit portfolio. In some cases, SPs also provided MTs with supplementary and reference materials useful in the enhancement.

Stage 2: Equally important was Stage 2, the ***Unit Plan Implementation*** stage. The period covering the actual unit implementation turned out to be the most challenging time for the MTs. This is where they needed as much support as their SPs could give.

Stage 2 consisted of a unit plan walk-through, class observations, post-observation conferences, and just-in-time coaching. The unit plan walk-through served as a simulation of the unit plan, which aimed to increase the likelihood of successful implementation by eliminating lapses in preparation, such as those related to logistics, scheduling and sequencing of activities. It was during this stage that SPs and MTs agreed on the dates of class observations. Class observations were extremely helpful in documenting implementation during vital days of the unit. A Post-Observation Conference took place soon after each observation session or, in some cases, after all observation sessions had been completed. There were instances when SPs gave "just-in-time" tutorials to MTs to help them cope with technology-related gaps that could be addressed by short, quick lessons, such as how to scan pictures and how to set up formulas in a computer spreadsheet program.

Stage 3: Reflection and Evaluation consisted of debriefing sessions, journal sharing-discussions, unit plan revision and, in some cases, access to web-mediated collaboration tools and services and viewing and discussion of video documentation of the implementation.

The activities in this stage helped MTs reflect and evaluate their experience during unit plan enhancement and implementation. Debriefings helped MTs to recognize, accept, and address the difficulties they encountered during the first two stages. The debriefing sessions also aimed to bring about realizations and desired changes that MTs may make use of in future implementations. Specifically, it was at this stage when SPs confirmed MT's journal entries on the following:

- Usefulness of specific support given during unit plan enhancement and implementation.
- Support which was not provided but would have been useful.
- MT's general recommendations on the processes and tools employed in the PSS.
- Aspect(s) of unit plan the MT needs to improve on based on their implementation experience.

Whenever applicable, SPs also showed and discussed video documentation taken during classroom observations of MTs.

The ***Participant Teacher Training Support*** covered the following tasks:

- Coordinating schedule of the PT Training;
- Providing assistance in coordinating requests for training materials for use in the school-based PT Training;
- Conducting pre-training orientation on the school-based trainings;

- Gathering of narrative reports; and
- Reflection on desired changes to the PT Training.

This component also included reflection and evaluation sessions that enabled all Support Providers and the new Master Trainers to recommend changes aimed at improving PT Training Support as well as the conduct of PT Trainings.

The Pedagogical Support Tools

A total of eleven tools were used in carrying out all the tasks both delivering the PSS and in gathering data in all stages of support. The tools comprised of both instruments used by SPs and MTs as follows:

Tools Used by MTs
- Stage 1 and 2 MT Journals

Tools Used by SPs
- Guidelines and protocols in reviewing the Unit portfolios of MTs
- Guidelines in conducting debriefing sessions
- Stage 1 and 2 SP Journals
- Classroom observation instrument and
- Stage 1, 2, 3, and PT Training Support Progress Checklists

The table below summarizes the description and purpose of each tool.

Table 1: Pedagogical Support Tools

Tool	*Purpose*
Support Document 1 - Unit Portfolio Review Guidelines for Support Providers	This tool describes the protocols that SPs need to observe in reviewing the unit portfolio of the MT. This was used in Stage 1 of the support to help SPs enhance the output of the MT.
Form 1.1 - Stage 1: Unit Enhancement Journal of MT	This form helps MTs document reflections, lessons learned, and challenges on the completed unit plan enhancement tasks. This was used to gather feedback and suggestions of MTs in enhancing the unit plan and on the usefulness of the support the MT received in improving his/her unit plan.
Form 1.2 - Stage 1: Unit Enhancement Journal of SP	This form helps SPs document reflections, lessons learned, and challenges in providing Stage 1 Support to the MT. This was used to gather SPs' feedback on the usefulness of the tools (e.g. review guidelines, journals, and progress checklists) for this stage in carrying out their tasks, on the area where the MT needed support and suggestions for improving provision of support at this stage (process, tools).

Tool	*Purpose*
Form 1.3 - Stage 1: Unit Plan Enhancement Support Progress Checklist	This form helps SPs monitor and document their progress in delivering their tasks in Stage 1.
Form 2.1 - Stage 2: Classroom Observation Instrument	This form helps SPs document observations on classroom management, teaching and learning process, use of technology, and student behaviour in class.
Form 2.2 - Stage 2: Unit Plan Implementation Journal of MT	This form helps MTs document reflections, lessons learned, and challenges during Unit Plan implementation. This was used to gather feedback from MTs on the usefulness of the support provided during Unit Plan implementation.
Form 2.3 - Stage 2: Unit Plan Implementation Journal of SP	This form helps SPs document reflections, lessons learned and challenges in doing the tasks under Stage 2 Support. This was used to gather SPs' feedback on the usefulness of the tools (classroom observation instruments, journals, and progress checklists) in carrying out their tasks, on the area where MT needed support and suggestions for improving provision of support at this stage (process, tools).
Form 2.4 - Stage 2: Unit Plan Implementation Support Progress Checklist	This form helps SPs monitor and document their progress in delivering their tasks in Stage 2.
Support Document 2 - Guidelines in Conducting Debriefing Sessions	This tool guides SPs on how to conduct debriefing sessions with MTs.
Form 3.1 - Stage 3: Reflection and Evaluation Support Progress Checklist	This form helps SPs monitor and document their progress in delivering their tasks for Stage 3.
Form 4.1 - PT Training Support Progress Checklist	This form helps SPs monitor and document their progress in delivering their tasks in providing support prior to the conduct of the MT's PT Training.

Challenges

Difficulties faced during the delivery of the pilot PSS are categorized into three main groups namely: challenges faced by MTs in unit plan enhancement and implementation, conducting PT training courses, and those faced by SPs in providing pedagogical support to MTs.

1. Unit Plan Enhancement and Implementation

Four issues were identified:

- Resources

The greatest challenge that confronted Master Trainers both during unit plan enhancement and implementation was the lack of resources -- which included time, computer facilities, Internet connection, and materials and equipment needed for the non-technology-related activities.

- Capacity of MTs

MTs also commonly exhibited difficulty in selecting the technology tools appropriate for a given student activity, formulating and matching CFQs with objectives, designing and properly sequencing activities, and developing facilitation strategies. Six MTs who were not able to implement their unit plan during the target grading period also had difficulty developing another unit plan. Monitoring student progress and providing them with appropriate and timely assistance was another difficulty most MTs experienced.

- Technical issues

Technical problems such as cancellation of computer use due to unexpected school events, unavailability of the needed technology tool, corrupted files, and power interruptions had negative effects on the unit implementation.

- Students' ICT skills

In a number of cases, students' poor ICT skills also added a burden to the MTs, made worse by the large class size.

2. Conducting PT training courses

Five issues were identified:

- Attendance

Meeting the required number of PTs to train posed the greatest challenge during the training sessions. The participants' dwindling attendance towards the second week of the training, and in classes conducted on Saturdays, became a real problem.

- Students' ICT skills

The PTs' inadequate computer skills and their limited understanding of technology-pedagogy integration likewise became a challenge for MTs.

- Logistical issues

There were also logistical problems such as insufficient number of computer units, unavailability of a projector, slow Internet connection, and power interruptions.

- Support from school leaders

Lack of support and encouragement from school heads also posed difficulty to a number of MTs.

- Capacity of MTs

MTs who conducted their PT Trainings before they had the opportunity to implement their Unit Plans had particular difficulty handling the session on "Developing the Unit Plan" as they lacked background knowledge on the topic and were not confident to handle the session. Teaching co-teachers how to create and upload websites was extremely challenging for many MTs as well.

3. Provision of Support

Three issues were identified:

- Areas of expertise

In terms of providing support to MTs, more than half (nine) of the Support Providers had difficulty reviewing and improving the unit plans of MTs whose subject area was different from their content specialization. These SPs expressed difficulty in relaying comments of content and instructional design reviewers to MTs as well as in helping MTs identify more appropriate technology-based student activities. To cope with this difficulty, SPs did more research on ways of applying technology in the lesson without doing much change to the MT's original Unit Plan, and concentrated on identifying aspects of the Unit Plan where important results from research and related suggestions may be helpful.

- Time, distance and scheduling

SPs reported that scheduling and meeting up with the MTs posed another challenge. This was due to conflict with their own class schedules, simultaneous implementation of MTs from different schools, and the distance of the school to the SP's place of residence. Indeed, proximity of SPs to MTs offered some benefits such as accelerating submission of requirements (e.g. revised unit plans, MT journals). Similarly, teaching in the same school became advantageous for both SPs and MTs especially in terms of efficiently communicating with each other. Other challenges mentioned by a number of SPs included preparation of reports for each MT handled and helping MTs demonstrate effective classroom management during the Unit implementation stage.

- Motivation of MTs

Support providers found it difficult to motivate and encourage MTs to continue with Unit Plan implementation especially when the MT has a pessimistic attitude.

Key Lessons Learned

Lessons learned through the implementation of the pilot PSS can be divided into three areas: Provision of Support, Technology Integration in Schools, and Impact of Using Technology in Class.

1. Provision of Support

In relation to the objective of this pilot project, it was remarkable to note that 97 percent of those who received pedagogical support (following the training) implemented their technology-enhanced Unit Plans. Therefore, the post training support was successful in effecting MTs' implementation of their technology-enhanced Unit Plans.

The Unit Plan enhancement stage gave MTs the time to improve their outputs after the May 2005 training and after unit implementation. Master Trainers expressed that the inputs from the SPs helped them improve their unit plans such that:

- It employed teaching strategies and learning activities appropriate to students.
- The learning activities were student-centred and authentic.
- The sequencing of activities was appropriate.
- It included support materials and strategies that served as a springboard to student learning.

Thus, guiding MTs in enhancing unit plans entails know-how of best practices in the learning area and expertise in content to ensure appropriate technology-integration. Furthermore, SPs expressed that the areas where MTs needed more support were in formulating good curriculum-framing questions and learning objectives that target development of higher-order-thinking skills (HOTS) among students, and in designing student-centred learning activities.

An analysis of MTs' journals revealed that SPs who were pre-service faculty focused their inputs in unit plan enhancement and implementation on teaching strategies and tips in classroom management while those from UP NISMED emphasized more the need for designing student-centred activities and how to match them with targeted learning objectives.

Among the suggested supplementary and reference materials, Internet sources were the most useful to the MTs. Master Trainers further pointed out that the support they received during Unit Plan Enhancement helped them come up with better revised Unit Plans and made them confident in implementing their Unit Plan. Below are a few quotes from MTs regarding the instructional support they received from their SPs:

> *"Coming up with a good unit plan becomes better through the help of someone who can give praise and feedback."*
> *Rosalie Bongon, San Francisco High School*

> *"Project-based learning and the use of technology would really be effective if here is co-operation, guidance and support from the people involved."*
> *Melanie Cleofe, Novaliches High School*

Master Trainers found the classroom observations useful in the sense that it helped them identify self-strengths (which they can leverage on) and enabled them to target the weaknesses they needed to address to improve their Unit implementation.

With regard to the attitude of MTs towards the provision of post training support, at the start they were apprehensive about the presence of SPs, especially during classroom observations. However, towards the end of Unit Plan implementation, MTs became more appreciative of the support and more receptive to comments and feedback provided by the SPs. It is therefore important to emphasize to the MTs and school administration that the purpose of the PSS is to assist teachers in implementing their technology-enhanced lessons and not to evaluate their performance. Providing pedagogical support also requires not just knowledge and skills on best practices, and expertise in content but also patience, determination, and persistence on the part of the Support Provider. Below is a quote from an SP regarding her experience in helping other teachers implement a technology-enhanced unit plan:

> *"PSS helped me improve my skills in designing lessons using technology. I realized that technology integration is not merely the use of technology in the classroom but using it to facilitate and enhance learning. I realize the same mistakes I do in my class. That is why I consider this activity also a learning opportunity for me."*
> *Merced Liwag, Batangas City National High School*

For SPs, the experience was an opportunity for them to learn and enhance their skills in designing lessons. More than half of them expressed that they become more patient, confident, and persistent. SPs who are also secondary teachers were motivated to do more technology integration in their own classes.

Based on focus group discussions with the MTs, all respondents appreciated the efforts and sound advice of the providers. The SPs were described as "easy to communicate with" and always ready to address

whatever questions they had about the programme. They appreciated, especially, the suggestions on student activities that integrated technology.

Most of the MTs said that their providers assisted them in enhancing their Unit Plans, particularly in the formulation of essential questions, inquiry approach and student assessment rubrics.

In Davao, MTs cited that the support they received consisted of consistent follow-ups, one-on-one sessions to discuss their unit plans, comments and suggestions and constructive criticisms to improve and deliver their lesson effectively. In Cavite, the MTs reported that pedagogical support also boosted their confidence in the conduct of PT training. The providers were likewise around to give them moral support during the implementation of their Plans.

According to the MT respondents in San Juan, Makati, Quezon City, Laguna, Batangas and Davao, regular communication through text messages, emails, and phone calls with their providers was useful while the MTs were developing and implementing their Unit Plans.

In Batangas, MTs supported by a previous MT from a nearby division added that they can easily avail of the PSS because their provider was from a nearby division.

2. Technology Integration in Schools

The experiences gained from delivering the PSS provided valuable insights on technology integration into schools. It was found that the main contributing factors that enabled MTs to integrate technology in their own classrooms included:

- MTs' initiative and strong background in content and pedagogy.
- Strong collaboration among teachers, support providers, and administration coupled with encouragement and constant follow-up from both SP and school head.
- Availability of, and access to, required ICT infrastructure.

Other key lessons gleaned from the delivery of the PSS were:

- Guiding MTs in enhancing unit plans entails, on the part of the SPs, know-how of best practices in the learning area, expertise in content to ensure appropriate technology-pedagogy integration, as well as patience, determination, and flexibility.
- Effective technology integration hinges on how technology is used to support the attainment of targeted learning objectives, and depends to a large extent on how well the teacher designs and facilitates technology-based activities such that students attain curricular goals.
- School administrators played a big part in the implementation of the MTs as their role was not only limited to ensuring MTs and their students' access to ICT resources but also extended to providing pressure and at the same time moral support.
- Inspiration was gained from attending the follow up activities such as the Master Trainers' Forum, where MTs gathered and shared implementation experiences. MTs were also motivated to implement their Unit Plans by their desire to be included in the other technology-integration workshops.
- It was observed that most of the schools covered by the PSS were just beginning to understand the concept and requirements of technology integration in the classroom. MTs are still at the stage of appreciating the potential of technology to increase their productivity and enhance teaching.
- From the Unit Plan implementation of MTs, it was apparent that the design of technology-based lessons varied with, and was dependent on, the school's ICT infrastructure and the teacher's and students' capability.

- It was observed that the more the MTs are used to having group activities in class, the more they are prepared to troubleshoot student monitoring-related problems.
- It was also noted that the richer the content and strategies background of MTs, the more they are likely to employ varied learning activities for their students and the lesser intervention the SPs had in improving their Unit Plans.
- Genuine student-centred technology integration requires flexibility in delivering the Philippine Basic Education Curriculum, strong foundation in content and strategies, and strong collaboration among the key players - teacher, school heads, students, and the community. There is also a need for the school administration to recognize the potential of ICT in the classroom such that technology integration in school is not sponsor-driven nor sponsor-dependent.
- Teachers returning from training indeed need a support structure or arrangement in the school that will enable them to apply newly acquired knowledge and skills to maximize the skills they gained from the technology integration training course. This will lead to greater impact on their teaching practices, on the kind of learning activities their students will do, and the quality of outputs their students will produce.
- School-based, school-maintained support is advantageous because of its ability to provide timely and appropriate assistance to teachers.
- It was evident from the feedback gathered from MTs' and SPs' journals that inadequate ICT resources and access as well as lack of equipment during laboratory activities adversely affected the nature of implementation. There were three cases, where MTs opted to demonstrate the activities rather than let students perform them due to lack of science equipment. Furthermore, in ten classes, large groupings were resorted to ensure that each group had a computer and laboratory resources needed for the activity. This affected the nature of student participation in learning activities. In cases such as these, many students merely observed what their group mates were doing, instead of participating and contributing to the activity output. Maximizing student learning was extremely difficult to attain in such situations. Indeed, optimizing the potential of technology in enhancing student learning presupposes an enabling school environment.

3. Impact of Using Technology in Class

An analysis of the tools revealed that the PSS had contributed greatly to the formation of CoLs. Other than the PSS, the holding of strategic planning workshops for divisions and schools, enhancement workshops and the annual Intel® Teach Forum all supported the goal of creating CoLs in different DepEd divisions across the Philippines.

The data from the MT journals, used to gather MTs' reflections and evaluations of their technology integration experience, reflected gains of MTs in using technology in class which included the following:

- Improved ICT skills
- Increased confidence in using technology
- Increased confidence and motivation for innovative work in class using technology
- Improved teaching practices
- Better understanding of what it means to use technology in the teaching-learning process

Furthermore, MT's technology-integration experience also paved the way for MTs to start sharing their Unit Plans and that of their fellow MTs to colleagues in school who were knowledgeable in the use of ICT. They have also become more interested with other ICT integration workshops to learn new strategies in using ICT in class. Some MTs also revised their Unit Plans and others planned to revise it for future implementation.

Reports were unanimous in noting that, as a result of using technology in class, there was increased motivation among students. MTs also observed that technology-enhanced learning activities fostered students' creativity, empowered students through new skills and resources, and increased their level of confidence. Given the insufficient number of computer units in school, students also learned to work in groups, thereby promoting collaboration among students—a much valued 21st century skill. Furthermore, it was also observed that students have become more participative. Below are some quotes from teachers who implemented their technology-enhanced unit plans in class:

> *"The experience I gained from using technology in class made me realize how technology facilitates learning and increases motivation of my students. It has made my work easier and focused more on collaborative learning."*
>
> *Evelyn T. dela Cruz, San Isidro National High School*

> *"Using technology in class made the students more interested, focused and excited. It is a new learning process for them that some are requesting to have it again."*
>
> *Desiree Domingo, San Francisco High School*

> *"The experience I gained from using technology in class made me a better and more effective teacher, not only because of the knowledge I gained and imparted but also because students learned to apply these things in real life situations."*
>
> *Emylou Lansang, Camp Gen. Emilio Aguinaldo High School*

> *"Integration of technology helped a lot in getting the attention of students and in motivating them to discover things on their own."*
>
> *Myline Villaflores, Prenza National High School*

Alongside these positive effects is the observation that interactions with technology were more thought-out than what has so far occurred in the MTs' classes, and they enabled students to learn how to (a) evaluate and synthesize information gathered from various sources, (b) express ideas in their own words, and (c) learn to cite and acknowledge sources. Students' participation must not only be driven by students' interest to use technology but also by the students' interest to learn about the content. Hence, effective technology integration largely depends on how the teacher designs and facilitates technology-based student activities such that the ICT help students attain maximum benefits.

Conclusion

The Pilot Intel® Teach Pedagogical Support System has shown how a post-training support scheme enabled almost all (97 percent) newly trained teachers to implement the technology-enhanced Unit Plan they developed during training.

The challenges experienced by MTs and SPs as well as the lessons learned from these challenges demonstrate that, consistent with past findings, educational reforms with technology in schools is a complex process. In particular, utilizing lessons learned from a technology-pedagogy integration training course requires an enabling school environment coupled with support from within the school and from the wider community of experts and co-learners.

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5. ICT-Capacity Standards for Teachers in China

Feng-chun Miao [34]

Introduction

The use of information and communication technologies (ICT) in schools in China has seen significant growth in recent years as the Chinese government looks to establish education for all (EFA) in Chinese schools.

In 2004, a National Educational Technology Standard for Teachers, with ICT at its core, was issued in China. According to the standard, every teacher should master the necessary knowledge, skills and application ability of ICT. All teachers also need to receive training and pass assessments based on the standard.

This paper aims to introduce China's ICT-capacity standards and the areas in which teachers will be trained. The paper begins with an overview of the education reforms that have been implemented in China over the past 30 years, and introduces China's curriculum framework. Following this, the paper describes China's initiatives in terms of integrating ICT into school-level education. Finally, the paper discusses China's national educational technology standards for teachers and lists some of the activities being undertaken and some suggestions for changes.

Background

Numerous reforms have taken place within the Chinese educational system over the last 30 years. Since 1978, education in China has undergone significant reform and progress. For example, the 1985 "Decision on the Reform of the Educational Structure" made local governments responsible for basic education, while the 1993 "Guidelines for the Reform and Development of Education in China" set out the direction and policies for the development of basic education in China for the foreseeable future.

The concept of "five co-ordinations" was set up as the guiding principle to carry forward national education development: coordination between urban and rural; local and national benefits; between social and economic development; human and nature; international trade ad domestic economy.

The education reforms led to the development of the compulsory education law. The "Compulsory Education Law of the Peoples Republic of China" has been implemented since 1986 and guarantees the right to at least nine years of education for school-age children (five years of primary and fours years of secondary). The secondary schooling system in China is divided into three stages: primary education (five to six years); junior secondary (three to four years); and senior secondary (three years). Therefore the law provides for nine of the 12 years needed to complete secondary school in China. This law also provides a solid legal basis for basic education in China, thus establishing education as a key part of China's future.

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Education for All

The overall goal of China's compulsory education programme is to achieve education for all (EFA) throughout China, including in all the rural regions, by the end of 2007. The statistics show that this goal is not far from being achieved. At the end of 2005, the total enrolment rates for school age children were 99.3 percent for primary education and 85 percent for secondary education, with a total enrolment of 200 million children. Furthermore, 85 percent of the under-45 year olds are now literate and the percentage is expected to rise. By 2008 it is hoped that the nine-year compulsory education programme will cover all China and the entire 15 to 45 age group.

The nine-year compulsory education law has provided the catalyst for the introduction of further changes within the Chinese education system, namely the focus on integrating the use of ICT into schools. Compulsory education and thus increasing enrolment rates across the country have meant that the introduction of ICT into schools has consequently reached more students.

High Quality Education

As well as the EFA programme, the Chinese Government launched the National Curriculum Reform programme in 1999 with the goal of providing high quality education for all children. This was the most extensive educational reform seen in China since 1949. The main components of the National Curriculum Reform programme are outlined below.

- Curriculum objectives

To promote children's problem-solving ability, critical thinking, and the four pillars of learning: "learning to know, learning to do, learning to live together and learning to be".

- Curriculum structure

To focus on comprehensiveness of learning areas, balance between different areas and subjects, and thereby give students more flexible learning choices.

- Curriculum content

To relate students' learning to their daily experience, social development and technological innovation; to change the textbook-based content delivery process; to employ ICT to help students to get access to rich learning content.

- Teaching-learning approach

To encourage learner-centered teaching approaches, with teachers as facilitators and guides; to offer an ICT-enhanced interactive learning environment.

- Learning assessment

To change assessment differentiation and selectiveness function; to use assessment to monitor students' learning progress, and to diagnose the teaching process.

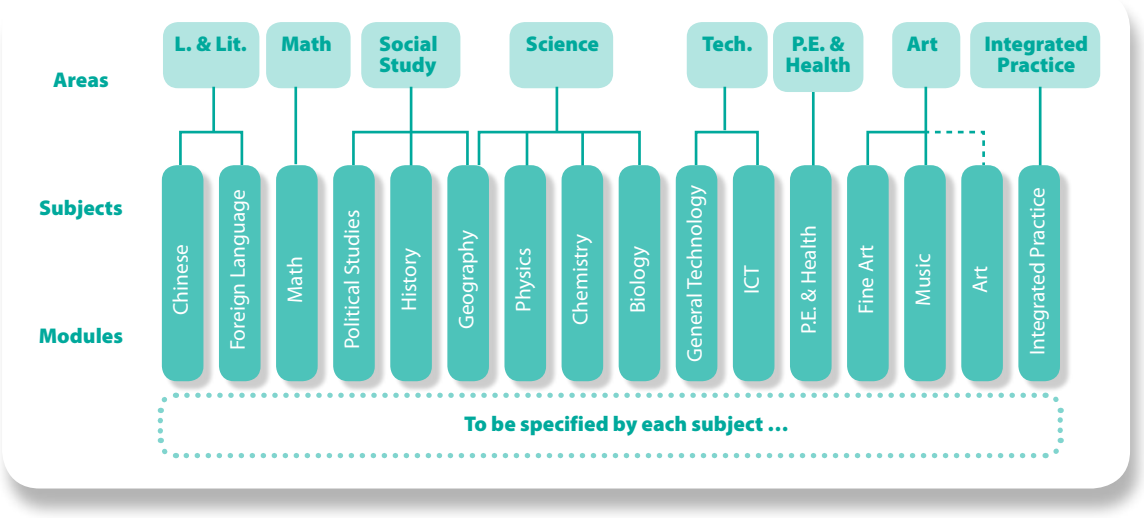
- Three-level curriculum management system

To decentralize curriculum management to provinces and schools; to respond to the diversified learning needs and different regions' cultural, economic, and educational differences. To empower schools with the capacity to develop and implement a school-based curriculum by assisting school-based action studies.

Figure 1: China's Curriculum Framework for Grades 1 to 9

<table>
<tr><th rowspan="2"></th><th colspan="9">Grade</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td rowspan="12">Subjects</td><td colspan="3" rowspan="4">Morals & Life Skills</td><td colspan="3" rowspan="3">Morals & Social Studies</td><td colspan="3">Morals & Social Studies</td></tr>
<tr><td colspan="3">History & Social Studies</td></tr>
<tr><td colspan="3">Option: History or Geography</td></tr>
<tr><td colspan="3" rowspan="2">Science</td><td colspan="3">Science</td></tr>
<tr><td colspan="3">Option. : Biology, Ph. or Chem.</td></tr>
<tr><td colspan="9">Chinese Language</td></tr>
<tr><td colspan="9">Math</td></tr>
<tr><td colspan="2">×</td><td colspan="7">Foreign Language</td></tr>
<tr><td colspan="9">Physical Education and Health</td></tr>
<tr><td colspan="9">Art (Music or Fine Art)</td></tr>
<tr><td>×</td><td>×</td><td colspan="7">ICT</td></tr>
<tr><td>×</td><td>×</td><td colspan="7">Integrated Practice (including Technology, Inquiry-Based Learning Activities & Community Service)</td></tr>
<tr><td colspan="9">Local & School-Based Curriculum</td></tr>
</table>

Figure 2: China's Curriculum Framework for Grades 9 to 12

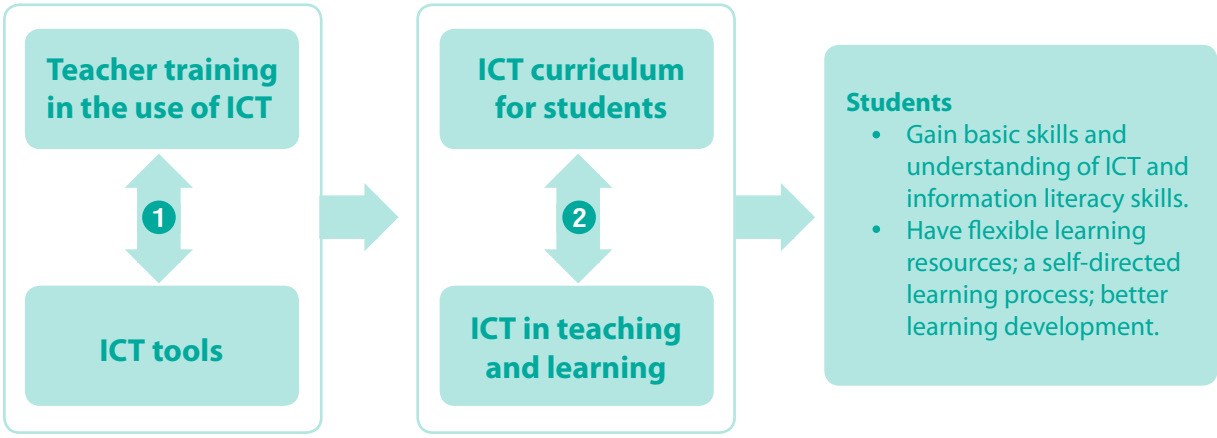


ICT in Schools

The Chinese Government recognizes the tremendous potential that ICT hold for enhancing education. The Government believes that technology and information literacy are essential, not only for youth to improve in their learning activities, but to adapt themselves to a more technology-based life, and to be prepared for future working environments.

The adoption of ICT in K-12 schools in China is a systematic project as shown in Figure 3, below. Based on the structural framework, the Chinese Ministry of Education (MOE) has been launching a series of initiatives to accelerate training in ICT tools and increase ICT use in schools.

Figure 3: Structural Framework of ICT in China K-12 Schools



❶ Provision of necessary ICT tools and resources for teachers to use to improve their ICT skills and to utilize to produce better learning outcomes.

❷ An ICT training course (curriculum) enables students' to develop the necessary ICT skills for participation in modern knowledge societies. Using these skills in various subject areas at school will provide a real-world context in which students can practice and apply their ICT skills.

ICT in Education Initiatives

The National Distance Learning Programme for All Rural Schools (2003 -2007) was launched in 2003 and will run until the end of 2007. The initiative will invest 10 billion RMB (US$1.25 billion) in providing rural schools with ICT facilities and educational resources, benefiting some 160 million rural children.

The supply of these ICT tools is intended to assist in closing the education-quality gap that currently exists between rural and urban regions. As part of the initiative, the Chinese Government will continuously collect good quality educational resources from well-developed urban regions and transmit them to rural areas via the Internet, satellites or in DVD and CD-ROM format.

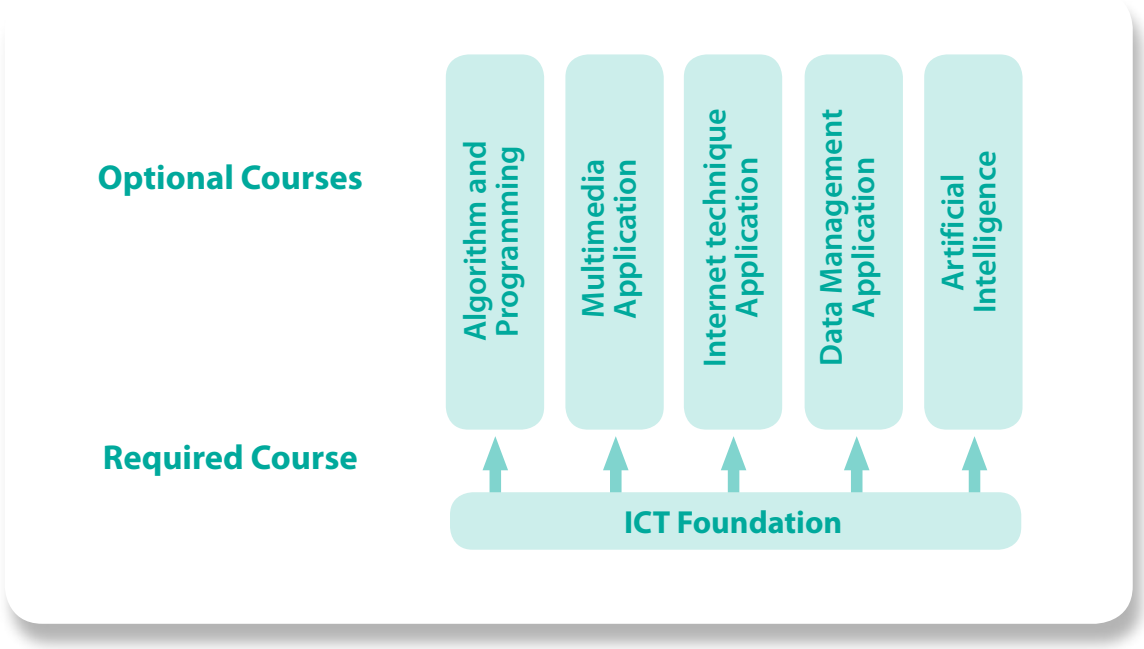
Rural schools will be equipped with different sets of ICT tools depending on their location, level and needs. Three models exist, as outlined below.

- Model One: 110,000 village classes will be equipped with a TV set, a CD-ROM and DVD player, and a set of curriculum materials (available on CD-ROMs).
- Model Two: 380,000 rural primary schools will be equipped with TV sets, CD-ROM and DVD players, a set of curriculum materials (CD-ROMs), and satellite receiving facilities.
- Model Three: 40,000 rural lower-secondary schools will be equipped with the tools in Model One and Model Two, as well as computer labs and Internet connection.

ICT in the National Curriculum

Within the new curriculum framework, ICT has been set as a required course from Grades 3 to 12. The ICT curriculum is designed to provide an opportunity for pupils to learn basic computer skills, and to employ tools to find, explore, analyse, exchange and present information. During this process, teachers are expected to assist students to increase their capacity to use computers and teachers are expected to utilize the ICT tools in the classroom to promote initiative and independent learning among students. By using ICT in this way, both teachers and students will develop the ability to make informed judgment about when and where to use ICT best. For primary and lower secondary schools, the computer-skills curriculum focuses mainly on enabling students to gain the skills and understanding required to use common application software. China's ICT curriculum structure for upper secondary schools is as outlined in diagram 4 below.

Diagram 4: The upper-secondary school ICT curriculum



National Education Technology Standards

According to the "National Education Initiatives for 2003-2007", all classroom teachers, along with school administrators and school technical coordinators of K-12 schools should receive effective training in the use of ICT in education by the end of 2007.

To ensure the relevance and quality of the training and to develop performance indicators for teacher preparation, the China Educational Technology Standards (CETS) was developed. Issued in September 2004 (Teachers [2004]No. 9), the standards set up three types of standards, one for teachers, one for administrators and one for technical coordinators of K-12 schools.

Standards for Teachers

The Standards for Teachers are divided into two areas of activity:

A. Digital Resources Development and Sharing

- The Government developed "Meta-Data Standards for Digital Resources Development and Exchange".
- A national digital learning resource database based on the national curriculum has been designed and shared freely through on-line portals, such as, the China Basic Educational Resources Network (http://www.cbern.gov.cn), the China Educational Resources and Service Portal (http://www.cersp.com).
- Dedicated satellite channels deliver learning materials to schools regularly and freely.
- Every province has established a local, dedicated, educational website.

B. Integration of ICT into teaching and learning

- Teachers are encouraged to facilitate extensive use of ICT by students in inquiry-based classroom learning activities.
- Since 2001, a national programme on ICT for Teaching and Learning has been in effect.

Areas of Training

According to the Standards, all classroom teachers should be prepared or trained in four areas. Each area of training has its own performance indicators.

1. Awareness and attitude

- **Awareness of technology's value**

Teachers should be aware:

  - Of the potential of technology to promote educational reform.
  - That the ability to apply technology appropriately is one of the necessary skills for a good-quality teacher.
  - Of the value of applying technology effectively for enhancing the teaching process and cultivating innovative teachers.

- **Self-Assessment**

Teachers should be able to evaluate themselves on:

  - Use of technology for delivering teaching materials.

- Implementing a technology-enhanced teaching process.
- Effectiveness and efficacy of technology-enhanced teaching.

- **Concepts of lifelong learning**

Teachers should be able to demonstrate the ability to:

- Learn and re-learn about emerging technology over time.
- Use technology to support life long learning, professional development, and personal life.

2. Knowledge and skills

- **Concepts**

Teachers must demonstrate an understanding of:

- Commonly-used technology.
- Fundamental educational technology theories.
- Educational technology methodologies.

- **Skills**

Teachers should master the skills of:

- Information searching, processing and presenting.
- Selecting and developing teaching media.
- Designing a technology-enhanced instructional system.
- Managing teaching materials, the teaching process, and learning projects.
- Evaluating teaching media, teaching materials, the teaching process and teaching outcomes.

3. Implementation and innovation

- **Designing and implementing technology-supported lessons and activities**

Teachers should be able to:

- Describe teaching objectives, analyse teaching content appropriately, and design teaching activities appropriate to students' characteristics and local situations.
- Explore effective technology-enhanced instructional strategies.
- Design and create technology-enhanced learning environment for students and provide guidance.
- Apply technology to support assessment.

- **Using technology to support teaching and management**

Teachers should be able to:

- Identify, locate and collect technology and information resources of high relevance to the curriculum.
- Use technology to manage resources effectively.
- Use technology to monitor students and manage the diverse learning activities effectively.
- Use technology to manage the instructional process.

- **Using technology to enhance research and professional development**

Teachers should be able to:

- Use technology to support subject-specific research.
- Identify and implement studies of technology application.

- Use technological tools to enhance their in ongoing professional development and lifelong learning.

- **Using technology to mediate collaboration and communication**

Teachers should be able to use technology to communicate:

- With students, about learning activities.
- With parents, to update them on students' performance.
- With peers on teaching ideas, materials and research.
- With administrators of different levels, about management.
- With technicians in fields such as courseware design, media selection and development.
- With experts to ask for professional assistance.

4. Social responsibilities

It is important for teachers to understand the social, ethical, legal, and human issues surrounding the use of technology in schools and apply that understanding in practice. Teachers should be in a position to:

- Apply technology equitably: facilitate students of different genders and economic status to have equitable access to technology resources in classrooms.
- Apply technology resources effectively: enable and empower learners with diverse backgrounds, characteristics, and abilities.
- Apply technology resources appropriately: guide safe use of technology resources.
- Demonstrate good practice: model and teach legal and ethical practice related to technology use.

Implementation Activities

The Ministry of Education (MOE) will undertake a number of activities related to establishing the Standards. These include:

- Creation of a systematic content framework to guide the preparation of training modules.
  Two series of training modules have been completed and have met the MOE's requirements.

- Provision of suggested training methods of proven effectiveness, to promote ongoing training activities and to ensure training is of a high quality.
  Teacher Education Institutes (TEIs) and Teacher Training Institutes (TTIs) that meet the standards will be selected as core training centres. Peer coaching and co-operative instructional design will be encouraged in teacher education.

- Development of assessment indicators as tools to evaluate teachers' post-training performance.
  Standard assessment tools have been designed and the evaluation system for the standards has been developed. All trained teachers will be tested using the system and various levels of grades will be given. Teachers will identify whether they should receive further training and what training they require.

Recommendations

A number of changes are recommended in order to improve the Standards for Teachers, as listed below.

- Refine Standards suit local needs and conditions

The CETS were based mainly on the American National Educational Technology Standards (NETS for Teachers, Students, and Administrators). To ensure their suitability for local needs and conditions, the CETS may need to be localized further.

- Develop better indicators

The Standards advocate learner-centred approaches but the indicators do not adequately measure these approaches. Furthermore, while the indicators measure teachers' direct performance, they do not necessarily measure teachers' use of technology to facilitate students' learning. For example, standards are mainly described as "using technology to support the teaching process", instead of "using technology to support learner-centred strategies that address the diverse needs of students".

- Identify various standards depending on teachers' levels of ICT competency

The existing Standards go beyond most Chinese classroom teachers' existing technology level. Teachers will lose confidence, however, if they feel the standards are unachievable. Various levels should be identified for the Standards, such as introductory level, medium level, and expert level.

6. Using Video Technology for Primary School Teacher Training in Rural Nepal

Sarah Lucas Pouezevara
Binita Parajuli [35]

Introduction

This case study describes a project which equipped teacher educators with digital video recorders and laptops as tools to utilize in a 2.5 month teacher training course which was provided in three locations in rural Nepal. The case study examines the impact of the project and discusses whether using these ICT tools was effective in bringing about better learning outcomes among the trainee teachers.

Background

With the aim of providing developing member countries (DMCs) with better guidance to use information and communication technologies (ICT) effectively in education, the Asian Development Bank (ADB) funded a 21-month regional technical assistance (RETA) study in four countries: Bangladesh, Nepal, Mongolia, and Samoa.

The RETA researched approaches to using ICT in education, for improvements in teaching and learning that are not only successful but also feasible and sustainable given the region's development challenges.

The study, titled "Innovative Information and Communication Technology in Education and Its Potential for Reducing Poverty in Asia and the Pacif ic Region" commenced in April 2006 and was implemented in the four countries by RTI International[36] in partnership with iEARN-USA. Outcomes from the four studies were shared at a regional ICT in education conference in October 2007 at ADB Headquarters in Manila, Philippines.

The study aimed to:

- Explore and highlight promising models of ICT integration and best practices
- Identify drivers and barriers to successful ICT integration
- Share lessons learned, with a specific focus on rural and remote areas.

The study combined policy analysis, programme evaluation (mainly interviews and focus groups), and small-scale activities (professional development and provision of selected ICT resources).

The study built on existing projects in each of the four participating countries. In Mongolia and Samoa, the study focused on projects which introduced e-Resources (electronic teaching and learning materials) to remote and isolated areas of the country, enabling them to have access to up-to-date resources.

In Bangladesh and Nepal, the study focused on projects using ICT for teacher education. The Nepal study examined the use of video recording as an innovative method for primary school teacher training in rural Nepal.

[35] This summary case study was adapted by UNESCO, with permission, from the full research report: Pouezevara, Sarah and Binita Parajuli. 2007. *Old Technology or New? A Study of Video Recording as an Innovative Method for Primary School Teacher Training in Rural Nepal. Nepal Country Report*. RTI International. ADB TA6278-REG. Research Triangle Park.

[36] RTI International is a trade name of Research Triangle Institute.

The Nepal Teacher Education Project

In 2001, ADB approved a loan for $19.6 million to the Government of Nepal to implement an initiative titled the Teacher Education Project (TEP). Co-financed by the Danish International Development Assistance programme (DANIDA), the TEP aims to assist the Government of Nepal to improve the quality and efficiency of and access to basic education through provision of better-qualified teachers.

Through the TEP, nine primary-teacher training centres (ETC-As) have been provided with multimedia Resource Centres. The TEP is also supporting delivery of mandatory 10-month training for all untrained teachers currently teaching in the school system. This training is carried out in three phases:

- 2.5 months face-to-face
- 5 months school-based distance learning
- 2.5 months face-to-face

Because the face-to-face components require trainees to travel to a government centre, this can pose barriers for teachers in remote areas who can not easily travel long distances. For this reason, a mobile team approach was developed so that the training programme can take place in remote areas. Trainers are dispatched, with training materials, to remote areas to provide the 2.5 month-training under the supervision of the District Education Office (DEO). Normally, these trainers are equipped with an overhead projector, cassettes, flip charts, markers, handouts, and musical instruments to supplement the texts. The training is generally delivered in a school classroom with only basic infrastructure.

Using Video Recording in Teacher Training in Rural Nepal

The RETA study built on the Teacher Education Project (TEP) and aimed to ascertain whether use of digital video recording and laptops as tools would enhance the training provided to teachers under the TEP and bring about better learning outcomes among the trainee teachers.

The findings from the study served to inform the TEP and the Nepal National Centre for Educational Development (the central teacher education authority, under the Ministry of Education and Sports) about ways to optimize the use of existing, but underutilized, equipment provided to major primary teacher training institutes around the country. Furthermore, it may provide other countries with practical tips for implementing video recording and playback in the classroom, and suggestions for how the use of video can be expanded beyond its traditional use for self-assessment and critique in microteaching.

To complement the usual TEP teaching materials, the study provided a laptop and digital video recorder each to three mobile teams (which travelled to three areas: Rolpa, Taplejung and Dolpa) – and a package similar to the existing equipment available in the ETC-A multimedia labs mentioned above. The ICT tools were used during an in-service training programme that ran from 15 April to 29 June 2007.

Two trainers from each mobile team were brought to a workshop to learn basic equipment handling and techniques for using the equipment in the classroom for pedagogical purposes.

At each location, the mobile training team provided the standard teacher training programme but also utilized video equipment and laptops in ways that suited the needs, interests and capabilities of the trainers. The number of trainees at Rolpa was 57, while Taplejung and Dolpa had 22 and 36 trainees, respectively.

Digital video technology in education

Although VHS video has been around for many years, and has been common in teacher training in some countries since the 1970's, the advent of digital recording offers many new possibilities for using video in the classroom, and in developing-country contexts, because of the compact and easily distributed nature of this technology. Digital video creates many new opportunities for viewing, editing and sharing, which were not possible with traditional video recorders and televisions.

The compact and portable nature of today's video cameras make this much more feasible than VHS tapes played back on a television (the way that video has traditionally been used in teacher training in most countries) for remote and resource-poor settings. Short video capture is now available in most digital cameras and many mobile phones. Some phone networks also allow sending short video clips across the network, similar to a traditional phone call.[37]

Furthermore, digital video provides more convenient options for sharing and storing videos. Sharing digital clips can be an effective way to enhance teacher training programmes by allowing trainees to see current practices in other schools, and share cultural and methodological videos. Again, this is particularly beneficial to remote schools which might not otherwise have this opportunity. Therefore, it makes it a particularly suitable tool for remote areas with poor communications infrastructure, such as the mountainous regions of Nepal.

The use of pre-recorded video in higher education can be used as either a resource to supplement lectures or to substitute for lectures, but the most common use is the former. It is generally selected to help deliver curriculum in cases where visualization is important to understanding, such as scientific simulations and natural phenomena. A common constraint faced by teachers, is selecting appropriate video resources, therefore central management and dissemination of appropriate videos linked to specific curricular goals encourages optimal use of video in higher education. It is also crucial to recognize that video alone does not make an appropriate lesson, but must be combined with preparatory and follow-up activities in a holistic lesson plan.

The use of pre-recorded video, as described above, is translated into 'learning objects' in the modern age of computers and digital resources. Learning objects can be defined as: an electronic resource that purposefully combines digital assets, such as a pictures, video or audio snippets, bits of text, or smaller web-delivered applications to communicate a specific concept or message, and therewith has an explicit learning objective inscribed to it. Pre-recorded video can be reused over and over again, according to the needs identified by the teacher. Teachers who can access a repository of learning objects can integrate them into their lesson plans as needed, providing an additional source of teaching aids to enrich the training program. As well as being used to create learning objects, video recorders can be used in teacher training centres to improve teaching practice through self assessment and reflection.

[37] See also the study report for Bangladesh: Pouezevara, Sarah and Rubina Khan. 2007. *Learning Communities enabled by Mobile Technology: A Case Study of School-based, In-service Secondary Teacher Training in Rural Bangladesh.* Bangladesh Country Report. RTI International. ADB TA6278-REG. Research Triangle Park.

Through interviews with trainers and pre- and post-training questionnaires filled out by trainees in both the study classrooms and a previous training classroom that did not use ICT (a control group), the study team was able to analyse how the technology could be used as a teaching and learning tool in the context of teacher training, whether the use of this technology had any effect on learning outcomes.

The questionnaires delivered to the mobile teams (which used ICT tools) asked how the tools were used, and what effect it had on the teaching and learning processes. The uses of the technology are summarized in Table 1, below.

Table 1: Summary of technology use in teacher training

Tool	Uses
Video recorders were used mainly to:	• Record training activities and classroom lectures • Record extra-curricular activities, cultural, and community events • Record microteaching practice
Laptop computers were used mainly:	• To edit and play the videos • For administrative purposes (creating teacher lists and writing letters)

Uses of the video recorders

The trainers reported that they had used the digital video recorders to record and playback (using the laptop) three main types of activities.

1. To record actual classroom lectures and activities

This activity served the following purposes:

- Trainers could improve their training practice by reviewing the video and self-assessing performance; they would also be able to review the video before the next time they teach the lesson (maybe after several months) to remind themselves what worked and what did not.
- Trainers would be able to review trainee participation over the course of the 2.5 month period, which helped them to give final marks.
- Trainees could retain the subject-matter content better, and could review lessons where they had specific questions by replaying the video later. Similarly, trainees who were absent could review the actual lesson on the video.
- Trainees were more attentive and participated more, knowing that the lesson was being filmed.
- DEOs and other training supervisors could verify the quality of training and provide feedback to trainers, or adjust the curriculum as necessary.
- Trainees could take a CD copy of these activities, which could help to remind them of some certain processes, especially games and developing teaching aids.

One team also recorded group work and feedback sessions, which allowed the trainees in other groups to see what their fellow peers were discussing.

2. To record extracurricular activities, including school opening and closing ceremonies and local cultural events.

This activity served the following purposes:

- Trainers could use these videos later to provide local content to support social studies lessons.
- Video recordings could be shared among different training institutions, to show differences between urban and rural settings, or different cultures and regions.

3. To record microteaching[38] (practice teaching in the training centre with peers) and student teaching (school-based, with children).

This activity served the following purposes:

- Trainees were able to see their performance, self-assess their weaknesses, and make corrections.
- Trainees could also compare their performance during microteaching with performance in the actual classroom.
- School supervisors' comments on practice teaching to trainees in school, with help of video recording, was more effectively and positively received by trainees than without the recording.

Uses of the laptop

The trainers used the laptop for two main purposes.

1. To edit and play the videos

Laptops were mainly used for processing the video from the cameras to edit it to a reasonable amount of time, organize important clips, and playback video to the classroom. (No other projection equipment was provided). The laptops had CD drives, allowing them to playback pre-recorded model teaching videos provided by NCED. This was the first time any of the trainers had ever seen these videos, much less use any kind of video as a teaching aid.

2. For administrative purposes

Where they had the skills to do so, the trainers used the laptops for administrative purposes.
Activities included:

- Creating a spreadsheet with student information;
- Using the word processor to write letters and reprint a training manual for civic education. The analysis of the laptop hard drives shows that apart from the video clips (both unedited and edited), the application used the most by all teams was the word processor, with about 6 new documents created and saved per team.

There were very few edited video clips or movie files created. Most of the video was the full, original clips indicating that the task of editing the clips down to the most useful parts was either too time consuming or the trainers felt that all of the video was worthwhile to keep. Interviews with the trainers indicate that both explanations are likely, and more training will be necessary in order to help users limit the amount of video stored on the computers to a useable amount.

None of the teams used the video cameras for taking still photos. In two cases this is because they did not know how, and in one case it was because they still have traditional cameras for this purpose.

[38] 'Microteaching' the term used when trainees practice teaching a lesson in front of the classroom, with other trainees acting as pupils. It is distinguished from 'student teaching', or school-based practicum, which is when the trainee practices methods in front of an actual primary school classroom, under the supervision of a trainer or school supervisor.

Innovative uses of the equipment

When the study was originally designed, it was anticipated that the video recorder and laptop would be used somewhat differently than the ways they were actually used by trainers. Prior to the activity, a set of suggested categories were given to trainers, with the option of adding additional uses, as needed.

For the video recorder the purposes were:

- Classroom demonstration (Showing a model classroom demonstration)
- Self assessment (Assessing a trainee practicing teaching skills from the training curriculum)
- Personal learning
- Personal use, and
- External relations (Creating or showing video about the training programme or training outputs to the community or other concerned individuals)

It was intended for the video recorders to be used for self-assessment of the trainees' own teaching practice and to develop a repository of model teaching videos to share with other teacher training institutes. However, the equipment orientation period did not leave a sufficient amount of time for training the users on these purposes. (Most of the 2-day training period was spent just learning how to operate the equipment). Moreover, developing a repository of best-practice or model teaching videos, or even subject-specific videos such as local cultural events or preparation of teaching aids using locally available resources that could be shared among training institutions requires the support and buy-in of the Education Training Centres (ETCs) to make this an effort worth the trainers' time. The short study period did not leave enough time for that level of advocacy.

It was not expected that the trainers would use the video cameras for recording actual lectures or recording trainees' participation in classroom activities (except for microteaching). However, this turned out to be the most frequent use of the video recorders, and trainers and trainees alike mentioned the benefit of having a record of the actual training session.

An important unintentional outcome of the study was that the *trainers* actually used the video for self-assessment and reflection of their teaching practice in the manner expected for the trainees. It also became a supervision tool, to help record training participation marks. Similarly, DEOs and other training supervisors at the ETC level had an opportunity to see how the mobile training sessions were actually carried out and some of the issues they face (for example, the condition of the classrooms).

For example, in Dolpa, the trainers recorded every day's first session, consisting of a review of earlier day training (in which comments were made by a group of trainees on what other trainees think about the training). The recording helped the supervisors and DEO to know the real situation of the everyday training. Since the third phase training is particularly designed for group work, trainees perform many projects in groups. They felt that recording of group work presentations would give trainees a chance to hear what other groups had been discussing.

The Rolpa team managed to integrate the technology into the training programme with the help of one administrative staff, an experienced technology user, of the DEO who was usually responsible for recording, storing, processing and replaying the video clips throughout the 2.5 month period. This meant that the trainers were not distracted from their training tasks, and there was one staff member

who was able to develop expertise in processing and replaying the video. The Rolpa team chose to allow trainees to view the video clips in small groups or as individuals after school hours, rather than as a full group. There were, however, clear protocols for reviewing video (after 2:00 PM in his office).

For the laptop the suggested purposes were:

- Personal learning (practicing computer skills, or learn how to do something new)
- Personal use (Using for a purpose unrelated to the training programme (i.e., watching a movie, listening to music, writing a personal letter)
- Administrative use (Conducting administrative tasks related to the training programme, including lesson planning, data collection, etc.)
- Curriculum learning (Teaching something related to the curriculum of the Phase III training), and
- Basic skills learning (Improving basic subject knowledge such as math, English, or science)

In practice, however, the laptop was never used for basic subject knowledge training, no doubt because the trainers had neither supplementary resources – i.e., educational CD-ROMs – nor training to do so.

Except in the case of Taplejung, the trainers did not make a specific effort to improve their own computing skills outside of the tasks related to the study, although they certainly did improve their skills indirectly as a result of the study, mainly concerning video capture and editing.

Although the study suggested using the equipment for community outreach purposes it was not anticipated that the video would be used to create videos relative to the local culture, which could be reused in an instructional setting later.

There were no reports of the computers or videos being used to share information with the community and parents, although they were shared with DEOs as an accountability tool.

Many trainees requested copies of all types of videos on CD so that they could review them again after the training period. It was not anticipated that CD-ROMs would be given to trainees, since there would be no computers available for watching them later. The mobile teams explained, however, that although most schools and homes do not have computers, it is usually possible to find a computer somewhere in the village or neighbouring village, including district education offices, so it is possible that they will be able to view videos later.

Added value of technology

As part of the study, interviewers gave questionnaires to both the mobile training teams and a control cohort of teachers who completed the same training programme in the same location and with the same mobile teams, but without using the video and computer tools.

Given the limitations of the study instruments and sample size, the qualitative data from trainer interviews and open-ended questions provides most of the data for the analysis, conclusions and recommendations. However, quantitative data gathered from the questionnaires, and compared between the control group and the study group, does provide some important considerations, which could be followed up with more research in the future.

For example:

- the perceived usefulness of the technology decreased where it was used the least frequently (Taplejung).
- the perceived usefulness of the technology was highest in the site where the trainers were most comfortable with the equipment (Dolpa).
- in Rolpa, the perceived usefulness of watching video was rated as very useful by a slightly larger percentage of trainees, and this may be related to the fact that teachers were able to watch the video individually, after school hours, rather than as a group (on a small screen).
- when the three sites are combined, and compared between the control and study group, there was only a very small increase in overall training satisfaction for the study group, when technology was used.
- where the technology was used the least frequently (Taplejung), the perceived knowledge gain ("How much new knowledge did you gain during this training?") was much less.

When trainees from the implementation group were asked only about whether they believe that the use of these technologies improved the learning experience, they overwhelmingly answered "Yes", citing further that the technology made the experience "exciting and fun", and that they appreciated being able to see their own performance as well as review the lectures over again. Trainers also spoke much more about the advantages of the technology for the training programme, than about the inconveniences or constraints (see next section). They were very enthusiastic about repeating the experience in the future, and had many ideas about how it could be further applied to the teaching process. None of the participants indicated that the technology alone, or learning about technology, was the attraction which would have been expected given the newness of this technology in rural Nepal.

To summarize, the study found that the use of video recording:

- Improves the reputation of the training, as it is a symbol of a more modern approach.
- Improved practice on the part of the trainers as a result of being recorded, and viewing their performance on the video.
- Improves participation (of trainees and trainers), since they know that their performance may be reviewed again by a superior.
- Improves the learning experience by making it more interesting and fun.

There are many ways in which technology proved to be exciting and fun for the participants, but the purpose of the study was to understand its impact on learning.

This is very difficult to measure quantitatively, but some of the ways that video technology can improve teaching effectiveness, as perceived by participants in this study, are as follows:

- Trainees prefer learning through visual methods.
- Improved content retention by being able to re-watch lessons more than once.
- Improved content understanding by being more attentive to the lesson when it is being filmed.
- Improved teaching practice by being able to review and self-identify weaknesses.
- Increased self-confidence as a result of being able to watch oneself performing in front of the class.

A summary of the specific advantages and disadvantages of using this technology in the classroom (as perceived by trainees) is provided in Table 2.

Table 2: Positive and negative aspects of video technology in the classroom[39]

Positive Aspects of Technology	Negative Aspects of Technology
¤ Makes training interesting, exciting, unique, fun, creates learning environment ¤ We could know about our performance, get feedback, identify our weaknesses ¤ Permanency; having a record for a long time of our performance and activities ¤ Learning is more effective, practical, real, and meaningful ¤ Visual/sound is more effective way of learning ¤ It is helpful for trainers to conduct training (organization, workload, and more active) ¤ Various topics (including subject topics) related to training were shown ¤ Can view colleagues activities, share best practices, get to know other places ¤ Trainees were encouraged for participation, discipline, support and cooperate to learn ¤ Could learn about technology ¤ Arouses competition among participants ¤ Can analyze overall training ¤ As a tool for entertainment ¤ Can show to students and parents	¤ Classroom congested, dark, visual not clear ¤ Lack of electricity, limited battery power ¤ Lack of adequate resources (other resources) ¤ Technical diff iculties ¤ Not used enough ¤ Not enough video cameras ¤ Time constraint so could not see all of our recorded activities ¤ Use less creativity, less thought with video involved ¤ Trainers were nervous, needed more training ¤ Trainee did not get to use the video recorder ¤ Expensive ¤ Screen not big enough to see as a group ¤ Too much attention on technology part ¤ Not proper planning ¤ Not used appropriately ¤ Everyone could see other people's weaknesses[40]

Issues and constraints

Seven issues were identified as posing constraints to the use of the technology for improving training effectiveness, as outlined below.

1. Language was a barrier to learning to use the computers.

Due to the fact that the computer operating system that was used was in English, it was understandably difficult for trainers to learn to use the computer through trial and error. Although Nepali fonts were installed, allowing word processing in Nepalese, there were no other Nepali programs available for the computers used in the study.

2. Reluctance to use equipment in case it was damaged.

The trainers were very nervous about being held responsible for any damage to the equipment. Therefore they were unlikely to discover on their own, through experimentation, advanced uses of the equipment that they were not specifically trained in.

[39] Listed in order of frequency, the comments are combined from both the open-answered opportunity to say why they answered either 'Yes' or 'No' to the question: "Do you think that the use of technology improved the learning experiences"? , as well as the open-ended opportunity to list pros and cons of technology use at the end of the questionnaire.

[40] Only one person mentioned this as a concern, but it is an important risk to consider when assessing whether the context is appropriate for and how to manage the use of video in teacher training.

3. Insufficient training in the use of the equipment.

Given that this was the first time the trainees had ever operated a laptop or a video camera, most of the two-day orientation workshop was spent just learning how to operate the equipment.

To be more effective, the workshop should have lasted three to four days. Additional training was needed on the following:

- Organizing video clips in folders or a database (list) to make it easier to find them later.
- Advanced features for operating the computer and camera. For example, the teams never used the cameras for taking still photos.
- How to use the equipment for pedagogical purposes. For example, specific steps for using video for self-assessment of microteaching practice.

Furthermore, it might have been easier for the trainers to learn to use the laptop if it had been configured differently, i.e. without unnecessary icons on the desktop, and without reminders (in English) to register and update virus software every time they used the computers.

Only one site (Rolpa) had a staff member (an administrator – not a trainer) who was able to manage the technical aspects of the tools (recording and processing video clips). In the other sites, this was the responsibility of the trainers.

4. Lack of technical support.

Not only did lack of technical orientation to the equipment make the trainers nervous, it also led to them facing technical difficulties that they were sometimes unable to resolve (for example, one training team was unable to save video clips to the computer due to a accidental camera setting). Due to the extremely remote location of these training locations, there was no local technical support available, and no way for the study team to provide technical support remotely.

A lack of technical support was also cited as a constraint to use of the existing video equipment in the ETCs (provided through the TEP project). In most ETCs, the video equipment is used rarely, if at all. In one ETC, they stopped making videos for lack of human resources and anyone properly trained in using the equipment. To be able to utilize the tools more effectively, trainers will need full time technicians who can tape the instructor delivering lessons or microteaching practice, help transform and edit the video clips for playback, and solve technical problems as they arise.

5. Lack of associated tools.

Several associated ICT tools and equipment would have been very useful for the trainers. These include the following:

- A tripod for filming. This would have been a minor additional expense, but would have made it much easier for trainers to film themselves teaching, or film trainees, without being preoccupied by the act of filming. It would also mean that there would not necessarily be a need for a separate camera operator every time, and it would also improve the quality of the videos.

- A projector for viewing videos on the computer as a group. When viewing the videos as a learning activity, the projector is an important piece of equipment for effectively using the video playback feature. However, it is not very feasible in a context where there is no reliable electricity source, and where transportation constraints would make it very difficult to transport such a fragile piece

of equipment. Cords were provided with the cameras to allow projection through a television, but none of the teams had a television available.

- External speakers. A set of external speakers would have made the sound louder – enabling groups watching the video to hear more clearly. Including a set of external speakers (if they run on battery power as well as AC/DC supply) would be feasible to add to the package.

6. Lack of electricity in the training centres.

The lack of a reliable electricity source made it difficult to use the equipment effectively. In these rural areas, electricity is only available at a central location, and not all schools or training centres are connected to the grid. Therefore, the trainers had to plan carefully about where to charge the equipment (at the DEO's office and at their own residences). Solar-powered equipment might have been a viable way of overcoming some of these difficulties.

Due to the lack of electricity, many trainees found the training centre classrooms were too dark. Therefore video recordings were dark and of poor quality for reviewing effectively (especially when no additional projection equipment were available).

Part of the training programme involves several weeks practicum in a nearby school classroom. Although the trainers tried to visit trainees in their schools to record their practice, it was impossible to do this for every trainee because there was often no place to recharge the camera between school visits.

7. Lack of staff at the training centres.

In some training centres there was not sufficient staffing to effectively utilize ICT in the teacher education programme. The extremely rural location of Rolpa, for example, means that they have trouble attracting qualified trainers that are willing to stay for two and a half months. There were not enough school supervisors available to visit each trainee teacher to review teaching practice during the school-based practicum.

Conclusions and recommendations

With regard to the TEP project and its objective of improving the quality of basic education through provision of better-qualified teachers, this experience does provide some compelling anecdotal evidence that the use of video in teacher training can improve the quality of the training and, as such, the learning outcomes.

A lesson learned from the study that can be applicable on a wider scale is that teachers – both school teachers in training or teacher trainers – value the opportunity to see themselves practicing in front of the classroom, and being able to correct their weaknesses and gain confidence.

The results of the study suggest ways in which the use of video can be expanded beyond its traditional use for self-assessment and critique in microteaching. Some additional ways that video and computer technologies can be used include:

- Using video to improve the quality of teacher trainers through self-assessment and reflection on their own practice
- Improvement of the training classroom through feedback from the central level based on reviewing video recordings

- Addressing a lack of material resources for teaching aids through development and dissemination of visual examples of locally produced teaching aids, or video lessons (i.e., model teaching videos, cultural and natural events, etc.)
- Using video for whole school supervision and ongoing teacher performance evaluation for certified and serving teachers. Remote teacher performance evaluation could also be carried out using video recordings that are sent to a subject or methodology expert for review, where one is not available locally (as in many rural areas).
- Improving relations between the community and school by showcasing examples of good teaching practice and student engagement.

In terms of the future application of the video recorder and laptop in the Nepal Teacher Education Project, a number of recommendations were made. In addition to recommending that the constraints (identified above) be overcome, the following recommendations were made:

- To be most effective, there should be one staff member in charge of planning the recording schedule, editing, and replaying video clips, as well as keeping track of the clips.

- Establishment of a community of practice among trainers and training centres would be worthwhile. Each training centre will have to make decisions about the most effective way to integrate video recording and replay into the curriculum, but sharing lessons learned and strategies for optimizing the use of video in teacher training will be important.

- Further benefits of the equipment can be explored when different training institutions – including ETCs, mobile teams, National Centre for Educational Development (NCED), and private teacher training centres – begin sharing digital resources, such as model classroom videos, local cultural documentaries or case studies, and clips of innovative teaching materials among each other. Distribution could be carried out either through recorded CD-ROMs (CDs) sent by postal mail or eventually through email or Internet.

- Television could complement the radio distance learning programme by diffusing model teaching videos, videos of teaching materials preparation, local cultural events and characteristics, and subject-specific educational programmes. The use of videos – created either in the ETCs or through NCED – can also be used to enhance the radio distance learning programme by diffusion through the television or during weekly contact sessions, through tutored video instructional mode.[41]

There was no way to know, during this study period, whether the teachers participating in the study would be able to utilize video technology and associated new teaching methods in their classrooms. A follow up to this study might seek to re-contact these teachers, as well as the control groups, and see whether or not they have used the new tools and teaching methods.

As soon as data is available, a first comparison can be done to determine whether or not exam scores were equivalent or different between control and study groups. Since the same three teams will most likely be able to use the equipment for one more training year, there is an opportunity to review with them, after this period, whether new uses of the equipment in teaching, or further implications of the same, have been discovered.

[41] See Cadiz, J., Balachandran, A., Sanocki, E., Gupta, A., Grudin, J., and Jancke, G. (2000). *Distance learning through distributed collaborative video viewing.* Microsoft Research Technical Report MSR-TR-2000-42.

7. Building teachers' capacity to make better use of ICT in Philippines schools

Carol Rodriguez [42]

Introduction

Text2teach is a pilot project being implemented in science classes in Grades 5 and 6 in elementary schools in the Philippines. It is the Philippines version of a global programme called BRIDGEit, an initiative that aims to improve the teaching of basic education in developing countries.

The text2teach project aims improve the teaching of science in the Philippines through the provision of interactive easy-to-use multimedia packages designed to make science learning more exciting and meaningful for young learners. The project makes use of digital satellite broadcasting and mobile phone technologies to transmit video materials directly to the classroom. This case study focuses on the teacher education component of the text2teach project.

Background

Among the 55 nations included in the Information Society Index (ISI)[43] , the Philippines is ranked 48th in terms of preparedness and ability to absorb advances and growth in information and communication technologies (ICT). Recognizing the need for improvements in the use of ICT in education and training, the Philippines Government has enacted laws to foster the use of ICT for widening access to education, improving the quality of teaching and fostering the development of lifelong learning skills.

The Philippines' "Information and Communication Technology Plan for the 21st Century" (1998) sets forth the following objectives:

- To provide physical infrastructure and technical support that will make ICT accessible and useful to students, teachers, administrators and support staff.
- To develop competence among teachers in using technology, in designing, producing and using ICT-based instructional materials.
- To ensure access to the latest developments in ICT and to support research and development in this area.
- To undertake a curriculum improvement programme focused on the integration of technology into education.
- To promote the use of appropriate and innovative technologies in education and training.

A survey commissioned in 2002 by the Philippine Senate Committee on Education, Arts and Culture to the South-East Asian Ministers of Education Organization Regional Centre for Educational Innovation and Technology (SEAMEO INNOTECH), examined the ICT infrastructure of elementary and secondary schools in the Philippines.

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[43] The ISI was developed by the World Times and the Data Corporation.

Some of the survey findings are as follows:

- Two-thirds, or 66.07 percent, of the 36,368 schools surveyed have electricity. The regions with the highest electricity supply are the highly industrialized regions of Luzon namely: National Capital Region (NCR), Region I, Region III and Region IV;
- Of the schools surveyed, 5,217 (14.28 percent) indicated they have computers. Only 726 (2 percent) have access to the Internet.
- 4,866 (13.3 percent) of the schools surveyed have access to landline telephones.
- The most common audio-visual and multimedia equipment in schools are traditional media equipment. Specifically, these are: radio-cassette players (42.22 percent of all schools); television (26.80 percent of all schools); and VHS players (17.19 percent of all schools).
- Schools in provinces in Mindanao (Regions IX, X, XI, XII, CARAGA and ARMM) have the lowest incidence of computers.
- Only one out of every seven schools has teachers who are computer literate.
- More schools have computer-literate teachers (6,632 or 18.24 percent) than have computers (5,217 or 14.28 percent).
- In the survey, 27,042 school heads (74.36 percent) indicated they had received no training on any topic related to ICT in the past five years. The remaining 4,774 school heads (13.13 percent) indicated they had received some sort of ICT training.

The survey also examined the level of computer training provided at schools:

- While in the majority of private elementary schools computer training starts at grade 2, in public elementary schools introduction to basic computer operations starts in grade 4, if computers are available.
- At high school, computer training is for further skills enhancement as an area of study in Technology and Home Economics (THE).

In recent years, the Philippines Department of Education (DepEd) has embarked on various "ICT in Education" projects. A brief review of the projects reveals that the projects generally aim to:

- Improve access to ICT by teachers and students.
- Develop the ICT competencies of both teachers and students.

Some examples of projects include:

- The Department of Education "Modernization Programme". This project was initiated by the Office of the President in 1996. It earmarked PhP375 million for use on hardware and software procurement (75%) and staff training (25%) including training for teachers, administrators and support staff.
- The "Adopt-a-School" programme, initiated in 1998 by the DepEd aimed to enlist the help of private corporations in delivering educational goods and services including computer laboratories and equipment to schools in underserved areas.
- The Department of Transportation and Communication (DOTC), in partnership with the Science Education Institute (SEI) and Intel Philippines, provided Mobile Information Technology Classrooms (MITCs). These mobile classrooms are air-conditioned 32-seat buses equipped with laptops, television sets, video players, LCD projectors and screens, a public address system, a printer and a generator set. These mobile classrooms are also equipped with audiovisual and instructional materials on topics relating to science and technology.
- Coca Cola Philippines' "Edventure" provides three ICT courses for administrators and teachers. The courses train teachers to use on-line communication tools and to initiate project-based

learning and telecollaboration. The administrators are equipped with knowledge, strategies and tools for making a school technology plan and ensuring its sustainability. During the courses, the administrators also build their capacity to develop policies on ICT use, and in community mobilization and resource generation, as well as monitoring and evaluation skills.

- "e-Mage 2000" (Math Games for excellence for secondary level) is a collaborative project in partnership with the private sector to enhance the teaching skills of mathematics educators through the use of ICT.

In her speech at the 2nd National ICT in Basic Education Congress held in September 2006, Philippines President Gloria Macapagal-Arroyo explained that the Department of Education and the Commission for ICT are crafting a national ICT programme for teachers, the National ICT Competency Standard for Teachers. This initiative will be implemented in all public high schools and the majority of the teachers should be able to satisfy the requirements of the ICT standards by 2010.

The BRIDGEit programme

The BRIDGE*it* programme aims to:

- Help provide access to high-quality educational resources for learners in remote geographical locations.

- Address social exclusion caused by limited or lack of education. BRIDGEit aims to create an open platform that provides access to new and innovative teaching solutions to teachers in emerging economies and improve both teachers' and students' motivational and skill levels.

- Harness public and private partnerships. Digital bridging in education requires the coordination of diverse partners among a number of public and private organizations.

The goals of BRIDGEit were a major consideration in the conceptualization and planning of the text2teach conceptual framework.

Text2teach goals and objectives

The overall goal of the text2teach project, implemented between July 2003 and March 2004, was to raise the quality of education in the Philippines in order to strengthen the competencies of the country's youth and to properly prepare them for the challenges of the 21st century.

The main objectives of the pilot project were to:

- Enhance basic education learning in science for Grades 5 and 6 students.
- Train science teachers, school heads and schools division supervisors in the pilot schools on the use of technology for enhancing learning.
- Develop a blueprint of a model for delivering digital content to science classes in the Philippines. Test the tenacity of the architecture and infrastructure of the said model for delivering digital content for education.
- Generate data and measure the results to determine the viability of scaling up the programme nationally and replicating it on a global level.

Text2teach pilot project

The programme was implemented by 82 teachers from 15 schools in Batangas, 13 schools in Cotabato City and 10 schools in Quezon City.

Under the programme, 120 science lesson plans were developed – 60 in Grade 5 and 60 in Grade 6 – complemented by over 100 video clips.

The major management partners of text2teach are: the Global Support Team (GST) composed of the International Youth Foundation (IYF), Nokia, Pearson Education and the United Nations Development Programme (UNDP), and; the Philippine Project Team composed of Ayala Foundation, the Department of Education, SEAMEO INNOTECH, Globe Telecom, PMSI and Dream Broadcasting.

Project components

The text2teach project had four main components:

1. Content Planning and Lesson Development
2. Capacity Building
3. Advocacy and Promotion
The main activities under this component were:

- A launch event was held to generate interest in the project at the national and international levels.
- Community launches and orientation sessions which were held at each project site to inform the education sector and other community stakeholders of the nature and scope of text2teach and to generate support from the community. The majority of the schools held school or *barangay* project launches.

4. Monitoring and Project Coordination
Project monitoring was undertaken by SEAMEO INNOTECH together with designated project monitors at each of the pilot sites.

The monitoring objectives were to:

- Prepare a profile of how the project was being conducted at various levels in the three pilot sites.
- Identify gaps, deficiencies and potential problem areas.
- Determine project features which may serve as insights in improving project operations.
- Document best practices which may be useful for modifying or enhancing project activities.
- Disseminate the results of monitoring work to the project managers and stakeholders to update
- them on project progress.

Content development and capacity building

Two of the most important components of the text2teach pilot project were Content Planning and Lesson Development, and Capacity Building.

The Content Planning and Lesson Development component included two major activities:

- Planning and development of lessons which involved: review of the DepEd Basic Education Curriculum (BEC), specif ically the curricular programmes of Grades 5 and 6 Science which enabled the identif ication of over 100 video packages to be made available to teachers and the development of 60

lesson plans for Grade 5 science and 60 lesson plans for grade 6 science. A team of DepEd master teachers and lesson plan writers developed these lessons. The lessons are in compliance with the DepEd Basic Education (Science) curriculum.

- Review and revision of the lesson plans based on the lessons learned from the experiences gained through implementing the text2teach programme during the school year.

The second major component is capacity building. It has two strands:

- Training of trainers (TOT), which involved training a core group of trainers who conducted the training of the project teachers.
- Training teachers, school principals, project monitors and school division officers at the project's pilot sites

A five-day live-in training programme was held in May 2003 for the participating science teachers, school principals or school heads, assistant school division superintendents and school division supervisors.

The objectives of the training programme were to:

- Explore the role of today's teacher and how it relates to use of technology in the classroom.
- Orient the project participants on the project concept – its objectives, scope and coverage, expected outputs and different project components.
- Discuss the pilot project, the roles of the participants, expectations, and support network.
- Explore the lesson plans augmented with video material and review how they were developed.
- Develop participants' competencies and skills in utilizing ICT tools and conducting project activities, namely: using the teachers' manuals; using cell phones to request video packages from the Pearson KnowledgeBox; using the Nokia Mediamaster and video technology to enhance science lessons; enriching student learning with the use of innovative teaching strategies; and project monitoring and evaluation activities.
- Plan for successful project implementation.

In addition to the training programme, the teachers, school heads and other local education officials were also given suggestions and advice on various aspects of text2teach implementation during the regular school visits by the project monitors.

During the project communication was encouraged between the teachers, school heads, and SEAMEO INNOTECH and Nokia (in charge of technical aspects of the project). Through the project help desk, this communication facility served as an avenue for continuing provision of advice and mentoring activities of the project.

Text2teach technology

The text2teach project utilizes a system that integrates digital satellite broadcasting and mobile phone communication to transmit video materials directly to the classroom for use in grade 5 and 6 science subjects.

The video materials are directly transmitted via satellite to the schools, recorded by digital broadcast recording specially provided for this purpose, and used by science teachers to supplement their teaching in the classroom.

Video materials are ordered by the teacher through Short Messaging Service (SMS) on the mobile phone from the KnowledgeBox (KB) Video Library of Pearson Education. The KB is an on-line digital library of multimedia resources that support instructional goals.

The text messages sent by the teachers are converted into ASCII texts to be sent through email to the Nokia media server. Nokia then directly transmits the ordered video clips via satellite to the schools. The video materials are then recorded on the Nokia Mediamaster. This is a digital recording device that enables the viewing of the recorded video materials on the 29-inch television set in the science classroom.

Using text2teach in the classroom

During the project, participating teachers followed these steps whenever they gave a lesson:

Step 1: The teacher refers to a prepared lesson plan to check which video will be needed for a particular science lesson.

Step 2: The teacher orders the recommended video clip using a provided Nokia mobile phone. The teacher sends an order via SMS, specifying the code of the selected video clip.

Step 3: The text is received through an order processing system facilitated by Globe, Chikka and Dream Broadcasting. Orders for the day are compiled and transmitted via satellite the next morning. The school's Nokia 260S Mediamaster, also provided under the project, records the video clip as it is broadcast.

Step 4: The material is stored in the Mediamaster digital recording device, ready for viewing.

Step 5: The teacher previews the video material and prepares for the scheduled lesson using the prepared lesson plan.

Step 6: On the day of the scheduled science lesson, the teacher teaches the prepared lesson using the video material to demonstrate the science concepts, and engages the students in an interactive discussion of the topic using the techniques recommended by the text2teach programme.

Results and impact of the project

Following the implementation of the text2teach pilot project, SEAMEO INNOTECH examined and analysed the Teachers' Lesson Logs (3,256 logs) produced by the teachers at the three pilot sites.

Analysis of the teachers' logs indicated that:

- Preparation by teachers (for teaching a lesson) entailed previewing the video, studying the lesson plan, planning out the lesson and preparing the learning materials and teaching aids to be used. Adding more activities and reading texts required more time, as did research on the topics for discussion.

- Teachers needed substantial time to prepare for the lessons. The time spent for each preparation depended on the level of difficulty of the lesson. Time for lesson preparation varied widely. A third of the teachers (30.5 percent) required between 2 and 2.5 hours to prepare, while 27.9 percent

needed less than two hours. A significant number of teachers (22.6 percent) required five hours or more of lesson preparation.

- All teachers took the time to view the videos before class. The majority of teachers previewed the video many times. In Batangas, 91.5 percent of teachers previewed the video at least three times, while in Quezon City 73.6 percent of teachers did so, and in Cotabato City 64.4 percent did so. Teachers generally previewed the video more than once because they wanted to master the concepts to be learned by their pupils and be well prepared in presenting the lessons. The teachers also wanted to be prepared in case they needed to do additional research on the topic before the class.

- To enrich teaching, the teachers used a range of teaching materials. In most (92.2 percent) of classes, teachers prepared materials for the lesson. They used teaching aids such as charts, pictures, activity cards and flashcards.

- In around half of the classes (46 percent), the teachers felt that the materials they had and the KB videos were enough to enable them to teach the lesson well. For the other 50 percent of classes, teachers felt that they needed additional materials. Teachers used various reference materials to substantiate the science lesson to be taught, including science textbooks and reference books, encyclopaedia (in print and CD-ROM formats), Internet resources, VHS tapes magazines, atlas, maps, puzzles, pictures, dictionaries, laboratory materials, models, pamphlets, graphs and charts, activity cards, drawing materials, posters, news clippings, and BEC lesson plans.

- To emphasize some processes being demonstrated in the video, to become more acquainted with the science concepts, and to allow students to take note of key words shown on screen, teachers chose to make "video pauses" (75.3%) and "video replays" (66.9%). When teachers repeatedly paused or replayed the video, and the video was not completed in one session, they would then continue the lesson in the next class meeting.

- The use of videos in class had the advantage of enabling students to have repeated exposure to the subject matter. Because the video materials are digitally recorded, teachers and students could pause the video and playback (repeat) to gain a better understanding of the subject matter. Students were also able to watch the video again in their spare time. The students took particular pride in having learned how to operate the video equipment.

- Most teachers (95 percent) agreed that the lesson plans developed under the text2teach programme were easy for them to follow and implement. In addition, they commented that the lesson plans significantly eased out their burden because with ready-made lesson plans they had more time to prepare for a particular lesson. Teachers also found that the lesson plans contributed to meaningful learning and enhancement of attitude and behaviour toward science. Teachers observed that the pupils became more enthusiastic about the lesson and more participative in class. The teachers also perceived that the lessons resulted in the desired student knowledge, attitude and behaviour in most classes.

- Teachers in all of the participating schools found that there were increases in teacher-student, student-student and student-video interactions in over 96 percent of their classes. In 72.1 percent of the lessons taught, teachers "strongly agreed" that the "video was interesting". The teachers

also noted that the videos and lesson plans were useful tools which significantly reduced the difficulties of teaching science. These results indicate that utilizing video in these science classes was effective in creating a more dynamic classroom environment and enhancing science learning and teaching.

- With regard to the manipulation of the ICT tools, the teachers were confident and knew how to operate the tools in almost all (95.6 percent) of their classes. This indicated that the design of the equipment was user-friendly and that the training of the teachers had been effective.

- Teachers were able to use SMS with ease and confidence and had enough knowledge to assist their co-teachers to address problems. The project thereby assisted teachers in finding solutions to their problems and in sharing experiences. As a result of the project, teachers also engaged in peer to peer demo-teaching and critiquing.

- Many of the teachers affirmed the positive impact that the project had on their teaching of science and on the pupils' performance in science. They were also proud to be associated with the project and believed that the project nurtured camaraderie among the teachers, within the school and between schools. The project also had unforeseen benefits. For example, when the text2teach project's utilization of new technologies in science teaching became known in the community, this enabled the schools to be successful in requesting funding from the community for various activities.

Another outcome of the project was that even teachers who were not formally trained under the project learned how to use the technology and to implement the lesson plans, with the encouragement and support of their formally trained colleagues and school principals.

Project monitors (Division Supervisors for Science) conducted classroom observations to identify how the teachers put into practice what they learned in the text2teach training sessions. The monitors carefully noted the teachers' behaviour and activities.

With regard to the preparation made by the teachers for their lessons, it was observed that:

- Teachers usually ordered the KnowledgeBox (KB) videos five or more days before the scheduled text2teach lesson that matched the video, and prepared additional instructional materials and teaching aids to enrich their teaching of the science concepts.

- Teachers generally followed the text2teach guidelines given in the training workshop. They all knew how and when to cue the video to start and pause during playback. They used the prescribed video and watched the complete video clip. They gave repeated viewings of the video to their pupils, most commonly, two or three times. The number of video viewings or pauses was dependent on either the teacher or the ability of pupils to comprehend the lessons. The teachers also followed guidelines for giving directions and for group work.

- In implementing the lesson plans, the teachers usually followed the text2teach lesson plan as it was written but also incorporated some changes, the most common of which were video pauses and replays. Other modifications included rephrasing of questions, addition of questions that would lead to higher order thinking skills and changing of grouping strategies. These changes were performed to highlight certain points and familiarize the pupils with the content and

language used in the video. The teachers evaluated their pupils by giving them a test or class exercise. All teachers gave their students additional work to be accomplished at home or outside the classroom.

- The lesson plans involved interesting activities designed to make the lesson more entertaining and enriching for the pupils. The activities included role-playing, experiments, demonstrations, guessing games, group activities and singing. While some teachers were content to remain within the recommended activities in the lesson plan, many teachers conducted additional activities. The teachers were able to motivate their pupils to actively involve themselves in various classroom activities.

- In all three schools, teachers reported reduced absenteeism as a result of the text2teach classes. In the first quarter of the school year, project teachers and school heads began to notice that fewer students would miss class. These observations were supported by school records which indicated a reduction in absenteeism since the text2teach project was implemented.

The project monitors noted that as a result of the text2teach project, students gained science knowledge more effectively and became more active in class discussions. During visits by the monitoring staff, some students were asked how they liked the text2teach classes, and if there were any changes in the classroom environment. Some of the findings are as listed below:

- All students agreed that science was much more interesting with the use of videos and they were beginning to enjoy science more because of the video clips they were watching. The interviews confirmed what the teachers and school heads had observed: students were more interested in attending classes because text2teach helped to make the learning of science fun.

- One student summed up the effect of text2teach on her motivation to come to class by saying, "I no longer want to miss my science classes. I find it exciting to watch the video clips, and I enjoy science more now."

The teachers were also asked for their feedback. Overall, the teachers were delighted to have had a chance to participate in the project, especially as it allowed them to experience utilizing technologies in the teaching of science. Regarding the effect of the project in increasing student motivation to learn, some of the teachers responded as follows:

- "Students enjoy the multimedia content being presented to them and cannot wait for their text2teach classes".
- "It is the fascination with seeing things that they have never seen before that motivates them to come to class and learn – they do not want to miss the video for that day".

Summary of benefits of the text2teach project:

- Reduced absenteeism among the pupils for their science classes.
- Students found science learning interesting and fun.
- Teachers organized themselves into discussion groups to share learning experiences, problems and solutions.
- Some parents became more interested and visited the school to observe text2teach classes.

Issues and recommendations

Some of the problems encountered during the project are outlined below:

- Students sometimes had difficulty in comprehending the English language used in the video. The narration, in American English, proved difficult for the students to understand. Words and accents were unfamiliar to most of the learners. The narrations were also sometimes too fast for students to follow. Teachers tried to explain unfamiliar words to the pupils. Teachers often felt, however, that this provided a good opportunity for pupils to improve their English communication skills.

- Some videos seemed too long for the class time allotment. Other videos were only five minutes long and were considered too short.

- Although it was generally easy to manipulate the equipment, teachers encountered some technical glitches such as: failure to receive the video clips that were ordered; incomplete and defective downloading of video; and technical problems with the Mediamaster. These problems often arose from a poor satellite signal, unfavourable weather conditions and power fluctuations.

- Foreign plants, animals and other materials presented in the videos were unfamiliar to students. Exposure to the videos, however, enabled the students to learn about a range of new materials and objects.

Despite its general success, there is still much room for improvement in the project. The following recommendations were made to address some of the concerns encountered during project implementation:

- Clearer narration in English or narration in local languages.
  Some students, and even teachers, thought the American accent used by narrators was difficult to understand.

- Videos should be an appropriate length for the class.
  Teachers and students felt that a five-minute video was sometimes too short to explain the scientific concepts introduced in the lesson. On the other hand, some videos were too long.

- Localization of the video content.
  Participating teachers and project monitors recommended development and production of videos that are more suitable for Filipino pupils. Videos could be made using local items (eg. native animals, plants, and scientific events) in order to give students a local perspective about science.

- Inclusion of more activities.
  More classroom activities were seen to benefit students, as the hands-on work would make them better understand the scientific concepts introduced in each lesson.

- Videos for other subjects.
  Teachers and students felt that all lessons should have videos to aid in better understanding of the lessons.

- Expansion of the text2teach project to other schools and grade levels.
  Teachers, parents, principals and LGUs felt that the Project was so beneficial that a majority of schools could benefit from it.

- Deployment of more Mediamasters especially in schools with large numbers of students.
  There were a number of schools that had so many students that it was logistically difficult to schedule each group to view videos for their science class. It was therefore suggested that this problem could be solved by the delivery of additional Mediamaster units, as it would allow classes to view the videos at different classrooms.

- Use text2teach technology not only in a formal education setting, but also in community learning centres. Relevant educational digital content could be created and educational videos could cover subjects ranging from Filipino history to AIDS/HIV awareness lessons.

Future Possibilities

In 2004, the ELSA text2teach project was initiated which addressed some of the recommendations made following the pilot text2teach project.

ELSA text2teach, under the USAID Education Quality and Access for Learning and Livelihood Skills (EQuALLS) Programme produced videos that were more suitable for Filipino learners. The narrations were simplified, made clearer and spoken at a pace Filipino students could understand. The materials also used local scenes and situations that both the teachers and students could relate with. The subject matter of the audio/video materials expanded to include not only science but also mathematics and English.

ELSA text2teach is on-going and has reached out to more than 100,000 students since 2004 when the project was first implemented in 122 schools in the Cotabato, South Cotabato, and the Autonomous Region of Muslim Mindanao (ARMM) including Maguindanao and Sharif Kabunsuan. It has trained 720 teachers and oriented school heads from the 122 schools to implement the project. The project has produced an additional 129 video and 144 audio packages to illustrate to learners important concepts in science, mathematics and English.

SEAMEO INNOTECH's experience in text2teach indeed bears witness to the boundless possibilities of integrating technology as an important component of teaching and learning. However, the recommended approach to integrating technology must focus on comprehensive planning that involves all of the stakeholders, foremost of which would be the teachers. Teachers must have a reason to use the technology -- it is important to promote teacher-development of projects or plans where teachers can apply technology to meet particular instructional and student needs identified within such projects and plans. Teacher training, therefore, is very critical. Time and money must be set aside for formal training classes as well as opportunities for teachers to discuss discoveries or problems with their colleagues. There is need for teacher involvement to produce commitment to sustain integration of technology into teaching.

Another important consideration is to make sure that it is the curricula that drive the technology, and not the other way around. It is not prudent to just accept materials or hardware that do not fit with the curriculum and the school's technology plan. Technology decisions must be based on curriculum and instructional needs. The approach to implement technology emphasizes instructional and student needs first, and then through planning, integrates technology in ways that enhance and extend

instructional and learning opportunities. It is also important to remember that acquiring technology is not a matter of plugging in a computer – it will affect all aspects of the school culture, from architecture to interpersonal relations.

Lastly, it is also important to remember that technology requires administrative and community support and involvement that are critical to its successful integration in education. Studies constantly show that the commitment and interest of teachers and school heads is the most critical factor for successful implementation of any school innovation, especially technology.

In a survey of 100 schools that benefited from the computerization programme implemented by the Philippine Department of Education, it was found that the student to computer ratio averages at 267 students per computer.

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8. Training secondary teachers in rural Bangladesh using mobile technology

Sarah Lucas Pouezevara
Rubina Khan [44]

Introduction

This case study documents the results of a study which examined the potential for using mobile communications technology in the ongoing professional development of secondary teachers in rural Bangladesh. The case study also examines the issues encountered and the lessons learned while using mobile technology in teacher education.

Background

In 2006 and 2007, the Asian Development Bank (ADB) funded a 21-month regional technical assistance (RETA) study in four countries: Bangladesh, Nepal, Mongolia, and Samoa. The RETA study researched approaches to using ICT in education, for improvements in teaching and learning that are not only successful but also feasible and sustainable given the region's development challenges.

Titled the "Innovative Information and Communication Technology in Education and its Potential for Reducing Poverty in Asia and the Pacific Region" project, the study commenced in April 2006 and was implemented in the four countries by RTI International[45] in partnership with iEARN-USA.

The RETA study built on existing projects in each of the four participating countries. The Bangladesh study was part of the e-Teacher Training component, and complemented the existing ADB-funded Teaching Quality Improvement in Secondary Education Project (TQI-SEP), which has as one of its objectives: to provide in-service professional development at least once during the project period to all serving teachers working in secondary schools recognized by the Ministry of Education (MoE).

This Continuous Professional Development (CPD) component of the TQI-SEP provides two-week, face-to-face, subject-based training programmes that require participants to go to one of the government teacher training colleges (TTCs) for the duration of the training (residential training). Three "Outreach Centres", serving rural and remote areas, are planned in order to be the link between remote schools and training colleges, but they will still require teachers to take leave from their schools to attend training. The TQI-SEP staff recognize, however, that for many teachers it is difficult to leave their home, family, school, and other obligations for an extended period. The staff were therefore looking for alternative methods of delivering CPD courses.

[44] This summary case study was adapted by UNESCO, with permission, from the full research report: Pouezevara, Sarah and Rubina Khan. 2007. *Learning communities enabled by mobile technology: A case study of school-based, in-service secondary teacher training in rural Bangladesh.* RTI International. ADB TA6278-REG. Research Triangle Park.

[45] RTI International is a trade name of Research Triangle Institute.

Using Mobile Technology in Teacher Training in Bangladesh

The purpose of the study was to explore innovative strategies, including distance learning and the application of ICT, to serve educators in remote areas, in order to inform TQI-SEP of the feasibility of using these strategies to scale up access to quality in-service training.

Two subject trainers, a training co-ordinator, and a cluster of 10 schools were equipped with "smartphones"[46] (with video, speakerphone, and three-way calling capabilities). These smartphones were to be used by 20 Bangla and mathematics teachers in 10 schools of the Barisal region in southern Bangladesh. The phones were intended primarily to enhance communication, motivation, and multimedia delivery.

The study sought to examine the use of mobile connectivity in support of distance education (in a country with high population density and wide mobile communications coverage) and determine whether:

- It is an effective mode for teacher training and improvement in classroom practice.
- It is a suitable mode to reach rural and remote teachers, including women and disadvantaged groups.
- It presents other benefits in terms of education administration (including student assessment and costs) and pedagogy.

The study also sought to determine the costs of this model, and the features of mobile phones that would be most useful as a support to distance learning.

The study builds on existing experiences in "mobile learning"[47] from other countries but this study was not strictly a "mobile learning" project since it did not use mobile technology for the delivery of the course content. Instead, this project used phone communication as a support for traditional distance learning with print-based self learning materials and active learning techniques.

In this study, the existing TQI-SEP training curriculum was revised from a two-week, face-to-face workshop to a six-week distance-mode training course based on printed materials and practical application of training content with peers, incorporating activities that utilize the features of the mobile phone.

Each week in the six-week course consisted of two instructional units. Each unit contained the following elements and tasks:

- Trainee receives an introductory set of discussion questions and supplemental readings.
- Trainee reviews the readings, reflects on questions, and plans peer group session.
- Trainee leads a peer group session during which discussion and role-play take place. The group is asked to conclude by stating the two most important aspects of the lesson, and the trainee makes notes in a journal.
- During this time there is unscheduled, informal contact with the trainer using the mobile phone, both to verify that activities are being completed and to ask questions as necessary.
- A conference call is held among trainee, trainer, and colleagues to discuss the main questions and outcomes of peer group sessions.

[46] A smartphone is defined as a mobile cellular telephone that has with many of the same functions as a handheld computer, including e-mail, photo and video capture, document viewing, and web-browsing.

[47] Mobile learning is a term used to describe learning through portable, handheld, electronic devices, generally with wireless communications ca pabilities. It is not limited to mobile phones, however, since it can also refer to the use of personal digital assistants, handheld computers, or mobile gaming devices. It generally implies that all course content is delivered through the mobile device.

Therefore, each week there were four peer review sessions and two telephone conferences. Unit summaries, examples, and other reference texts are included throughout the manual. The curriculum did not differ substantially from the face-to-face course, which also uses peer group discussion; the main work of the instructional designers was to split the course appropriately into 6 modules and 12 units, with opportunities for conference calling among the participants. The design included conference calls between schools and with the trainer.

In order to maintain a focus on training quality and reduce dependency on the technology (and ultimately failure of the project if the technology failed), a blended approach was adopted. A combination of print-based learning materials; a face-to-face orientation workshop; synchronous, on-demand voice communication; asynchronous Short Messaging Service (SMS) text messaging; video and photos sharing; and school-based group discussion activities were all incorporated into the design of the training programme. The adaptation of the curriculum involved contracting the services of a professional instructional designer and SMEs in Bangla and mathematics instruction.

During the study preparation phase, some preliminary research into costs and availability of different types of mobile phones was carried out within Bangladesh. Further research was done by reading reviews over the Internet and asking for recommendations from other experienced individuals, including the local phone service provider. This proved to be a very difficult aspect of the planning process because it was impossible to test the features on a phone that was actually connected to local service, or even charged. In considering the instructional design of the project and the purposes of incorporating mobile technology, the features of mobile phones were reviewed to determine those that could best facilitate learning and communication.

These were seen to be:

- voice, including audio conference calling between multiple sites
- SMS
- video and photo capture
- transfer of photo and video through Multimedia Messaging Service (MMS)[48]

Since a printed learning package would be provided to the trainee teachers, it was not seen as necessary to have features for printing from the phone, nor were e-mail and Internet connectivity seen as critical in this study.[49] The final phone model chosen (Sony Ericsson P990i) had a large screen size and a full alphabetical keyboard to facilitate writing text messages.

The study procured the following equipment:

- One laptop computer (for use by the training co-ordinator and subject teachers for administrative purposes, to create electronic materials to send to the teachers, to send messages, and to browse the Internet for learning resources)
- 13 mobile handsets (one for each of 10 participating schools, with two teachers undergoing training from each school, and one for each subject teacher and the training co-ordinator)
- Phone service for 13 phones for 2 months from the Grameen phone network.

A three-day orientation and training workshop was held at the Barisal TTC from 6 to 8 June, to acquaint trainee teachers, head teachers, principals, trainers, and training co-ordinators (TC) to the new

[48] Similar to SMS (text messages), MMS uses multimedia to allow telephones to send audio and video clips from one to another.
[49] These are certainly features that can be exploited in the future, particularly for the teacher trainers.

mobile-phone-supported in-service teacher training materials. The workshop also aimed to provide training in the use of smartphones, orient participants to the various features of the smartphone and provide opportunities for simulation, group discussion and asking of questions.

After the orientation workshop, the participants returned to their schools and the six-week training programme was conducted from June 15 to July 30 2007. The trainee teachers completed each module by following the training manual. The weekly teleconferences had been scheduled during the orientation workshop, but the trainees were responsible, with the support of their head teachers, for managing their own learning and scheduling the peer discussion sessions. All trainees finished their modules within the intended six-week period.

A monitoring visit to Barisal was conducted by members of the study team from 8 to 10 June (about halfway through the course), during which time the team visited three study schools in Golachipa and Potuakhali, Sadar.

The visit achieved the following activities in support of the study:

- conducting discussions with the TTC co-ordinator, trainers, head teachers, teacher trainees, and the DEO, in order to verify the progress of the distance training and identify any problems
- gathering views about the learning materials and technology, as well as suggestions for improvement
- observing audio conferencing sessions
- reviewing log sheets and journal notes of trainees
- reaching an agreement with the TC co-ordinator and trainers about practical arrangements for the wrap up and evaluation workshop scheduled for the end of the training period.

It was observed at this time that the phone model chosen was much too complicated for the needs and abilities of the users, and it was also not fully compatible with the Grameen phone network. Nevertheless, the participants reported being able to cope with these constraints, and were pleased with the process overall. The DEO also reported having done some monitoring of the program, which resulted in overall positive feedback from the participants.

A closing and equipment handover workshop was held in Barisal on 30 and 31 July. The agenda covered the following items:

- Post-test administration (standard, content-related questions related to general teaching and learning strategies and subject-specific questions)
- Simultaneous group debriefing sessions and presentations in plenary
- Handover of phones
- Administration of evaluation questionnaires (process-related, prepared for the study)
- Presentation of video clips taken by trainees in their classrooms, using the phones
- Structured interviews with trainees/trainers/TTC staff
- Certificate award ceremony

Eighteen out of 20 trainee teachers attended, as well as 10 head teachers, four trainers, four TQI-SEP staff, two study consultants, the TTC Barisal principal and training co-ordinator, the Barisal DEO, and two *Upazila* Education Officers from Patuakhali and Galachipa.

During simultaneous group debriefing sessions, math trainees, Bangla trainees, and head teachers formed three separate groups and discussed assigned questions. They were asked to comment, both individually and as a group, on the strengths and weaknesses of the technology-based training programme (e.g. on the learning materials and technology), to comment on any observable changes, and to make recommendations for future implementation of the distance learning training. Head teachers, were asked to identify strengths and weaknesses of the programme and to provide suggestions about their role in the programme, highlight its impact, and point out changes in classroom practice (if any). In each group there was a note-taker and a leader to organize and present the group work at the plenary session the next day.

Feedback and Issues

Trainees, trainers, and administrators provided feedback and comments on the materials, curriculum, training in the use of the ICT tools, and other areas. The main points raised are summarized below:

- Training materials

The distance learning package was generally perceived to be clear and adequate. There were minor flaws, however, such as lack of additional examples, subject specific examples, lack of answers to questions, and spelling mistakes. Some participants mentioned that there could have been more direction and clarity on specifically what to do and when (this is a common concern in distance learning programmes, where learners are expected to be much more self-directed than in the traditional classroom).

- Curriculum

The format of the curriculum enhanced interaction between teachers, extended the training opportunity to more teachers in the school, and fostered collegiality between trainers and trainees. In particular, trainee teachers enjoyed the flexibility and independent nature of this new modality. The journals indicate that the main points of the lessons were clear from the printed materials, and the group discussion allowed teachers to debate about the ideas and their application. The journals also showed that trainees were able to keep to the expected schedule, usually carrying out activities six days per week, in some cases even seven. Often, the seventh day was used to review the training process among colleagues in the school and other schools.

- Integration of phones into the training curriculum

In the original design of the curriculum, the conference calls with trainees and trainers were to take place among several different groups at different schools. But because the audio conferencing feature did not work well (the sound quality was poor and the loudspeakers did not function properly), it turned out that the trainer called trainees individually or as a small group from one school on a rotational basis, rather than having conference calls with several schools. During these calls, they would go through the discussion questions for each session, do some problem solving, and answer specific questions from the trainees. One difficulty reported was that the phones were often kept with the head teacher, so trainees were not always able to use the phone when they were needed. This was mainly for security reasons, so that the phones could be locked up after school hours. This is the time, however, when trainees most wanted to reach the trainers, but could not. They all highly recommended that in future it would be best to have one phone per person, rather than sharing one phone betwen two trainees. Analysis of the journals and log sheets shows that the main purpose of the phone calls were:

- Trainee would inform trainer of progress, reporting on outcomes of readings and discussions.
- Trainees would receive encouragement and motivation to apply techniques from the lessons.
- Trainer would call and ask questions, verify lesson comprehension.

- Trainer would answer questions that trainees would have compiled in their group discussion beforehand.
- Trainee would call when they had problems or didn't understand.
- Trainer would resolve disagreements that came up between peers during discussions.
- Trainees and trainers would exchange ideas for school improvement.

- The technology

Although the participants were not able to use all the smartphone features for training purposes, they were aware of its potential and benefited immensely by talking on a one-to-one basis with their trainer and with other teachers. As mentioned above, conference calling worked, but the sound quality diminished so much that the activity was abandoned. There were some problems with SMS due to the language barrier, since messages could only be written in English (or using the Latin alphabet). Some of the teachers were not comfortable with this alphabet. MMS did not work. Most likely because the network could only transfer clips up to 10 seconds long, but the trainees created clips that were several minutes long.

It had been hoped that because all of the participants were experienced phone users and mobile phone owners, they would be able to adapt to and easily integrate the smartphone and it's more advanced features into the training experience. This did not turn out to be the case, however, since the users did not readily use the advanced features of the phone, and they abandoned experimentation quickly, after the first failed attempts. Therefore, much more time and training will be required for the effective use of the smartphones in distance training.

This is why it is important to concentrate training and advanced didactic use of the phones at the level of the trainers, since the trainees do not have time to effectively learn all of the phone features, nor would it be desirable to spend time training them for these limited purposes (unless they will be able to access this type of technology in the future).

- Attitudes towards the training

Regardless of the technology, an important finding of this study is that teachers are highly in favour of CPD through distance learning because it allowed them to remain in the schools and with families during the training period, and the training content could be immediately applied. The main advantages of the distance-mode training compared to the face-to-face mode:

- Participation in the training programme without disruption to their students, their school, or their family life.
- Allows the trainee to immediately apply the concepts in the classroom.
- Saves time (the trainee's) and money (the training provider's).
- Requires shared responsibility between trainer and trainee (i.e., can not be a passive learning experience since they must prepare for conferences).

Further research is required to know the long-term effectiveness of the training, the benefit of the technology to the distance learning environment, and the full didactic potential of the phone features. The following could be starting points for further research:

- Visiting the control and implementation trainees who participated in this study to observe their classroom teaching practice and compare the extent to which the trainees of each learning method are implementing what they had learned.
- Compare the study schools (using the same equipment and curriculum) to a set of control schools that would use only the print-based learning materials in order to isolate the added value of the technology to the distance learning mode.

- Document the usability of the phones and phone features over a longer period of time, to determine the value of different features (synchronous and asynchronous voice, video, text) for the learning experience, and possibly recommend a particular model of phone for the intended purposes.

Added Value of Technology

From the feedback gathered from trainees, trainers, and administrators (data was collected using questionnaires, interviews, focus groups, journals, and log sheets kept by the trainees) the ICT-enhanced training course was considered to be a success.

Trainers and trainees alike have were very receptive to the idea of training at a distance with support of smartphones, and adapted easily to the constraints encountered such as the lack of adequate training to use technology, occasional technical failure of phones, rigid conference timing and insufficient number of phones.

Participants noted benefits of using this new modality of training for professional development, including:

- Convenience – easy access to training from their workplace, and not being separated from their families or having to take leave from school. Participants strongly prefer training that allows them to remain in their homes and classrooms.
- Opportunities for ongoing communication with the trainer and fellow trainees at other schools.
- It is a modern and exciting approach-, as opposed to the traditional approach, so was more interesting to trainee-teachers.
- Increased face-to-face interaction between teachers and school administrators at the school level, due to the school-based nature of the professional development training course.
- Fostering of collegiality due to the need to work together and provide feedback to one another.
- Participating trainees have discovered a learning community within their own school, and have realized that they can learn through group discussion and self-directed methods.

The experience has generated interest and enthusiasm on the part of participating teachers, other subject teachers, and even neighbouring schools, who enquire about the process and use of new technology.

The trainees, when compared with a control group of trainees who completed the face-to-face training at the same time, demonstrated equivalent content-knowledge gains based on pre- and post-training scores. Head teachers also report that they have observed new teaching methods being applied in the schools, indicating that the distance-mode training is as effective as the face-to-face mode for improving knowledge and skills.

There is reason to believe that the training concepts will be more effectively put into practice among the distance-education trainees (compared to the face-to-face trainees who were trained away from their schools) since the distance-education trainees were trained at their schools so could immediately apply and experiment with the techniques that they are learning, rather than waiting until after the training period to do so. Follow up research would help to confirm that hypothesis.

The mobile technology project has helped to achieve the TQI-SEP objective of strengthening in-service teacher training by providing a solution for reaching the large number of untrained teachers through in-service training. The project also contributed to the improvement of the existing professional

development training materials by providing an example of how the existing materials could be adapted to distance training, while making improvements at the same time. The project also enables female teachers to participate in training courses more readily because they are not required to leave their homes and families for a two-week, face-to-face training course.

The training programme was considered particularly successful because of the distance mode, and the interactive design of the school-based training program. However, the precise added value of the mobile communications technology is two-fold. First, it gives the trainers and training providers confidence that the trainees will complete the training program effectively, because they have a way of providing regular follow-up and ensuring that the trainees stay on task. Second, the possibility for on-demand communication between trainees and trainers, as well as *among* trainees, helps to keep the trainees motivated and improves content understanding and application through question, answer and debate. Research in distance learning indicates that that feelings of isolation and difficulty with self-motivation can lead to drop out or failure[50] and that 'blended' learning environments which maintain some face-to-face contact are more effective.[51] The mobile phones are clearly a solution to this problem, where phone service is available and affordable.

The advanced features of the technology (i.e., MMS, SMS and photo sharing), though not utilized during this study, should not be too quickly discarded as superfluous. As users (especially trainers) become more familiar with the technology, and if the initial orientation to the technology and processes is improved, then there are still many ways that alternative communication tools, including multimedia, could further optimize the training programme. The emerging theoretical basis for using the phones for supplementary, multimedia prompting is found in 'micro-learning', which suggests that people learn more effectively if information is delivered in small units that are easy to understand and apply.[52] Complementing the complete, and perhaps intimidating, printed-course pack with these small multimedia experiences could help reinforce overall learning outcomes.

Recommendations

Given the ambitious task of TQI-SEP to provide training to all teachers nationwide, it would be worthwhile to consider implementing this experience on a wider scale, keeping in mind that the phone technology should be considered a supplement to traditional distance learning based on pedagogically sound curriculum materials and active learning, and not as the main mode of delivery of course content.
Some considerations for future use of mobile technology are:

- Use a simpler and more low-cost model if more phones would be purchased. Or, consider using the trainees own personal phones by finding a way to provide reimbursement for the cost of the calls that they make.
- Ensure that teachers have access to the phones at all times, including taking responsibility for them after school hours, if phones must be shared. Teachers can plan a schedule (on a school-to-school basis) to share the phones and schedule conference calls.
- Encourage schools to consider financing this type of experience using the Innovation and Development Fund.

[50] Fozdar, Bharat Inder and Lalita Kumar, 2007. Mobile learning and student retention. The International Review of Research in Open and Distance Learning. 8(2).
[51] See, for example, Rovai, A. and Jordan, H. 2004. *Blended learning and Sense of Community: A comparative analysis with traditional and fully online graduate courses.* The International Review of Research in Open and Distance Learning, 5(2).
[52] Habitzel, Mark, Stehno and Prock. 2006. Cited in Fozdar, Bharat Inder and Lalita Kumar, 2007. *Mobile learning and student retention.* The International Review of Research in Open and Distance Learning. 8(2).

- Improve the orientation programme by providing more effective training on the use of the phone features, and developing a trainers' manual that specifically suggests how and when they might use the phones to prompt discussion, provoke reflection, assess progress, etc. Experienced trainers could be called upon to help develop this manual.
- Continue to experiment with the didactic application of different phone features, including preparation of clips of model teaching examples that are very clear and short, or photos of unique teaching aids and other learning materials or classroom configurations, to the extent that smartphones are still available and the network can accommodate MMS.
- Ensure that the trainers take the lead with advanced use of the phone features, so that the trainees can concentrate on the course content and not the use of the technology. For example, trainers could still make use of MMS and SMS features of the phones to send content and instructions to the trainees, even if trainees only respond through traditional person-to-person calls.
- Utilize the laptop more effectively, if possible. The laptop should be linked to the Internet and e-mail in order to correspond with TQI-SEP and other education administrators at the central level.
- This may be possible using the phone as a router to connect through Global System for Mobile Technology (GSM) or Global Packet Radio Service (GPRS) technology[53].

Major factors contributing to the success of the training were:

- The enthusiasm, patience, and resourcefulness of the participating trainees, head teachers, trainers, and training co-ordinators.
- Support and supervision of the teacher training college principal and local education officers.

The trainers and training co-ordinator who participated in this experience should be recognized for the additional expertise that they have gained, and be provided appropriate incentives to continue to develop their skills as distance trainers, mentors, and subject-matter experts (SMEs).

The study f indings and recommendations are more relevant to research in open and distance learning, rather than mobile learning. They contribute to existing research by providing lessons learned concerning:

- The advantage of school-based distance learning for in-service teacher professional development
- The possibility of telephone communication as a support for distance learning (particularly relevant in Bangladesh for the Bangladesh Open University, which enrolls over 200,000 students per year) or other formal learning situations involving a trainer and trainee.
- The feasibility of using advanced mobile phone features in place of desktop computers or other large multimedia projection equipment for delivering additional course content in a distance learning programme.

Although many current case studies in m-learning utilize the mobile phone as the primary means of content delivery, this study does not recommend, at this time and in this context, that smartphones be the only mode of distance learning delivery. The blended mode, combining printed self-study materials and school-based peer group discussions and content application is important, and more suitable to the low-resource context.

It is with this principle in mind that this study has also developed the idea of 'learning communities' enabled by mobile technologies. That is, communities of practice among teachers in the same region or of the same subject matter who meet regularly and share knowledge and practical experiences. This is a concept to be explored further both within Bangladesh and elsewhere.

[53] This is a technology that allows communication between mobile devices and internet service providers. The connection to mobile internet is permanent, but data transfer takes place through radio link.

9. ICT in Education Initiatives in Rural Schools in Mongolia

Carmen Strigel, Lkhagvasuren Ariunaa, Sukhbaatar Enkhjargal [54]

Introduction

This case study documents the results of a study which examined the impact on the quality of education of programmes which sought to train teachers in rural Mongolia to utilize information and communication technologies (ICT) effectively in the classroom. The case study also identifies key issues and makes recommendations for future research and for future ICT in Education initiatives in Mongolia.

Background

With the aim of providing Developing Member Countries with better guidance for using ICT effectively in education, the Asian Development Bank (ADB) funded a 21-month regional technical assistance (RETA) study in four countries: Bangladesh, Nepal, Mongolia, and Samoa. The RETA study researched approaches to using ICT in education, for improvements in teaching and learning that are not only successful but also feasible and sustainable given the region's development challenges.

Titled the "Innovative Information and Communication Technology in Education and its Potential for Reducing Poverty in Asia and the Pacific Region" project, the study commenced in April 2006 and was implemented in the four countries by RTI International[55] in partnership with iEARN-USA.

The RETA study built on existing projects in each of the four participating countries. In Mongolia the study built on two ADB-funded "e-Resource initiatives"[56]: the ICT for Innovating Rural Education in Mongolia (IIREM) project and the Second Education Development Project (SEDP). In this context, the study as such was not an extension or follow-on for either IIREM or SEDP, but focused on strengthening and complementing investments already made, while studying the approaches and lessons learned under the existing initiatives.

Under SEDP, more than 100 schools in rural areas of the country were provided with up to six computers, some also with a printer and related accessories. Basic training in computer set-up, trouble shooting and training in informatics instruction was provided to some of the informatics teachers in those schools.

Under IIREM, 45 schools in rural areas of the country were provided with an equipment package containing at least one laptop, one LCD projector and one digital camera, and were provided with training for subject matter teachers (not informatics) in the use of the equipment, development of electronic teaching materials and basic introduction to integrating ICT into classroom teaching. IIREM also provided a set of Mongolian education software titles for subject matter teaching, professional development and teacher productivity. In cases where no electricity was available, IIREM also provided diesel generators to selected schools.

[54] This summary case study was adapted by UNESCO, with permission, from the full research report: C. Strigel, L. Ariunaa, and S. Enkhjargal 2007. *Where Desert meets Technology: Findings from ICT in Education Initiatives in Rural Schools in Mongolia – Summary of Findings*. RTI International. ADB TA6278-REG. Research Triangle Park.

[55] RTI International is a trade name of Research Triangle Institute.

[56] Initiatives which provide equipment and resources such as computers, digital cameras and other ICT tools, along with electronic teaching materials and training for teachers in how to utilize these tools and materials in the classroom.

Study Implementation

While there have been efforts and studies in the Asia-Pacific region to identify lessons learned regarding the use of ICT in education, no systematic approach to cataloguing drivers of effective ICT integration in classroom teaching had been done. The Mongolia study addressed this by aiming to provide an account of lessons learned, good practices and successful approaches with regard to integrating ICT into education, with specific reference to the IIREM and SEDP teacher education initiatives.

In order to define, however, what a "good" or "successful" approach constituted it was necessary to clarify if there had been any tangible, positive outcomes in terms of education quality. "The teacher" was selected as the unit of assessment, and "teaching quality" was selected as a key aspect of education quality.

The study addressed the following two main research questions:

- Are there differences on indicators of teaching quality in schools that featured an e-Resource initiative compared to schools that did not?
- Do e-Resources address specific needs or challenges of rural and remote schools?

Specifically, the study intended to identify whether the e-Resource initiatives, as they took place, triggered any differences in teaching quality or not. If yes, it would be possible to classify the e-Resource initiatives under investigation, including at least a number of their defining approaches, as having been "successful".

Twelve schools participated in the study, including four schools that had participated in the IIREM project, four schools that had received computer equipment under SEDP and four control schools.

The aim was to compare teacher data from both IIREM and SEDP schools with data from teachers in control schools, and compare the data of participants from IIREM and SEDP schools for differences that may have been caused by the former having been exposed to ICT for a longer period of time and having received substantially more training due to their earlier participation in IIREM.

The study is unique in that it couples indicators of teaching quality with ICT-related indicators in addition to contextual aspects. This was to highlight the myriad of factors that can have an impact on the effectiveness of ICT in Education initiatives. In this sense, the study provides a more comprehensive contextual perspective to ICT integration and its relation to education quality than was formerly available.

Various activities were undertaken as part of the study. These were guided by a site assessment and need analysis, to strengthen and complement IIREM and SEDP inputs. The activities included:

- A one-week intensive training programme for teachers, training managers, and representatives from the Education and Culture Department (ECD)[57] in August 2006.
- Moderate procurement of equipment and software for SEDP schools.[58]
- Two-day, follow-on training interventions at each IIREM and SEDP school in the study, in October 2006.
- A four-day training course for trainers with three-day follow-on regional trainings in April 2007.

[57] Ministry of Education, Culture and Science on regional level.

[58] SEDP schools in the study were provided with the same equipment package that IIREM schools had: one laptop, one LCD projector, one digital camera and some self-study software on desktop applications, such as Internet browser software, word processing software and spreadsheet and presentation software.

The training courses for teachers focused on providing teachers with methodological skills on ICT integration into their classrooms and with their curricula. For training managers[59] and ECD counterparts, the courses focused on issues of pedagogical leadership and organizational integration. SEDP and IIREM school representatives took part in the same study activities.

Following the activities, data collection was conducted in each of the twelve participating schools. The study surveyed and interviewed 57 teachers, 13 training managers, 11 principals and 125 students. In addition, focus groups were conducted with 71 parents, 70 students and 70 teachers.

To answer Research Question 1, the study investigated a number of indicator dimensions of teaching quality, including (a) teacher pedagogical support, (b) teaching practice and evaluation or assessment, (c) teacher efficacy, (d) teacher lesson planning and material production, (e) teacher collaboration, (f) teacher job satisfaction and attendance, and (g) access and use of equipment and materials.

To be able to answer Research Question 2, the study complemented outcomes for Research Question 1 with detailed ICT case studies from the participating schools.

Study Findings

Findings on Research Question 1

Findings by Indicator Dimension

- Teacher Pedagogical Support.

Classroom observations and review of lesson plans and documentation are necessary mechanisms for providing teachers with feedback and pedagogical support. Data analysis shows that the classrooms of teachers in control schools are significantly less likely to be observed by their training managers or principals than classrooms of IIREM and SEDP teachers and, for most of them, observation does not take place more than once a year. Furthermore, control school teachers' lessons plans and other documentation are reviewed considerably less frequently than those of the participating IIREM and SEDP teachers, and for the majority of them less than once a month. The study also found that teachers from all three groups mostly turn to their colleagues for support and guidance on specific challenges or questions they face. Data from this dimension suggests that control school teachers receive considerably less pedagogical support than their peers in schools that participated in e-Resource initiatives.

- Teaching Practice

In order to gain more insight into teaching methodology and instructional practices, teachers were presented with a set of statements, some of which exemplify conventional, teacher-centred teaching methods, others that indicate a more student-centred and constructivist approach. Reviewing responses of teachers across statements indicates that there are no significant differences between teachers who participated in e-Resource initiatives and teachers who did not. These results were conf irmed by responses of training managers. There are certain teaching methods in which frequency of usage considerably varies, however. For example, teachers in schools that participated in e-Resource initiatives are much more likely than their peers from control schools to let their students explain how they have gone about solving a problem. Furthermore, control school teachers require the whole class to repeat sentences that they say first more frequently than their colleagues from other schools.

[59] Deputy principals responsible for pedagogic leadership, teacher performance evaluation and school-based in-service professional development

- Student Assessment

Participating teachers report several ways of using results from student assessments. Least likely among them is using results to prepare the next lesson or to decide about student retention. A great many teachers use results to group students by ability. While differences are not significant between the three groups of teachers, control school teachers use results to a lesser extent for improving their teaching practice. More significantly, however, control school teachers feel less confident about their capacity to utilize a variety of assessment strategies, compared to their counterparts in IIREM and SEDP schools.

- Teacher Evaluation

Qualitative definitions of a "good teacher" by school principals do not differ very much between groups, and neither do training managers' accounts of criteria of teacher performance evaluations. Training managers mainly state "student grades", "getting along well with everyone" and "experience" as the three main criteria playing a role in such evaluations. Teachers in control schools, however, are more likely to state that "seniority" plays a role in teacher performance evaluations than their peers from IIREM and SEDP schools. In addition, teachers from control schools are significantly less satisfied with the procedures of teacher performance evaluation at their school than IIREM or SEDP teachers.

- Teacher Efficacy[60]

As part of the study, teachers rated their efficacy on a validated set of 12 statements. The instrument captured teachers' feedback on three subscales: efficacy in student engagement, efficacy in instructional practices, and efficacy in classroom management. Data analysis shows, that while answers to individual statements may vary between groups, participating teachers have a similar sense, overall, of how well they are able to control certain situations and difficulties in their classrooms and with their students. Therefore, there were no significant differences observed on teacher efficacy between teachers in schools which participated in e-Resource initiatives and teachers who did not.

- Lesson Planning and Material Development.

There are some differences to be observed in the time dedicated to lesson planning between the different groups, with IIREM teachers investing most, and SEDP teachers least of their time per week on this task. Training managers across the three groups estimate a lower level of time investment compared to teachers' estimates. The three groups do not differ significantly on this item. They do differ significantly, however, in the amount of money they spend on the raw materials necessary to develop teaching and learning aids. IIREM and SEDP teachers spend about 30% less per month than control school teachers on items such as cardboard, paper, colours, etc. For selected control school teachers, the amount they spend may be up to a seventh of their monthly salaries. As was expected, given their participation in the project, there are also significant differences in the time teachers spend on developing electronic teaching and learning materials. Teachers who participated in e-Resource initiatives are much more likely to spend time in developing electronic teaching and learning resources than those that did not. Comparing IIREM to SEDP teachers in this regard did not yield any considerable differences.

- Teacher Collaboration.

Control school teachers on average spend less time working with other teachers compared to teachers who participated in e-Resource initiatives. When they do, they prefer to work on issues of lesson planning

[60] Teacher Efficacy in this context is understood as a teachers' sense of ability to control certain situations and difficulties in their classrooms and with their students, that is, function as instructional leaders.

and school events, and comparatively little on issues of teaching and learning material development. Most notably, it is significantly less common for teachers from control groups to exchange materials with each other, than teachers who participated in e-Resource initiatives. In addition, teachers who participated in these initiatives have more exchange with other schools. More than a third of control school teachers have this chance only once a year or less.

- Teacher Job Satisfaction and Attendance.

Data analysis shows that there is a significant difference between teachers who participated in e-Resource initiatives and those who did not in terms of their satisfaction with their jobs. Teachers who were part of the e-Resource initiatives are more likely to agree to statements that exemplify satisfaction with their jobs than teachers in schools that were not part of e-Resource initiatives. While SEDP teachers show the highest mean score on this dimension, there were no significant differences between the IIREM and the SEDP group to be observed. Although there were hardly any differences in teachers' self-assessment of the quality of their attendance, there was some difference in their training managers' evaluation. Most training managers from control schools rated their teacher's attendance worse than training managers from IIREM and SEDP schools assessed that of their teachers.

- Teacher access and use of equipment and materials.

Teachers in all three school groups are able to draw on resources such as teachers' guides and student textbooks or books in their libraries. The general availability of student textbooks and teachers' guides seems to be appropriate across all three groups of teachers. Many of the participating teachers report problems, however, in that their students do not have their textbooks in time for the start of the school year. Principals confirmed this challenge, outlining a number of reasons and highlighting their schools' remote locations and textbook affordability for parents as key among them. In addition, a big part of the books and science models available in all schools are not usable for teachers because they are damaged, too old, or not relevant to the curriculum.

IIREM teachers make most use of the library books, cassette recorders, televisions, computers, and education software for lesson planning, professional development, or teaching. Control schools, according to their teachers, are less well equipped, not only in terms of new media, such as computers, but also in terms of older technology, such as radio, cassette recorders, and television, as well as science models. For several of these items, however, their training managers' replies did not confirm the lack or shortage reported by their teachers.

Furthermore, teachers in control schools tend to make less use of these tools (when known to be available) for educational purposes than their counterparts from schools that participated in e-Resource Initiatives. Triangulating results from teachers with that of their training managers and students confirms this pattern. Comparing usage between IIREM and SEDP teachers, data suggest that the latter make considerably less use of most of the items under discussion, except for the use of the digital camera to develop teaching and learning materials.

Conclusion – Research Question 1

In regard to Research Question 1, study outcomes indicate that there are indeed differences to be noted on dimensions of teaching quality between schools that participated in the e-Resource initiatives and schools that did not. On some dimensions, teachers from schools that participated in the e-Resource initiatives show more positive results than their peers. This is the case specifically for teacher

collaboration, teacher job satisfaction and teacher use of equipment and material. On other dimensions no significant differences could be found. These dimensions include teaching practice, teacher efficacy and teacher attendance. On none of the dimensions, however, did teachers from control schools show significantly more positive results. Our research suggests, therefore, that the e-Resource initiatives under investigation have had a positive effect on teaching quality, as assessed by this study.

Findings from ICT case studies

Outcomes for Research Question 1 suggest that the e-Resource initiatives under investigation have been successful in advancing critical aspects of teaching quality. To better understand the context in which these changes have taken place, it is important to have a clear understanding of ICT-related aspects on school level in these schools. The study therefore conducted detailed case studies in each of the participating schools to gain insight into the contextual factors that may play a role for the effective integration of ICT.

In this section, summary data from the case studies in the participating schools is presented along with key dimensions of ICT integration at the school level, such as ICT infrastructure, access to ICT, purpose of use of computers, ICT-related policies and strategies on school level, access to resources and guidance on ICT and attitude to ICT.

Findings along ICT-related aspects:

- Infrastructure and ICT equipment

Electricity is a key challenge among all of the schools that are not located in the *aimag*[61] centre. *Soum*[62] schools have electricity only on an hourly basis, mostly from diesel generators, but also use wind and solar power. Electricity in most *soum* schools is available only outside school hours, in the evening.

Principals in *soum* control schools[63] report a larger number of functioning computers, on average, than IIREM or SEDP principals. At the same time, computers in those schools are more likely to run under older operating systems. None of the schools mentioned utilizing any open source applications and the operating system and desktop applications in use are all in English and Arabic script, not in Cyrillic script.[64]

The majority of schools have most of their computers situated in a computer lab, and also have at least one printer. There are more control schools in the sample that have a more "traditional" computer room set up, organizing computers in rows, facing the front. All IIREM schools have their computers organized along the wall, with the screens facing the room.

Except for one SEDP school, none of the *soum* schools has Internet access. In addition to the number of functioning computers, control schools are also better equipped when it comes to overhead projectors. Otherwise, however, it is clearly participation in e-Resource initiatives that allows IIREM and SEDP schools to report laptops, LCD projectors, and digital cameras in their inventory. IIREM schools are in general better equipped and feature more fax, scanner, and copy machines than participating SEDP and control schools.

[61] *Aimag* – second biggest administrative unit of Mongolia after capital city Ulaanbaatar, similar to a "province".
[62] *Soum* – third biggest administrative unit of Mongolia, similar to a "district".
[63] Excluding the generally larger and better equipped *aimag* centre schools.
[64] Mongolian (Khalkha Mongolian) is the dominant national language of Mongolia and its dominant script is Cyrillic orthography.

- Access to ICT tools by teachers, trainers administrators and students

IIREM teachers mainly report using the school laptop,[65] whereas SEDP teachers also make use of the computers in the computer lab (much more than their IIREM counterparts). Most responding control school teachers indicated that they don't make use of computers at all. Those that do, tend to use a computer from the school administration. Some teachers also have a computer at home.

Training managers in IIREM schools mostly use the school laptop, whereas training managers in SEDP schools also use the computer lab and the computers that are available to the school administration. Training managers in control schools share a computer with other school administrators. Most principals have a computer in their office.

A clear majority of students from control schools have never used a computer, whereas the majority of IIREM and SEDP students clearly make use of computers, and do so mostly in the computer lab. It is apparent that more students in schools that participated in e-Resource initiatives report access to computers than students in schools that did not.

- Purpose of ICT use

In general, there are no significant differences between the schools in the purpose for which teachers are using computers. Mainly, computer use is for student and class administration or lesson planning. IIREM teachers are more likely to make use of computers for information research than their peers. Training managers mostly use computers for school administration. Notably, training managers from IIREM and SEDP schools make use of computers for a larger variety of purposes than their control school counterparts. There are no major differences between groups in terms of how principals are using computers: mostly for school administration. Students who report using a computer, mainly tend to do so for their informatics subject.

- ICT-related policies and strategies

There is a significant difference between schools that participated in e-Resource initiatives compared to those that did not in the existence of policies guiding teacher ICT competence. Nearly all of the IIREM and SEDP schools feature such a tool. There are also different approaches to providing incentives for teachers to utilize ICT in their teaching. Control schools tend to provide access to electricity and computers, whereas SEDP and IIREM schools offer more personalized and targeted schemes, such as salary increases and scholarship nominations. Furthermore, a large number of participating teachers think there are teacher performance evaluation criteria related to the use of ICT in the classroom in their schools. They did not mention specific criteria; rather, general guidelines that exist at their schools. Training managers interviewed pointed out that some teachers have achievements regarding ICT integration in their performance contracts[66] with the school.

- Resources and guidance on ICT

Most IIREM and SEDP teachers report receiving and utilizing resources and guidance on ICT integration. They also find support from the ECD on this issue. Control school teachers do not report many sources of guidance on this topic, or support from ECD. In fact, most control school teachers did not know where to find such guidance. Notably, nearly all IIREM and SEDP training managers feel confident about providing methodological feedback to their teachers in this area. This is significantly different to their peers from control schools, who don't share that same confidence.

[65] Laptops were provided under IIREM for IIREM schools and under this study for SEDP schools.

[66] At the beginning of the school year, a contract is drawn up between every teachers and her/his school, that specifies aims and targets (both for their students, their professional development, but sometimes also for "innovative" elements or professional achievements in other form) for the year and the incentives or "bonus", to be received upon their achievement.

- Attitudes to ICT

While there are some differences to be seen on selected statements capturing teachers' attitudes toward ICT, summative results did not yield any significant differences in this dimension. In fact, the group with the lowest mean score on this dimension is that of the SEDP teachers. Overall, however, the data did not indicate a significant difference in attitudes toward ICT by teachers who participated in e-Resource initiatives compared to teachers who did not.

Applying the same scale to training managers and principals, however, yields more differentiated results. Due to the very small sample size of these groups of respondents, these have to be considered with care. Training managers in IIREM and SEDP schools share the same results on this assessment; however, training managers from control schools show a significantly more positive attitude toward ICT than their IIREM and SEDP counterparts. Principals from control schools are the most positive in their attitude toward ICT compared to their IIREM or SEDP counterparts or any other group in the study.

On an adapted scale, a slightly more positive attitude to ICT was recorded for students whose teachers participated in e-Resource initiatives, compared to those who did not. While differences are not significant, students in IIREM and SEDP schools tend to have a more positive attitude toward ICT than their control school peers.

- System-level support on ICT integration

Principals from participating schools tend to receive non-financial support regarding ICT from the *soum, aimag,* or state, mostly in form of training for themselves or their staff. There are no significant differences between groups of schools on this item. In addition, most participating principals stated that they have an opportunity to express their views on ICT (e.g. on access issues and integration issues) at least on a regional level, e.g. during general principals' and teachers' meetings.

- ICT financing, servicing and procurement

Data does not indicate a clear relationship between expenditures for equipment maintenance and servicing and group membership. Except for two IIREM schools, all participating schools make explicit budget allocations for this item. The IIREM *aimag* centre school, being the largest, most affluent and best equipped in the region, shows the largest expenditures on this item. In terms of percent of the annual school budget, the control school in the *aimag* centre spends the least, even less than any of the *soum* schools that make budget allocations. Among *soum* schools, SEDP schools spend the most money on this item in absolute terms. At the same time, it is the control schools that allocate the highest percentage of their annual school budget. With information from only one IIREM *soum* school, however, results of the data analysis are not fully conclusive.

In terms of decision-making on procurement of new equipment, there are considerable differences between schools that took part in e-Resource initiatives and schools that did not. In both, IIREM and SEDP schools, the decisions regarding ICT procurement is made jointly by school management and teachers, and often on the teachers' initiative. In all control schools, procurement decisions rest with the school principal.

Findings on Research Question 2

Complementing findings and data from Research Question 1 and the ICT Case Studies, targeted questions were integrated into the interviews with principals, training managers, and teachers to answer Research Question 2: "Do e-Resources address specific needs or challenges of rural and remote schools?"

The study aimed to identify what challenges schools face due to their geographic location in the country, in delivering high quality education. Conclusions for this research question were then made on the basis of outcomes from Research Question 1 and what was found in terms of the ICT-related context of each of the participating schools.

Outcomes of data analysis indicate that there are common challenges participating schools and teachers are facing. These include the following:

- Lack of information and communication
- Lack of electricity and appropriate infrastructure
- Lack of teaching and learning materials
- Inadequate learning environment
- Insufficient professional staff and teacher capacity
- Lack of community and parent engagement

In the following sections, the potential of ICT to address specific challenges in rural schools is discussed in the context of the schools under investigation, drawing on data from Research Question 1 and the ICT Case Studies.

- Lack of information and communication and lack of electricity and infrastructure.

Some of the communication and information access challenges are a result of the fact that it is very difficult for teachers and school managers from some *soums* to attend any in-service training programmes, conferences, or other events. These challenges also limit the opportunity for regular professional exchange with peers. In most *soum* schools, there is only one teacher per subject. While this teacher may be able to draw on other teachers' support for some areas, such as general methodological issues, possibilities of subject-specific didactical and pedagogic deliberations, or peer-to-peer capacity building, are extremely limited. This does not help to alleviate issues of teacher capacity, especially in areas of didactical skills.

Internet access, repeatedly requested by teachers and school managers in the study, would alleviate some of these issues. It is not yet available in most of the *soums,* however. Practices established under IIREM, where teachers would develop emails offline, and then connect the laptop to the Internet in the *aimag* centre every two to three weeks, have, as study outcomes show, made a difference to teachers already. While not regular or on a daily basis, the IIREM teacher email network alleviated some of the isolation *soum* teachers are experiencing, and increased opportunities for professional exchange and peer-to-peer capacity building.

- Lack of teaching and learning materials

The lack of materials and resources for teaching was a key challenge raised by school principals, training managers, and teachers. For teachers, the cost of the raw materials to develop teaching and learning aids is a barrier and contributes to a limited use of visual aids and teaching and learning materials other than teacher guides and textbooks in classrooms.

In this environment, the CD ROMs provided to teachers, including graphics, pictures, texts, and a myriad of other resources, have shown to be of signif icant value. Teachers have capitalized on the ability to take pictures and video-clips with the digital camera and engaged in preparing their own electronic teaching and learning materials and have shared those materials. This did not require any f inancial investment, other than time, but greatly diversified their information sources and enhanced their classroom teaching practice.

- Inadequate learning environment

It is questionable if e-Resource initiatives can have much impact on the overall learning environment, unless accompanied by structural changes. Classrooms are not secured and electricity outlets are faulty, leading, together with the challenges of generator performance, to equipment damage. In many schools, sand and dust are an additional problem, especially in *soums* located in the south of Bayankhongor, at the northern Gobi Desert. Under IIREM, one room in each school was rehabilitated and equipped with tables, chairs, bookshelves, and other items in order to provide an adequate environment. In some IIREM schools these rooms now function as the teachers' room, a classroom, or the computer lab. Calibrated to the specific equipment package provided, such small structural improvements may be required to protect equipment and ensure its operation.[67] The many broken computers in nearly all of the participating schools[68] are a clear indicator for the gravity of this issue. While e-Resource initiatives don't address some of the challenges that schools are facing in regard to their larger environment, appropriately designed e-Resource initiatives need to include some basic rehabilitation, if only for the sake of equipment and project sustainability, and in this will make a small, but noticeable difference for these schools.

- Insufficient professional staff and teacher capacity

Our data suggest that the opportunity for professional exchange with peers, facilitated through email networking, and augmented through the opportunity to share teaching and learning resources, has already had a positive effect on teachers' collaboration and, according to participants, on their methodological skills. In focus groups, teachers also report that they feel their subject matter knowledge has increased. Appropriately designed e-Resource initiatives, therefore, following the example the study has set, that focus on teachers' didactic and pedagogical capacity in regard to ICT integration, rather than their computer skills, can have a positive effect on general teacher capacity.

- Lack of community and parent engagement.

As in other whole school reform approaches, and ICT integration certainly counts as a similar change, community and parent engagement are critical for success. Such engagement, as current knowledge about education indicates, is also a key dimension in education quality. E-Resource initiatives, if properly designed, should therefore take this into account and explore ways to engage parents and communities in support of schools' development objectives. Specific efforts were not made under IIREM or under this study to include the community (beyond holding informational meetings at the outset of the IIREM project).

Focus group discussions with parents indicate that across all three groups, parents are concerned about their children's schools' capacity to appropriately equip their students with informatics skills. According to those parents, such skills are critical in the "21st century" and in "modern society", and they don't want their children to lag behind. It is obvious that parents have a rather limited perspective regarding the use of ICT in education. Their perspective is mainly limited to the informatics subject that provides computer skills to their children. At the same time, their demand and interest do drive ICT development at the schools, with principals reporting receiving frequent enquiries and significant demand.

- Student Motivation

According to participating principals, student motivation and engagement seem to be a challenge for schools, especially in the absence of appropriate and stimulating learning environments.

[67] The study equipment to SEDP schools was all provided with protective bags for this purpose.
[68] See full country report for reference.

The dire situation not only in the schools, but also in the dorms, seems to contribute to students' disengagement in their own learning. Focus groups with students clearly showed that students are very excited about their teachers' use of ICT in classrooms and about having the chance to access the technology themselves. For many, computers and especially computer games open a new door into a world hitherto unknown. Teachers, in focus groups and discussion, were unanimous in their affirmation that using technology in the classroom increases student motivation.

Conclusion - Research Question 2

Study outcomes indicate that e-Resources can address challenges such as lack of teaching and learning materials and lack of information. The value of e-Resources, in the form of providing schools with electronic teaching and learning aids and educational software, is limited, however.

Data clearly indicate that while all the schools have such resources, they need to be accompanied by:

- familiarization with the resources (among teachers)
- training of teachers in the use of a computer
- access to appropriate equipment for their use
- models of their integration with instructional practices

Without these associated requirements, the resources are not utilized as tools for teaching and learning in the classroom, or as tools for self-study and professional development.

Our data suggest that e-Resource initiatives, if designed appropriately, have the potential to address some of the challenges that schools in remote areas of Mongolia face. These include aspects of teacher capacity, the learning environment, and student motivation.

Drivers and Barriers to effective use of ICT in education

Study outcomes indicate that there are a number of drivers and barriers to effective use of ICT in education, specifically the use of ICT by teachers to enhance learning. Drivers and barriers exist at the teacher-level, school-level, and system-level. Table 1, below, outlines the drivers and barriers to effective ICT integration into classroom teaching, as identified in the study.

Table 1. Drivers and Barriers to Effective ICT Integration into Classroom Teaching

Teacher-level	
Drivers	**Barriers**
Motivation to change and learn	Aversion to change
Advanced methodological skills Ability to translate theoretical instructional models into active student-centred teaching practices	Lack of encouragement for innovation
Basic computer skills	Lack of methodological skills
Positive attitude to ICT	Lack of basic computer skills Lack of clarity and information on potential of ICT for personal productivity and to enhance teaching and learning
Encouragement and support for innovation by school management	Lack of appropriate professional development programmes that take teachers' existing skills and experiences into account
Confidence to use technology in didactically appropriate ways	
Ongoing access to resources, guidance and models for appropriate instructional ICT integration	
Capacity to develop locally-appropriate content	
Flexibility in the allocation of some curriculum hours and topics	
Ongoing pedagogical support from colleagues and school management	
Alignment between student assessment, instructional practice and teacher evaluation	
Incentives for professional development and innovation	
Integrated, ongoing professional development	
Pedagogical leadership and follow up on ICT integration by school management (e.g. via classroom observations and in-school professional development)	

School-level	
Drivers	**Barriers**
Electricity during school hours	Lack of electricity
Access to functioning equipment appropriate for educational objectives	Absence and poor quality of ICT infrastructure
Availability of locally appropriate content, suitable and easy to integrate with curriculum and instructional practice	Limited access to ICT equipment
School management with experience in whole school reform. Policies on teacher ICT competencies and strategies/planning for professional development and their follow-up	ICT infrastructure not aligned with educational objectives (e.g. only computer labs and no computers in classrooms or mobile units)
Incentive structures for teacher innovation and engagement, that align with policies and teacher evaluation practices	Lack of Internet
School management with ability for strategic planning and financial management	Lack of change management capacity
Participatory planning and decision making regarding ICT	Lack of integration of ICT with school development strategies
Explicit use of ICT to achieve school development goals (organizational and financial integration)	Lack of appropriate solutions for equipment maintenance and servicing
Opportunities for regular collaboration among teachers	High teacher-student ratios
Opportunities for exchange with other schools	Lack of information and communication to parents and the community about role of ICT in achieving educational objectives
A critical mass of champion teachers that promote ICT integration and lead exploration of innovative practices	No specific ICT champion(s) and resource persons at school to promote ICT integration and innovation

System-level	
Drivers	**Barriers**
Flexible elements in formal education system (e.g. in regard to some portion of the curriculum hours)	Rigid curriculum structures
Alignment of ICT in education policies with national education development strategies (on all levels)	Rigid student assessment structures
Ownership and awareness by regional/national government agencies (e.g. ECD)	Rigid teacher evaluation approaches
Consultations and forums for teachers and school managers on regional level	Rigid school budget structures
Certain flexibilities in regard to utilization of school budgets and funds	Uniform, per-capita funding structures for schools, without adjustments for distinct challenges of schools in rural locations
System level support, starting on school level, via regional government and to national level	Lack of clarity on role of ICT to achieve educational objectives
Well-documented pilot experiences that provide the anchor for future initiatives	
Information based decision making regarding role of ICT in education	

Recommendations for Future Research

Given the small sample size and that some of the issues under investigation were explored for the first time in such a framework, it is recommended that future research focus on the following:

- Longitudinal research that would shed insight into the impact of the ICT initiatives under investigation on student achievement.
- Complement indicative findings on teaching quality of this study with data from standardized regional and state-level teacher assessments and school-level performance evaluations.
- Conduct in-depth classroom observations to identify and document advanced models of ICT integration. Findings should then be integrated into the design of locally appropriate professional development programmes.
- Complement the dimensions in this study with further aspects hitherto not considered, such as:
  - Specific personnel dynamics in schools that may influence teacher's attitudes and practices.
  - Informal encouragement mechanisms and support practices of school management to encourage innovation.
  - Role of actors such as the community and local government to foster innovation at the school level.
  - Aspects of ECD capacity to support school's reform process.

  Investigate in more detail a possible correlation between ICT maturity of a school and its teachers with increased access to ICT by students, without any activities, such as training, having directly targeted this group.

Recommendations for Future Initiatives

The study raised a number of recommendations for future activities, either directly derived from responses study participants, or deduced from study findings and outcomes. A few are highlighted below.

It is recommended to build on the momentum which pilot initiatives such as IIREM have generated, in framing ICT integration as a discussion about educational development objectives, with specific pedagogic goals, rather than as a discussion about technology.

Basic computer skills are critical to build the necessary familiarization and rapport between teachers and technology, a pre-condition for ICT use in classroom teaching and other purposes. Integrating computer skills training from the outset with explicit models for ICT use in teaching seems to be more appropriate however, than isolating computer skills training from teachers' daily needs and practices. Professional development, in formal pre-service and in-service training programmes, needs to focus more deeply on the relationship between pedagogy, curriculum and technology. Existing policies for teacher pre- and in-service training should be reviewed to better meet the growing needs and demands in this field.

For integration of ICT and instructional practices, appropriate models and samples to learn from are necessary. Thus, it is recommended to conduct classroom observations and teaching simulations and document teaching practice with ICT. This can help teachers translate innovative ideas into (instructional) practice and speed up effective technology adoption.

Student assessment and teacher evaluation approaches need to be reviewed to capture issues of ICT integration. Broader definitions of student achievement, beyond grades and results on standardized student assessments, are needed to fully capture the impact ICT may have on areas such as life skills, student creativity and higher-order thinking skills.

Future initiatives need to acknowledge and strengthen the role of training managers as pedagogical leaders at their schools. Training managers need to have the capacity to function as role model for their teachers, as trainers on ICT integration, but also have the capacity to link elements of student assessment, instructional practice and teacher evaluation.

Future initiatives also need to acknowledge and strengthen the role of the ECDs as support and reference units in the education system. As with training managers, ECD staff, especially methodologists, should receive more support and professional development to support training managers and teachers in linking pedagogy, curriculum and technology.

Future initiatives may build on the positive experiences with the mentor school model made under IIREM. Such an approach can alleviate some of the challenges rural schools face, such as not having access to the Internet and an overall lack of information and teaching and learning materials. Mentor schools in urban areas, in which some of the environmental factors and school-level barriers (such as lack of electricity and Internet) are not as apparent as in the rural *soum* schools, should therefore better positioned to explore innovative and new instructional practices, integrate ICT, and provide their peers in the more remote schools with ideas, examples, and lessons learned. This way, collaborative capacity building can take place.

Furthermore, future initiatives should learn from and promote equipment packages such as the one provided under IIREM (a package consisting of one laptop, one LCD projector, and one digital camera), that have been proven to affect teaching quality.

It is recommended to provide schools with regular networking opportunities around ICT in Education issues, so that teachers in remote schools have opportunities to share knowledge and skills with other schools – another means to raise teacher capacity. At the same time, such exchanges between school managers are equally critical to promote exchange of ideas and strategies for organizational integration.

More appropriate solutions for hardware maintenance and servicing need to be found, especially in *soum* schools. Given an increased focus on Technical and Vocational Education and Training in upcoming education reform approaches, such as under the Third Education Development Project and the proposed activities under the Millennium Challenge Corporation,[69] may provide a possible opportunity for public-public partnership in this regard.

A specific recommendation is to strengthen investments already made and to maximize existing capacity in IIREM schools and the SEDP schools that participated in this study. It would be critical to provide these schools with one or two more laptop computers each to increase access to technologies for teachers, so that use of ICT in teaching can take place more frequently. This would allow these schools to continue being frontrunners in innovating teaching practice with ICT.[70]

Finally, a national-level ICT in Education portal in Mongolia, where teachers can upload their own e-materials for exchanging with others and download necessary e-Resources and tools for their own use, could further promote information and material exchange and sharing of best practices on effective ICT integration into classroom teaching.

[69] "The Government of Mongolia wants to develop a vocational education system that serves the demands of a modern, private-sector led economy." Millennium Challenge Corporation (MCC). 2007. *Mongolia and Millennium Challenge Corporation. Building a Dynamic Partnership for Poverty Reduction through Economic Growth*. Washington D.C.

[70] Data indicate that the frequency of use of computer in the classroom is restricted mostly by the availably of the laptops (with one laptop per school being shared by at least some 9-10 teachers), rather than by teacher motivation. International studies indicate that, "...pupils and teachers who use ICT the most are also the ones who experience the greatest impact. " (Ramboll Management. 2006. *E-Learning Nordic. Impact of ICT on education.* Copenhagen. 9)

10. ICT Professional Development of Teachers in Thailand: The Lead-Teacher Model

Pornpun Waitayangkoon [71]

Introduction

In recent years, the Institute for the Promotion of Teaching Science and Technology (IPST), an autonomous body within the Ministry of Education of Thailand, has developed a Teacher Professional Development (TPD) programme in support of educational reform.

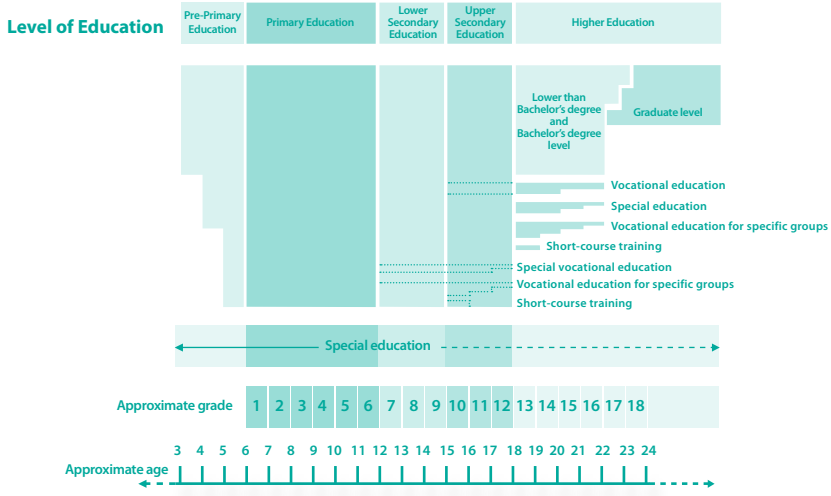
The TPD contains a component that aims to improve the skills of teachers in the use of information and communication technologies (ICT) and enable teachers to utilize ICT effectively as tools for teaching. The ultimate goal of IPST in terms of in-service teacher training is to improve students' learning outcomes, particularly in science and mathematics, to reach international standards.

The IPST has adopted the Lead-Teacher Model as a vehicle for developing professional development through partnership and collaboration between schools and organizations such as universities.

ICT Education in Schools in Thailand

Since the enactment of the National Education Act in 1999, the education system in Thailand has undergone reforms and has been decentralized so that it now operates on the basis of Education Service Areas (ESA). School education is mainly under the control of the Office of the Basic Education Commission (OBEC). During the transition period the OBEC still has direct influence on an ESA's schools in terms of funding and authorities. The structure of the educational system is depicted in Figure 1.

Figure 1: Thai educational system structure



Source: Office of the National Education Commission (2000), Education in Thailand 2001/2002, Bangkok, Kurusapa Ladprao Press, p.21.

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IPST has been committed to the development of school science, mathematics, and technology education in Thailand since the 1970's. IPST's major responsibilities involve curriculum development, teacher training, and science talent promotion and development.

The information and communication (ICT) policies and practices for basic education follow the National IT 2000/2010 Strategic Plan which aims to promote innovation, build human capacity, and strengthen the information infrastructure and industries to transform Thai society into a knowledge-based society. The MOE regards the use of ICT as an important tool for driving educational reform and sets the policies and standards for ICT in Education to maximize the uses of ICT in educational management and administration, and teaching and learning across subjects. The policies focus on ICT accessibility and preventive action on internet safety, digital resources development, ICT professional development, and community involvement.[72]

The first phase of ICT use in education in Thai schools began in 1984, when computer courses were first delivered to school students, in order to provide students with the basic skills in operating and applying ICT. The courses were compulsory within the mathematics subject cluster. Revisions were made in 1990 and 1997 to cope with rapid technological advancements. Lower secondary courses included: Introduction to Computers and Information Technology, Introduction to Computer Applications, Introduction to Database Management, Introduction to Programming Concepts, Graphics and Computer Presentation, and Computer Creativity. Upper secondary courses included: Computer and Information Technology, Electronic Spreadsheet, Database Management, Computer Applications and Word Processing, Advanced Computer Technology, Multimedia Presentation, Programming I, Programming II, Introduction to Computer Architecture, Data Communications and Computer Network, and Computer Projects. These courses were offered to students according to their preferences and each course earned students two units (comprising four periods of instruction per week per semester).

In response to the enactment of the Education Act 1999, in 2001 the Ministry of Education (MoE) established the National Curriculum Standards for all key learning areas in order to drive reform of school education. Standards for core subjects, including ICT curriculum standards, were developed for students at all 12 grade levels. Technology education included not only ICT but also Design and Technology (D&T) courses. Both D&T and ICT courses have been offered to students within the cluster of Technology and Career subjects.

Various initiatives were undertaken to facilitated the development of ICT skills in all students, including training of teachers and provision of hardware and software. In many cases, however, efforts were stymied by the lack of resources, computer personnel, equipment, and funding.[73]

The second phase of ICT use in education in Thai schools was influenced by the findings by studies that the students' achievements in the core subjects at primary and secondary grade levels in recent years were below the international average.[74] These results led to the development of a sense of urgency regarding the need for education reform.

In response, the National ICT for Education Master Plan 2001-2005 and the MOE Education Reform Roadmap (2005-2008) mandated the use of learning technologies to improve the quality of education and training in Thailand.[75]

[72] Thai Ministry of Education, 2007
[73] Pelgrum & Anderson, 1999
[74] OBEC, 2007; Klainin & Soydhurum, 2004; Klainin & et al, 2007
[75] OEC, 2006

The Lead-Teacher Model

The IPST Teacher Professional Development Programme was established in 1995 with the goal of building the capacity of ICT teachers nationwide. This programme was funded by the government and by other donors.

The primary objectives of the programme were to:

- Develop, support and empower lead trainers for in-service teacher training in the uses of ICT tools, particularly in mathematics and science subjects.
- Design and disseminate ICT-relevant training materials for in-service teachers.
- Utilize distance learning technologies to provide services to both trainers and teachers.
- Develop networks with local authorities and organizations to facilitate the work of teacher trainers across schools in remote areas.

In the early years of integrating ICT into education in schools, most of the training programmes were designed to build the capacity of teachers who were assigned to teach computer courses. These teachers had different subject backgrounds and demanded intensive training to be able to teach the courses.

IPST, in collaboration with university partners, began a series of train-the-trainer workshops. Well-skilled ICT teachers from schools all over the country were recruited to be IPST lead trainers. These teacher trainers provided training to other teachers both in their own and other schools in their area. By 1995, there was a lead teacher trainer in each province (76).

In 1999, IPST by requested the Provincial Education Authorities to recommend potential ICT teachers from secondary schools in their areas to be lead teachers. The total number of ICT teacher trainers rose to 325. In 2005, 230 additional ICT teachers from 168 schools joined the programme. Currently, there are 555 lead trainers who provide training services to other teachers, both ICT and non-ICT, all over the country. These trainers provide training for in-service teachers at 20 training centres in the Education Service Areas, training approximately 1,000 teachers each year.

The ICT training courses were frequently revised and updated with respect to content, pedagogical practices and assessment, in accordance with the ICT curriculum standards implementation guide.[76]

The courses include the following components:

- Fundamental Concepts of Information Technology: Basic knowledge and understanding of data, data processing, basic applications of computers and operating systems.
- Computer Assisted Task Creation: Application of word processing, graphical and presentation software to real life tasks.
- Assessment Tools: Knowledge and understanding of spreadsheet software and its applications for assessing student's learning. Managing and practicing learning activities using spreadsheet software.
- Internet and Web Creation: Basic knowledge and skills development for communicating via the Internet. Basic webpage creation using HTML.
- Hardware, Software, and Computer Network: Windows Operating System and installation. Office software installation and removal. Assembling microcomputer parts. Basic problem solving. Fundamental concepts of computer network. Intranet and data management in web servers.

[76] IPST, 2002

- Algorithm and Problem Solving Tools: Identifying problems and problem-solving Implementing problem solving plans, testing, verification and improvement.

Additional courses requested by the trainers included "how to" courses such as ICT School Curriculum Development, Web Resources Construction, Test Item Construction, and Assessment Strategies. Theses courses were designed for both ICT and non-ICT teachers.

In the 10 years since the implementation of the ICT TPD programme, these ICT lead trainers become valuable resource persons for IPST, the MoE, and other ICT in Education projects. They are charged with reviewing digital materials, and with creating resources and training course materials. The trainers have played a major roles in building the capacity of both ICT and non-ICT teachers and have created a technology-friendly culture in their schools. In addition to providing training to teachers in their own school and neighbouring schools, the lead teachers have been involved in various activities, including:

- Providing distance training (12,207 teachers from 1,514 schools were registered for six training courses).
- Providing training for ICT teachers of the IPST Special Project, the "Development of High Calibre Science and Mathematics Teachers".
- Providing training customized for teachers in schools located in remote areas.
- Organizing outreach programmes for youth, to develop their ICT skills. For example: Computer Youth Camp and Robot Control Programming.
- Developing teaching packages for ICT-integrated project-based learning.
- Developing websites to provide on-line digital resources for teachers (www.krumontri.com) and students (www.thaigoodview.com).

Factors influencing the effectiveness of the TPD

Over the course of implementing the TPD programme, a number of factors were identified as being important for its success. Several of these factors are described below.

- Continual development of lead trainers

In addition to regular training workshops based on new practices these trainers are encouraged to participate in conferences and to attend special training courses and seminars which enabled them to keep up-to-date with changes in technologies. Developing these lead trainers' skills and knowledge not only benefited the teachers but also the learners in the areas within which they work.

- Sharing knowledge and skills

There are 20 school clusters in Thailand. Within each cluster, trainers provide teacher training with regard to their expertise and teachers' needs. ICT teachers pass on what they have learned to other teachers in their schools and coach them to utilize ICT in other subjects. In this way, non-ICT teachers gain confidence in using ICT tools in their classrooms. For example, mathematics and science teachers learn to use tools such as the Internet for classroom activities.

- Collaboration and partnerships

The TPD programme led to the formation of partnerships among teachers, trainers, university instructors, education supervisors, and personnel from the private sector. These collaborative networks facilitated interaction and sharing of experiences and common interests, leading to further improvement in the use of ICT in classrooms.

- Support from school principals and administrators

Formal and informal support from school principals is vital for the integration of technology into classroom teaching. For example, it is important for principals to understand that computer laboratories can be used for teaching other subjects as well as ICT and to support such use. Likewise, it is important for principals and administrators to provide a supportive environment for teachers; one that enables them to apply and integrate technology into the curriculum and engage students in various ICT-enhanced learning projects. Similarly, it is necessary for principals and administrators to recognize that professional development of teachers requires time, and teachers must be encouraged to invest time in improving their skills in using ICT in education. Principals and administrators should also be flexible in terms of allowing teachers to adjust the school time-table, where necessary, to allow them to make better use of ICT tools.

Conclusion

Building the capacity of teachers in the uses of ICT for education requires long-term continuous development of the lead trainers, sharing of knowledge among teachers, partnerships and collaboration among educators and organizations, and support from principals and administrators. These factors must be in place in order for ICT use to bring about change in the classroom.

To be able to lead, both teachers and trainers require ongoing support and opportunities to experiment with new skills and strategies over time. A professional development programme should also include provision of leadership skills, such as decision making, team building, communicating, and problem solving.

Although the TPD programme has been a success, there remain a number of challenges. A key challenge is the need to scale-up the TPD programme to provide training opportunities for a larger number of teachers. Another challenge is to coordinate various components of the system to provide sufficient support to teachers to assist them to change their practices. A further challenge is quality control. It is necessary to monitor and evaluate the work of trainers and monitoring and evaluation mechanisms should be integrated into the TPD programme. An additional challenging area is in determining the extent to which the teacher training programme has had an impact on the students' learning outcomes. These challenges are areas which the IPST will focus on in the future.

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11. Teachers and Technology in Education in Samoa

Carmen Strigel, Ioana Chan Mow, and Ruby Va'a [77]

Introduction

This case study examines the use of information and communication technologies (ICT) in Samoan schools and provides insights into the key issues faced by teachers in Samoa with regard to the integration of ICT into education.

Background

With the goal of providing developing member countries with better guidance in using ICT effectively in education, the Asian Development Bank (ADB) funded a 21-month regional technical assistance (RETA) project in Bangladesh, Nepal, Mongolia, and Samoa.

Implemented by RTI International,[78] in partnership with iEARN-USA, the RETA researched approaches to using ICT in education which can bring about improvements in teaching and learning that are not only successful but also feasible and sustainable given the Asia-Pacific region's development challenges.

The study commenced in April 2006, building on existing projects in each of the four participating countries. In Samoa the study focused on projects introducing e-Resources (electronic teaching and learning materials) to better reach remote and isolated areas of the country with up-to-date teaching materials. Specifically, the study built on the Samoa SchoolNet and Community Access Pilot,[79] funded by ADB. The study was not an extension or follow-on for SchoolNet, which had involved five Samoan schools, but strengthened and complemented investments already done, while primarily aiming at studying the existing approaches and lessons learned.

The study in Samoa is timely in providing critical information about lessons learned and recommendations upon completion of the first ICT in education project conducted in the country, and in advance of a future initiative already planned under the ADB-funded Education Sector Project II. The study provides a systematic insight into early experiences from participating schools and includes consideration of key factors both, internal and external to the schools.

Under SchoolNet, five Samoan schools and communities had been provided with support in setting up a Community Learning Centre (CLC). On average, each CLC was equipped with 10 Internet-ready networked computers (thin client configuration[80]), two PC servers, a video camera, a data projector, two printers, a fax-scanner, a photocopier, and uninterruptible power supply (UPS) devices for the servers.

[77] This summary case study was adapted by UNESCO, with permission, from the full research report: Ioana Chan Mow, Carmen Strigel, and Ruby Va'a, 2007, *Provoking Change: Technology in Education Case Studies from Samoa.* Samoa Country Report, RTI International, ADB TA6278-REG. Research Triangle Park.

[78] RTI International is a trade name of Research Triangle Institute.

[79] From here on also called "SchoolNet".

[80] A thin client setup features central servers on which all applications and data are hosted, while the individual (student) terminals, featuring a monitor, keyboard, and mouse, are directly connected to these servers for any significant data processing. This way, a Local Area Network (LAN) is created among the computers involved.

Three of the five schools had been connected via dial-up to the Internet and two of the schools, those in the capital city of Apia, via a wireless area network.

SchoolNet had also set up a portal and developed a number of e-Resources[81] and collected links to electronic teaching and learning resources on the Internet, accessible via the SchoolNet portal.

Furthermore, SchoolNet had provided training to teachers who volunteered and were appointed by their principals as the key teacher counterpart for the project ("ICT Administrators"), and a few teachers at each school.

Training covered the following areas:

- Basic skills in computer and digital media.
- Using the computer as a teaching and learning tool.
- Development of resources and lesson materials for selected subjects.
- Managing CLCs at the school (business planning).

Study of the Samoa SchoolNet project

Given SchoolNet inputs and study objectives, the study involved conducting a number of activities, guided by a site assessment and need analysis, to strengthen what had already been done.

Activities included:

- A one-day strategic planning workshop for participating principals, ICT administrators, and Peace Corps Volunteers (PCV)[82] based at the SchoolNet schools;
- A two-day strategic planning workshop for staff of the Curriculum Materials and Assessment Division (CMAD) at the Samoan Ministry of Education, Sports and Culture (MESC);
- A five-week (35 hours) ICT training programme for CMAD staff.
- Moderate equipment procurement for CMAD.

Six schools were selected to participate in the study, the five original SchoolNet schools and one additional school (an early ICT-adopter school in the country).

The study aimed to provide an account and reliable documentation of lessons learned, good practices and successful approaches on integration ICT into education, on the basis of the project under investigation.

Following the activities mentioned above, detailed case studies were conducted in each of the participating schools. The case studies required interviewing six principals, five "ICT Administrators", 12 teachers, 24 students, and 11 parents in the study schools.

Issues and approaches

A number of common issues and approaches were identified from the case studies. These are presented below in terms of some key dimensions, such as: ICT environment, professional development, cost, and access.

[81] Nine Learning Objects and 15 adaptations of electronic learning materials have been developed. In addition, SchoolNet organized an inventory of useful sites for teaching materials.

[82] PCV are volunteers under the United States Peace Corps scheme.

» Stakeholder Buy-In and Local Ownership

Schools were, overall, very enthusiastic about being part of an ICT initiative; principals, teachers, students, and parents alike. ICT administrators especially took on ownership of the initiative and were fully engaged, often at considerable expense of personal time. Principals were strongly supportive of the initiative and are eager to make it succeed. Some participating schools also mentioned strong and positive engagement by their school committees and high interest and demand for access by their communities. For a variety of reasons, however, the nature of which may need further investigation, some of the principals seem to have difficulties negotiating issues of cost recovery and management of the CLC with their school committees and communities, and finding the necessary buy-in and engagement from these actors.

» ICT Environment and Infrastructure

As it is, the ICT environment of the participating schools is not conducive to the successful implementation of ICT initiatives. For example, the fluctuating power supply and frequent blackouts cause damage to the equipment. Poor or no telephone lines are barriers to Internet access. Irregular public transport makes it difficult for school staff and the community to access the CLC outside regular school hours. The general lack of Internet access or poor connectivity is a problem in all schools. According to study participants, other problems include insufficient numbers of PCs and lack of maintenance services. Some of the ICT equipment, such as the photocopy machines, proved to be very valuable for the schools, not only in terms of their own needs, but also as a tool for revenue generation. Other equipment, such as the video camera, does not yet seem to be fully made use of.

» Professional Development and Training

According to staff interviewed at the participating schools, professional development and training is a priority and is urgently needed. Indeed, all schools raised the issue of the inadequate training received to date. Responses indicate that schools expect MESC to provide at least some further training, if teachers are to perform to expectations in managing and utilizing the CLC. Specifically, teachers require training in computer skills. Principals and the ICT Administrators require professional development in management, so as to assist them in their roles with regard to CLC management and administration.

The study participants indicated that, instead of one-shot training activities here and there, on-going and continuous professional development was needed. ICT administrators, especially, voiced a strong demand for more formalized, certificate-based training programmes that give them not only the skills, but also the recognition needed to fully take on their roles. Training that had been provided so far has allowed at least ICT administrators to achieve a foundational level of competence that can be expanded on. They in turn were able to start imparting some of their skills and support their colleagues (but still on a rather small scale and often in a more unstructured way). Schools with Peace Corps Volunteers with IT skills are fortunate and are making use of the volunteers for training their staff and teaching the computer studies classes. However, this strategy needs to be strengthened by a better matching and skill sharing with local school staff, to avoid capacity vacuums upon PCV departure.

» Teaching and ICT

To date, the ICT facilities have been of most use as a place for basic computer skills training for teachers and students. Still, the majority of teachers at the participating schools have yet to be trained or given lessons in the basic usage of computers and other available ICT equipment. There are pockets of ICT integration practices happening at schools, such as geography or English classes being taught in the computer room and making use of the the projector for more effective visualization of maps and

graphs. Only some principals, ICT administrators, and teachers knew about the SchoolNet portal[83] and the learning objects and e-Resources provided there. To most study participants, lack of awareness is a major barrier concerning this specific resource. Lack of appropriate Internet in general is considered the main barrier to teachers researching for materials on the Internet or communicating and collaborating with each other.

» Access

Access was highlighted by all staff, students, and community members as being a problem. Although some schools have scheduled and planned periods for teachers and students to use the CLC, this does not meet the demand. Teachers, students, and parents want to use the facilities more frequently. Schools are forced to prioritize and restrict access for the most part because of an apparent lack of human resources to provide the support and oversight needed during those times. Where such capacity was available, after-hour transportation issues for ICT administrators and facility managers are aggravating the problem.

» Cost

For the community, students, and individual teachers, affordability (cost) did not provide an obstacle to access. Many considered the fees and regulations quite appropriate and manageable. Cost is a big problem for the school, however. Strong concerns were expressed by all participating schools about the increased electricity bills, communication expenses, facilities and hardware maintenance, as well as allowances for the ICT Administrator. At the same time, parents seem to be willing to give extra funds for the sake of providing their children with access to this technology.

» Sustainability

It is recognized that local staff must be appointed and trained for long term sustainability. Three schools that "lost" their PCVs are examples of the gap arising if there is no one to continue. The issue of sustainability of the facilities also includes issues of hardware and equipment: the repair and replacement of damaged or worn out equipment is an area that needs to be included in management plans and budgets. However, schools have not yet fully managed to engage in planning for long term funding strategies.

» Policies and Strategies

There are still major gaps in schools' plans to provide access and capacity not only for the community, but also for their students and teachers. Principals are asking for more support in developing policies, strategies, and appropriate management models. The activities conducted in areas of policies and strategic planning under SchoolNet and this study provided an important platform for stakeholders to share their views, exchange ideas, and gain experience in developing such models. However, more support in this area had been requested.

» Community Access and Awareness

As indicated above, community access has yet to be implemented in most of the participating schools. Barriers identified include the lack of a qualified trainer to provide classes after school hours and the absence of a longer-term strategic plan to extend the service. Furthermore, some schools are prioritizing access for staff and students over access for the community, while at the same time struggling with issues of cost and earning revenue to sustain services for the school, which the latter would provide. In some schools, however, information exchange with parents and communities has not yet been sufficient in terms of generating awareness about the initiatives taking place. The awareness programmes, especially

[83] The portal address is: www.samoaschoolnet.edu.ws

a television advertisement that had been developed to disseminate information on the SchoolNet pilot project, have been successful in raising awareness among communities and played an important role in generating interest and demand.

» Education System Support and Engagement

A key challenge, according to the participating schools, is the lack of involvement and support they receive from MESC. School representatives also seem to not be entirely clear on roles and responsibilities and to whom to turn to when help and support is needed.

» Private Sector Involvement

According to the participating schools, vendors selected under the SchoolNet pilot project have been very diligent in following up on their maintenance and support responsibilities. Some have even gone beyond that, for example, by providing a school with some additional computers. Apart from these examples, schools did not mention any collaboration with the private sector.

Discussion of findings

This section discusses of some of the issues identified during the case studies.

A. Education Development Objectives

While many projects aim to use ICT to improve the "quality of education", the concept of "education quality" and definitions thereof are multi-fold and complex. It is recommended to go beyond terms such as "education quality", and identify more specific goals so as to help to clarify project objectives and to better align monitoring and evaluation. It is important, however, to ensure that the specific targets are appropriate in terms of the overall aim of the project and that the targets are achievable within the given time frame, budget and other constraining factors.

The Samoa SchoolNet pilot project aimed to enhance "…the environment for poverty reduction in rural areas of Samoa by improving access to basic services through improved communications".[84]

At the same time, some of the SchoolNet project targets (indicators) included:

- "50% increase in teachers completing in-service training"
- "decline in teacher resignations by 50%"
- "improved student outcomes by 2%"
- "pilot school student grade point average improving by 5%"[85]

An examination of the overall goal and the specific targets indicates that, as in many similar projects and initiatives:

(a) There is incoherent alignment between the aim of the project and the indicators by which its progress and impact were to be evaluated.
(b) The project assumes a role for ICT that ICT as such can not fulfill – that of a magic bullet to improve education outcomes.
(c) Comparing the indicators with the nature of the activities conducted, questions arise as to how those indicators could have been achieved at all.

[84] Asian Development Bank (ADB). 2003. *Technical Assistance to the Independent State of Samoa for Supporting the Samoa SchoolNet and Com munity Access Pilot Project.* TA4305-SAM. Manila. 2
[85] Helsinki Consulting Group. 2007. *Samoa: Supporting the Samoa SchoolNet and Community Access Pilot Project.* Final Report. ADB TA4305–SAM. 16.

(d) Finally, even if the project objective, activities, and monitoring indicators had been aligned more appropriately, it is highly questionable how any of the above-mentioned monitoring targets could have been achieved at all within the original timeframe of an 11-month project.

There is no doubt that the SchoolNet pilot has achieved some of its objectives and aims, most notably:

- raising awareness about ICT
- engaging a number of schools to explore the technologies' potential for education
- piloting a connectivity and computer lab configuration model that seems to be appropriate given both country context and school environments.

However, the computer lab configuration model drives a very specific way ICT is being used at schools, and its impact therefore may not be measurable via any of the "targets" (indicators) listed above.

As the case studies from participating schools in Samoa show, and international experience confirmed, computer labs such as the CLCs can play an important role in providing access to ICT for students, teachers, and the community. However, in practice, computer labs mostly serve the teaching of computer studies classes, with the aim to develop students' computer skills.

If the aim of a project is indeed to increase students' computer skills (e.g. to equip them for the demands of a competitive employment market with skills that most likely will play a role), then activities should focus on providing the infrastructure required to teach the computer studies classes, as well as build the skills of computer studies teachers to effectively teach the curriculum.

Monitoring and evaluation approaches could then include clear indicators that are calibrated to measure progress towards those aims. Such an indicator could exemplary be "X% increase in students that meet International Society for Technology in Education (ISTE)[86] basic computer skills standards for that grade at the end of year 8." This ensures that the objective, activities, and indicators to measure progress are aligned.

In defining appropriate objectives for ICT in education, it may help to clarify the domain in which ICT is to be integrated. ICT in education is a broad area, and while lines are not clear cut, but rather overlapping, a number of domains encompassing "ICT in Education" can be identified:

- ICT to support education management
- ICT to support school administration
- ICT to support teacher productivity
- ICT to enhance teaching
- ICT to promote computer skills
- ICT to provide community access to information and communication
- ICT to support student self-pace learning
- ICT to support distance learning

These domains are directly linked to education development goals, such as enhancing the quality of teaching, increasing the efficiency of education administration, or enhancing the development of critical life skills among youths. Guided by these broader goals and objectives, it is quite possible to design a successful school reform project that utilizes ICT as a lever for change in not only one, but several of the domains mentioned above. Such considerations are to be applied, both on school level, but also in terms of national education sector development plans.

[86] International Society for Technology in Education (ISTE) www.iste.org

In the specific case of Samoa, therefore, it would be important to better detail the objectives and aims of future ICT in education initiatives. This would allow implementers to better focus their activities and at the same time to design a monitoring and evaluation framework that is appropriate and realistic, taking project and country characteristics into account. At the same time, it would allow for more coherent messages and information to be shared about the initiative, clearly outlining anticipated outcomes and impacts. With this in mind, some issues of local ownership and buy-in, detailed in the section below, may be avoided.

B. Stakeholder Buy-In and Local Ownership

» Schools and Communities

Despite challenges, participating schools are positive about the changes that have happened in their schools so far, and the opportunities the new infrastructure, training, and network participation are offering them.

As case study findings indicate, the approach taken to engage schools and communities in the SchoolNet pilot project, however, may not have been the most appropriate. Future initiatives may want to consider engaging schools by providing information and support in the development of school-related strategic plans and appropriate business (if community access is to be a component of the project) or cost-recovery models at the outset of the project.

Training ahead of the arrival of the equipment could also be considered, at least for principals and ICT administrators. It is clear, however, that equipment installation should not be delayed to such an extent that teachers will not be able to apply in practice what they learned during training.

In terms of community engagement, it is important to clarify if community access, which was part of the SchoolNet model, truly is a priority element in the early stages of a schools' technology adoption. It may have been overambitious to include this component under the initiative, and distracted efforts and resources from focusing on teaching and learning.

The study also highlighted and confirmed the importance and benefits of peer sharing as a lever for establishing local ownership. The exchange of experiences and the sharing of technical expertise and hardware costs (bulk ordering of hardware) resulted in the setup of computer centres in two Samoan schools before SchoolNet took place. These informal incidents of collaboration and peer support should be more formally supported and encouraged among schools, especially given the prospect of extending SchoolNet to additional sites. In order to generate local ownership and buy-in on a national level and among schools, it may be important to provide for regular structured opportunities for exchange and communication. Regular forums, workshops, and round tables may be one way; online learning communities or communities of practice another. Engaging representatives from these "champion" schools on national forums, such as the national ICT committee should be considered.

» ICT Administrators and Teachers

Case studies revealed that not all teachers in all schools are interested in engaging with ICT. These teachers prioritize other activities. Reluctance to engage and actively participate in the ICT initiatives is likely to be caused by a number of reasons, which may include fear of change; a negative attitude to technology; negation of the need for professional development to improve teaching practice; lack of information about tangible benefits of ICT for education; a lack of motivation for extra work – aggravated

by a perception of comparatively low salaries; and practical issues such as lack of public transportation after schools hours. Systemic issues can also play a role, when personal engagement and initiative are not being rewarded or appreciated.

Not all of the issues may be possible to address, but some steps can be taken, such as inclusion of teachers in the decision-making processes regarding the acquisition of ICT and related facilities, or more appropriate recognition of those teachers that do engage. This could be achieved, for example, through running a public recognition scheme that would select the "teacher of the month" from all those that have taken training, and share information about the award with parents and the community. It may also include organizing small contests among teachers, in return for free Internet time or print-outs for personal use, to stimulate application of ICT in classroom teaching. Also, appropriate schedules for teachers to receive training during free periods of the school day, as some of the schools already started. National initiatives need to be designed to step in, where school-level initiatives cannot sufficiently address the known obstacles.

For ICT administrators, incentives may also include nomination for appropriate certificate-based training that would provide them with the skills and credentials they need. Currently, such a programme does not exist in Samoa, therefore opportunities for its development or international partnerships with providers of existing programmes should be explored. Furthermore, better recognition of the efforts of the ICT administrator, especially among parents and community members, will already help the situation.

The education system must also provide more support, especially collaborating with schools in the nomination of ICT administrators for professional development programmes, recognizing ICT administrators and principals on a national level (such as engagement in national forums, as mentioned above), and better financial and career-related incentives to foster change at the school level.

C. ICT Environment and Infrastructure

Despite the challenges raised by respondents of the case study, utilizing an expandable thin client configuration seems to have worked well for the schools involved. While there may be some concern over the specific processing capacities of the servers provided, the thin clients allow a CLC manager to centrally monitor and manage data exchange and activities on each of the individual terminals. This configuration also leaves less opportunity for individual workstations to be damaged because there are no individual data processing components to begin with. The core of the configuration, the central severs, are safely locked up at all schools. A further advantage of the configuration is that adding additional terminals to the thin client is generally cheaper than buying additional new desktop computers to expand a computer lab.

As case studies showed, some equipment, such as the photocopier and printers, seem to be more used than others. One of the reasons may be the lack of local skills in utilizing this equipment at the school, especially where training has not been sufficient to build the required familiarity. At the same time, the general absorption capacity in Samoan schools, given the early stage of technology adoption, may also need to be taken into account. Video recorders can serve the dual purpose of a video recorder and still camera, but realistically, schools seem to mostly make use of the latter function. It may also be more appropriate to add a laptop to the equipment package in lieu of the fax machine or scanner (if Internet is indeed functional, then email or fax application software, combined with the video recorder and its still camera function, can serve the same purpose). It should be emphasized that equipment packages and configurations need to be tailored to fit specific school development objectives, and not vice-versa.

Future initiatives may consider phasing-in equipment package installation into schools. The short duration of the SchoolNet project made phasing-in the equipment difficult. Schools therefore received the equipment all at once. Visiting schools shortly after the equipment had been provided, it was clear that they were overwhelmed. Months later, the video recorders in some schools still had not been unpacked or used, as schools were focusing on the computer, photocopy and print equipment. At the time of data collection, only three of the schools reported using the videos recorders, and only rarely.

In addition, schools may need to be better informed about best practices in computer room setup and design. Some of the PCVs have already passed on very valuable experiences in approaches to maximizing air-conditioning power, reducing consumption, and designing appropriate computer-room facilities that should be documented and shared.

An additional concern related to the ICT environment is directly related to maintenance and replacement of equipment. Experiences show major difficulties already in the initial procurement of equipment. Availability of parts, shipping times and customs all played a large part in delays experienced by both projects, SchoolNet and this RETA. Even if the budgets are in place and funds are available, procuring or replacing any equipment seems to be a major challenge.

Stability of electricity, as well as cost for power expenditures, seems to be a big problem for most of the schools, especially the rural ones. It is worth considering alternatives to the conventional power grid. For example, a solar-powered community Telecentre, with funding by the International Telecommunication Union, was established in 2005 in the village of Ulutogia on Upolu Island. The Telecentre's three computers, fax, copier, scanner, and printer are powered by two solar panels and a set of two batteries. With a loading time of 35 minutes they provide up to about 33 hours of power. The two solar panels have a capacity to charge and operate up to 12 batteries, which could easily address the power needs of a 15-computer lab, including printer, fax, and photocopy machines. Experiences with this solar-powered Telecentre pilot have been positive; no incidences of damage or dysfunction have been reported in over one year of existence.

D. Professional Development and Training

When interviewed, school stakeholders were very vocal in their demand for more training. There is a clear desire among many stakeholders to improve their skills, including skills in computer operations and in effective pedagogy for using ICT in education.

» School Management

International experience has demonstrated the important roles of school leaders and administrators in providing an enabling environment for school change.[87] Introduction of ICT into teaching and learning faces the same requirements as other school-reform interventions. The nature of ICT, impacting on all of the key aspects of school life, learning, teaching and administration and management, makes it even more critical for school administrators to carefully plan, model, support, and monitor its introduction.

Principals and deputy principals of schools clearly need more than their admirable enthusiasm and willingness, they also need ongoing, appropriate training. Principals participating in the study specifically requested training at a central location, away from their everyday work environment and responsibilities, to allow them to fully concentrate on developing their skills. This should be blended with ongoing on-the-job support.

[87] See European SchoolNet. 2006. *The ICT Impact Report. A Review of Studies of ICT Impact on Schools in Europe.* Brussels.

Areas in which principals require training include:

- computer skills
- management and business planning for principals, including a detailed analysis of usage and cost figures to properly manage the centre
- leadership and support of the integration of pedagogy, curriculum and technology

» ICT Administrators

It is questionable whether a teacher should be responsible for anything beyond very basic ICT troubleshooting, but without an appropriate system for timely and reliable maintenance and support, the most feasible way to ensure operation of the CLCs and functioning of the equipment is to train one of the school staff.

Content areas for further training for ICT administrators may include:

- advanced skills in utilizing equipment
- skills in hardware trouble shooting and maintenance
- training of trainers to support fellow teachers
- ICT integration into teaching and learning (pedagogy and methodology).

» Teachers

An assessment of existing computer skills conducted under SchoolNet indicated that most teachers required intense training. Throughout Schoolnet, some level of competency has been established, but the study results indicate that teachers are not yet confident in the use of technology for their own productivity or in their teaching.

It is important to emphasize, however, that effective and appropriate integration of ICT into teaching and learning requires more than just computer competency. Ultimately, the core competency required of teachers is the ability to make sound didactic and pedagogic choices regarding the appropriate tools, social forms, methods, and activities that would enable students to achieve the learning objective of a lesson or unit.

Ad hoc training does not meet best practices in adult education, which requires relevant, self-directed training which integrates learners' immediate experiences and daily work challenges. Similarly to what had been suggested for principals, future initiatives could couple intensive trainings with school-based courses and ongoing support through telephone conferences or online training elements, where possible.

An important area for further training for all of the stakeholders is the SchoolNet portal; its use in teaching and learning, communication, and information sharing. Very few of the study participants had any knowledge of this resource. There is both a lack of information and a lack of appropriate Internet access to allow teachers to explore it.

E. Teaching, Learning, and ICT

The CLC facilities have allowed schools to teach computer studies classes more effectively. There are individual instances in which the facilities have been used to teach other subjects as well but, as outlined above, the ICT environment at the schools drives the way ICT is being made use of in the schools.

Experience has shown that computer labs mostly serving the development of computer skills and easily become the sole domain of the computer studies teacher. The use of a computer lab for other subjects requires cumbersome organizational preparation, including: booking the room, preparing the computers and other tools needed, moving the students, settling the students, locating and preparing the computer-based resources that are required, and monitoring student's activities. Given this amount of preparation involved, it is rare to see the computer labs used for other subjects.

It is necessary, however, to encourage teachers to utilize ICT tools and electronic teaching resources during their classes. For example, teachers can use software to better illustrate abstract topics such as dynamic geometry. For teachers to utilize ICT tools more effectively, an entirely different equipment configuration may be required. This may include mobile stations, coupling a laptop and a LCD projector, as provided in Mongolia,[88] or using whiteboards in selected classrooms, as has been done as part of the Jordan Education Initiative in Jordan.[89] Another configuration would be to have three to five computers in each classroom instead of a larger number in a computer lab. Such a model would allow for methodologies such as learn streets[90] or student group research stations, or provide resources and information during the development of independent student projects. It is clear that such an equipment package, however, is very resource intensive.

Teacher education should assist teachers to develop skills in searching for and evaluating the quality of electronic resources and in utilizing ICT tools effectively. Teacher training should also enable teachers to design learning experiences (lessons) for their students that appropriately and effectively integrate ICT tools and resources, to enhance teaching and learning. It is critical to help teachers translate theoretical models of student-centred learning into practice.

The current responses of schools, stating that more workstations are needed, are certainly understandable given high student-computer ratios. However, as can be seen from the above, an effective equipment model does not necessarily require a lot of equipment, but a clear understanding of its potentials and limitations. It may be advisable therefore to help schools explore and develop a variety of teaching and learning scenarios with the equipment they currently have.

International studies show that in many European countries,[91] past teacher training has concentrated very much (and often still does) on providing abstract computer skills and capacity in the use of software applications and the Internet. Relatively little attention has been paid to enabling teachers couple these skills with their professional capacity as teachers. As a result teachers are not confident in using technology in didactically appropriate ways in their classrooms.

Future initiatives in Samoa should take those international experiences into account and carefully plan the content and focus of ICT initiatives and related training. The consolidation between pedagogy, curriculum and ICT is critical.[92] Local models need to be tried and experienced before initiatives such as SchoolNet are being scaled up to further sites.

[88] This was the equipment package provided under the RETA in Mongolia. See Strigel, Carmen, Lkhagvasuren Ariunaa, and Sukhbaatar Enkhjargal. 2007. *Where Desert meets Technology: Findings from ICT in Education Initiatives in Rural Schools in Mongolia.* Mongolia Country Report. RTI International. ADB TA6278-REG. Research Triangle Park, for more information.

[89] Under the Jordan Education Initiative (JEI), 100 "discovery schools" have been selected and provided with equipment, resources and training. One such model included the provision of digital whiteboards. More information on JEI can be found here: www.jei.org.jo. Furthermore, a study on the use of Whiteboards to support Literacy and Numeracy instruction under the "Embedding ICT in the Literacy and Numeracy Strategies" pilot project can be found on the website of the British Educational Communications and Technology Agency (BECTA) www.becta.org.uk.

[90] Learn Street is a teaching method that organizes the classroom in different areas. In a Learn Street, students, in groups or individuals, move from area to area in an organized pattern to inductively experience new aspects of the topic under investigation.

[91] See Ramboll Management. 2006. *E-Learning Nordic 2006.* Copenhagen.

[92] Edmunds, Julie A. and Nita J. Matzen. 2007. Technology as a Catalyst for Change: The Role of Professional Development. *Journal of Research on Technology in Education* 39(4): 417-430. 417.

F. Access

Providing access to ICT to teachers, students and community members, has been a key challenge for all of the schools participating in the study.

While schools voice a demand for more computer workstations, at most schools the number of computers is sufficient to provide classes to students in basic computer skills. As mentioned earlier, it may therefore be important to help schools find alternative teaching, organization, and access models to optimize the use of the numbers of computer they do currently have, rather then acquiring additional hardware.

G. Cost

According to the findings of the study, schools are struggling with two issues:

- Management of the CLC facilities
  Schools have not yet had a chance to fully cost-out expenditures and adjust their fees or budgets. Several of the pilot schools have not yet structured and implemented community access, therefore have not yet had a chance to truly generate revenue. Early discussion among schools also highlighted the concern that the communities, especially in the more rural areas, may just not offer enough of a market to realistically believe that recurrent costs of the facilities could be met by the revenue generated from the CLC.
- Charging for use of facilities
  The most common use of the CLC facilities is by teachers: for their training or for work-related tasks, for which schools feel they cannot charge a fee.

H. Sustainability

In terms of organizational sustainability, a key lesson can be derived from the study: The nomination of local ICT administrators at each school has been a critical factor in ensuring sustainability of ICT in education initiatives. While there are issues, and individuals are struggling in their roles, the ICT administrators are filling a critical function.

These champions on the local level need to be matched by champions on regional and national levels. As can be seen from other such initiatives, a key driver for successful ICT integration into education is a champion agency or team that can spearhead such innovations.

Future initiatives may consider the formation of an ICT in education working group including stakeholders from all levels of the education system. Such a scenario would provide a critical enabling environment for more sustainable ICT in education initiatives in the future.

I. Policies and Strategies

Strategic planning on the school level concerning the ICT initiative has mostly been short term, with little consideration of long-term organizational change management and school development. Cost recovery and sustainability require planning, however. As discussed in previous sections, the need for better planning and strategy development has been recognized by principals. It is a key part of any initiative for integrating ICT into education.

At the school level, policies need to be in place with regard to such factors as: access and use of facilities by different groups, teacher professional development, integrating ICT into teaching and learning, community engagement, and productivity. Linked to issues of buy in and sustainability, development of school policies is most effective with the participation of all stakeholders, including teachers, parents and students. The box "ICT-related policies and strategies", below, describes an ICT policy which was developed in a school in Mongolia, with the goal of improving productivity.

ICT-related policies and strategies at school level

In Mongolia, a school that participated in the IIREM project decided on a policy that requires teachers to develop all formal submissions, such as reports, timesheets, student assessment overviews, etc., electronically. At the same time, school management in turn also adopted this policy for itself. All communication from the principal to the teachers is being done electronically. Handwritten submissions are not accepted anymore. According to the principal and teachers, strict adherence to this policy has not been easy, especially at the beginning; but after a while it has noticeably increased efficiency of school management and teacher productivity. Now, everybody is so used to it, that this practice is no longer a challenge or questioned.

On a national level, study results in Samoa indicate that existing policies have not yet been coupled with appropriate action plans and clear budget allocations. Furthermore, there is no clear assignment of roles and responsibilities in terms of policy implementation.

J. Community Access and Awareness

The awareness programmes organized under SchoolNet proved to be effective in generating awareness of the initiative among communities. The campaign at the same time raised interest in accessing CLC services.

Information sharing and marketing of such initiatives are important drivers in generating local ownership and buy-in, raising recognition, rewarding engagement, and attracting public support. Community access, in turn, can be a tool to generate appropriate demand and informed feedback for the school. Greater training among parents and community members to utilize the technology may also dispel possible misconceptions[93] or unrealistic expectations, while at the same time generate demand for its appropriate use in teaching and learning.

[93] See a discussion on misconceptions around the use of ICT in education in Watson, Julian. 2007. *From Policy to Pupil: How Governments Encour age ICT in Education*. Regional ICT Policy and Strategy Report. RTI International. ADB TA6278-REG. Research Triangle Park.

K. Education System Support and Involvement

The MESC Information Technology (IT) unit, instrumental in the implementation of the SchoolNet project, is staffed by only two people. One of the two staff is responsible for IT support and maintenance for all schools in the country. Clearly, this is neither sufficient nor sustainable, especially as more and more schools are equipped with and use ICT. The ministry may do better by establishing appropriate partnerships with private sector firms or other organizations to share the responsibility for managing ICT integration into schools.

Apart from brokering such partnerships, there are a number of other areas in which the MESC could play a key role. These include setting minimum standards and quality criteria for equipment in order to guide schools' procurement processes outside specific donor-funded projects. Furthermore, in absence of a strong and dedicated Professional Association, MESC may also suggest standards related to ICT competencies of teachers and education administrators. MESC could also be involved in the formulation of appropriate, country-wide ICT in Education indicators, in order to ensure better data collection and measurement of the longer-term impacts of ICT initiatives on the quality of teaching and student learning.

L. Private Sector Involvement

Private sector involvement in ICT in education in Samoa is mainly limited to the provision of maintenance and services for equipment and facilities established under SchoolNet. Few private sector involvement or partnerships have been established. As case studies indicate, many of the rural schools in the country cannot draw on the private sector in their communities, which limits partnership options.

New partnerships should be explored, however, to address some of the most urgent needs and issues schools are facing in terms of infrastructure and support services. International experiences may provide some helpful examples to be considered and possibly adapted. The use of a small business, run by young entrepreneurs, to provide maintenance and servicing to the schools may be such an example. Providing the business with a one-year contract would give stability to the small business and room to attract additional customers, while the schools could draw on timely services from a dedicated service provider. Another example is negotiating with an existing business to share its Internet bandwidth with a school nearby outside the business' peak hours.

Conclusions

Overall, the study found that schools are very enthusiastic about being part of an ICT initiative. ICT administrators, in particular, have taken ownership of the initiative and are very engaged, often investing considerable personal time.

Teachers and schools face a range of challenges, including infrastructural issues such as lack of power, telephone and Internet access, which hinder the effective use of ICT in teaching and learning. Schools also struggle to optimize use of the technology, due to a lack of appropriate professional development. While many teachers have developed basic computer skills, they have not yet become confident in using the technology to improve their own productivity and bring about pedagogical change. At the same time, ICT administrators and principals are requesting more support in technology management and organizational integration of ICT. Such support is needed in order to align the aims of ICT initiatives with overall school development objectives.

A small number of schools have already started to provide the community with access to the ICT equipment. Community access and provision of technology-enhanced services, such as photocopying, provide small but important budget contributions for schools. This revenue is critical to cover ongoing costs, such as toners and paper. The majority of parents seem to be willing to support the school beyond regular school fees to help cover some of the additional costs in return for their children being able to make use of the new tools.

The ongoing costs are a major concern for school principals and school committees. Organizational challenges, such as lack of personnel to manage community access, coupled with external challenges, such as lack of after-hours public transport, constitute critical barriers to further access.

Teachers and schools are also struggling to clarify roles and responsibilities vis-à-vis the larger education system and are unclear about the support that they can expect from the government and other actors in the country. The study found that great advances have been made at the national level in formulating guiding policies for the use of ICT in education. At the same time, however, important follow-up activities, such as targeted budget allocations, the harmonization of school development strategies with national education development objectives, and the necessary organizational adjustments (distribution of roles and responsibilities) within government and other education stakeholders, have not yet been fully implemented.

The study results identify useful lessons learned from the ICT in education initiatives implemented in Samoa. The results of the study indicate that the initiatives have been successful in contributing to generating an enabling environment for ICT as a catalyst to enhance teaching and learning. At the same time, however, the results of the study have highlighted a number of areas which require additional work in order to better meet local needs and educational goals.

With this in mind, a number of critical issues have been raised that should be considered before ICT initiatives in their current form are expanded to additional schools. Overall, there is reason to believe that if such considerations and lessons learned are taken into account, necessary steps undertaken, and appropriate interventions put in place, ICT can prove to be a valuable tool for improving access to, and the quality of, education in Samoa.

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