South Korea Singapore
Indonesia Malaysia
Philippines Thailand
Malaysia Philippines South Korea Singapore
Overview

As ICT enters the socio-cultural setting of a school, it “weaves itself into the learning process in many more ways than its original promoters could possibly have anticipated” (Papert 1993, p.53). There is a context for ICT experiences that encompasses activities peripheral to the particular time and format of ICT interactions. Salomon (1993, p.189) proposes: “No tool is good or bad in itself; its effectiveness results from and contributes to the whole configuration of events, activities, contents, and interpersonal processes taking place in the context in which it is being used.”

Therefore, a study of ICT in education cannot be isolated from the learning environment in which it is situated. ICT may trigger changes in the activities, curriculum and interpersonal relationships in the learning environment, and is reciprocally affected by the very changes it causes (Salomon, 1993). Experiences in the six countries have shown that ICT has not been radically incorporated in a systematic way into current curricular offerings and national textbooks, although there is a growing trend to gradually introduce ICT in selected subjects, such as science, mathematics and language.

In this component, the discussion focuses on six issues: (i) integrating technology in the curriculum and assessment, (ii) shift in pedagogy, (iii) content and services that support continuous improvement of curriculum practices, (iv) development and selection of culturally sensitive content, (v) ethical and political implications of using English as lingua franca, and (vi) intellectual property rights related to educational software.
Lessons learned

Based on the experiences of the six countries with respect to curriculum, pedagogy and content development in the integration of ICT in education, the following are the lessons learned:

1. Integrating Technology in the Curriculum and Assessment
   - When teachers perceive ICT as a tool to meet curricular goals, they are more likely to integrate ICT in their lessons.
   - Equipping students with ICT skills facilitates the effective integration of ICT in schools.
   - Teachers play a pivotal role in the integration of ICT in the school curriculum and assessment.
   - When ICT is introduced into the assessment process, there is a need to reconsider the assessment approaches.

2. Shift in Pedagogy as a Result of Integrating ICT in the Curriculum
   - Shifting pedagogical approaches to the use of ICT in education is time-consuming.
   - Shifting pedagogies, redesigning the curriculum and assessment, and providing more autonomy to the schools help to optimize the use of ICT.
   - Shifting pedagogical approaches is facilitated through appropriate professional development of teachers.

3. Contents and Services that Support Continuous Improvement of Curriculum Practices
   - Attracting well-established foreign education software developers to work with local companies helps to develop high quality ICT-based resources.
   - Establishing a clearing house or digital libraries of ready-to-use and customizable ICT-based resources promotes better use of ICT in teaching and facilitates quick and easy access to resources for making lesson plans and for teaching.

4. Development and Selection of Culturally Sensitive Content
   - Having a mechanism in place for evaluating content developed for schools ensures political and cultural validity, reliability and correctness.

5. Ethical and Political Implications of Using English as Lingua Franca
   - While local content in the local language promotes better use of ICT-based resources and materials, the use of English in schools optimizes the potential of ICT (especially the Internet) for teaching and for learning.

6. Intellectual Property Rights Related to Educational Software
   - A cost-benefit analysis conducted before deciding on whether to acquire the intellectual property rights to educational materials, or to acquire a perpetual license to use the materials, prevents waste of resources.
When teachers perceive ICT as a tool to meet curricular goals, they are more likely to integrate ICT in their lessons.

The instructional design for any courseware should conform to the curriculum specifications and pedagogical requirements of the national education system. The different types of ICT tools complement one another to meet curriculum goals. For example, the Internet may complement PowerPoint where students are first instructed to search for relevant information from the Internet and are subsequently asked to present their findings using PowerPoint.

a. **Malaysia**: Teaching and learning materials for the Smart School Pilot Project were developed in four selected subjects: Bahasa Melayu, English Language, Science and Mathematics. The materials were in the form of browser-based courseware, teachers’ guides, student worksheets, and sample lesson plans to guide the teachers in integrating the courseware in their lessons. The instructional design for each of the four Smart School subjects took into account the curriculum specifications and the pedagogical demands of the Smart School. The specifications stressed the need to cater to students’ capabilities, learning styles, learning modalities; to respond to a variety of learning environments; to support students’ self-paced, self-accessed, and self-directed learning; to build in assessment capabilities so that assessment records can be stored electronically; to promote values, skills (especially creative and critical thinking skills), knowledge and language ability; and to allow for horizontal integration between subjects, and vertical integration between learning areas in a subject.

b. **Philippines**: The new interactive and integrative curriculum, Revitalized Basic Education Curriculum (RBEC), has changed the way ICT is used in schools. “What makes this curriculum interactive is the use of information technology and the greater emphasis on computer literacy in all the learning areas in every school where equipment is available.” (DepEd, 2002).

ICT use is further articulated in terms of “skills in accessing, processing and applying information, and using educational software in solving mathematical problems and conducting experiments”. At the secondary level, the RBEC does not provide direct teaching of ICT skills under Technology and Home Economics; instead basic ICT skills are integrated in different learning areas.

c. **Singapore**: Under MP1, ICT has been integrated in all subject areas and software and other ICT resources consistent with the curriculum objectives have been made available. The initial focus at the primary level is on English, Mathematics, Science and Chinese Language, and on Geography, History, English Literature and Civics and Moral Education at the secondary level. Extensive use is made of
Integrating ICTs into Education

... the Internet in many of these areas at the secondary level. Open tools, such as word-processing, spreadsheet, and presentation packages, are also used for all subjects, including mother tongue languages.

**Equipping students with ICT skills facilitates effective integration of ICT in schools**

The skills may include keyboard skills, information search and evaluation skills, word-processing skills, web-authoring skills, and other more specific ICT skills (such as image and video editing and flash development).

*a. Indonesia*: ICT is an essential part of the 2004 national curriculum. While it has also become a means for instruction, not all schools are able to use ICT because of infrastructure and financial constraints. Schools that make use of ICT have made ICT a subject. In these schools, students learn World Processor (MS Word), Spreadsheet (MS Excel), Creative Design (CorelDraw, Photoshop), and Internet (browsing, e-mail, and mailing list).

*b. Philippines*: Grade 2 students at private primary schools are exposed to the background, functions and parts of computers; followed at Grade 3 onwards by lessons on basic computer operations. In public primary schools, however, computers are not introduced until Grade 4 under Home Economics and Livelihood Education. In public secondary education, the teaching of basic ICT skills is done in the fourth year under Technology and Home Economics. Schools with sufficient resources also offer the course to third year students. Some private secondary schools offer programming and website development courses.

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*c. Singapore*: Students are expected to acquire specific ICT skills from primary school upwards, through just-in-time learning (prior to starting a project) or integrating ICT in different subject areas. By the end of secondary schooling, most students would have acquired minimum competencies in desk-top publishing, spreadsheet and database construction, and sourcing information from CD-ROMs and online resources. Respondents (i.e. teachers, principals and heads of departments) to a survey conducted by IDA in 2002 (http://schools.s-one.net.sg/findings1.html) agreed on the readiness and preparedness of students who grew up in the ICT era for the FastTrack@School initiative.

*d. South Korea*: Training in ICT literacy provides equal access to information and reduces the information gap in public education. Since 2001 the Government has required mandatory ICT education for students from first grade to sixth grade, unlike in the past when ICT-related classes were elective subjects in secondary school and no other type of ICT training was available. Furthermore, in every subject, more than 10% of classroom activities are encouraged to make use of ICT. Training in ICT utilization should not be considered as a special subject or as a part of technical education.
e. **Thailand:** There have been tremendous changes in ICT education since the introduction of educational reform. Firstly, the new ICT curriculum, despite being introduced separately, has been made compulsory from primary through upper secondary years. Secondly, ICT is one of several technologies included in the newly developed Design and Technology Curriculum. Thirdly, ICT will be integrated in the curriculum as a tool for developing decision-making, critical thinking and communication skills. The established ICT learning standards for the ICT curriculum focus on basic understanding and skills, value and ethics, and effective applications of ICT in handling information, communications, problem solving, and work and career. Before the implementation of the new curriculum standards in 2003, ICT was treated as a separate subject and offered as an elective course.

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**Lesson Learned 3**

*Teachers play a pivotal role in the integration of ICT in the school curriculum and assessment*

Lim et al (2002) stressed the importance of orientation activities in ICT-based lessons so that they support learner autonomy and help students to become more engaged in the learning process. These activities include introductory sessions to ICT tools, advance organizers and instructional objectives, activity sheet and checklist, and ICT and non-ICT tools for post instructional reflections. In order to carry out these activities effectively, they should be supported by sociocultural factors in the learning environment, including supportive leadership, professional development (both formal and informal) and access to ICT-based resources.

a. **Singapore:** ICT facilitates learning as it shifts from information receiving to searching, collating and synthesizing relevant information, and from applying information to problem-solving and communicating ideas effectively. ICT strengthens the teachers’ skills and offer a wide array of learning resources for students, encouraging independent learning and the expansion of horizons beyond the standard curriculum.

Sharing their experience of ICT integration in a survey conducted by IDA in 2002 (http://schools.s-one.net.sg/findings1.html) in relation to the FastTrack@School, respondents from River Valley High School noted that teachers’ training in ICT integration began with the implementation of the ICT in Education Master Plan. The teachers explored ICT as a learning tool and private vendors offered rigorous training programmes so that the teachers could conduct ICT-based lessons, enabling them to jumpstart ICT use at a faster pace than their contemporaries. School authorities reviewed the implementation of the ICT in Education Master Plan continuously to ensure that all the teachers were involved and were able to cope with the process.
When ICT is introduced into the assessment process, there is a need to reconsider the assessment approaches

Effective ICT use should take into consideration integration issues in relation to the curriculum and assessment approaches. Curriculum and assessment are interdependent and mutually supportive and both should be considered. There may be a greater role for formative assessment when ICT is integrated in the assessment process.

**a. Singapore:** An initiative on ICT integration covering both formative and summative assessments was the Enigma Project undertaken by the ITAL Unit (Interactive Technologies in Assessment and Learning) in UCLES (University of Cambridge Local Examinations Syndicate). It consisted of trial online examinations conducted in Singapore in September 1997 and October 1998, in line with the country’s goal to move towards a more ICT-based assessment system. In the first trial, papers from a Physics examination were transferred directly into a computerized format to determine whether a traditional paper and pen test format (multiple choice and short questions) could be administered through a computer. The second trial had two components: conceptual and analytical. The conceptual component was similar to the first trial, but questions in the analytical component were similar to those in a practical examination in science that require students to carry out a simulation. Both trials demonstrated the feasibility of ICT-based assessment, but there were many technical, administrative and educational issues that needed to be addressed. Activities that interacted with the assessment process included the use of ICT in test administration, setting questions and manual and automated marking, and supporting teachers in using ICT-related materials in the classroom and in using electronic content (Harding & Raikes, 2002).

Other initiatives include exploring assessment modes in an ICT-based learning environment to measure students’ skills in assessing and applying information, thinking and communicating. While current modes of assessment remain relevant, ICT could facilitate assessment of pupil competencies in more than one subject area and in several skills. Such modes of assessment include project work, simulation software to assess students’ ability to formulate and test hypotheses and self-assessment software so that students can monitor their own learning.
A foundation may be needed to provide the necessary conditions (e.g., basic ICT infrastructure, ICT competent teachers, and clear vision) for a shift towards more student-centred approaches for ICT-based lessons.

a. Indonesia: A shift in pedagogy as a result of integrating ICT in the curriculum has not happened yet due to several reasons: (i) lack of ICT literacy among teachers, (ii) limited support infrastructure (i.e. LCD Projector, PCs, etc.), and (iii) limited ability to develop ICT-based learning materials.

b. Singapore: MP1 has provided a broad base for ICT integration in the curriculum and school activities. There have also been changes in pedagogical approaches. An IDA interview with principals, heads of departments and teachers in 2002 (http://schools.s-one.net.sg/findings1.html), noted a shift to more self-directed learning processes and learning environments. The shift in pedagogy is most noticeable when the goals of MP2 are compared to the present status of ICT use. The key differences between the present situation and the goals of MP2 are described as follows: (i) whereas ICT is used at present to support the curriculum, in the future there will be seamless integration of ICT right from the planning of curriculum design; (ii) from a largely static content in print form, there will be a repository of dynamic digital content; (iii) the one-size-fits-all approach will change to mass customization and an ability-driven approach; (iv) teachers’ skills in the use of ICT for teaching will move from basic to a wider range of competencies; (v) from a phased approach to the integration of ICT, schools will move to a sense of greater ownership of and accountability for ICT implementation; (vi) ICT provision for all will become more flexible; and (vii) pedagogies will shift from being teacher-centred to being student-centred.

c. South Korea: The pedagogical shift concerning ICT use in education has been gradual and is best reflected in the new educational environment. Descriptions of these environments vary, but they tend to include two important characteristics. First, there is greater freedom in the choice of time and place. Students can choose their preferred activities and the time to learn them. The freedom to choose time, place and activity means that education becomes more individualized. Second, knowledge is conceptualised as something generated or constructed by each individual. This changes the roles of the student and of the teacher in education. The student is no longer a passive recipient of knowledge. With the help of the teacher, knowledge is constructed in the minds of individual students.
When ICT enters the school environment, the environment has to change to maximize opportunities and address the limitations of ICT. A shift in pedagogical approaches could facilitate the building of a community of thinking and independent ICT-savvy students in schools.


In teaching Mathematics and Information Technology, a series of web-based CAI programmes have been developed to make mathematical concepts more interesting and meaningful to grade seven students. The teacher facilitates the students’ learning with questions and comments and provides explanations. Students submit their work and discuss with the teachers via e-mail and the web board. The quality of the students’ questions and opinions is taken into account as part of the students’ evaluation. Both teacher and students enjoy working together and modifying the pre-designed lesson plans, as necessary.

In teaching about electrical matters to ninth grade science class, the teacher uses Internet resources and services to enable the learners to develop basic knowledge and understanding of electrical equipment through website exploration and discussion. Both teachers and students utilize ICT as a teaching and learning tool and gradually develop their ICT skills. Students learn more with pleasure and they explore and update materials. Their thinking skills are developed as a result of the opportunity to select, analyze, and synthesize information.

b. Singapore: The MOE has incorporated ICT use in curriculum planning, design and delivery and is working with electronic publishers on a comprehensive repository of digital media content to complement existing resources like textbooks. This repository will allow teachers to use and customize content to meet the learning needs of students (Soh, 2002). Emerging technologies are being explored to increase the efficiency of summative assessments, and to expand the scope and nature of formative assessments. These changes will support the shift of pedagogy to a social constructivist paradigm, where teachers and students work together using ICT to carry out learning tasks and construct knowledge.

Under MP2, the Education Technology Division works with schools to explore the most effective use of ICT in learning and administrative programmes. Schools have more autonomy in the management of ICT-related resources than under MP1, and will have access to clear performance indicators for evaluating their ICT programmes. ICT consultancy teams in each school cluster are being formed to support these new initiatives to encourage greater diversity in creative approaches and processes in ICT integration (Soh, 2002).
Shifting pedagogical approaches is facilitated through appropriate professional development of teachers

a. **Malaysia**: The Smart School Pilot Project introduced electronic learning materials in four subjects in which the in-service and pre-service training conducted by the Teacher Education Division concentrated. As a result, other teachers and staff members in the pilot schools regarded themselves as non-Smart School teachers and maintained their usual methods of teaching. Fortunately, the MOE had emphasized learner-centred teaching, higher level of thinking skills, generic skills and co-operative learning long before the start of the Smart School Project. Therefore, the better teachers were already practicing “smart pedagogy” by using a variety of methods, strategies, tools and materials to cater to individual differences in their students, with or without the use of ICT.

b. **Philippines**: Some attempts have been made to shift the emphasis of teacher professional development programmes from basic ICT skills training to pedagogies for effective integration of ICT in the school curriculum. One such attempt is the FIT-ED/Coca-Cola Ed.Venture pilot programme where teachers are taught pedagogy-based skills, such as learning theories, instructional planning models, and student-centred approaches in teaching and learning with ICT.

c. **South Korea**: The focus of most professional development programmes is on how to effectively achieve teaching-learning goals by utilising existing educational content, rather than how to develop new educational content. There is a lot of emphasis on pedagogical approaches in integrating ICT in the curriculum. The plan for training in ICT use was undertaken in 2002, outlining teaching-learning goals in 10 common basic subjects in the Seventh school curriculum. Under this plan, a teaching-learning model for ICT use in a teaching-learning plan for each subject was developed, in accordance with subjects in the curricula and the high-tech learning environment in the classrooms, group study rooms and individual multimedia study rooms. The plan has been in progress for two years, from 2002 to 2003, and has been applied to training in ICT use for teachers.

d. **Singapore**: The shift in pedagogy requires teachers to be equipped with a new set of skills, attitudes and knowledge to take on a pivotal role in the learning environment. Hence, there is a need for a sustained model for the professional development of teachers in the use of ICT in education. This model should have clear benchmarks for the beginning teacher, the trained classroom teacher, the peer leader and the organizational leader. This model may be mediated by network technologies where existing training initiatives are streamlined and integrated with existing and new ones into a single e-learning system (Shanmugaratnam, 2002).
Lessons Learned 1

Attracting well-established foreign education software developers to work with local companies helps to develop high quality ICT-based resources

Local development of ICT-based resources is crucial to support the curriculum as it enhances the relevance and authenticity of resources for students and teachers. This also promotes the transfer of skills and technologies.

a. **Singapore**: Under the MOE-Local Industry Upgrading Programme, local partner companies established global software houses to develop educational software and to facilitate the transfer of skills and technologies. The focus was on developing high quality software, especially in areas where suitable titles were lacking. The NCB helped to develop the base of talent required to produce educational software, and encouraged software distributors to provide value-added services to schools, such as proactive sourcing of educational software to match their needs and provision of after-sales technical support.

Many locally developed educational software packages are now recognized internationally, including the Active Primary Mathematics CD-ROM series (comprising three titles) which features sound pedagogy, innovativeness and content-rich activities. The MOE, project development specialists, and Times Media Private Limited collaborated in producing this package.

Lessons Learned 2

Establishing a clearing house or digital libraries of ready-to-use and tailored ICT-based resources promotes better use of ICT in teaching and facilitates quick and easy access to resources for making lesson plans and teaching

Teachers who are provided with a recommended list of ICT-based resources (software and websites) spend less time to identify the most appropriate ICT-based resource for their lessons. In addition, the MOE could provide them suggestions on the use of particular websites or software products for particular lessons. This will be especially helpful for novice teachers or teachers who are new to ICT in education.

a. **Malaysia**: Although good electronic materials are not easily available in Bahasa Melayu, Science and Mathematics teachers are happy to access the Internet for Science and Mathematics materials in English, such as GetCyberEd.com, a portal provided by the consortium that developed the Smart School Integrated Solution. Several other local companies have established e-learning portals to provide services and
materials to students and teachers. Most of these portals offer drill and practice materials to help students prepare for public examinations. Other portals offer a wide variety of services and materials to help teachers and students learn better. The Smart School Pilot Project established BESTARInet, the Smart School portal, to enable the pilot schools and parents of Smart School students to access their own schools remotely. The school’s IT coordinator with approval from the School Head controls access.

b. **Thailand**: Science, mathematics, and ICT education materials are mostly developed by IPST and are disseminated via the IPST Web Site and its e-library. NECTEC, in collaboration with IPST, has developed science, technology, and engineering content for the Digital Library, as a part of SchoolNet services to secondary school students. The Digital Library covers more than 7,100 subjects in 10 subject areas. The MOE has developed a database for over 3,689,744 catalogues and the work is continuing. Database development, in the form of e-Book, e-Journal and Courseware, is also ongoing. In addition, there is a reference database to store electronic data from various colleges and universities. A recent project, Developing an Educational Resources Clearing House initiated by the MOE, is a database of resources produced by all ministerial departments and organizations, including curriculum and supplementary materials in eight subject areas.

c. **Singapore**: Respondents to an IDA survey cited various reasons for choosing courseware developed under the FastTrack@School Project (http://schools.s-one.net.sg/findings1.html). The reasons are as follows: (i) broadband interactive multimedia content for education (e.g. videos, simulation aids, and games) enhances students’ understanding of subject areas; (ii) learning should be independent, fun, flexible and self-paced; (ii) the ICT tracking system for the auto-grading of quizzes could help students to reflect upon their efforts and to develop independent learning; and (iv) there is a value added dimension to the creative processes of teaching and learning in all subject areas.

The MOE has a compilation of recommended software that has been evaluated by the MOE Clearinghouse for IT Resources (http://www.moe.gov.sg/edumall/edu_library/rsl_englishl.html). Schools, however, have the autonomy to purchase software. Under the Educational Software Procurement Scheme (ESPS), schools could purchase any number of software titles in the ESPS list at a special educational price and directly from a locally appointed agent. The ESPS also allows teachers in primary or secondary school, JC or CI to purchase one personal copy of each software title at a special educational price.

The Digital Media Repositories (DMRs) provide media clips, web pages and courseware snippets for multimedia resource-based learning. The Internet serves as a platform for delivery of materials in the DMRs. There is also a database of Internet educational resources for use in the local curriculum (http://www3.moe.edu.sg/ier/).
Issue 4

Development and Selection of Culturally Sensitive Content

Lesson Learned 1

Having a mechanism in place for evaluating content developed for schools ensures political and cultural validity, reliability and correctness.

a. **Malaysia**: All materials developed for the Smart School Pilot Project were stringently tested for technical and content accuracy. Some Ministry officials, teachers and teacher trainers were seconded to the shortlisted consortium to ensure that the materials were free of culturally and politically sensitive matter. The warranty for all the Smart School Applications Software runs for one year after the end of the pilot project. During the warranty period, all defects, errors and bugs in the software that are reported to the Ministry’s Smart School Help Desk will be remedied.

Issue 5

Ethical and Political Implications of Using English as Lingua Franca

Lesson Learned 1

While local content in the local language promotes better use of ICT-based resources and materials, the use of English in schools optimizes the potential of ICT (especially the Internet) for teaching and learning.

a. **Malaysia**: Following the Government’s decision to leapfrog into the ICT Age and transform itself into a knowledge-based society, there has been general consensus that school-leavers do not have the necessary competence in the English language that will enable them to deal with challenges in the ICT Age. The ICT industry has regularly urged the Government to radically improve the standard of English competence in schools and universities. There has been much public debate on increasing the use of English in schools and universities. In 2002 the Cabinet finally made the decision to use English to teach Science and Mathematics. Intensive training courses are underway to ensure that all Science and Mathematics teachers are fully equipped to teach these two subjects in English. The provision of an allowance to all Science and Mathematics teachers teaching in the English Language is a welcome incentive to all the teachers involved.

b. **Thailand**: Using English in ICT application is a great barrier for many Thais. Only those who are capable of understanding English can become self-directed learners in the Internet.
Those who are not are limited to Thai language programmes only. While developing SchoolNet, the NECTEC noted that one key element for the successful use of ICT is the opportunity for schoolchildren to become bilingual. It was proposed to the Cabinet on 17 September 2003 that if students were capable enough to master more than one language, it would move the country forward rapidly since they could take advantage of their technological knowledge and language skills.

**Issue 6**

*Intellectual Property Rights Related to Educational Software*

A cost-benefit analysis conducted before deciding on whether to acquire the intellectual property rights to educational materials, or to acquire a perpetual license to use the materials, prevents waste of resources.

a. **Malaysia**: The Intellectual Property Rights (IPR) to the Smart School Integrated Solution and its components, including the Applications Software, was passed on to the Government upon the MOE’s acceptance of the Integrated Solution. An earlier proposal for the Government to acquire a perpetual license from the consortium instead of the IPR was not supported by the Attorney-General’s Chambers, who felt that the Government’s interest might be compromised if the IPR were not passed on to the Government. Therefore, all Government institutions and Government schools are allowed to use the Smart School Applications Software without having to pay license fees.