The Second International Information Technology in Education Study
Hong Kong SAR Report

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Executive Summary

Research Background

The Second International Information Technology in Education Study (SITES) is an international comparative study carried out across twenty-six countries and regions. The research project is conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA). The Hong Kong component of SITES is coordinated by the Centre for Information Technology in School and Teacher Education (CITE) at the University of Hong Kong and funded by the Quality Education Fund (QEF).

Research Objectives

The study aims to collect information on the application of information and communication technology (ICT) in school education for international comparison. This includes ICT-related curriculum goals and its level of implementation, the availability of hardware, software and network facilities in schools, staff development, the organization of ICT coordination in schools and difficulties encountered. The research also focuses on how teachers and students use ICT in teaching and learning both in school and at home, as well as their self-evaluation of their own ICT competence. Results from the research will serve as reference for school principals, teachers, policy-makers, professionals and educational institutions, and provide a basis for in-depth discussion of the development of ICT in education in Hong Kong.

Research Tools, Sampling and Data Collection

SITES has designed four types of questionnaire for the research: the Principal Questionnaire, Technology Coordinator Questionnaire, Student Questionnaire and Teacher Questionnaire. We distributed the first two types of questionnaires to all the schools which use ICT for teaching and learning and obtained a response rate of 74% (317 copies) from secondary schools and 70% (218 copies) from primary schools. We then selected 60 schools from among the respondents to our initial survey and sent them the Student and Teacher Questionnaires. The return rate for the Student Questionnaire was 92% (1646 copies from P6, 2238 copies from S2, 2281 copies from S4 and 1702 copies from S6) and 72% for the Teacher Questionnaire (1398 copies from primary school teachers and 2370 copies from secondary school teachers). The International Steering Committee stipulated November to December, 1998 to be the data collection period for the Principal and Technology Coordinator Questionnaires. Data collection for the Student and Teacher Questionnaires was conducted in February 1999.

ICT-related Curriculum Goals and Pedagogical Practice Paradigms

Many countries have already drawn up their master plans for the development of ICT in education, the emphasis of which is to develop in the younger generation, the competencies required of citizens of the information era. This includes: the capabilities for life-long learning, (such as taking control of one's own learning, setting one's own learning goals and paths, and monitoring learning progress), the ability for autonomous learning and to engage in open-ended learning tasks which involve collaboration and communication with peers and experts. New pedagogical practices, such as innovative ways of organizing classroom learning, new roles for teachers and improved evaluation procedures, are hence indispensable for the attainment of these new goals. One of the emphases of SITES is therefore to understand the impact of ICT on the overall development of school curriculum, and to investigate if any pedagogical practice paradigm shift has emerged during the process. As this research focus is unprecedented in any international comparative study, the definition of an "emerging paradigm" is still in its initial exploratory stage. In the present study, an emerging paradigm is understood as the educational goals to develop students' capacities for self-learning, problem-solving, information seeking and analysis, critical thinking and the ability to communicate, collaborate and learn via the Internet.

Responses from the Principal Questionnaires reveal a strong correlation between the use of ICT and the school and classroom cultures of that country. The policy goal of having "teachers use computers for instructional purposes " gained greater significance in Hong Kong, Belgium, the Czech Republic, France, Israel, Italy, Japan, Singapore, South Africa, Thailand and Slovenia. Canada, the Scandinavian countries and most of the European countries participating in the study, on the other hand, focus more on enabling students to use computers as supportive learning aids. They have chosen to cultivate in their students the ability to "process and analyze information", "use e-mail for communication" and "gain access to external databases via the Internet" as their policy goals.

Both in Hong Kong and across all countries, the prevalence of emerging pedagogical practices in classes using ICT is higher than that in other classes, indicating promising beginning of a pedagogical paradigm shift. In secondary schools, the overall median for the presence of 'student-centered pedagogical practice' is close to 0%, while the median for such practices realized through ICT approximates to 20%. Large dispersions, however, are found among Hong Kong schools regarding the prevalence of ICT-realized pedagogical practices, with the percentages of using ICT to implement 'student-centered practice paradigm' ranging from 0% to 100% among schools. Better communication and coordination among schools regarding the use of ICT in teaching and learning will expedite the paradigm shift in pedagogical practices.

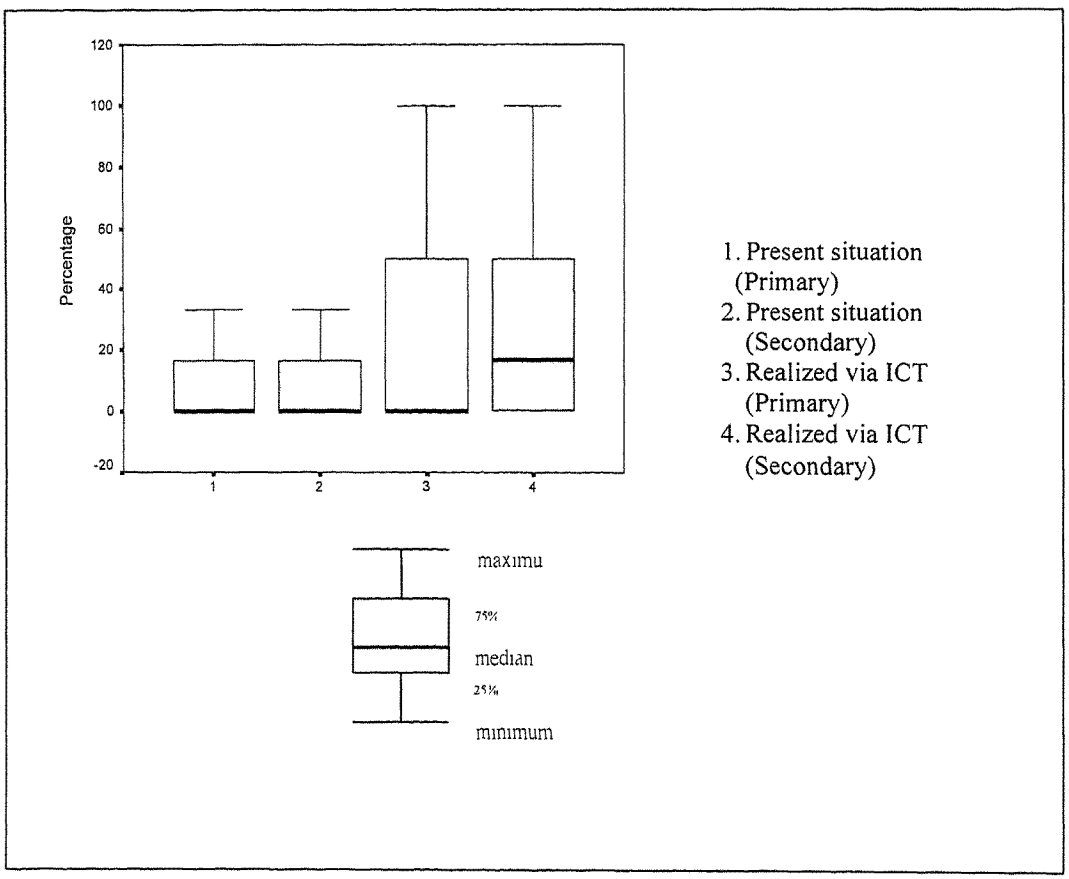

Figure 1

The present situation of secondary and primary schools in HK adopting "student-centered pedagogical practice" and the situation realized through the use of ICT

Student:Computer Ratios and Computer Peripherals

The highest provision of computer facilities are found in Canada, New Zealand, Singapore and Norway, with student:computer ratios of 18:1 or lower. The Russian Federation, most of the East European Countries, China Taipei, Hong Kong and Japan reported relatively higher student:computer ratios at both primary and secondary levels. In Hong Kong, the ratio is 36:1 in secondary schools, and 53:1 in primary schools. In terms of the quality of the ICT infrastructure, Singapore and Hong Kong stood out as the school systems equipped with the most sophisticated computers, where more than 80% of their computers were installed with powerful processors, operating systems and multimedia capability. For most other countries, the average percentages of computers with multimedia capability were only about 50%, 40% and 25% at the primary, lower secondary and upper secondary levels..

Regarding computer peripherals, Hong Kong has an exceptionally high availability of video projectors and LCD panels, both being above 50% for secondary schools, compared to the international averages of 30% and 15% respectively. These findings reflect that Hong Kong teachers tended to use computers for whole class teaching through multimedia presentations. Moreover, none of the 510 primary and secondary schools surveyed were equipped with peripheral devices for disabled students, while out of the 25 special primary schools surveyed, only four have such devices installed. The results pointed to the need to boost the use of IT to assist students with special needs in Hong Kong.

Networking and Communications

The majority of the schools surveyed do not have their computers connected to a local area network. Only 17%, 33% and 34% (compared to the international averages of 42%, 52% and 57%) of the computers in primary, Lower secondary and upper secondary respectively were connected to local area networks, ranking Hong Kong relatively low on the international scale.

The Internet is a powerful learning tool. However, Hong Kong's primary schools have one of the lowest rates regarding Internet connection (10%) when compared to other countries (international average is 59%). Worse still is that among the 218 computer-using primary schools surveyed, of those school that does not yet have the access, 34% of them have no plans to install Internet facilities before the year 2001.

Software Provisions and Pedagogical Applications

Compared to other countries, Hong Kong schools have less variety in their provision of computer software, most of which were designed for general use instead of subject-specific teaching purposes. The majority of school principals and technology coordinators consider the lack of teaching and learning software the main obstacle in promoting the use of ICT in education.

Moreover, among the primary and secondary school teachers surveyed, less than 10% have conducted computer-mediated learning activities in either computer rooms or classrooms. Only about 10% of the sampled schools reported that their teachers have used e-mail or the Internet for teaching purposes.

Staff Development

In the survey, most school principals point out that teachers' lack of ICT knowledge and training are the major barriers to ICT development in schools. In addition, over half of the technology coordinators considered the low quality of the existing ICT training provision for teachers at primary, junior lower secondary and upper secondary schools the main obstacles to ICT development. The research also finds that most teacher training courses focus on basic computer operations rather than advanced computer skills and subject-specific pedagogical applications.

Technology coordinators, in particular those in primary schools, proclaim lower confidence in their ICT pedagogical competence than technical competence. Compared to other countries, primary school technology coordinators in Hong Kong demonstrated a lower self-confidence both in the application of ICT and the use of Internet in schools, while technology coordinators in secondary school proclaim lower confidence in the appropriate integration of ICT in teaching and learning.

Teachers in Hong Kong generally felt that apart from word processing, they had not received sufficient training to enable them to integrate ICT into their teaching. Training most requested by teachers includes using multimedia in teaching (about 66%), word processing (about 57%), designing and writing software for teaching purposes (about 51%). This indicates the teachers' preference for using ICT as a teachers' tool.

Strategies for the Implementation of ICT in Schools

In Hong Kong, only 39% of the primary school principals and 42% of secondary school principals indicated that their schools had drawn up an explicit ICT policy plan, a relatively low rate compared to the international averages of 52% and 50% respectively. The most common component in the ICT policy of the schools in Hong Kong concerns staff training and development. Items like Internet policy and equity of access to use computers in primary schools, and the policy for the application of ICT in teaching for the current and future school year in secondary schools, were less found in Hong Kong than other countries. In general, primary and secondary school principals in Hong Kong have positive expectations for the implementation of ICT in education, even though their enthusiasm about average or relatively low compared to that of other countries.

In terms of administrative usage, Hong Kong reached the international average, with more than 70% of primary schools and 80% of secondary schools using computers both for keeping students' records and monitoring their progress and for managing school resources. However, the use of computers to manage library resources was lower in Hong Kong's primary schools than in other countries.

Organization of ICT Coordination in Schools

According to result of the Principal Questionnaire, only 7% of primary schools and 9% of secondary schools revealed that they did not have any one responsible for the coordination of ICT in schools, while most of the surveyed schools have teachers or committees involving teachers to coordinate ICT work. More than 48% of the principals indicated the presence of an ICT coordinating team consisting of an average of five members in their school. 12% of the surveyed principals also reported the involvement of school principals or senior administrative personnel in the coordination of ICT in their schools. Furthermore, the employment of a full-time technology coordinator was reported by 15% of primary school principals and 8.4% of their secondary counterparts.

Results from the Teacher Questionnaire revealed that 7% of the primary and 6.3% of the secondary school teachers participated in the coordination of computer hardware and software in their school. 11% of primary and 13% of secondary school teachers have also assisted their colleagues in using ICT in teaching. This indicates that the formation of a collaborative culture among teachers in ICT usage had already started.

Ownership of Computers and Internet Facilities at Home

The percentages of computer ownership at home for students from P6, S2, S4 and S6 are 51%, 72%, 82%, 91% respectively, and 87% and 91% for primary and secondary school teachers respectively. Among those who own computers at home, 37% of P6 students, 49% of S2 students, 58% of S4 students, 67% of S6 students, 63% of primary school teachers and 71% of secondary school teachers also had their computers connected to the Internet. On the other hand, the large difference in the percentage of students owning computers among schools is especially apparent at the primary level, with percentages ranging from 4.2% to 97% for P6 among the school.

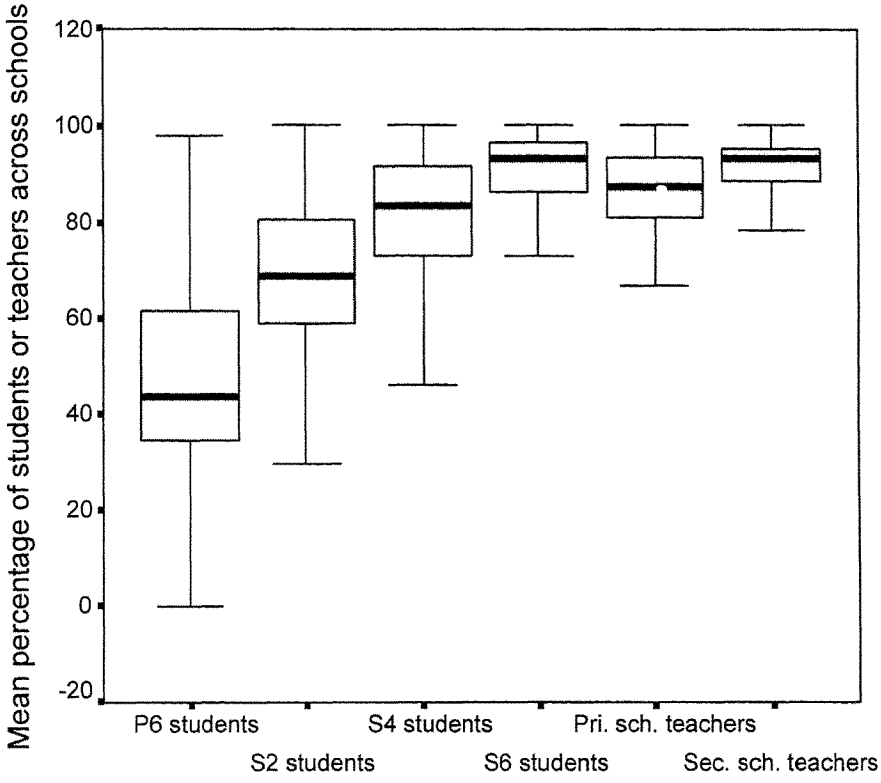

Figure 2
The percentage of teachers and students owning computers

ICT Competence and Source of ICT Knowledge

Percentages of students who indicated competence in basic computer operations ranged from 75%, 83%, 84% to 88% for P6, S2, S4 and S6 respectively. Students rarely use ICT as a problem-solving tool, with only 6.7%, 7.2%, 8.5% and 9.6% of P6, S2, S4 and S6 students respectively claiming experience in this aspect.

Results also revealed newspapers as a prominent source for acquiring new ICT knowledge for both students and teachers. As the grade level increases, the popularity of newspapers as a means for students to acquire ICT knowledge also increases, while that of television programs decreases. Most teachers did not report feeling uncomfortable when students' ICT skills surpass theirs.

Students said that they would seek help from friends and classmates when difficulty arose. The higher the grade level, the greater was the number of students seeking help from the Internet and media, and the less of them would ask teachers and parents for assistance. 6% of the P6, 11% of the S2, 17% of the S4 and 21% of the S6 students would resort to the Internet for help when encountering difficulties, and the rate of which was much higher than that of their teachers (only 5%), implicating that students have developed a stronger inclination and habit to acquire knowledge from the Internet.

Conclusion

The objective of this international comparative study is to provide a foundation upon which we can develop the vision and strategy to enhance development of effective ICT use in education in Hong Kong. This report is released almost one year after the data collection which took place between the end of 1998 and the beginning of 1999. Therefore, with fast developments both in Hong Kong and other countries, the situation in many of the aspects surveyed may have already been altered. The research team would like to highlight in this report that, although Hong Kong is a late-starter in terms of the establishment and implementation of its ICT policies, its direction and goal is similar to that found in many other countries which is to engender a pedagogical practice paradigm shift. At the same time, the study also discerns a positive attitude among principals and teachers towards ICT, and discovers that many attempts have been made in schools to experiment with the application of ICT in the emerging pedagogical practices. It nevertheless also exposes how ICT has widened the gap between schools. We hope that the shortcomings revealed in this research will catalyze educational development in accordance to the 21st Century Hong Kong Education Blueprint where the implementation and integration of ICT into education will nourish a new generation of progressive and life-long learners.

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Chapter 1 Background of the study

This chapter provides a description of the international and local contexts for the SITES Study as well as information about its organization and funding.

International Context

Computer technology was first introduced to schools in the early 1980's. Along with the exponential growth of technology in the society, the education system has also started to incorporate both information and communication technology since the 1990's. How are different countries responding to these challenges? What is the role of computers in schools? What kinds of curriculum initiatives have been introduced?

In response to these considerations, the International Association for the Evaluation of Educational Achievement (IEA) conducted an international comparative study of 'Computer in Education' (CompEd) in 1989 and 1992. The study proceeded in two stages. Stage one collected information on the status of computer use in education at three school levels (elementary, lower secondary and upper secondary). Stage two comprises two parts. Part one was the extension of stage one, and investigated the use of computer over time. Part two aimed at finding the relationship between policy, practices and outcomes with respect to computers in education. Overall, the main goal of the CompEd study was to describe and analyze the status of computer technology in education around the world.

During the last few years the need for implementing ICT into the classroom has become critical to the mission of schools as we prepare students for living in the 21st century. Government agencies have put in unprecedented efforts to ensure that schools are preparing pupils to meet the challenge and demands of the information age. For example

- In 1996, the U.S. President announced a plan to connect all schools to "the information highway by the year 2000", a policy objective that has also been adopted in Denmark, Japan, Finland, the Netherlands, Portugal and Spain (Pelgrum 1997).
- In 1997, The Dutch government established experimental teacher training institutes to prepare teachers for the "school of the future" in which ICT will play an important role (Plomp et al. 1996).
- In April 1997, Singapore launched an ambitious plan to incorporate ICT into the school curriculum.
- In 1998, The HK government issued a five-year plan for integrating information technology across the curriculum for enhancing the quality of education.

Thus we can foresee not only the approach of a boom decade in using ICT in teaching and learning. Recent developments across the world have moved much beyond the vision of using ICT as a teaching and learning aid. ICT has the potential to reshape the delivery of instruction and bring about changes in education -- transforming education in the industrial society to education in the information society. More updated information concerning the actual situation in educational practices is therefore needed.

Developments in Hong Kong

Computers were first introduced in Hong Kong schools as a pilot scheme for the new HKCEE subject *Computer Studies* at Secondary 4 & 5 levels in 1982 in 30 secondary schools. Two years later, the Director of Education of the Hong Kong Government announced that a further batch of 75 secondary schools joined the scheme. This brought the total number of schools equipped with computers to 105. In 1987, another computer subject, *Computer Literacy*, was incorporated into the junior secondary curriculum which aimed to provide students with some basic knowledge about computers and programming as well as some awareness and skills in the use of computers as a business productivity tool. Two years later, *Computer Literacy* and *Computer Studies* were introduced to special schools. In 1992, two new subjects were introduced at the top end of the school system: AS-level *Computer Applications* and A-level *Computer Studies* were implemented in Hong Kong Secondary schools.

Until 1997, computers were present in the school curriculum only as computer-related subjects at the secondary school level. In 1997, the Chief Executive of the newly established HKSAR government expressed in his first policy address a much broader vision and a stronger concern for ICT in education. Since then a series of initiatives to encourage and support schools in using ICT across the school curriculum to support teaching and learning have been launched in primary and secondary schools. This included the provision of computers for secondary and primary schools, training for teachers, funding for software and networking and the introduction of a pilot scheme in 10 primary schools and 10 secondary schools.

In May, 1999, the Education Department announced the allocation of 120 ICT coordinators for both primary and secondary schools for the new academic year starting September 1999 and the plan to increase the number of ICT coordinators to 250 in the 2000-2001 school year. Table 1.1 gives a summary of the key events in the history of ICT developments in Hong Kong schools.

In November 1998, a five-year policy on Information Technology for Quality Education was released after consultation. The document laid down a clear vision for promoting the use of IT in education. Both the strategies and time line for the implementation were also included in the document.

Table 1.1
Some landmarks in IT education in Hong Kong

10/1979	1st meeting of Computer Studies Task Force.
7/1980	1st meeting of the Computer Studies Subject Committee.
2/1981	CDC endorsed the first draft version of the Computer Studies subject at the secondary 4-5 level.
9/1982	Computers Studies was introduced in 30 pilot secondary schools.
12/1983	A task force was established by the Computer Studies subject committee to review and revise the curriculum.
5/1984	The first HKCEE examination for Computer Studies was held.
6/1984	A separate inspection unit for Computer Studies was established within the Education Department Inspectorate.
9/1984	Another 75 secondary schools joined the Computer Studies pilot scheme
7/1985	Computer Studies became a generally available subject open to all secondary schools
12/1986	Computer Education Centre of the Education Dept commenced operation.
9/1987	Computer Literacy was introduced in 70 secondary schools as a subject at secondary 1-3 levels.
9/1989	Computer subjects were first introduced in special education schools. A second revision of the Computer Studies curriculum started
9/1990	Computers Literacy was implemented in another 30 secondary schools
9/1992	AS level Computer Application and A-level Computer Studies started implementation.
9/1992	A Computer Awareness Programme was introduced to eight pilot schools
12/1992	Upgrading computers to 486SX (with Chinese and English Windows installed) for 315 secondary schools
9/1993	The revised syllabus for Computer Literacy was implemented.
9/1994	The programming language 'BASIC' was no longer taught in the HKCEE computer curriculum. Only the PASCAL programming language was taught.
9/1996	The subject committees of the various computer subjects recommended to undertake a comprehensive review of the curriculum
3/1997	Multimedia computers were first introduced to primary schools
4/1997	Consultation for the various revised computer curricula started
10/1997	The HKSAR Chief Executive expressed his commitment for a five year plan on IT in education
4/1998	The list of 20 pilot schools for integration of IT across the curriculum was announced
5/1998	Installation of 15 computers in all primary schools started
5/1998	Establishment of multimedia learning centres in 100 schools was announced.
9/1998	IT Regional Support Section of the Education Dept. commenced operation
9/1998	ED Information Technology Resource Centre commenced operation
9/1998	A revised curriculum for AS and A-level computer subjects started implementation.
11/1998	The consultation on 'IT for quality education: 5 year strategy' was completed.
9/1999	A 6-hr Basic Computer Assisted Learning training course for about 15200 primary school teachers started
4/1999	Establishment of IT Learning Centres in 46 prevocational schools and secondary technical schools and a computer laboratory in each of the 27 prevocational schools commenced.
5/1999	IT coordinator scheme commenced in 120 schools.
8/1999	Initial cash grant to provide Basic Information Technology (BIT) training for all teachers issued to schools.
9/1999	The second revision of Computer Literacy and the third revision of Computer Studies started implementation in schools.
9/1999	The Computer Awareness Programme should be offered by all primary schools by incorporating it into the school curricular activities

It is clear from the above description that Hong Kong is still very much in a state of flux with regard to the use of ICT in the school curriculum and the scene is literally changing everyday. At the time the survey was conducted (November 1998), only 310 out of 829 primary schools indicated that the school has had any experience of using computers for teaching and learning purposes, including extra-curricular activities. Furthermore, of the computer using primary schools, more than 80% had used computers for less than 2 years while the majority of all secondary schools surveyed had used computers for at least 6 years. It is important that we keep this context in mind when interpreting the findings from the SITES M1 Study.

The IEA and International Studies

The International Association for the Evaluation of Educational Achievement (IEA) is an international, non-profit making, non-government association of educational research institutions with a permanent secretariat located in Amsterdam, Netherlands. It was set up in 1959 as a cooperative network by researchers who were interested in studying organizational and curriculum-related issues that cannot easily be investigated in a single school system or country. There is a shared belief that naturally occurring differences in curriculum, educational organization and delivery among countries provides a ready-made "laboratory" for studying the relationships between these factors and student achievement. Each participating country or system is represented on IEA by one of their leading research organizations. The institutional member of IEA for Hong Kong is the Faculty of Education of the University of Hong Kong.

Since the establishment of IEA, a broad range of subject areas has been studied, including mathematics, science, social studies, reading comprehension, writing, reading literacy, second language learning, computers in education, classroom environment, civic education and pre-primary education. The number of countries taking part has ranged from eight in the study of French as a foreign language to 45 in the Third International Mathematics and Science Study.

The Aims and Main Components of SITES

Aims

From the above descriptions of recent developments, it is clear that educational systems in many countries are facing an increasing pressure not only to integrate the use of ICT in schools, but also to adopt and implement educational programs that reflect new ways of learning in order to prepare citizens for the information society. At this juncture, major questions confronting policy-makers, principals, teachers, teacher educators, education related professionals as well as parents are: To what extent has progress been made in realizing these reforms? Are there gaps between objectives and educational reality?
Which innovations exist and what evidence there is of their effectiveness? How is our education measuring up to other countries with regard to its innovative potential? Is there anything that we can learn from the experience of other countries in this regard?

In more concrete terms, the above questions can be translated into the following questions for which empirically based answers can be sought:

- To what extent have education systems adopted and implemented objectives that are considered important cornerstones of education in the information society?
  How does this develop over time?
- To what extent is ICT facilitating the implementation of objectives that schools are intending to realize?
- How, by whom and to what extent is ICT used in education systems, and how does this develop over time?
- Which differences in ICT-related practices exist within and among systems and how can these differences be explained?
- What is the impact of ICT on educational organizations, processes, and outcomes in different education systems?
- Which innovative practices exist that may offer educational practitioners new targets within their reach?

The Three SITES Modules

In order to seek answers to the above questions SITES has developed a three-stage scheme (Anderson, Haider, Pelgrum & Wanatabe, 1997) with slightly overlapping time-schedules:

Module 1: a survey of principals and technology coordinators in primary, lower secondary and upper secondary schools to furnish initial indicators for various aspects of ICT use in schools (1997-1999). This module will be referred to as SITES M-1 in the rest of this report;

Module 2: case studies of innovative pedagogical practices using ICT to provide a better understanding of the nature of such practices and the preconditions that facilitate exemplary ways of using ICT (1999-2001);

Module 3: a survey at school, teacher and student levels to investigate the similarities and diversities in ICT use in schools (2000-2005).

Module 1 Schedule

In 1997 the IEA General Assembly endorsed Module-1 and the International Coordinating Centre began its operations. The pilot study for this module was completed by June 1998 and the questionnaires were finalized by September 1998. Data collection started in November and was completed by December 1998. Data entry, cleaning and initial processing was conducted during the first quarter of 1999 by the IEA Data Processing Centre and the International Report for SITES was released on November 19, 1999.

Participating Countries

The study was designed as a survey among a representative sample of schools in each country that participated in the study. Schools were sampled at three levels in the education system: primary (I), lower secondary (II), and upper secondary education (III). The countries that participated at each of these levels are shown below:

	School level		
Country	**I**	**II**	**III**
Belgium-French		✓	✓
Bulgaria		✓	✓
Canada	✓	✓	✓
China Hong Kong	✓	✓	✓
Chinese Taipei	✓	✓	✓
Cyprus	✓	✓	✓
Czech Republic		✓	✓
Denmark		✓	
Finland	✓	✓	
France	✓	✓	✓
Hungary		✓	
Iceland	✓	✓	✓
Israel	✓	✓	✓
Italy	✓	✓	✓
Japan	✓	✓	✓
Latvia			✓
Lithuania		✓	✓
Luxembourg		✓	✓
New Zealand	✓	✓	
Norway	✓	✓	✓
Russian Federation		✓	✓
Singapore	✓	✓	✓
Slovenia	✓	✓	✓
Slovak Republic			✓
South Africa		✓	✓
Thailand		✓	

Organization and Funding of SITES Module 1

The International Coordinating Centre (ICC) of SITES M1 is located at the Centre for Applied Educational Research (OCTO), University of Twente, in the Netherlands. The International Coordinator is Dr. W J Pelgrum who has also coordinated the First IEA Computers in Education (CompEd) Study in 1989 and 1992. The International Steering Committee of the Study consists of Dr. R E Anderson (Chair, USA), Dr. C Dede (USA), Dr. N Law (China Hong Kong), Dr. F A Oedegaard (Norway), Dr W J Pelgrum (ICC-The Netherlands), Dr J Strakova (the Czech Republic), and Mr R Watanabe (Japan).
The sampling coordinator for the study is Dr C A O'Muircheartaigh from the University of Chicago.

The funding for the international overhead of Module-1 was provided by:

- The Japanse National Institute of Educational Research (NIER), and the Ministry of Education, Science, Sports and culture.
- The Norwegian Ministry of Church, Education and Research.
- The Dutch Science Foundation.

A further contribution to funding came from the participation fees provided by the participating countries.

Each of the participating countries is represented by a National Research Coordinator (abbreviated as NRC). NRCs and their national research teams play a crucial role in the process of defining the study design and instrumentation. Moreover, these national research teams are responsible for collecting survey data in their countries (according to guidelines that have been agreed upon by all participants). In Hong Kong, the SITES Study is conducted by the Centre for Information Technology in School and Teacher Education (CITE) of the University of Hong Kong and the NRC for Hong Kong is Dr Nancy Law, Director of CITE.

In addition to participation in the SITES M1 Study, Hong Kong also conducted concurrently a local extension to the Study which comprised a survey of teachers and students as well as case studies of good practices in the use of ICT in primary and secondary schools. The aim of the local extension was to provide further and richer information to schools and the education community to support more effective implementation of ICT in teaching and learning.

The entire SITES study in Hong Kong, including both the international participation and the local extension, is funded by the Hong Kong Quality Education Fund. The Hong Kong study is directed by a local Steering Committee. Members of the Steering Committee are :

Name	Institution
Mr. Chan Wing Kwong	Principal, Po Leung Kuk Luk Hing Too Primary School (AM)
Mr. Kan Wing Lok	IT coordinator, South Tuen Mun Government Secondary School
Mr. Ki Wing Wah	Deputy Director, CITE, HKU
Mr. Lai Suk Ming	Hon. Advisor, Hong Kong Association For Computer Education
Dr. Nancy Law	Director, CITE, HKU (Chair)
Dr. Law Hing Chung	Principal Curriculum Officer, Curriculum Development Institute, ED
Mr. Leung Shiu Keung	Principal Curriculum Development Officer (Science), Curriculum Development Institute, ED
Dr. Li Siu Cheung	Deputy Director, CITE, HKU
Mr. Ng Hok Ling	Dean of Academic Affairs, Lutheran School for The Deaf
Mr. Ng Sui Kou	Principal, S.S.Y. Ho Ngai College
Mr. Pun Sai Wing	Senior Lecturer, Hong Kong Institute of Education
Mr Tong Kai Hong	Deputy Director of Education, ED
Mr. Tsui Kim	Teacher, Buddhist Wong Cho Sum School
Mr. Yip Chee Tim	Vice principal, Pui Ching Middle School
Dr. Yuen Hoi Kau	Deputy Director, CITE, HKU

Organization of the Report

As the local survey extension of the Hong Kong SITES Study contributes to a deeper understanding of the issues studied in SITES M1, we consider it more appropriate that the reporting on both the international and local data be integrated to provide a more comprehensive understanding of the current status of ICT use in Hong Kong. Further, in the description and discussion of research findings, we will present the key findings from an international comparative perspective, highlighting how the Hong Kong results relate to the global picture. We will also explore further into the Hong Kong data and triangulate the various sources of data for a more complete picture where appropriate.

Chapter 2 provides an overview of the conceptual framework and main indicators for SITES M1 and the local survey as well as the population definition and sampling design for the entire Study. Chapter 3 describes the ICT-related curriculum indicators used in the study and presents the survey results in terms of ICT related policy and curriculum goals, pedagogical practice paradigms and learning outcome expectations at the school leadership level. The status of ICT infrastructure in schools reflect the goals and priorities of the leadership at various levels of the education system as well as affects the achievement of school goals. Chapter 4 reports on the availability of hardware, software, internet access infrastructure, ICT related learning opportunities and perceived implementation obstacles. Chapter 5 reports on the provision, organization and nature of the staff development opportunities provided for teachers as well as the teachers' perceived needs for such opportunities. Educational transformation will not occur simply because the technology is available. What is more important is how various stakeholders view the role of ICT. Chapter 6 examines the goals and policies regarding the use of ICT in schools as well as teachers' and students' attitudes towards the role of ICT in education. Learning does not take place only as planned by the school curriculum. Both students and teachers can be autonomous learners and this is especially true in the learning of IT knowledge and skills. As such, easy access to ICT facilities and the Internet becomes an extremely important asset. On the other hand, inability to gain access to such facilities may become a serious form of deprivation. Chapter 7 reports on the findings related to students' and teachers' access to computers and the Internet from home. Chapter 8 gives a description of the teachers' and students' self-reported ICT competence as well as their reports on instructional use of ICT from their own perception. The final chapter reviews the key findings from the Study and makes recommendations on the implementation of ICT in education in Hong Kong.

References:

Anderson, RE, Haider, G, Pelgrum, WJ, Watanabe, R (1997) *Second Information Technology in Education Study: Revised Proposal to the IEA General Assembly 1997.* Amsterdam:IEA.

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Chapter 2 Research Framework and Design

This chapter gives an overview of the conceptual framework and main indicators for SITES M1 and the local survey. Descriptions of the population definitions, sampling, instrumentation and quality control measures are also presented.

ICT Use in Education and the Emerging Paradigm

One key question motivating the SITES Study is whether the use of ICT in education is accompanied by the emergence of new pedagogical practices that would help transform education from a mode that is characteristic of the industrial society to one characteristic of the information society. Table 2.1 contains an overview of the expectations associated with each of these two educational paradigms as derived from a literature review

Table 2.1
Expected changes from "education in the industrial society" to "education in the information society" (from Pelgrum et al., 1997)

Actor	Education in the Industrial Society (traditionally important paradigm)	Education in the Information Society (the emerging paradigm)
School	- Isolated from society - Most information on school functioning confidential	- Integrated in society - Information openly available
Teacher	- Initiator of instruction - Whole class teaching - Evaluates student - Places low emphasis on communication skills	- Helps students find appropriate instructional path - Guides students' independent learning - Helps student to evaluate own progress - Places high emphasis on communication skills
Student	- Mostly passive - Learns mostly at school - Hardly any teamwork - Takes questions from books or teachers - Learns answers to questions - Low interest in learning	- More active - Learns at school and outside school - Much teamwork - Asks questions - Finds answers to questions - High interest
Parent	- Hardly actively involved in learning process - No steering of instruction - No life-long learning model	- Very active in learning process - Co-steering - Parents provide model

Source:

Pelgrum, WJ, ten Brummelhuis, ACA, Collis, BA Plomp, Tj, Janssen Reinen, IAM (1997). *The Application of Multimedia Technologies in Schools: technology assessment of multimedia systems for pre-primary and primary schools.* Luxembourg: European Parliament, Directorate General for Research.

In SITES, the characteristics of education in the industrial society is labeled as belonging to the "traditionally important paradigm" while those associated with the information society is labeled as belonging to the "emerging paradigm". Emerging paradigm is used in preference to "life long learning" or "constructivism", which are also popular labels, to avoid the myriad of connotations these may bring to different readers.

Conceptual Framework

The main aim of SITES M1 was to collect international comparative statistical data so as to describe the status of ICT use in schools at one point in time (end 1998). It was hoped that such data might shed light on the way ahead in implementing ICT in schools. Four elements have been identified as most essential for describing and comparing ICT related activities in education in the international study:

- **Curriculum:** What are the ICT related objectives that schools have adopted and what ICT related opportunities are schools offering to students?
- **Infrastructure**: What ICT facilities are available in schools?
- **Staff development:** How do schools help staff to become capable of applying ICT? What incentives are offered to teachers to encourage the acquisition of ICT related skills and what training opportunities are available for teachers?
- **Management and organization:** What policies and other actions are taken by the school management to support and facilitate ICT use? To what extent are school principals in favor of ICT? Which financial arrangements are in place?

These four elements are interwoven with the central focus on curriculum and pedagogy.

In addition to the collection of school level data, the local Steering Committee for the Hong Kong SITES Study decided to develop a local extension to the Study in order to collect information from teachers and students in relation to home access and avenues for the learning of ICT, as well as their self-reports on own ICT competence and ICT use at school for teaching and learning purposes. Such data would provide finer grain information about the actual status and readiness of school in terms of ICT use for teaching and learning.

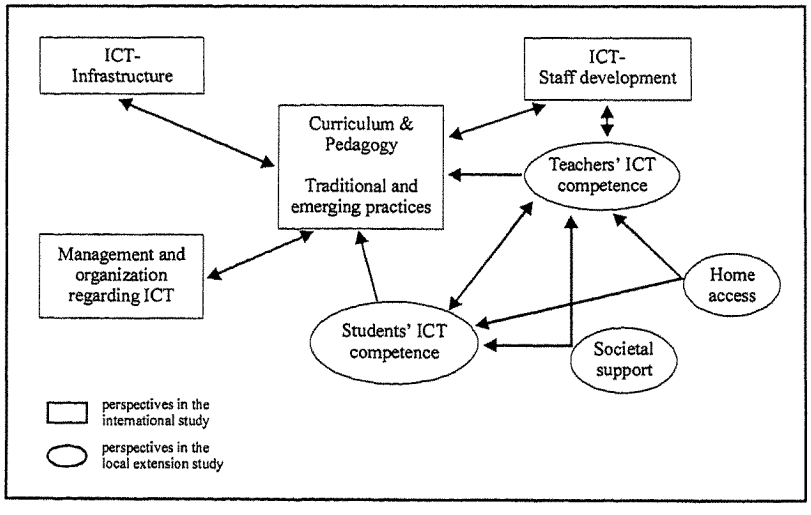

Figure 2.1.
Main conceptual perspectives for SITES M1, international & local components.

Indicators

Each of the four elements in the framework was elaborated further to develop measures that could serve as indicators in the Study. These elaborations are detailed below.

Curriculum and pedagogy

Curriculum is defined as educational contents and processes offered to students and encompasses pedagogy and instructional practices of teachers. When examining the curriculum, three levels are generally identified: intended, implemented and attained. The intended curriculum refers to the curriculum schools intend to realize and is generally described in terms of achievement targets and educational processes defined at the national/system level. The implemented curriculum refers to the educational processes happening in the schools and can be described in terms of learning opportunities offered to students. The attained curriculum refers to students' learning outcomes derived from learning experiences at school.

In SITES M1, data for the intended and implemented curriculum were collected via the principal questionnaire. With regard to the intended curriculum, two major indicators, namely emerging paradigm and traditional paradigm, were distinguished. Further, the impact of ICT on the curriculum can only be properly studied in conjunction with the general pedagogical paradigm of the school. A set of four sub-indicators was thus developed: the presence of emerging and traditionally important paradigms in the school as well as the contribution of ICT to the realization of these two paradigms. In addition, two further indicators, the ICT related policy goals and the instructional objectives for ICT use in the school, were developed.

With regard to the implemented curriculum, the core distinction of emerging and traditionally important paradigms was sustained. The following indicators were developed: ICT related opportunities relevant to the emerging paradigm, ICT related opportunities relevant to the traditionally important paradigm, opportunities for using ICT applications and opportunities for using the Internet. In addition to the survey items in the principal and technology coordinator questionnaire, items on the teacher and student questionnaires that aim to gather information about ICT related learning opportunities in schools constitute an important source of data for understanding the actual status of ICT related learning opportunities in schools

Infrastructure

Infrastructure includes hardware, software, network connection and other physical resources that affect the use of ICT. Indicators on the following were collected via the technical questionnaire:

- Hardware availability: "students per computer ratio",
- Quality and functionality of available equipment (including processor power, operating systems, peripherals and access to the Internet),
- Software availability (including general purpose and school subject specific software),
- Location of computers.

The above indicators provide evidence of the integration of ICT in education as well as the strengths and weaknesses of the infrastructure. These indicators will also provide important reference points when the perceived obstacles are considered.

Staff development

As Berman & McLauglin (1976) asserted, teachers are the major human resource and the key ingredient in any change that takes place in a school. It is necessary for SITES to collect data on staff development at the school level. Data will be solicited from both principals' and technical questionnaires.
The staff development related indicators used in this Study are:

- Staff development policies and the extent of their realization,
- Availability of ICT related training courses inside and outside schools,
- Perceived adequacy of staff development opportunities in terms of quantity and quality,
- Perceived ICT related competencies of teachers.

Management and organization

Implementation of an innovation leading to institutionalization will not take place without administrative leadership and organizational support at the school level and above. Educational leaders can stimulate and steer ICT related development via the adoption of explicit policies and provision of incentives. Specific indicators on management and organization support used in this Study include:

- The existence, content and perceived realization of ICT related school policies,
- Attitudes and beliefs of school principals towards ICT regarding student achievement, Internet use, school management, life-long learning, importance of staff training and certification,
- Perceived obstacles to the realization of ICT related goals and priorities for external support
- School ICT support infrastructure.

Additional school level indicators

Apart from the above factors the following information were also gathered through the principals' questionnaire:

- School characteristics: school size, gender distribution and school location,
- Personal demographic information of school principal: gender, age, and experience,
- Principals' reports of innovative pedagogical practices involving ICT use.

Home ICT access and ICT competence

In the students' and teachers' questionnaires, information were gathered on the following:

- Home ownership of computers
- Home access to the Internet
- Home ownership of computer peripherals
- Self evaluation of own level of competence in various ICT-related skills
- Self report on sources of ICT knowledge and help
- Self reports on use of ICT in teaching and learning activities at school

Population and Sampling

IEA studies' central aim is to conduct "comparative studies that focus on educational policies and practices in order to enhance learning within and across systems of education". Therefore most of the studies focus on the measurement of students' achievement in school subjects. In order to provide a basis for comparison with other IEA studies and for comparison with the student survey data to be conducted in SITES Module-3, the SITES M1 population was defined in terms of the characteristics of students attending schools that used computers for teaching and learning purposes, even though the school was the unit of analysis in the study.

For the three populations equivalent to the upper primary, lower secondary and upper secondary respectively, the target age was defined as 10, 14 and the final year of secondary education. The level population for SITES M1 was defined as those schools containing the three grades that has the most students of the target age. Further, in M1, population 2 was chosen to be the main population for international comparison and all countries participating in the Study will be encouraged to participate in population 2 if they cannot participate in all 3 populations.

Population definition used in the Hong Kong Study

Population 1
The three grades containing the most students of 10 year olds in the eighth month of the school year is equivalent to grades primary 3 to 5. Since not all primary schools had access to computers for instructional purposes at the time of the survey, a screening survey was first conducted on all 829 schools using the local curriculum. It was found that only 310 of these schools used computers for teaching and learning purposes. These 310 primary schools thus form the population 1 schools in the SITES M1 Study.

Populations 2 & 3
The three grades containing the most students of age 14 in the eighth month of the school year are secondary 1 to 3 and thus coincides with the lower secondary school in the Hong Kong education system. As for population 3, it was defined as the final grade of secondary education with the grade range being the penultimate and final grade year of secondary education. However, in Hong Kong, both secondary 5 and secondary 7 can be seen as the exit points for secondary education. Thus, in the current Study, the schools containing the students of the population 3 grade range was defined as schools with students from secondary 4 to secondary 7, that is, upper secondary schools. In Hong Kong, most secondary schools run from lower secondary all the way to the upper secondary level. As all schools at the secondary level have used computers for at least some instructional purposes and thus no screening test was necessary. Thus for practical purposes, the population of schools in populations 2 and 3 can be taken to be the same although a few schools are exceptions to this. There were 428 schools in the entire population of secondary schools, excluding international schools and special schools.

Sampling and administration for the international component

In SITES M1, national centres participating in the study were required to submit national sampling plans that contain detailed information about the population definition and sampling procedures. Base criteria for national sampling was that schools using ICT should be selected on the basis of a probability proportional to the number of students from the desired target population and that the minimum sample size should be 200.

In the Hong Kong study, a complete census of computer-using schools for all 3 populations was undertaken for both the principal and technology questionnaires. The response rate is presented in Table 2.2.

Table 2.2
The response rate for the principal and technology questionnaires for the SITES HK study.

Population	Total number of schools in population	Number of Principal questionnaires returned	Number of technical questionnaires returned	No. of schools returning both or either questionnaires	Response rate
1	310	207	205	218	70.3%
2	417	298	299	312	74.8%
3	425	298	299	315	74.1%

Implications of the sampling design

An important implication of the sample design in SITES M1 is that all statistics reported on the international component are proportional to the distribution of students in each population. Thus a statement like *"the percentage of school principals in ICT using schools that gave a particular answer" in this report should be read as "the percentage of students in ICT using schools whose principal gave a particular answer"*. The more complex description is avoided to make easier reading but the reader is herby cautioned to note its interpretation. In other words, all responses reported in this report are percentages weighted according to the size of the school participating in the study.

Sampling and administration for the local survey

In view of the limited resources, it was considered adequate to collect information on teachers and students from 60 schools for each of the three populations. Further, in order that further analysis of the four sets of questionnaire data can be performed at the school level, only schools participating in SITES M1 international component were invited to participate in this local extension survey. A total of 104 primary schools and 135 secondary schools indicated that they would like to take part in the local extension. A total of 60 secondary and 60 primary schools were selected by random sampling.

The teacher questionnaire was sent to all teachers in the selected schools. As for the student questionnaire, it was distributed to all students in one randomly selected class for each of the target grades present in a selected school. The target grade levels for the student questionnaire were Primary 6, Secondary 2, Secondary 4 and Secondary 6, thus covering grades from primary, lower and upper secondary levels. The teacher and student questionnaires were sent to the sampled schools in January 1999. For the teacher questionnaires, 56 out of the 60 sampled primary schools returned the teacher questionnaire while for the secondary schools there was a full participation at the school level. 3768 out of 5300 teacher questionnaires distributed were returned. The overall response rate was 72%. Table 2.3 summarizes the sample size and participation rate in the various components of the local survey.

For the student questionnaire, 52 primary schools out of the 60 sampled returned the questionnaires. Of the 8 schools that did not return the questionnaires, 5 did not respond at all and the remaining 3 were special schools where the students were not able to respond to the questionnaire by themselves. For the secondary schools, all of the 60 sampled schools participated in the survey. The response rates for each grade level can be referred to in Table 2.3. Overall, 8512 student questionnaires were sent to schools and 7867 valid questionnaires were returned. The overall response rate was 92%.

Table 2.3
The sample size and participation rates for the local study.

Target group	Sample size	Questionnaires Returned	Response rate
Secondary teachers	3485	2370	68%
Primary teachers	1815	1398	77%
S 6 students	1865	1702	91%
S 4 students	2394	2281	95%
S 2 students	2360	2238	95%
P 6 students	1893	1646	87%

Quality control measures

The IEA has a set of detailed quality control guidelines involving population definition, sampling procedures and response rates in order to ensure that the resulting data yield statistically valid comparisons across countries. In the case of SITES M1, for complete enumeration, the response rate requirement was 70%. Thus the Hong Kong Study was able to meet the quality requirements for it to be compared internationally.

Instrumentation

Instruments used in the international survey
Two instruments were developed for SITES M1: a questionnaire for school principals and a questionnaire for technology coordinators[1]. Each comprised three types of questionnaire items:

1. Entire school items such as 'In relation to using ICT for teaching and learning, is any of the following practiced?'
2. Target grade items such as 'According to your school's objectives, which of the following skills should your students acquire by the end of secondary 3?'
3. Grade range items such as, 'How many years have computers been used by your school for teaching and /or learning activities/purposes for the students in secondary 1 to 3?'

Entire school items collected data from the school level perspective. Target grade items and grade range items collected information on classroom teaching and learning.

[1] Technology Coordinator is defined in SITES M1 as someone who participated in the coordination of ICT use in the school and was appointed by the Principal to complete the questionnaire. This definition is thus different from the position of IT coordinator newly established by the Education Department.

Table 2.4
Short description of the content of the international questionnaires

Topic	Principal Questionnaire	Technical Questionnaire	Reporting
Curriculum	- ICT related objectives of the school - Presence of types of teaching- and learning practices - ICT attainment targets - Realization of ICT-related objectives	- Use of e-mail/WWW for instructional purposes - Percentage of students/teachers using WWW - Internet related activities of students - Use of technology applications by students	Chapter 3
Infrastructure	- Needs and priorities - Perceived obstacles - Expenditures - Hardware - Software - Maintenance	- Number and types of computers - Operating systems - Processor types - Access to the Internet/WWW - Existence and content of home page - Number of computers not in use - Availability of peripherals - Availability of software types - Availability of software for school subjects - Hard and software related obstacles	Chapter 4
Staff Development	- Prescriptions towards teachers - Attendance by teachers - Expenditures on staff development	- Types of internal information exchange - Availability of in-house/ external training courses - Self assessment of ICT skills	Chapter 5
Management and organization	- Existence of written policies on ICT - ICT related policy measures - Attitudes towards ICT - Use of ICT for administration/monitoring - Technical support infrastructure	- Priorities for external support	Chapter 6
Innovative practices	- Most satisfying ICT related learning activities		To be reported later
Background information	- Gender, age, experience of principal - Own use and type of use of ICT - Enrollment figures - Area in which school is located - Years of experience with using ICT	- Roles and tasks - Experience as computer coordinator - Gender - Age	Used in relational analysis and not to be reported separately

Design and instrumentation for the local survey

Apart from the international survey, SITES Hong Kong also includes a teacher questionnaire and a student questionnaire. The local survey was designed from the perspective of gaining information about the use of ICT as a form of curriculum implementation. As Fullan (1991) pointed out, effective change in education does not happen by chance, nor does it take place because some simple set of causes has obvious effects. One must take into account a variety of factors that may facilitate or inhibit the implementation process. SITES M1 has investigated the implementation process from the administrative leadership's point of view. However, to get a full picture of the implementation, data should also be collected at both the teacher and student levels. Taking this into account a local survey was developed. Figure 2.1 shows the model that guided the design of the local study and how it relates to the international component.

For any innovation to become institutionalized it must be supported by the principal. A critical element in ICT leadership is the ability to develop and articulate a vision of how ICT could produce changes. This information was collected in the international principal survey. Since teachers are the prime implementers of an educational innovation, the reactions of teachers to ICT for teaching and learning are especially important in the implementation process. The international component collected data about this aspect at the school level in the form of principals' and technical coordinators' perceptions. The local survey thus provide another, more direct source of information on teachers' own perception of staff development needs, adequacy of training opportunities as well as their present status of ICT usage and access.

ICT creates new learning opportunities for students. The international Study gathers information about perceived ICT-related learning opportunities and students' expected learning outcomes via the principal questionnaire. In order to get a better picture of the status of ICT use in classrooms at different levels in schools and students' ICT competence, a student questionnaire was found to be very useful. Further, it is well known that students learn outside of the formal school curriculum and in the case of ICT related competencies, access at home and support outside of the school environment may play an important part in contributing to students' learning. The student questionnaire in the local survey addressed these questions asked students for their perception of the role of ICT in their learning as well as the obstacles they encountered.

Besides exploring further issues through the local study as detailed above, it also provides an opportunity for the triangulation and comparison of similar indicators as reported by the different stakeholders in the school context.

The indicators developed for the two local survey questionnaires were as follows:

- Hardware availability at home
- Internet access at home
- Self proclaimed ICT competence
- Obstacles encountered
- Attitude towards ICT
- Purpose for using ICT
- Reported use of ICT at school
- Expectations on school use of ICT
- Training adequacy and needs
- Sources of and needs for support

Table 2.5
A brief description of the content of the local questionnaires

Topic	Teacher questionnaire	Student questionnaire	Reporting
Background information	- Gender, age, educational background - Teaching experience, subjects & levels taught level of appointment	- Gender, age - Level of school attending	Used in relational analysis
Curriculum	- Current modes of ICT usage for teaching and learning - Educational goals & contribution of ICT to its realization	- Current usage of ICT in various school subjects - Expectation on ICT implementation in school	Chapter 3
Home ICT access & usage	- Home computer & peripherals ownership - Home access to Internet	- Home computer & peripherals ownership - Home access to Internet - Purposes & activities for using ICT at home	Chapter 7
ICT related competence and attitude	- Self proclaimed ICT skill - Attitude towards ICT	- Self proclaimed ICT skill - Attitudes towards ICT	Chapter 8
Obstacles to implementation	- Perceived obstacles	- Perceived obstacles (school factors) - Perceived obstacles (inequity of home access)	Chapter 6
Sources of knowledge & help	- ICT-related training received - Most important source of knowledge - Where to seek help	- Most important source of knowledge - Where to seek help	Chapter 8

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Chapter 3 Curriculum Goals, Expectations and Practices

This chapter describes the ICT-related curriculum indicators used in the study and presents the survey results in terms of ICT-related policy and curriculum goals, pedagogical practice paradigms and learning outcome expectations at the school leadership level.

Introduction

The IEA has, for a long time, conducted comparative studies within a curriculum framework that distinguishes the intended, implemented and attained curricula (Robitaille & Garden, 1989; Pelgrum & Plomp, 1993). These curriculum perspectives may in turn be described at three different levels: the macro- or educational system level pertaining to the administrative and political system of a country, state or region; the meso- or school level pertaining to the institution where curriculum and learning opportunities are organized on a day-to-day basis; and the micro-level pertaining to the classrooms and the students.

The intended curriculum refers to curriculum goals and objectives. In many cases, there is a national or regional curriculum laid down in official documents to describe the intended curriculum at the macro-level. At the meso-level, the intended curriculum of a school pertains to the specific curriculum objectives, achievement targets and intended educational processes which the school intends to realize.

The implemented curriculum consists of the content, time allocations, instructional strategies, etc. which are actually realized. It can be described in terms of the learning opportunities offered to students at either the school (meso-) or classroom (micro-) level.

The attained curriculum, generally measured at the micro-level, is defined as the competencies and attitudes of students that arise from teaching and learning.

The SITES M1 survey collected data specifically at the school level. As the curriculum blueprint lays the foundation for the school, the Principal Questionnaire asks school principals about their ICT-related school policies and curriculum goals. It also surveys the characteristics of their schools' pedagogical practice paradigm and investigates the principals' perceptions and expectations of ICT-related learning opportunities and student learning outcomes. In other words, the study measures the different aspects of the intended, implemented and attained curricula in relation to ICT from the school principals' point of view.

In order to describe and distinguish the various ICT-related curriculum indicators, SITES M1 has developed and used the framework as shown in Figure 3.1.

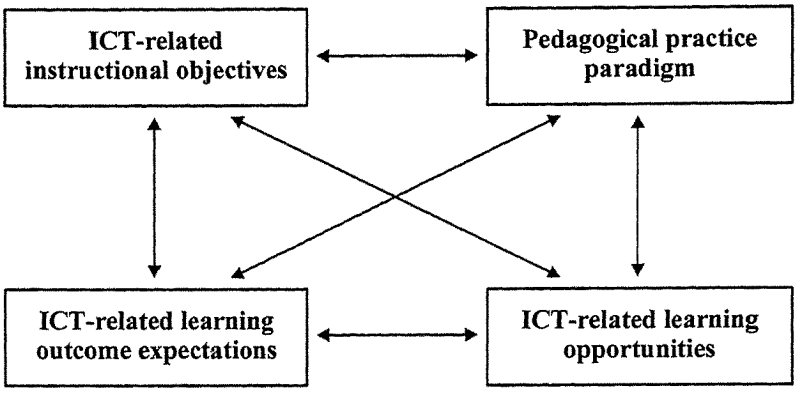


Figure 3.1
Framework for ICT-related curriculum indicators

Pedagogical practice paradigm is an important concept developed in SITES to highlight and account for recent trends in the expected role of ICT in education. The framework adopted by the CompEd Study (The First International Computers in Education Study), conducted in 1991 and 1993, focuses on two roles that ICT is expected to play in teaching and learning: to develop students' ICT-related competencies and to support and enhance teaching and learning across the curriculum as an instructional technology. Since then, there has been a growing recognition both within and beyond the education community that the fast pace of ICT development creates new learning opportunities and processes and also new demands on education. In the last several years, many countries have developed their national masterplans for "ICT in Education" which put emphasis on the new competencies demanded of citizens in the information age. These competencies include not only the capabilities for life-long learning, such as taking responsibility for one's own learning, setting one's own learning paths and goals and monitoring one's own progress, but also the abilities to engage in open-ended learning tasks which involve collaboration and communication with peers or experts. It has also been acknowledged that new pedagogical practices, such as new ways of organizing classroom learning, new roles for teachers and new evaluation procedures, are necessary in order to achieve these new goals. Such pedagogical practices, however, have yet to be fully developed.

Over the last decade or so, a large number of innovative pedagogical practices have emerged and extended the concept of the classroom, beyond the traditional physical and participant boundaries, enabling students to learn from a wide range of social and informational resources across geographical and national boundaries, such as museums, research centers and peers. The pedagogical practice paradigm is therefore developed by SITES M1 to characterize and capture the overarching distinctions between the "emerging" and "traditionally important" perspectives in the use of ICT in education.

ICT-Related Instructional Objectives

The Principal Questionnaire contains two questions that investigated the schools' ICT-related policy goals and learning objectives. The first one aims to find out which policy goals are important in determining the current use of ICT in the schools.

Table 3.1
Question about policy goals related to use of ICT in schools.

Q6. How important were each of the following goals in determining how computers are now used at your school?
Answer options: not important, important, very important.

1. To prepare students for future jobs
2. To improve student achievement
3. To promote active learning strategies
4. To individualize student learning experiences
5. To encourage more cooperative and project-based learning
6. To develop student independence and responsibility for own learning
7. To give students drill and practice exercises
8. To make the learning process more interesting
9. To satisfy parents' expectations

As shown in Figure 3.2, the goals related to promoting active learning strategies, developing student independence and responsibility for their own learning and making the learning process more interesting were the most popular ICT-related policy goals amongst school principals. A far smaller percentage of principals consider satisfying parents' expectation a very important policy goal.

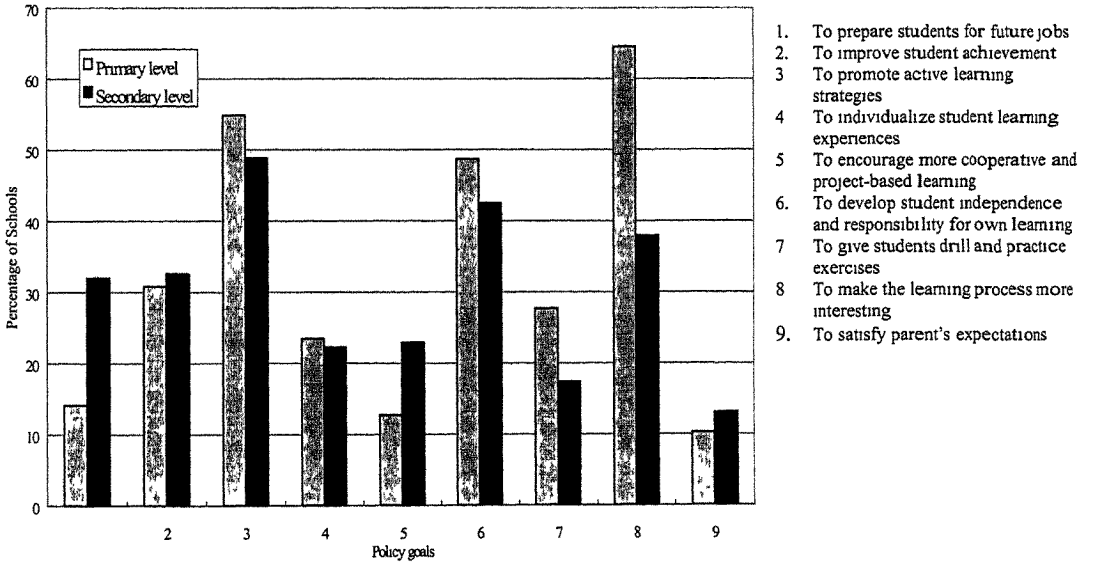


Figure 3.2
The percentages of school principals indicating that particular policy goals are very important in determining the use of ICT in schools in Hong Kong.

A factor analysis was performed to detect common response patterns among these items. Results suggested classification of the eight items into three factors, two of which are related to enhancing the learning process while the third concerns societal or parental expectations (1 and 9). It was found that school principals distinguished between the learning goal that focuses on drill and practice (7) and other more general learning goals (2,3,4,5,6 and 8).

Table 3.2
Different levels of importance for the three categories of ICT-related goals as perceived by school principals in Hong Kong.

Type of policy goal	Mean importance score[1] for primary principals	Mean importance score for secondary principals	F-score & p-value
To enhance teaching and learning	2.34	2.29	5.08, p<0.05
For drill and practice	2.19	2.05	14.82, P<0.05
To fulfill parental / societal expectations	1.84	2.12	56.32, p<0.05

[1] The importance score was based on the responses 1 = not important, 2 = important, 3 = very important

Table 3.2 shows significant differences between primary and secondary school principals in terms of the importance relegated to these three groups of policy goals. While both groups of principals place the highest importance to goals that enhance teaching and learning, primary school principals are less concerned with fulfilling parental or societal expectations while secondary school principals are less interested in using computers for drill and practice purposes.

Another question in the Principal Questionnaire asked about the current ICT-specific policy goals of the schools. Items that are related to teaching and learning uses are excerpted in Table 3.3.

Table 3.3
Statements about ICT-related policy goals on to teaching and learning

Q12. The following statements concern the use of computers in different aspects.
Is this a policy goal in your school?
Answers: no, yes

3. One or more computers available in every classroom
4. Teachers use computers in their instructional practice
5. Using software for students with learning problems
6. Encouraging students' learning on their own with the computer / encouraging independent learning with the aid of computers
7. Students using computers as supportive learning aids (e.g. searching, analyzing, and presenting information)
9. Students use e-mail
10. Students access external databases via the Internet/WWW
11. Cooperation with other schools in the area of computers

Factor analysis suggested categorization of these eight items into two factors. Items 3,4,5 and 6 were grouped as goals to encourage the use of computers as instructional technology, and as such are categorized as the traditionally important goals. Items 9,10 and 11 were grouped as goals related to the use of ICT for extending teaching and learning activities beyond the physical classroom boundaries in a way that matches with the concept of an emerging pedagogical practice paradigm developed in SITES, and thus categorized as "emerging paradigm" goals. It is interesting to note that the factor value for item 7, "to develop students'

information skills", is similar for both the traditional and emerging paradigms (0.55 and 0.54 respectively). While both primary and secondary schools adopted policies related to the use of ICT for teaching and learning, a much higher percentage of secondary schools have adopted goals related to the "emerging paradigm" ($F(1,458)=84.854$, $p<.05$).

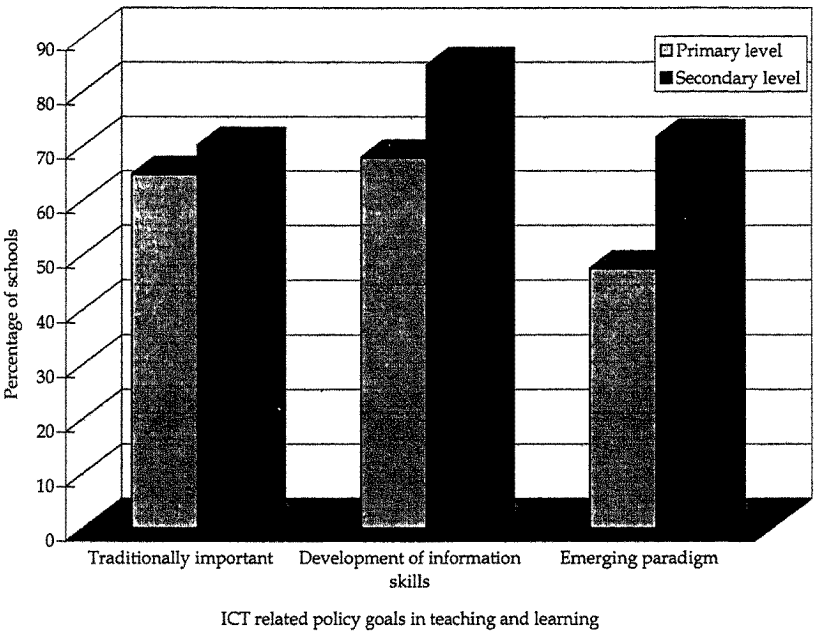


Figure 3.3
Percentages of schools in Hong Kong that have adopted policy goals concerning the use of ICT in three different aspects

As can be seen in Table 3.4, several noteworthy observations can be made from an international perspective. First, in all systems (including Hong Kong), there is a general increase from primary level to upper secondary level in the percentages of schools having adopted ICT-related teaching and learning policy goals. However, across all countries surveyed, Hong Kong has the second lowest percentage of computers-using primary schools that has explicit ICT-related teaching and learning policy goals, following Japan.

Second, the most popular policy goal across countries is for "teachers to use computers for instructional purposes", shared by Hong Kong and almost half of the participating countries: Belgium French, Czech Republic, France, Israel, Italy, Japan, Singapore, South Africa, Thailand and Slovenia. The second most popular goal is to use computers to develop information skills and/or to access external databases and is the most prevalent goal for the Scandinavian countries, Canada and most of the European countries.
The proportion of countries having information skills as the most popular goal increases from primary level through to upper secondary level. "Getting students to use e-mail" and "using ICT to cooperate with other schools" rank lower than the two aforementioned goals but are also observed to increase in popularity with the education level of the population surveyed.

Third, using ICT to help students with learning problems is a school goal that is present to a very large extent in many countries. In most countries, more than 60% of the schools include this as a policy goal, except for some Asian and East European countries, including Chinese Taipei, Hong Kong and Japan at primary level, Chinese Taipei, Hong Kong, Japan, the Russian Federation and Thailand at lower secondary level. These countries also tend to rank "teachers to use computers for instructional purposes" as their most important policy goal.

Table 3.4

Percentages of students whose school principals indicated that particular policy goals were present (B1-B8) - primary, lower secondary, and upper secondary education.

Country	Primary Education								Lower Secondary Education								Upper Secondary Education							
	B1. More computers in every class	B2. Teach. use comp. for instruc.	B3. Use by retarded students	B4. Encourage independent learning	B5. Developing information skills	B6. Students use e-mail	B7. Stud. access external data bases	B8. Cooperation with other schools	B1. More computers in every class	B2. Teach. use comp. for instruc.	B3. Use by retarded students	B4. Encourage independent learning	B5. Developing information skills	B6. Students use e-mail	B7. Stud. access external data bases	B8. Cooperation with other schools	B1. More computers in every class	B2. Teach. use comp. for instruc.	B3. Use by retarded students	B4. Encourage independent learning	B5. Developing information skills	B6. Students use e-mail	B7. Stud. access external data bases	B8. Cooperation with other schools
Belgium-French	~	~	~	~	~	~	~	~	*24	91	83	62	83	41	78	56	*24	88	82	66	84	39	78	57
Bulgaria	~	~	~	~	~	~	~	~	35	76	35	71	82	59	62	62	39	75	34	67	74	55	60	58
Canada	*82	78	78	73	86	49	76	53	*58	78	72	70	84	59	82	54	*53	81	81	68	87	60	86	62
China Hong Kong	44	79	57	77	68	39	45	59	53	87	57	85	85	69	81	65	53	87	57	85	85	69	81	65
Chinese Taipei	36	71	53	80	58	51	57	37	31	80	58	80	68	80	81	44	32	85	49	89	83	93	95	59
Cyprus	57	71	71	61	74	43	37	52	5	33	23	67	51	20	35	27	48	78	41	77	85	54	46	45
Czech Republic	~	~	~	~	~	~	~	~	12	78	60	65	68	31	46	55	18	88	27	70	83	66	79	71
Denmark	~	~	~	~	~	~	~	~	47	88	77	68	89	62	84	50	~	~	~	~	~	~	~	~
Finland	78	98	94	92	99	79	94	84	74	96	87	92	98	94	98	87	~	~	~	~	~	~	~	~
France	*55	85	83	68	83	53	50	53	40	94	86	78	91	50	75	57	50	96	67	77	88	56	84	54
Hungary	~	~	~	~	~	~	~	~	37	89	60	82	91	76	85	84	~	~	~	~	~	~	~	~
Iceland	89	83	95	82	98	79	92	70	89	82	96	82	97	85	93	70	71	67	95	82	100	95	95	92
Israel	*60	92	74	93	83	46	55	52	*27	97	79	92	89	58	71	56	*31	97	67	97	97	71	88	60
Italy	32	84	83	55	58	29	25	54	*35	93	50	72	87	46	72	58	*41	96	58	73	89	51	75	66
Japan	17	75	45	65	53	20	28	35	11	81	38	67	59	23	36	31	10	75	19	56	43	17	34	23
Latvia	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	*45	88	50	90	91	66	74	78
Lithuania	~	~	~	~	~	~	~	~	34	80	56	89	84	69	63	76	37	81	55	91	87	71	66	77
Luxembourg	~	~	~	~	~	~	~	~	74	86	72	62	100	86	100	86	73	87	69	62	98	85	98	85
New Zealand	95	91	84	86	93	77	75	62	*47	87	78	75	95	74	88	56	~	~	~	~	~	~	~	~
Norway	83	93	99	89	88	51	73	59	63	93	99	87	93	71	90	69	45	93	96	91	97	81	99	74
Russian Federation	~	~	~	~	~	~	~	~	*53	37	57	33	35	62	62	43	*53	37	57	33	35	62	62	43
Singapore	77	97	81	93	91	61	68	70	61	95	64	89	95	70	82	62	80	95	40	91	95	90	95	65
Slovak Republic	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	*70	20	90	44	28	33	27	36
Slovenia	41	94	59	80	89	71	85	76	49	93	66	90	93	79	89	78	*48	95	50	85	93	92	94	95
South Africa	~	~	~	~	~	~	~	~	*20	71	47	66	71	49	57	51	*23	66	45	71	69	49	55	51
Thailand	~	~	~	~	~	~	~	~	16	70	36	62	63	26	42	69	~	~	~	~	~	~	~	~

Notes: * countries that did not satisfy all sampling criteria for this population; ~: no data collected. ☐ indicates the most popular policy goal for the country at the particular level.

Pedagogical Practice Paradigm

Pedagogical practice refers to the oragnization of teaching and learning in schools. This study is interested in finding out whether some "emerging practices" have developed in conjunction with the use of ICT in schools. A list of statements originally developed by a Dutch research team (Brummelhuis, 1999) is included in the Principal Questionnaire to investigate the extent to which schools have adopted particular generic pedagogical practices (teaching and learning activities) which can be achieved with or without the use of technology. The statements are presented in Table 3.5. School principals' perceived pedagogical practice paradigm present in their schools should, to some extent, reflect the actual pedagogical practices. In a later section, we will report the extent to which the principals feel that these various pedagogical practices are realized through ICT.

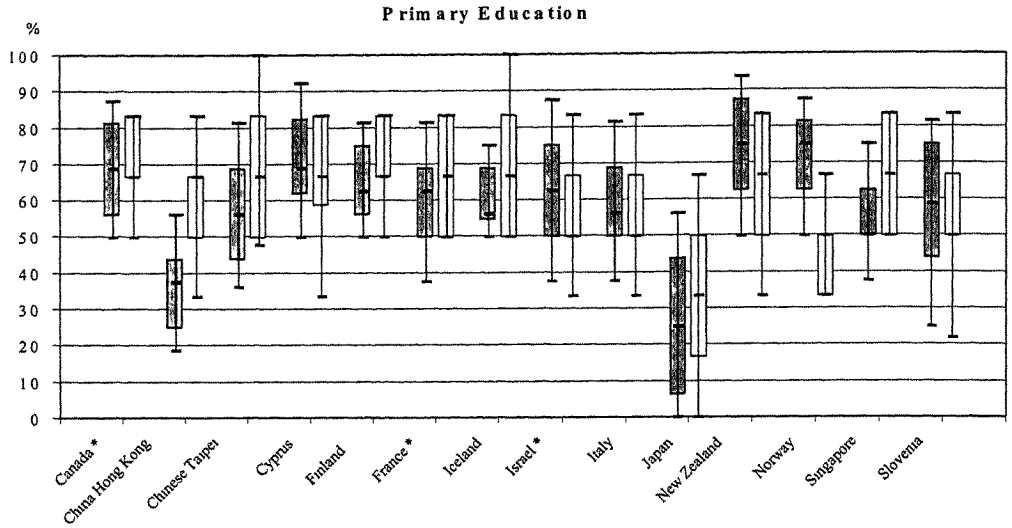
Table 3.5
Statements about the presence of pedagogical practices in schools

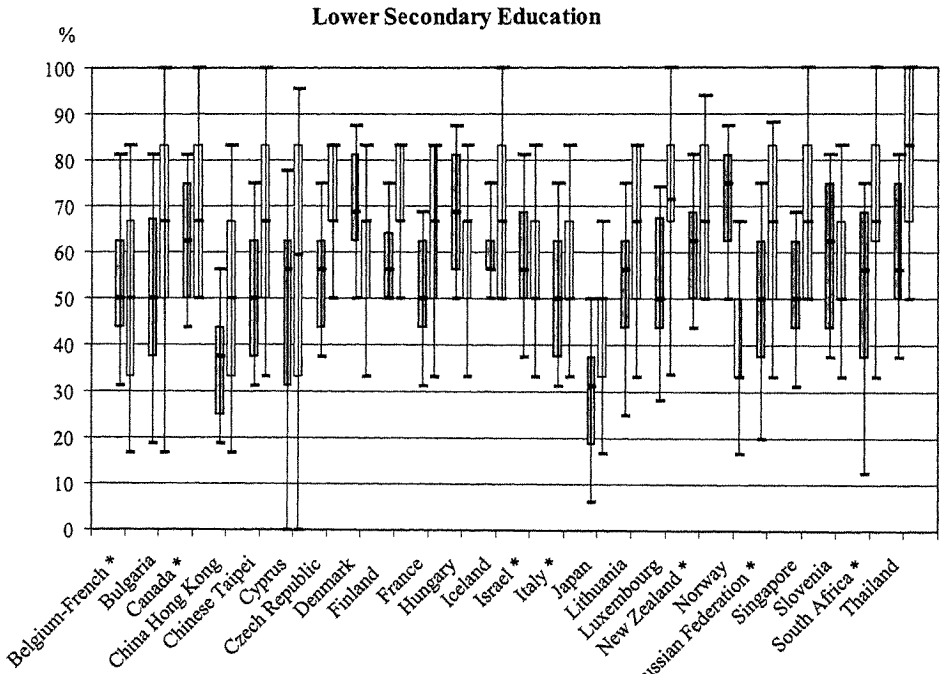
Q7. To what extent is each of the following aspects of teaching and learning present in your school?
Answers: not at all, to some extent, a lot

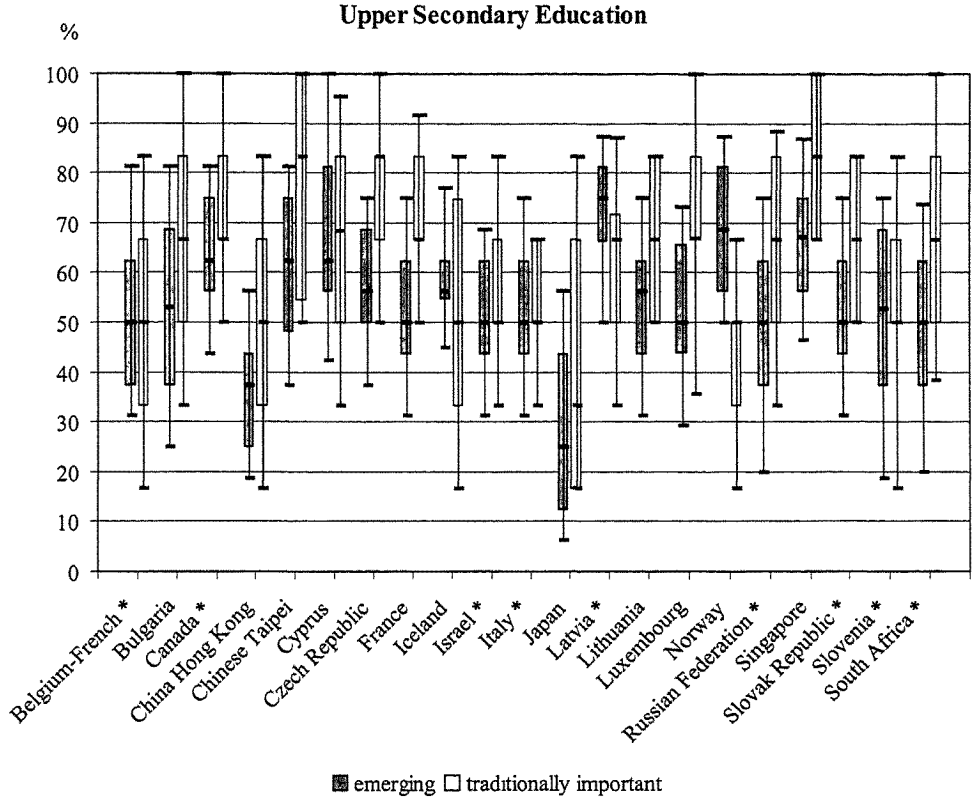
1. Students developing abilities to undertake independent learning
2. Providing weaker students additional instruction
3. Organizing teaching and learning so that differences in entrance level, learning pace, and learning route are taken into account
4. Students learning to search for information, process data, and present information
5. The emphasis in learning is on the development of skills
6. Students working on the same learning materials at the same pace and/or sequence
7. Teachers keeping track of all student activities and progress
8. Students being largely responsible for controlling their own learning progress
9. Students learning and/or working during lessons at their own pace
10. Students being involved in cooperative and/or project-based learning
11. Students determining for themselves when to take a test
12. Students learning by doing
13. Combining parts of school subjects with one another (multidisciplinary approach)

Traditionally Important and Emergent Practice Paradigms

SITES M1 researchers agreed that statements 1, 8, 9 and 10 were clear manifestations of the emerging paradigm while statements 5, 6 and 7 reflected the traditionally important paradigm. Further empirical analysis revealed substantial evidence that statements 1, 2, 3, 4, 8, 9, 10 and 13 can be interpreted as reflecting the emerging paradigm while statements 5, 6 and 7 can be combined into an indicator for the traditionally important paradigm.


Primary Education
%
100
90
80
70
60
50
40
30
20
10
0
Canada *
China Hong Kong
Chinese Taipei
Cyprus
Finland
France *
Iceland
Israel *
Italy
Japan
New Zealand
Norway
Singapore
Slovenia


Lower Secondary Education
%
100
90
80
70
60
50
40
30
20
10
0
Belgium-French *
Bulgaria
Canada *
China Hong Kong
Chinese Taipei
Cyprus
Czech Republic
Denmark
Finland
France
Hungary
Iceland
Israel *
Italy *
Japan
Lithuania
Luxembourg
New Zealand *
Norway
Russian Federation *
Singapore
Slovenia
South Africa *
Thailand



* countries that did not satisfy all sampling criteria

Note: Scores on each indicator scale of each school are calculated using the formula 100%*(mean-1)/n, where n represents the number of answer categories minus 1, and mean is the mean value across items in the indicator scale.

Figure 3.4

Box plots of indicators concerning the emerging and traditionally important pedagogical practice paradigms for primary, lower secondary and upper secondary education.

An inspection of Figure. 3.4 reveals a high correlation between the two pedagogical practice indicators. For example, Japan has the lowest score for both the emerging and traditionally important paradigms at all three populations while at primary level Canada, Cyprus and New Zealand have the highest score for both indicators. This may reflect cultural differences in the use of extreme responses which make respondents from some countries reluctant to choose the category "a lot." Comparisons of the absolute percentage of responses in each category across countries, therefore, may not yield very meaningful results. Several pertinent observations, however, can be made when the relative prevalence of the two kinds of practice paradigms within each country is examined.

First, practices belonging to the traditionally important paradigm are more prevalent than the emergent practices at primary level in half of the participating countries, including Chinese Taipei, Finland, France, Hong Kong, Iceland, Japan and Singapore. Not surprisingly, most of these countries also relegated high importance to the use of ICT by teachers for instructional purposes as a school policy goal while helping students with learning problems received much less attention. At primary level, the highest difference between the prevalence of these two kinds of practices was found in Hong Kong and Norway, but in reversed directions. For Hong Kong, the mean value of the indicator for traditionally important practices is

amongst the highest at 57% while that for the emergent practices is only 38%, the second lowest after Japan. The Norwegian picture is just the opposite: its mean value for emergent practices is amongst the highest at 71%, while that for traditionally important practices is only 44%.

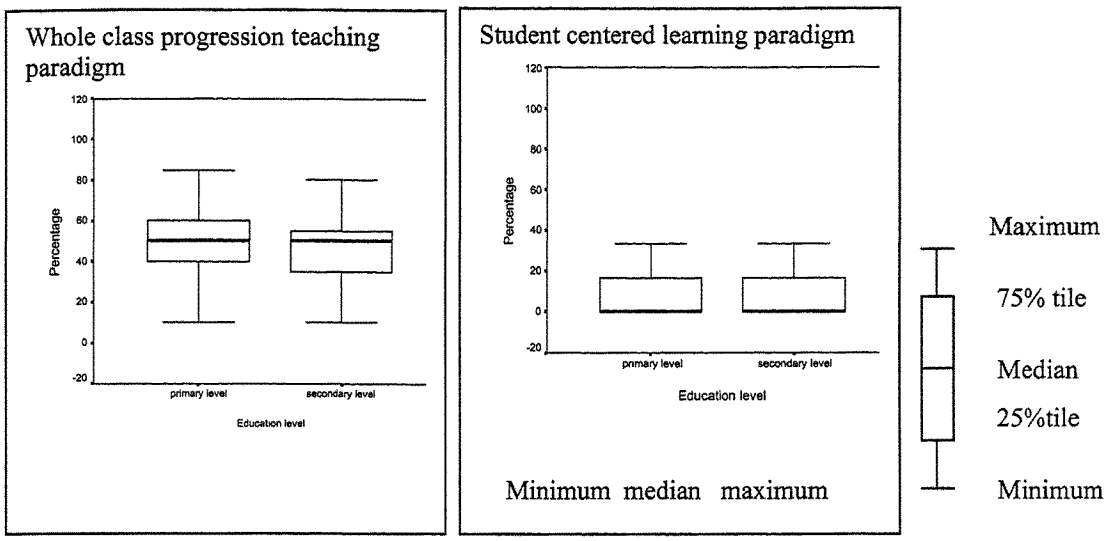
Second, the indicators for the presence of traditionally important practice were relatively higher for lower and upper secondary levels. The presence of traditionally important practices was in fact higher than the emergent ones in most countries. However, a similar pattern of differences in pedagogical practice is observed. Japan and Hong Kong rank amongst the lowest in terms of emergent practices. At lower secondary level, the presence of emergent practices was substantially lower than that of traditionally important practices in Bulgaria, Chinese Taipei, Finland, France, Hong Kong, Japan, Luxembourg, Russian Federation, Singapore and Thailand. At the secondary level level, only Latvia and Norway are able to maintain a higher level of emergent practices than traditionally important ones.

Whole Class Progression versus Student Centered Learning Approaches

Besides the above analysis on pedagogical practice paradigms that was conducted with the entire set of international data, a more in-depth analysis of the Hong Kong data was also carried out in this regard. A factor analysis of the responses to this question resulted in a different item clustering from the international one. Responses cluster into two factors, with statements 1, 2, 3, 4, 5, 6, 7, 10, 12 and 13 forming one factor and statements 8, 9 and 11 forming another one. A closer inspection of the statements revealed that the first factor reflects whole class progression pedagogical practices, while the second factor marks student-centered learning practices. Box plots in Figure 3.5 show the summary of distribution and median values of both indicators across schools. In addition, Table 3.6 provides a summary of the average scores and standard errors of both indicators in schools.

Table 3.6
Summary of average scores and standard errors of indicators of the whole class progression pedagogical practices and student-centered learning practices in Hong Kong schools

Pedagogical practice	Primary educational level Average score (S.E.)	Secondary educational level Average score (S.E.)
Whole class progression	49.27 (1.21)	46.26 (.98)
Student-centered learning	12.77 (1.25)	11.78 (.97)



Note: Items 1, 2, 3, 4, 5,6,7, 10,12 and 13 (table 3.3) are used as an indicator of the whole class progression paradigm and items 8,9,11 are used as an indicator of student centered learning paradigm. Scores on each indicator scale of each school are calculated using the formula 100%*(mean-1)/n, where n represents the number of answer categories minus 1, and mean is the mean value across items in the indicator scale.

Figure 3.5

Box plots of the distribution and median values of indicators for whole class progression pedagogical practices and student-centered learning practices in Hong Kong schools.

While the scores for both indicators are slightly higher in primary than in secondary schools, results from an ANOVA analysis find significant difference between the two school levels only in the whole class teaching paradigm ($f(1,463) = 8.027$, $p < .05$) but not in the individualized learning paradigm ($f(1,463) = 1.108$, $p = .293$).

Realization of Pedagogical Practice Goals through ICT

In addition to evaluating the presence of various pedagogical practices in their schools, principals were also asked to estimate the extent to which each of the practices listed in Table 3.5 has been realized through ICT (by choosing from the answer options: not at all, to some extent and a lot). Table 3.7 contains the percentages of students at pop 1 schools where principals claimed for each activity that a lot was present and the corresponding percentage for each kind of activity that was realized through ICT.

It should be noted that both in Hong Kong and in most other countries, the most prevalent pedagogical practice does not correspond to the practice most realized through ICT. In Hong Kong, the most prevalent pedagogical practice was "students working on the same learning materials at the same pace and/or sequence" (42%), which is considered only by 11% to be mostly conducted through ICT. The practices that were best realized through ICT in Hong Kong schools were "students learn information search" (16%) and "students learn by doing" (19%). However, these kinds of activities had a very low level of presence in schools in general (6% for "students learn information search" and 13% for "students learn by doing"). One possible interpretation of this is that the use of ICT fosters alternative pedagogical activities more than the traditionally important ones which is in fact an encouraging finding.

Table 3.7

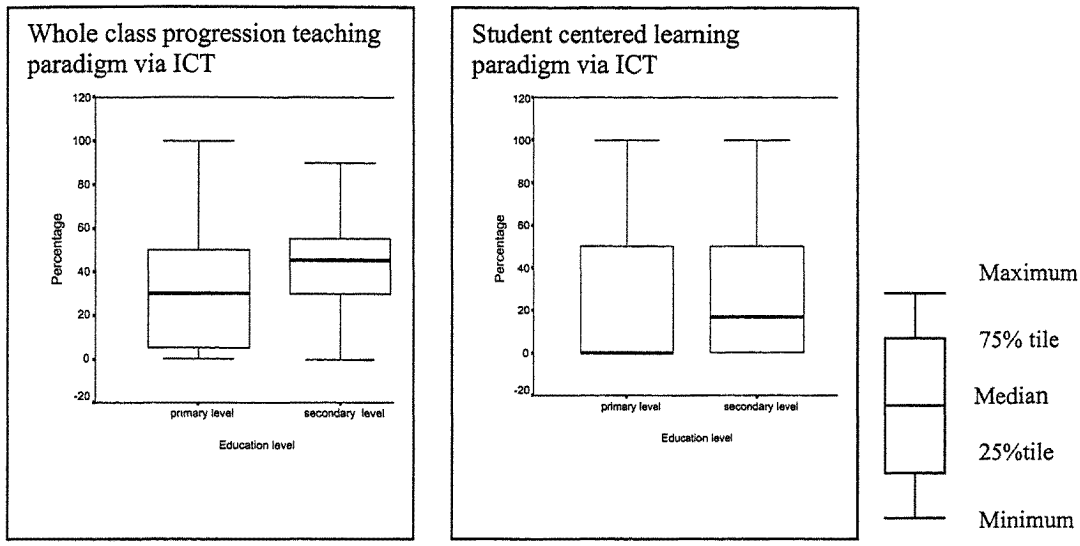
Table 3.7 Percentage of students whose school principals indicated that pedagogical practice were present a lot and had been realized a lot with the help of ICT in Primary education

	Percentages of students whose school principals indicated that pedagogical practices were present a lot in the school-primary education															Percentages of students whose school principals indicated per instructional activity that it had beenrealized a lot with the help of ICT-primary education														
Country	1. Independent learning by students	2. Weaker students: addit. instruc.	3. Differences in entrance level	4. Students learn info-search	5. Emphasis on development skills	6. Same materials, same pace	7. Teach. tracks all stud. activities	8. Stud. responsible own learning	9. Students work on own pace	10. Cooperative projects students	11. Stud. determine self taking test	12. Students learn by doing	13. Parts school subjects combined	Emerging pedagogical practice	Trad. important pedag. practice	1. Independent learning by students	2. Weaker students: addit. instruc.	3. Differences in entrance level	4. Students learn info-search	5. Emphasis on development skills	6. Same materials, same pace	7. Teach. tracks all stud. activities	8. Stud. responsible own learning	9. Students work on own pace	10. Cooperative projects students	11. Stud. determine self taking test	12. Students learn by doing	13. Parts school subjects combined	ICT-opportunities emerging	ICT-opportunities trad. important
Canada *	52	53	39	65	64	18	63	10	29	42	0	65	45	68 (0.4)	71 (0.5)	25	19	17	52	29	8	21	9	26	27	3	45	26	56 (0.5)	52 (0.5)
China Hong Kong	6	21	24	6	9	42	31	1	2	5	2	13	6	38 (0.7)	57 (1.0)	10	10	11	16	12	11	8	4	12	9	8	19	13	30 (1.4)	36 (1.5)
Chinese Taipei	33	25	37	34	38	50	44	23	27	23	6	47	23	57 (1.4)	68 (1.6)	21	16	25	28	31	34	29	24	25	16	9	37	21	51 (1.6)	59 (1.8)
Cyprus	26	57	34	52	44	29	60	15	59	65	9	62	28	70 (1.3)	69 (1.7)	64	34	49	63	49	7	53	40	55	40	7	76	29	68 (2.9)	62 (2.0)
Finland	30	31	26	68	49	17	81	15	17	20	0	59	38	64 (0.9)	72 (1.1)	10	12	8	35	14	9	18	8	20	16	0	35	22	53 (1.1)	47 (1.5)
France *	32	30	26	48	53	17	63	9	27	29	2	44	31	59 (1.0)	68 (1.1)	17	10	13	30	25	8	15	11	24	20	2	36	22	46 (1.3)	43 (1.4)
Iceland	14	48	43	31	51	16	73	12	47	14	1	8	3	61 (0.7)	68 (1.0)	5	19	17	18	21	9	18	6	23	7	4	11	2	43 (1.5)	43 (1.7)
Israel *	40	47	37	37	37	8	50	14	36	34	3	35	32	63 (1.7)	57 (1.6)	33	24	26	27	30	14	25	18	39	36	4	30	31	54 (2.5)	46 (2.6)
Italy	32	53	33	29	39	13	28	2	16	22	1	34	35	57 (1.4)	56 (1.6)	11	26	15	21	13	4	12	6	16	19	3	29	31	41 (2.2)	32 (2.1)
Japan	3	4	4	4	4	11	10	5	6	6	1	14	5	28 (1.6)	34 (1.9)	9	6	3	14	6	4	6	9	17	7	2	12	8	25 (1.9)	24 (1.7)
New Zealand	59	47	51	70	56	10	56	14	37	51	1	67	54	72 (1.3)	65 (1.5)	25	10	13	50	22	10	17	8	15	24	10	36	25	57 (1.2)	51 (1.7)
Norway	62	65	44	48	23	1	32	15	33	50	0	37	50	71 (0.3)	44 (0.3)	13	49	14	39	11	3	2	7	15	16	1	23	13	52 (0.3)	33 (0.3)
Singapore	5	32	20	15	42	21	46	6	12	28	0	37	6	54 (0.1)	67 (0.1)	29	26	16	39	35	18	32	26	35	33	6	45	25	61 (0.3)	62 (0.2)
Slovenia	33	39	31	33	20	21	36	21	33	22	5	27	35	56 (1.8)	56 (1.7)	20	9	21	30	16	18	31	26	38	23	5	30	32	46 (2.2)	46 (2.3)

Notes: * countries that did not satisfy all sampling criteria . Last two columns: average values and standard errors(in brackets) for indicators of the emerging and traditionally important ICT-opportunities. Standard error (se): value±2*se provides 95% confid

Principals' Perceptions of ICT-Related Learning Opportunities in terms of the Whole Class Progression Teaching and Student-centered Learning Paradigms

As data from the Principal Questionnaire reveal that principals in Hong Kong distinguished between whole class teaching and student centered learning paradigms, it is useful to explore their perceived ICT-related learning opportunities of students for these two paradigms.



Note: Items 1, 2, 3, 4, 5,6,7, 10,12 and 13 are used as an indicator of the whole class progression paradigm and items 8,9,11 are used as an indicator of student centered learning paradigm. Scores on each indicator scale of each school are calculated using the formula 100%*(mean-1)/n, where n represents the number of answer categories minus 1, and mean is the mean value across items in the indicator scale.

Figure 3.6

Box plots of the distribution and median values of indicators for ICT-related learning opportunities in terms of the realization of whole class progression and student-centered learning paradigms at primary and secondary levels in Hong Kong.

A comparison of Figures 3.5 and 3.6 indicates clear differences between the two pedagogical paradigms in terms of their overall prevalence as well as their realization through the use of ICT. First, the extent of realization through ICT for both paradigms are lower at the primary level even though significant difference between primary and secondary schools in terms of the general prevalence is only found for the student-centered learning paradigm. The median for the ICT-realized whole class teaching paradigm for the secondary level is 45% while that for the primary level is 30%. For the student-centered learning paradigm, the median extent of realization through ICT was 0% at primary level and 17% at secondary level.

Second, the dispersion for all the indicators becomes much larger for the ICT-realization of pedagogical practices, especially at the primary level. It is very worrying that at the primary level, the use of ICT for the realization of student-centered learning is close to nil for most of the primary schools. On the other hand, the upper quartile and maximum for the student-centered paradigm both increase from the general prevalence indicator to the ICT realization indicator, indicating that some schools have used the implementation of ICT in teaching and learning as an opportunity to improve student-centered learning practices.

Table 3.8
Summary of average scores and standard errors of indicators for realization through ICT of whole class progression and student-centered learning paradigms in Hong Kong schools

ICT-realized Pedagogical practice paradigm	Primary educational level Average score (S.E.)	Secondary educational level Average score (S.E.)
Whole class progression	33.62 (2.15)	43.41 (1.34)
Student-centered learning	22.42 (2.11	30.39 (1.84)

As shown in Table 3.8, the average score for the ICT-realized student-centered learning paradigm is higher in secondary schools, even though the difference is not statistically significant ($F(1, 411)=2.722$, $p=.1$).

ICT-Related Learning Outcome Expectations

In order to explore school principals' expectations of students' ICT skills learning outcomes, they were asked to indicate, on the basis of the school's objectives, which of the following ICT skills they expected their students to have acquired when they complete the target grade range for each of the three populations in this study:

1. Operating a computer (saving files, printing, keyboarding)
2. Writing documents with a word processor (typing, editing, layout)
3. Making illustrations with graphical programs
4. Calculating with spreadsheet programs (sheet creation, using formulas)
5. Writing simple programs (in e.g. Logo, Pascal)
6. Communicating via e-mail with teachers and other students
7. Sending, searching for, and using electronic forms of information

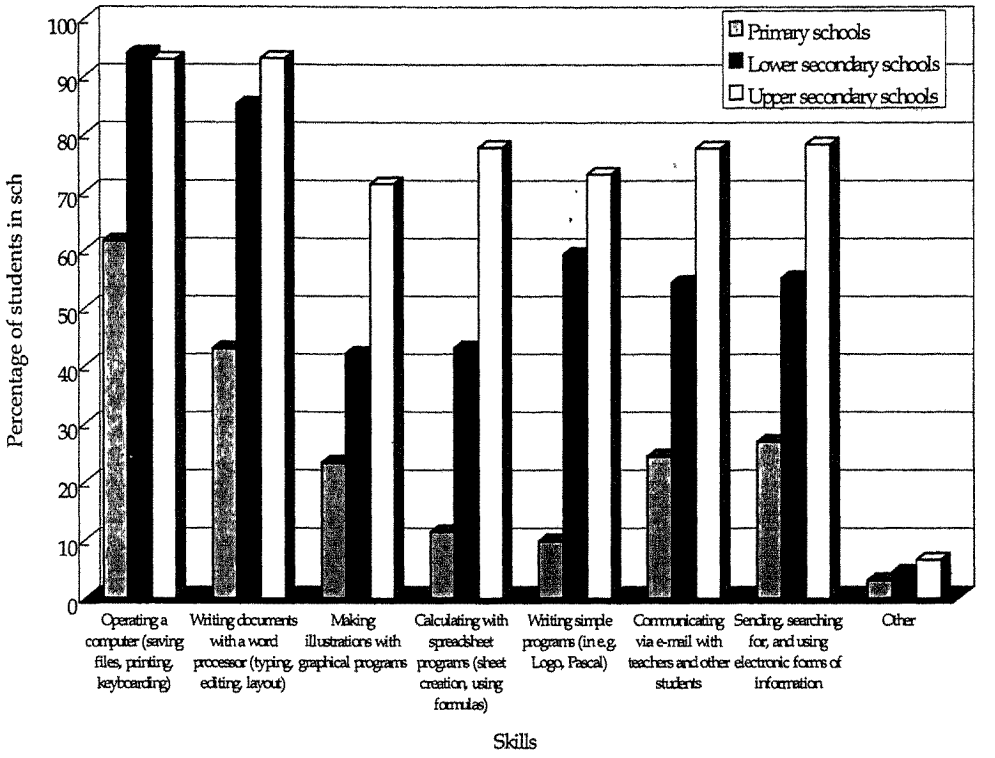


Figure 3.7
Charts of the percentages of school principals in Hong Kong who expected the acquisitions of these ICT skills.

The patterns of the expected learning outcomes across all three populations were very similar, although the overall expectation was rather low even for the computer-using primary schools. ICT skills with the highest outcome expectations were "operating a computer" and "writing documents with a word processor".
At lower secondary level level, skills least expected to be acquired were "making illustrations with graphical programs" and "calculating with spreadsheet programs" (42%). Abilities to "calculate with spreadsheet programs" and "write simple programs" (10% or lower) are least expected for students to have acquired upon finishing Primary 5.

Table 3.9

Percentage of students whose school principals indicated that students should have acquired particular ICT related skills at the end of the target grade - primary, lower secondary, and upper secondary education.
Last column in each education level: average values and standard errors (between brackets) for indicators of ICT skill coverage..

Country	1. Operating a computer	2. Word processing	3. Illustrating with graphics	4. Calculating with spreadsheets	5. Writing simple programs	6. Communicating via e-mail	7. Use electronic information	ICT skill coverage	1. Operating a computer	2. Word processing	3. Illustrating with graphics	4. Calculating with spreadsheets	5. Writing simple programs	6. Communicating via e-mail	7. Use electronic information	ICT skill coverage	1. Operating a computer	2. Word processing	3. Illustrating with graphics	4. Calculating with spreadsheets	5. Writing simple programs	6. Communicating via e-mail	7. Use electronic information	ICT skill coverage
Belgium-French	~	~	~	~	~	~	~	~	*82	49	32	14	26	32	35	39 (2.1)	*71	83	52	76	33	71	66	65 (2.3)
Bulgaria	~	~	~	~	~	~	~	~	87	65	37	19	38	25	19	41 (1.7)	92	86	48	60	61	26	19	56 (1.5)
Canada	*96	94	64	24	7	46	68	57 (0.6)	*95	94	49	44	9	51	76	60 (0.8)	*97	97	58	65	30	62	87	71 (0.9)
China Hong Kong	62	43	23	11	10	24	27	29 (2.0)	94	85	42	43	59	55	55	62 (1.6)	93	93	71	78	73	78	78	80 (1.7)
Chinese Taipei	75	56	51	7	1	38	35	38 (1.8)	99	92	80	30	10	70	66	64 (1.3)	97	95	60	63	50	88	82	76 (1.6)
Cyprus	92	96	66	14	23	27	31	50 (3.9)	74	44	72	6	10	29	22	37 (5.0)	97	97	76	76	82	38	55	74 (3.3)
Czech Republic	~	~	~	~	~	~	~	~	96	93	62	66	22	33	36	58 (1.4)	100	100	65	91	30	67	73	75 (1.2)
Denmark	~	~	~	~	~	~	~	~	99	98	64	77	3	62	79	69 (1 2)	~	~	~	~	~	~	~	~
Finland	91	79	47	1	2	36	34	41 (1.5)	97	91	47	37	10	71	74	61 (1.6)	~	~	~	~	~	~	~	~
France	*97	96	39	16	6	39	43	48 (1.1)	99	97	49	68	5	48	61	61 (1.1)	97	95	52	81	12	59	72	67 (1.2)
Hungary	~	~	~	~	~	~	~	~	98	89	65	53	51	28	44	61 (1.4)	~	~	~	~	~	~	~	~
Iceland	71	54	49	4	0	6	17	29 (1.8)	96	90	56	38	5	52	54	56 (2.5)	99	99	34	94	11	78	84	71 (3.2)
Israel	*80	80	69	16	13	24	24	44 (2.2)	*94	92	73	69	21	36	35	60 (2.2)	*99	97	79	93	61	55	59	78 (1.9)
Italy	78	76	49	16	12	36	31	42 (1.8)	*89	83	23	61	50	29	27	52 (1.7)	*82	83	46	71	53	48	58	63 (1.7)
Japan	58	34	50	5	3	12	7	24 (1.6)	75	64	51	20	11	13	7	34 (1.6)	71	73	22	60	28	21	14	41 (1.9)
Latvia	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	*100	97	92	85	52	26	19	67 (1.8)
Lithuania	~	~	~	~	~	~	~	~	88	67	53	34	42	39	33	51 (1.8)	92	92	65	68	82	74	69	77 (1.0)
Luxembourg	~	~	~	~	~	~	~	~	100	95	40	33	12	57	82	60 (4.8)	98	98	77	98	58	94	96	88 (4.1)
New Zealand	96	94	74	22	6	58	67	60 (1.5)	*99	98	63	58	10	46	67	63 (1.4)	~	~	~	~	~	~	~	~
Norway	72	69	10	6	5	16	28	29 (0.6)	89	88	25	61	4	49	70	55 (0.9)	95	97	37	84	8	65	81	67 (1.0)
Russian Federation	~	~	~	~	~	~	~	~	*42	21	27	19	30	4	6	21 (2.6)	*87	72	67	67	79	12	14	57 (2.6)
Singapore	98	96	81	10	6	41	54	55 (1.4)	97	99	89	42	10	67	73	68 (1.7)	98	98	69	76	46	97	94	83 (3.2)
Slovak Republic	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	*96	95	69	95	42	53	58	73 (1.6)
Slovenia	82	51	31	0	19	13	13	30 (1.5)	51	73	79	75	55	79	79	70 (1.9)	*89	93	64	64	15	66	78	67 (2.2)
South Africa	~	~	~	~	~	~	~	~	*83	68	40	34	16	30	26	42 (3.0)	*97	93	58	76	42	54	51	67 (2.5)
Thailand	~	~	~	~	~	~	~	~	90	80	36	28	12	10	10	38 (1.1)	~	~	~	~	~	~	~	~

Note: * countries did not satisfy all sampling criteria for this population.

There was a general increase in expectations in all skill areas across all countries with increase in educational level. "Operating a computer" was considered a very important skill for most countries even at primary level. The only countries where less than two thirds of school principals expect students to be able to operate computers after completing primary level were Japan (58%) and Hong Kong (62%) at primary level, and the Russian Federation and Slovenia at lower secondary level. At upper secondary level, the lowest expectation for "operating a computer" was found in Belgium-French (71%) and Japan (71%).

Word processing was considered the most important ICT skill at all levels by nearly all countries, reaching 80% or higher in most countries at lower secondary and upper secondary levels. The only exception is the Russian Federation where writing software programs was the most important skill next to operating a computer.

Diversity emerges regarding expected learning outcomes in ICT skills beyond "computer operations" and "word processing skills". In general, at primary level "making illustrations with graphics" and "sending, searching for and using electronic information" were ICT skills with the next highest expectations. While the same pattern of expectations was found at lower secondary level in most countries, two other skills emerged as candidates for the highest learning outcome expectations: "calculating with spreadsheet" in the Czech Republic, France and Italy, and "writing programs" in Bulgaria, and Hong Kong. At upper secondary level, however, a different pattern of learning outcome expectations emerged as "calculating with spreadsheet" became the skill with the highest outcome expectation next to operating a computer and word processing (found in 12 out of 21 countries participating at this population) and is followed by "writing programs" in four other countries: Bulgaria, Cyprus, Lithuania and the Russian Federation.

In terms of overall ICT skills coverage, there was a very large diversity in expectation across countries. At primary level, Canada, New Zealand and Singapore have the highest overall skills coverage expectations (all above 55%), while Japan, Hong Kong, Iceland and Norway have the lowest (all below 30%). At lower secondary level, Slovenia, Denmark and Singapore showed the highest overall coverage expectation (all above 65%), while the Russian Federation (21 %), Japan, Cyprus and Belgium French, Thailand (all below 40%) demonstrated the lowest. At upper secondary level, countries with overall coverage expectation higher than 80% included Luxembourg, Singapore and Hong Kong while Japan had the lowest expectation at 41%.

In general, countries with high emergent practice indicators also have high overall learning outcome coverage expectations but relatively low expectations on programming skills.

Summary

Results from the Study reveal a strong relationship between the use of IT and the school and classroom cultures of the system. Schools in Hong Kong, Japan, Singapore, France, Israel and a few other countries placed great importance on ICT as a tool for the teacher ("teachers using computers for instructional purposes"). On the other hand, schools in Canada, the Scandinavian countries and most of the European countries valued more the use of computers as students' learning aids in developing information skills, in accessing external databases via the Internet and in communicating via e-mail.

Both in Hong Kong and across other countries, the prevalence of emerging pedagogical practices in classrooms using IT is higher than that in other classrooms, indicating a promising step forward in the establishment of a pedagogical paradigm shift. Another important finding is that in Hong Kong, there is a much greater diversity across schools in the pedagogical practices realized through ICT in comparison to the diversity in overall presence of such practices. This indicates large differences across schools in terms of their understanding and vision of the role of ICT in education. The sharing of experiences across schools and in particular the dissemination of experiences pertaining to innovative pedagogical practices would be crucial to realizing a paradigm shift towards emergent pedagogical practices.

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Chapter 4 ICT Related Infrastructure and Learning Opportunities

The status of ICT infrastructures in schools reflects the goals and priorities of the leadership at various levels of the education system. At the same time, this also affects the achievement of school goals and objectives. In this chapter, the results concerning the availability of hardware, software and internet access infrastructure as well as ICT related learning opportunities will be reported. Finally, implementation problems related to infrastructure will be discussed.

The Technology Infrastructure

Before SITES and since CompEd, no international, large scale, comparative statistical surveys had been conducted of the ICT infrastructure in education. SITES is the first ICT related international study in education that Hong Kong has ever participated in.

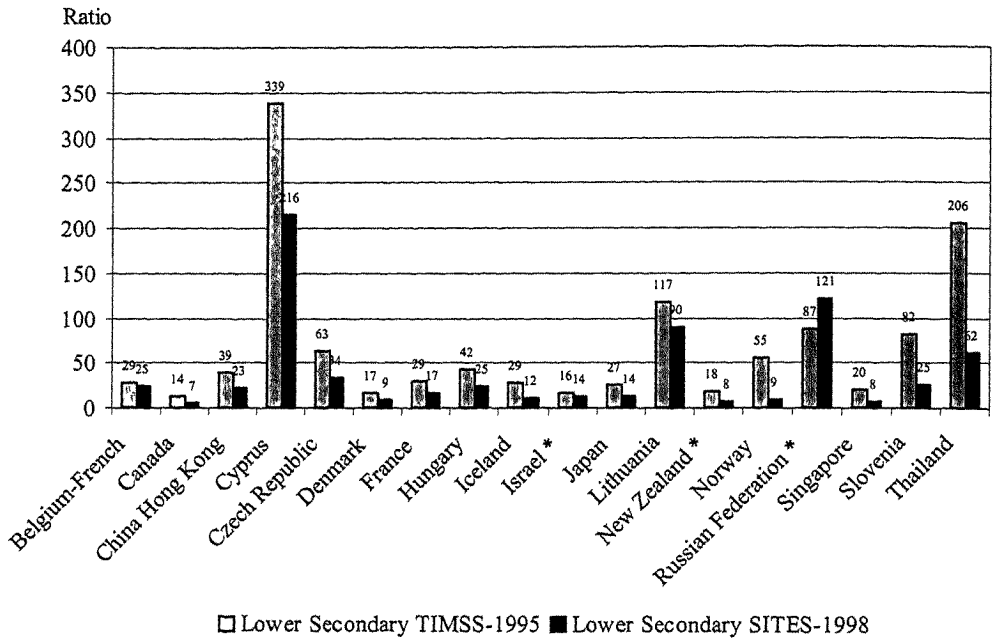
Hardware

Student:Computer Ratios
Student:computer ratio is a most commonly used indicator of ICT provisions in schools. This ratio is calculated by taking the total number of students per school divided by the total number of computers that were available for the whole school. Appendix 4.1 summarizes the availability of computers in each country at different population levels.

When comparing the three population levels in Hong Kong, a more favorable provision was found at the secondary level, with an average ratio of 36 to 1. This ratio increases to 53:1 at the primary level. This tendency for computer provisions to improve with the level of schooling is generally observed in other countries, with the exception of Canada, where the provision was consistently high at around 10 to 1. Further, there was a large diversity in student:computer ratios across countries at all levels. The highest provisions were found in Canada, New Zealand, Singapore and Norway while the lowest provisions were found in Russia and most of the East European Countries. Chinese Taipei, Hong Kong and Japan also had relatively high student:computer ratios, especially at the primary level.

At the primary level, the ratio varied greatly across countries. Canada was the country with the most favorable ratio of 11:1 while Finland and Singapore all had ratios below 20:1. At the other end of the spectrum, Chinese Taipei, Hong Kong, Japan, Italy and Slovenia had ratios that were almost two to four times higher. At the lower secondary level, the highest availability was observed in Canada and New Zealand (8.8:1 and 10:1 respectively), with Singapore, Norway, Denmark and Finland following closely, all having ratios of less than 15. At the upper secondary level, a high level of computer availability was found in many countries. The highest availability was found in Norway and Singapore (the means were 5.8 and 7 respectively) while Canada, Norway and Singapore all had ratios below 10. It is interesting to note that the greatest increase in computer provision across the three school levels was observed in Chinese Taipei, the ratio improving from 74 at primary to 35 at lower secondary to 15 at upper secondary level.

In 1995 when the IEA Third International Mathematics and Science Study (TIMSS) was conducted, the survey also collected school data on student:computer ratios. Figure. 4.1 shows a comparison of the student:computer ratios at the lower secondary level in 1995 and 1998 for countries that participated in both studies. It is not surprising to note that the ratio improved in nearly all countries. The only exception was the Russian Republic where the ratio increased from 87 to 121. The countries that made the greatest improvement in this short space of 3 years were Norway (improving from 55 to 9) , Thailand (improving from 206 to 62), and Cyprus (improving from 339 to 216).



* countries that did not satisfy all the sampling criteria

Note: The TIMSS figures were estimates based on total number of students divided by total number of computers in all schools in a country, including computer-using and non computer-using schools while the SITES figures were for computer-using school only.

Figure 4.1

Comparison of student: computer ratios in 1995 and 1998 for lower secondary education

Types of Processor and Operating Systems

Another indicator of ICT provisions is the power and sophistication of the ICT infrastructure found in schools. Three important items of data in this regard was collected in SITES: the percentage of computers having powerful processors that were Intel pentium+ or Mac103 and higher, percentage using Windows 95/98/NT or MacOS7.5 and higher and percentage of computers with multimedia capabilities. On all three items, Singapore and Hong Kong stood out to be the systems with the most powerful and sophisticated computers, all with percentages above 80% at all levels. For most other countries, the average percentage of computers that were suited for multimedia was about 50%, 40% and 25% at the primary, lower secondary and upper secondary levels respectively. It is interesting to note that in countries where the student: computer ratios were lowest, for example Canada, Norway and New Zealand, the percentage of multimedia suited computers were only around the international average or lower. The only exception in this respect is Singapore where both the quality and quantity of computer provisions were high.

The countries with the highest percentage (>60%) of low end processors (16-bit or lower) still actively in use were Bulgaria, Russian Republic and Slovak Republic. These three countries did not participate in the Study at the primary level and Slovak Republic only participated at the upper secondary level. It is also interesting to note that Japan, well known for its electronics and computer industries, still has a significant percentage of these low end computers in use: 29%, 24% and 18% at the primary, lower secondary and upper secondary levels respectively. Appendix 4.2 to 4.4 provides the detailed statistics for all countries participating in the Study.

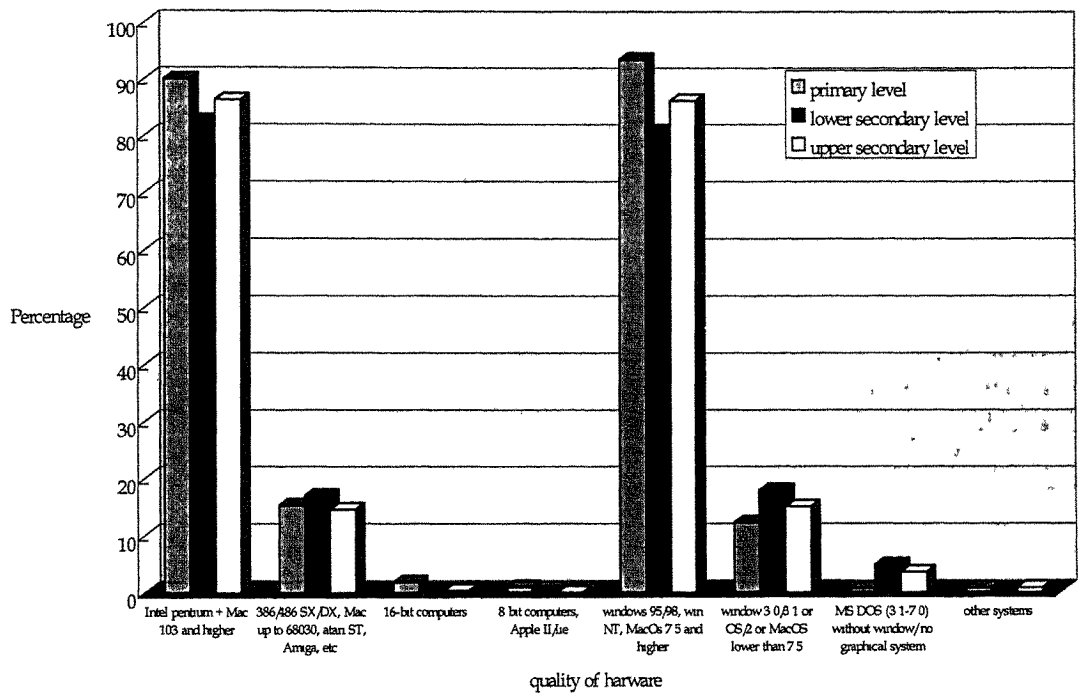
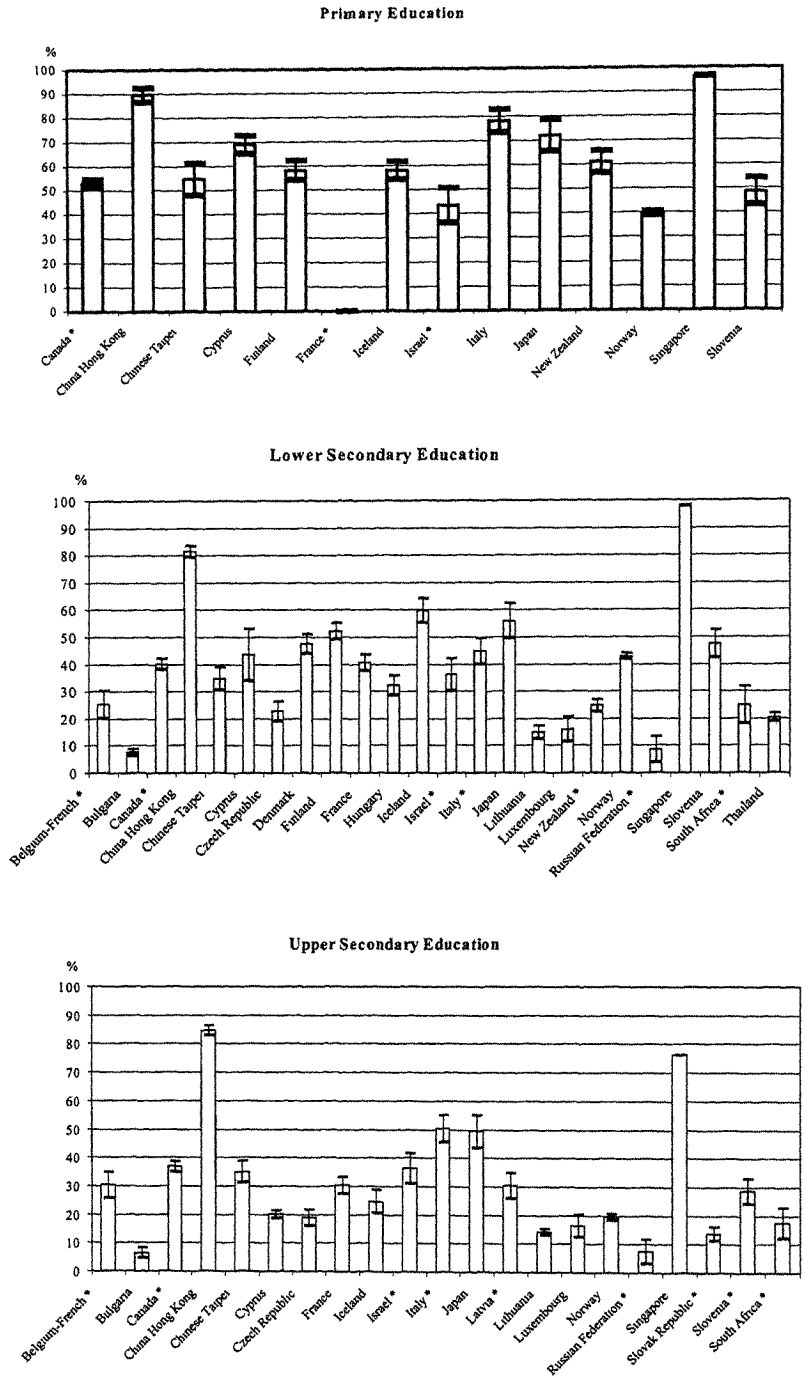


Figure. 4.2
Average percentage of computer processor and operating system configurations in Hong Kong schools.

Figure 4.2 gives a detailed breakdown of the processing power and operating systems for computers in Hong Kong primary and secondary schools. It is clear that generally they all had high-speed processors running advanced operating systems. The average percentages of computers equipped with high speed processors at primary, lower secondary and upper secondary levels were 90%, 83% and 87% respectively while 16-bit machines and lower were hardly found. The percentages of high-speed processors and advanced operation systems were slightly higher in primary schools possibly because of the much shorter history of IT use for teaching and learning at this level.

Multimedia Facilities and Peripherals

Another indicator of hardware functionality in this survey was the percentage of computers that were suited for multimedia, defined as those equipped with a CD-ROM and a sound card. Consistent with the finding that computers in Hong Kong schools were relatively powerful and new, it was also found that most of these computers were suited for multimedia applications (88%, 81% and 85% at primary, lower secondary and upper secondary levels respectively).



*: countries that did not satisfy all sampling criteria.

Figure 4.3

Bars and 95% confidence intervals of average percentage of multimedia computers for the grade range in computer using schools in primary, lower secondary and upper secondary education.

In terms of international comparison, it is not surprising to note that the percentage of multimedia ready computers were highly correlated with the power of the computers found in the countries: Singapore and Hong Kong stood out to have the highest percentage of multimedia equipped computers while Russian Federation and Bulgaria had the lowest. An interesting observation is that in general there was a higher percentage of multimedia ready computers at the lower school levels.

Peripherals

Apart from the availability of computers, the Study also gathered information about the availability of the following types of peripherals: laser printers, CD-ROM drives, devices for disabled students, devices for digital image processing, color printers, CD-Writers, graphic tablets, video projectors, scanners and LCD panels.

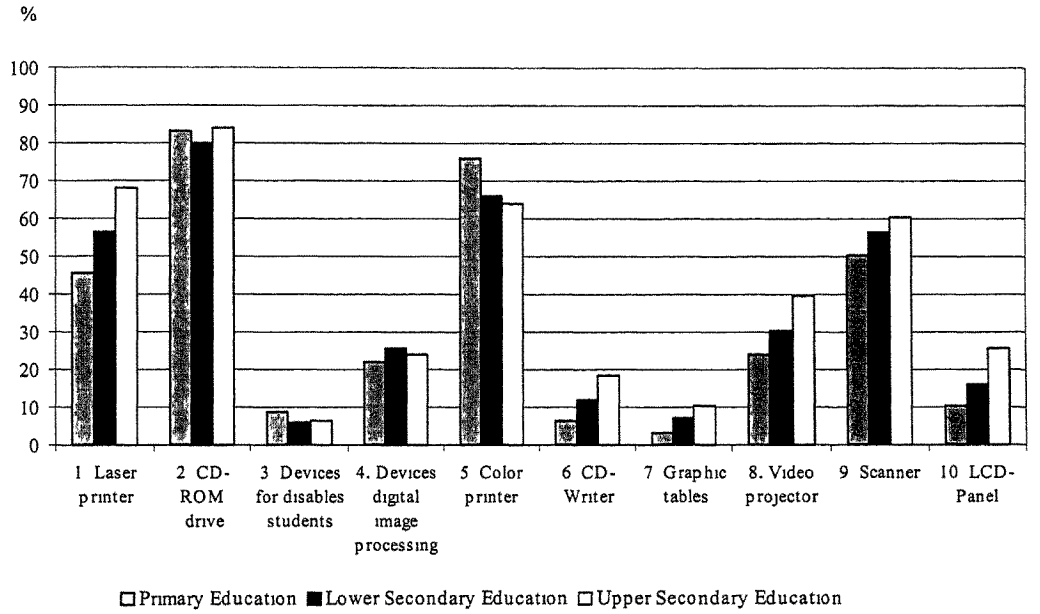


Figure 4.4

Percentage of schools per educational level averaged across all countries, indicating that particular peripherals (for use in the grade range) were available in the school.

In Hong Kong, out of the 10 types of peripherals surveyed, the mean percentage of types owned were 34%, 51% and 55% at the primary, lower secondary and upper secondary levels respectively. Over 70 % of the primary schools reported that owning CD-ROM drives, colour printers and scanners, making these the most available peripherals at this level. At the lower and upper secondary levels, the most commonly available peripherals were laser printers, CD-ROM drives, colour printers and scanners, all having reported ownership of over 80% and 90% at these two respective levels. Given the relatively high availability of peripherals in Hong Kong schools, it is noteworthy that only four primary schools (unweighted number) reported that they had devices for disabled students while none of the secondary schools surveyed reported such availability. This may reflect the low level of concern educators in Hong Kong have towards catering for special needs.

Another noteworthy observation regarding computer peripherals is that Hong Kong has an exceptionally high availability of video projectors and LCD panels, both being above 50% for secondary schools, compared to the international averages of 30% and 15% respectively. These findings reflect that teachers like to use computers for whole class teaching through multimedia presentations.

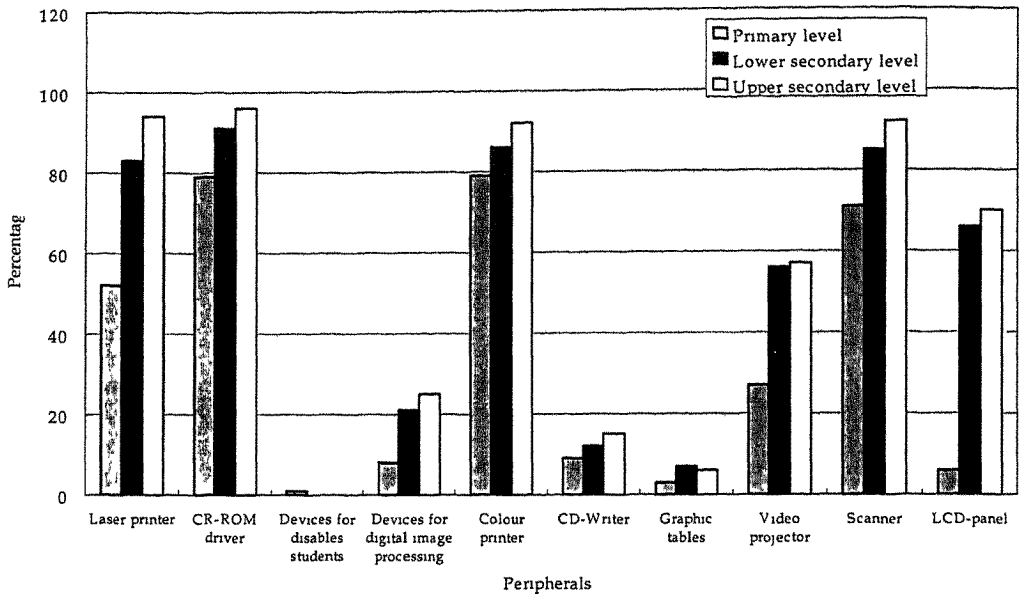


Figure 4.5

Percentage availability of various peripherals at different school levels in computer using schools in HK.

In terms of the availability of peripherals, there were substantial differences across countries. As shown in Appendix 4.5, the greatest variety of peripherals at the primary level was found in Singapore (51%), and the lowest was found in Chinese Taipei (14%). At the lower secondary level, Luxembourg (67%) and Singapore (60%) had the greatest variety of peripheral types available, while the least variety coverage was found in Russian Federation, Bulgaria, Lithuania, Cyprus and Thailand, with mean availabilities between 9 % and 17%. The disparity amongst countries was found to be even greater at the upper secondary level. The highest availability was found in Singapore (71%), Luxembourg (65%) and Norway (61%) while Bulgaria, Russian Federation, and Lithuania had availabilities of peripheral types below 12%.

Location of computers

Besides the quantity and quality of hardware, the location of computers in schools would also affect the kinds of teaching and learning activities that could be conducted. As can be seen in Figure 4.6, computers were mainly located in computer rooms at all three levels of education in Hong Kong. There was a higher percentage of notebook computers used in primary schools possibly because of an even greater shortage of space in primary schools, making it more difficult to convert existing rooms into computer rooms. The survey data also showed that in some schools, computers were only available in the computer rooms. This percentage at the primary, lower secondary and upper secondary levels were 21%, 32% and 35% respectively. On the other hand, 5% of primary schools reported that computers were only available in the classroom, while none of the secondary schools reported such a situation.

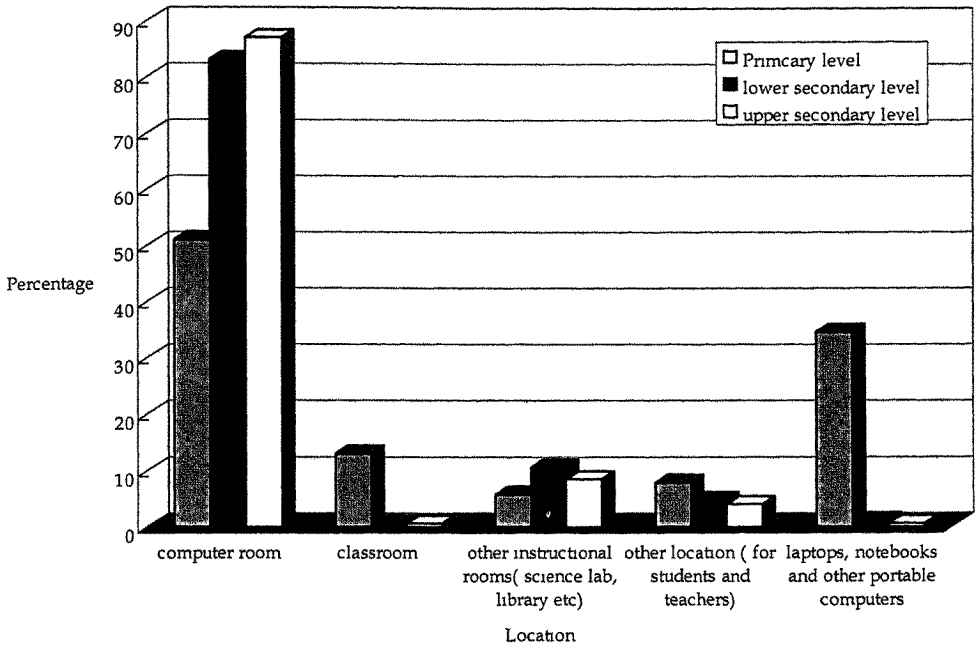


Figure 4.6
The percentage of computers placed at different locations in Hong Kong schools.

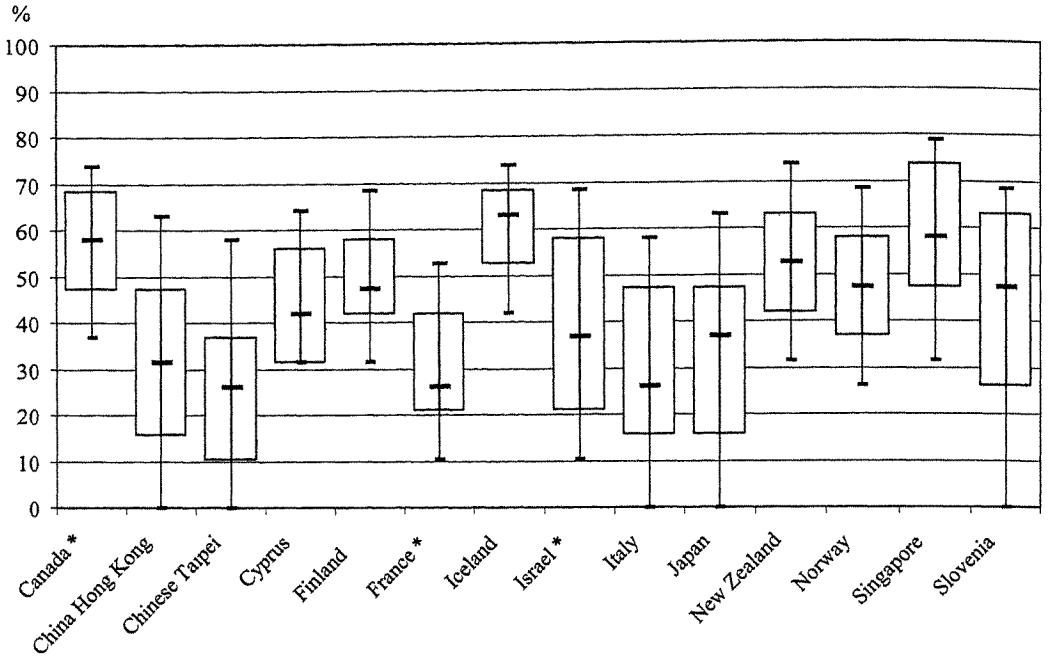
Software

This Study distinguished two main types of software, namely the general-purpose software and school subject specific software. Pelgrum & Schipper (1993) found that the use of the former was associated more with an informatics type of curriculum while the latter was associated more with the integration of computers in the school curriculum. In the SITES M1 survey, the technology coordinators were asked to indicate which items out of a list of 21 types of software[1] were available for teaching and learning purposes in their school.

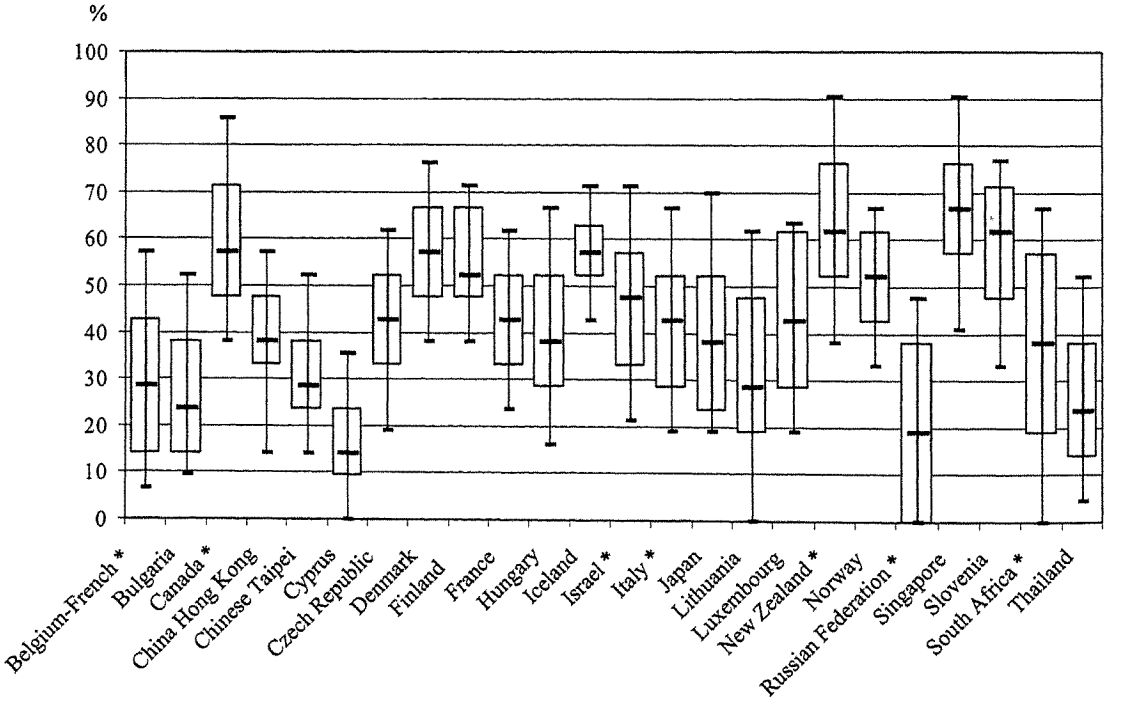
It can be seen from Figure. 4.7 that at the primary level, the percentage range of software available was lowest (median around or below 30%) in France, Italy, Chinese Taipei and Hong Kong, while Canada, Iceland and Singapore had the highest range of software available (median around 60%). At the lower secondary level, the lowest software availability was found in Belgium-French, Bulgaria, Chinese Taipei, Cyprus, Lithuania and Russian Federation, while the highest availability was found in Singapore, New Zealand, Slovenia, Iceland, Denmark and Canada. At the upper secondary level, the lowest software availability was found in Bulgaria and Japan while the highest were found in Singapore (median higher than 80%), Canada, Iceland, Norway and Luxembourg.

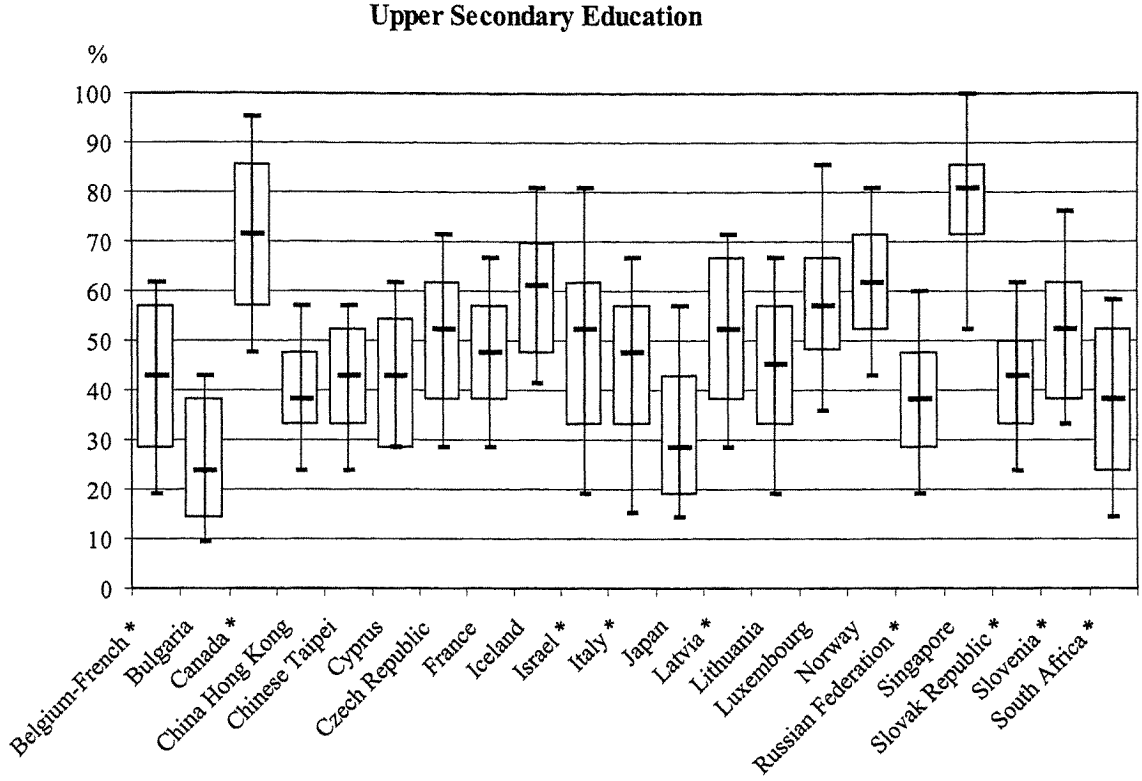
[1] Two items, CAD/CAM and accounting/ bookkeeping/financial software, were not included in the survey for primary schools.

Primary Education



Lower Secondary Education





*countries that did not satisfy all sampling criteria.

Figure 4.7

Box plots of average percentage availability of types of software for the grade ranges in primary, lower secondary, and upper secondary education across schools (from a list of 21 types of software).

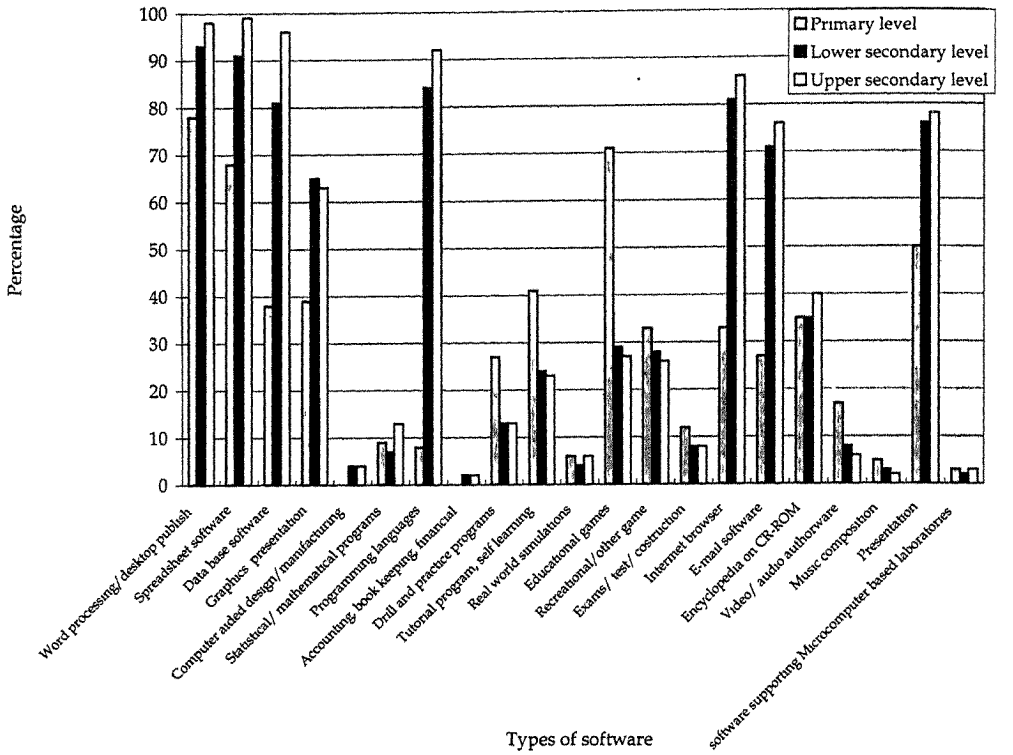


Figure 4.8

Availability of the software at the three educational levels for Hong Kong

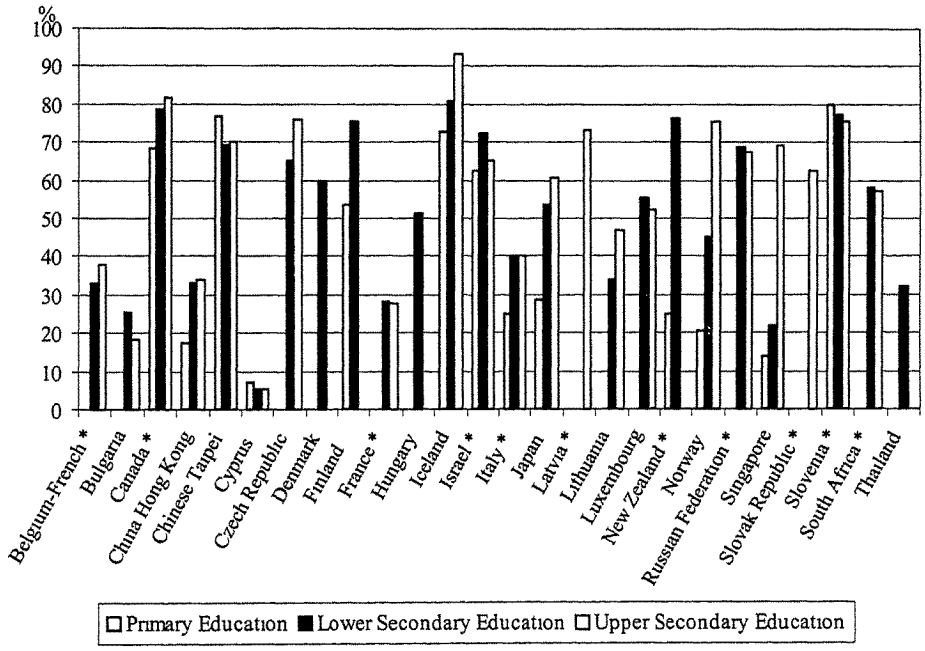
Compared to other countries, Hong Kong schools have less variety in their software, most of which are designed for general use instead of subject-specific teaching purposes. It is thus not surprising that the majority of school principals and technology coordinators consider the lack of teaching and learning software the main obstacle in promoting the use of ICT in education (to be reported in Chapter 6). The top three types of software available at the primary level were word processing, educational games and spreadsheet. At lower and upper secondary levels, word processing, spreadsheet and programming languages were available in most secondary schools. On the other hand, less than 10% of the schools reported that software for music composition, software for supporting microcomputer based laboratories, accounting and real world simulations were available. Figure 4.8 also shows that great differences between the three educational levels were found in some items such as the availability of programming languages, data base software, Internet browser and educational games. It was found that over 80% of the lower and upper secondary schools reported that programming languages were available whereas less than 10% of the primary schools indicated that this type of software was available in their schools. On the other hand, higher availability of software for educational games was found at the primary level.

The SITES survey also asked the technology coordinators in schools to indicate the school subjects for which educational software was available in their schools for the relevant grade ranges (see Appendix 4.6-4.8). In general, at the primary level, the availability of subject specific software was highest in Mathematics, followed by Language/Mother tongue. At the lower secondary level, these two subjects remain as ones having high availability of software in schools while the availability of software for Foreign Language and Informatics saw a substantial increase. In fact, at this level, Computer Education/Informatics software surged to become the subject with the highest percentage availability in schools in the greatest number of countries: Bulgaria, Hong Kong, Chinese Taipei, Hungary, Lithuania, Russian Federation and Thailand. The availability of software for the sciences and the humanities subjects increased with the education level while that for Mathematics and Language/Mother tongue decreased to some extent.

Communication Facilities

Local Area Networks

Whether the computers in a school are connected to a local area network (LAN) or operated as stand-alone machines comprises another important aspect of the hardware infrastructure in a school. In Hong Kong, most of the computers were still used in a stand-alone mode, with only 17%, 33% and 34% being connected to a LAN at the primary, lower secondary and upper secondary levels respectively. This is amongst the lowest in the international comparison, similar to those found in Thailand, France and Bulgaria. In Singapore, the percentage of networked computers were also low at both primary and lower secondary levels while at the upper secondary level, 69% of the computers were LAN connected. Canada, Chinese Taipei, Finland, Iceland, Israel and Slovenia have most of their computers in a network across all the population levels that participated in the survey.



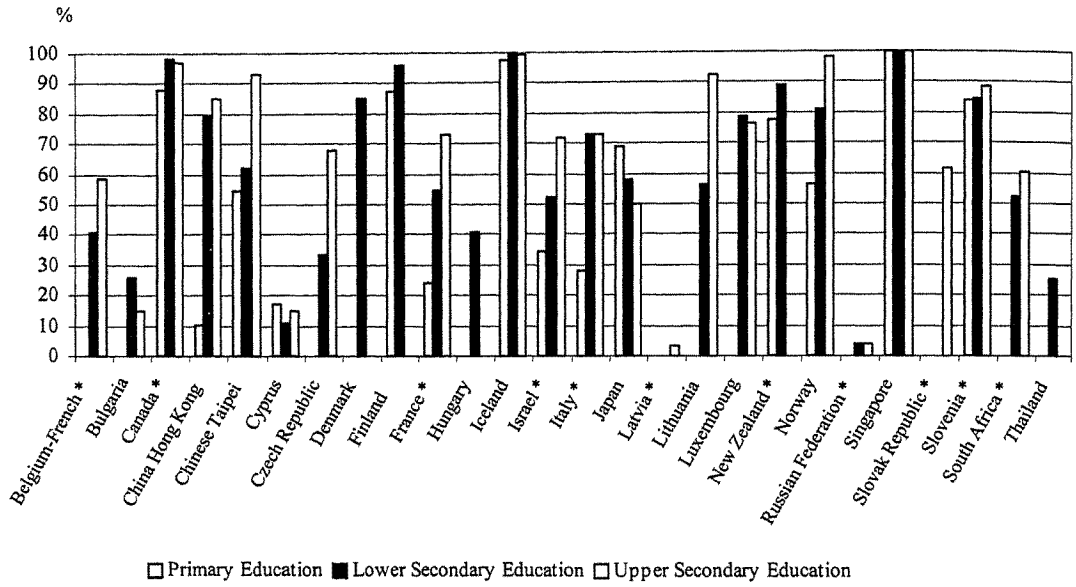
* countries that did not satisfy all sampling criteria. Missing bars: data not collected.

Figure 4.9

Bar graph of average percentage of computers accessible at the grade range connected to a local area network at the primary, lower secondary, and upper secondary levels.

Internet Access

Access to the Internet and WWW provides new potentials for teaching and learning activities in schools. At the primary level, only 10% of the schools in Hong Kong had access to the Internet for instructional purposes and was the lowest of all countries participating in the Study, while in Singapore, Iceland, Canada and Finland, over 85% of the population had access to the Internet for instructional use. In general, access to the Internet improved with the education level. In Hong Kong, access to the Internet became much improved at the secondary level: over 80% of secondary schools indicated having access to the Internet for teaching and learning purposes. This high access puts Hong Kong amongst the countries with the highest accessibility at the lower secondary level, which includes Denmark, Finland, Canada, Singapore, Iceland and New Zealand. Lowest access was found in Russian Federation and Cyprus (at 11% and under).



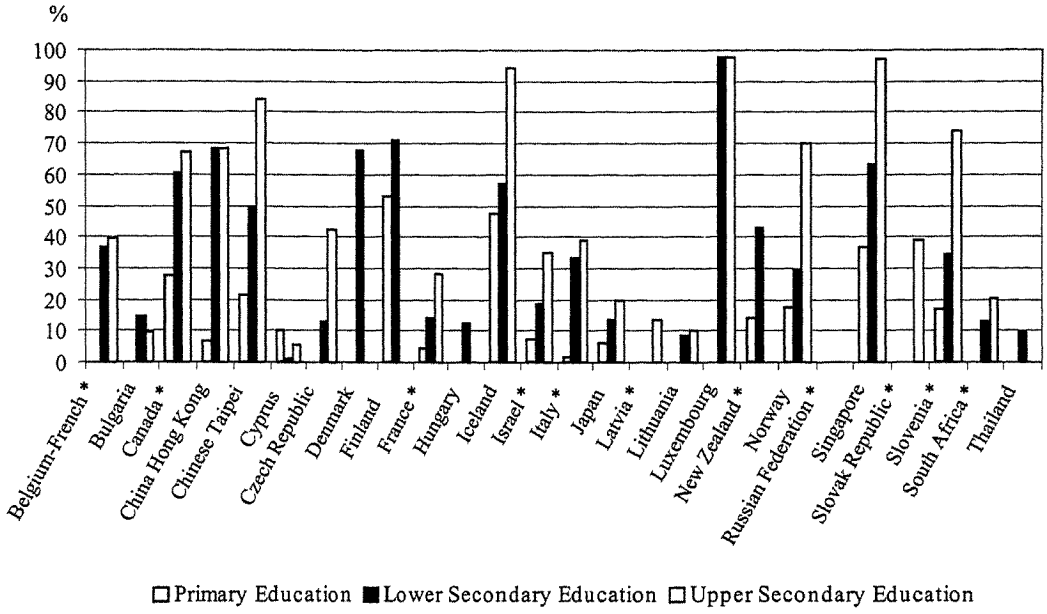
* countries that did not satisfy all sampling criteria. Missing bars: data not collected.

Figure 4.10

Percentage of schools had access to the Internet for instructional purposes at primary, lower and upper secondary education levels

It is expected that accessibility to Internet will improve significantly over the next two years. In many countries, a large percentage of the schools surveyed that cannot yet access the Internet indicated having plans to do so before 2001. In Hong Kong, primary schools seem to be less ready to push for Internet access. Of the computer using primary schools surveyed, of those school that does not yet have the access 34% indicated that they do not have plans to install Internet access before 2001. For schools that indicated having Internet access, the percentage number of computers in those schools having simultaneous access to e-mail or www was analyzed. In Hong Kong, this figure was around 35% at the primary level and a little under 50% at the secondary levels. Simultaneous access was relatively high in Finland, Iceland, Chinese Taipei and Canada at the lower secondary level, and in Iceland, Chinese Taipei, Norway, Singapore and Slovenia at the upper secondary level.

Homepage



* Countries that did not satisfy all sampling criteria. Missing bars: data not collected.

Figure 4.11
Percentage of schools having their own home page at the primary, lower secondary and upper secondary levels.

SITES also surveyed whether schools had their own homepages and the kind of information that could be found in the homepages. In Hong Kong, only 7% of the primary schools and 68% of the secondary schools had their own homepages on the WWW. Of the countries participating in SITES, Finland and Iceland had the highest percentage of schools possessing their own homepage at the primary level (about 50%). At the junior secondary level, a substantially larger number of countries had more than half of their schools having homepages: Canada, Chinese Taipei, Denmark, Finland, Hong Kong, Iceland Luxembourg and Singapore.

At the upper secondary level, over 90% of the schools in Iceland, Luxembourg and Singapore had their own homepages. However, in some countries such as Cyprus, Lithuania, Bulgaria, Hungary, Japan, Lithuania, Latvia, South Africa and Thailand, this hardly occurred even at the secondary levels.

With regard to the contents of the school homepages, the top three available information on the school homepages across all three school levels in all countries were general information about school, clickable links for teachers and results of students' projects. The information available in school homepages in Hong Kong is presented in Figure 4.12. The top three available information on the school homepage at the primary level were "information about the school", "special information for parents" and "results of student projects". In secondary schools, "information about the school", "announcement about events" and "special information for parents" were the most frequently available information on the homepage. While this content availability profile is similar to that found internationally, the results indicate that the school homepages in Hong Kong are less used for supporting teaching and learning activities than in other countries.

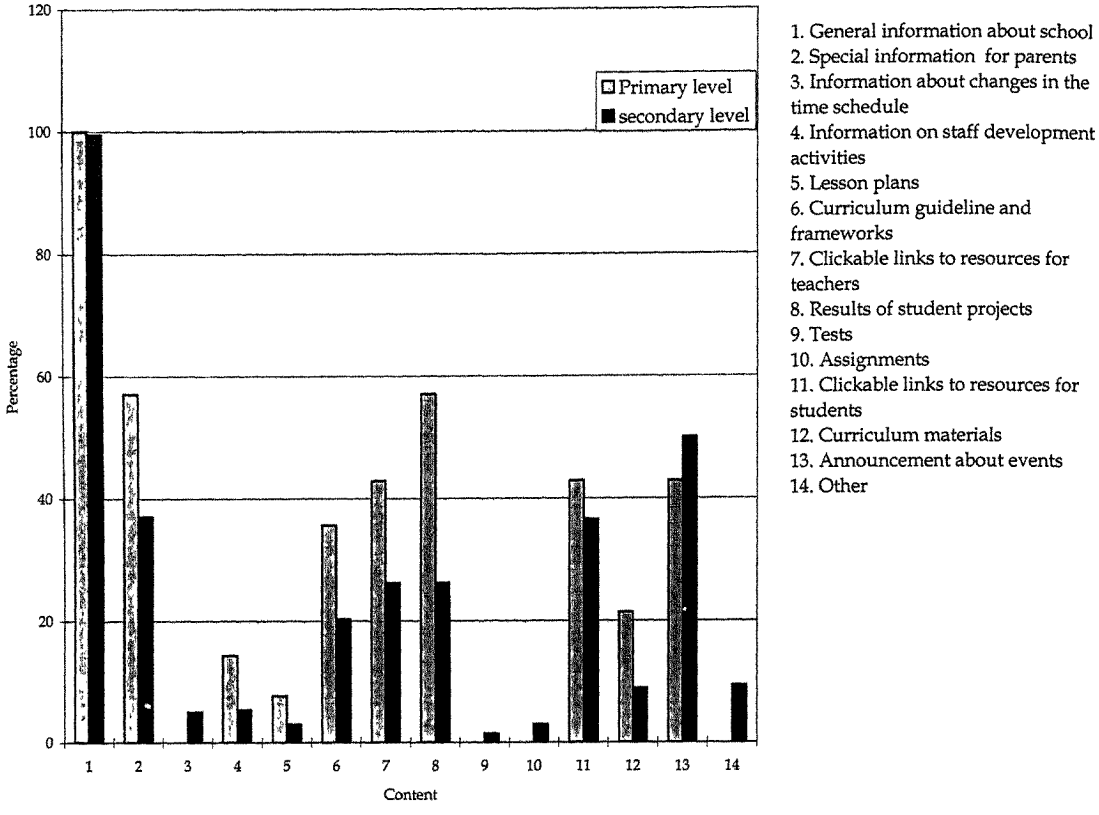


Figure. 4.12
Information available in school homepages in Hong Kong

ICT-related Learning Opportunities

Reported Usage of Computers for Teaching and Learning

Concerning the actual use of computers in class settings, teachers participating in the local survey of this Study were asked whether they taught in the computer room apart from lessons on computer-related subjects. Only 6.3% of teachers in primary schools and 10% of secondary teachers surveyed provided affirmative answers to this question. The survey also asked teachers about the usage of computers outside of the computer room for teaching and learning purposes. A low percentage of only 7.5% and 11% of the primary and secondary teachers respectively reported having such experiences. This indicates that in Hong Kong, the use of ICT for teaching and learning is still at an infant stage.

Perceived ICT-related Learning Opportunities

This section presents the perceived ICT-related learning opportunities experienced by students as reported by the technology coordinators in schools in the international survey.

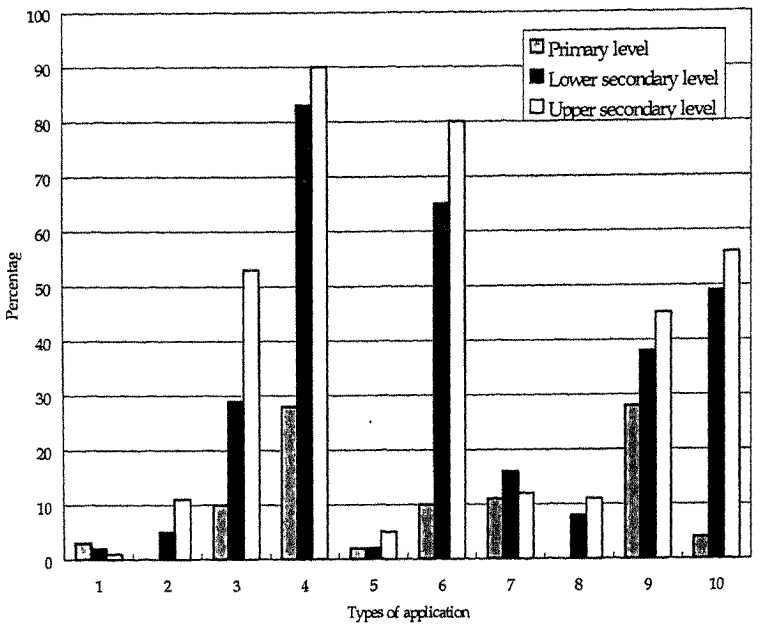
Opportunities to use ICT Applications

Technology coordinators were asked to indicate whether a typical student at the end of each grade range for the particular populations (primary 5, secondary 3 and secondary 7 respectively for the primary, lower and upper secondary levels) would have used any of the following applications[2]:

- Simulations of natural or man made systems (e.g. work environments, human and animal populations, etc.)
- Dynamic modeling and graphical modeling of mathematical functions
- Software for simple data manipulation and statistical analysis
- Word processing / desk top publishing
- Hard- and software for real time data collection (data logging) and data manipulation for science investigations
- Spreadsheets packages
- Software supporting creative works (music / arts)
- Computer aided design / computer aided manufacturing
- An interactive multimedia encyclopedia on CD ROM
- Software for learning programming skills

As indicated in Figure 4.13, the opportunity to use ICT applications differed significantly at the three school levels. At the primary level in Hong Kong, the ICT application with the highest usage was word processing/desktop publishing and Interactive encyclopaedia on CD-ROM, with a percentages of only 28% for both types, and has the lowest application coverage at this level amongst all participating countries. At this level, the countries with the highest ICT application usage coverage in terms of learning opportunities were Canada, New Zealand and Singapore, reaching an average percentage coverage of around 50%. In moving to the junior secondary level, Hong Kong students had much greater opportunities to use word processing, spreadsheet, interactive encyclopaedia on CDROM and programming software. However, the overall application coverage was still only 30%, a relatively low figure when compared to other countries. At this level, countries with a similar or lower ICT application usage coverage were Chinese Taipei, Cyprus, Iceland, Japan, Lithuania, Russian Federation and South Africa. The countries with high learning opportunity coverage were Canada, Denmark, France, Israel, New Zealand, Singapore and Slovenia, with averages between 45% to 57%. In moving to the upper secondary level, the greatest improvement in learning opportunity for Hong Kong students was found in the use of software for data manipulation and statistics, with an average percentage of 53%. The overall usage opportunity coverage increased to 36 % but was still amongst the countries with low usage opportunity coverage. It is interesting to note that at the upper secondary level, Japan was found to be the country with the lowest usage opportunity coverage of only 21% which is nearly 10% lower than Bulgaria, the country with the next lowest coverage.

[2] Two items, Dynamic modeling and graphical modeling of mathematical function and computer aided design/computer aided manufacturing, were not included in the survey for primary schools.



1. Simulation of natural or made systems
2. Dynamic modeling and graphical modeling of mathematical functions
3. Software for simple data manipulation and statistical analysis
4. Word processing/desk top publishing
5. Hard- and software for real time data collection and data manipulation for science investigations
6. Spreadsheets packages
7. Software supporting creative works
8. computer aided design/computer aided manufacturing
9. An interactive multimedia encyclopedia on CD ROM
10. Software for learning programming skills

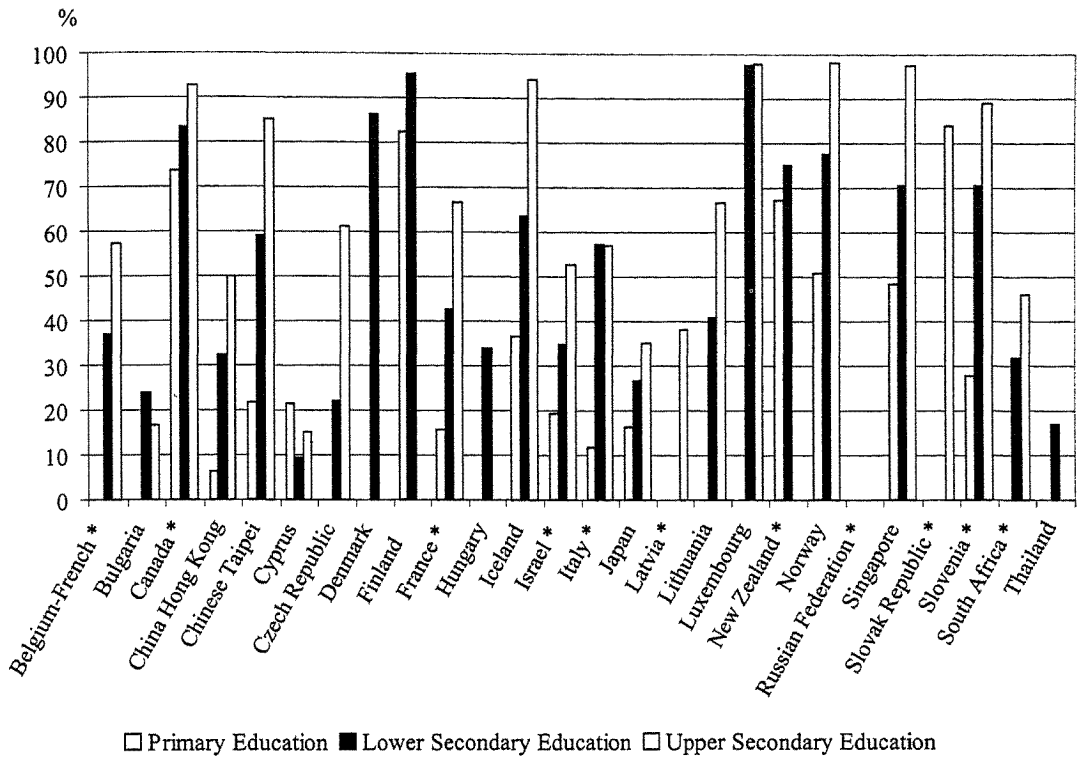
Note: Two items, Dynamic modeling and graphical modeling of mathematical function and computer aided design/computer aided manufacturing, were not included in the survey for primary schools.

Figure 4.13
Average percentage of schools reporting usage of ICT applications at different school levels in Hong Kong

Opportunities for Using the Internet

The Study tried to find out about the opportunities for the use of Internet/WWW for instructional purposes. Technology coordinators were asked whether teachers and students in their schools had used the Internet for instructional purposes. If yes, they were further asked to estimate the percentage of students that would have used this facility by the end of the relevant target grades, as well as the percentage of teachers that had used this facility for teaching within the grade range.

The survey found that in Hong Kong, 6.3%, 32%, and 50% of primary, lower secondary, and upper secondary schools respectively reported that their teachers and students had used the Internet for instructional purposes. Figure 4.14 shows that Hong Kong, has the lowest opportunity in use of the Internet for instructional purpose at the primary level while the percentage opportunity increase to a relative medium position at the secondary levels, surpassing the East European countries, Japan and Thailand.



* countries that did not satisfy all sampling criteria. Missing bars: data not collected.

Figure 4.14

Percentages of schools using the Internet/WWW for instructional purposes at the primary, lower secondary, and upper secondary levels

Concerning the use of the Internet for teaching and learning purposes, the level of usage was found to be rather low in Hong Kong, especially at the primary level. Only 6% of the primary schools indicated that their students would have used the Internet by the end of P5. For secondary schools, data indicated that the Internet was introduced to students at the upper secondary level more than the lower secondary level: about 31% reported that their students had used the Internet by the end of S3 Among those only 13% of them reported that most of the students (>50%) had used the Internet by the end of S3. While 50% reported that most of their students had used the Internet by the end of S7.

In terms of teachers' use of the Internet, most primary schools (94%) indicated that they did not use the Internet for teaching purposes. Only 4% of primary school principals indicated that 11-25% of teachers had used WWW or e-mail in their teaching. As primary schools in Hong Kong have a short history of using ICT in teaching and learning, it is not surprising to note that none of the schools reported more than half of their teachers having used WWW or e-mail in their teaching. For the lower secondary level, only 32% of the secondary schools surveyed reported that their teachers had used WWW or e-mail in their teaching and only 4% of the schools reported that most of their teachers (76-100%) had this experience. The level of reported Internet usage at the upper secondary level was higher than that at the lower secondary level. Half of the surveyed schools indicated that their teachers had used the Internet in their teaching and 5% of schools reported that most of their teachers (76-100%) had used WWW /Internet in their teaching.

Obstacles Encountered during ICT Implementation

In both the international survey of principals and technology coordinators and the local survey of teachers and students, the respondents were asked to indicate from a list of potential problems the obstacles they perceived as affecting the implementation of ICT for teaching and learning in their schools. The findings from the international survey will be first discussed, followed by the results from the local survey of teachers and students.

Major Obstacles Perceived by the Principals

Survey results (Appendix 4.9 to 4.11) indicated that the top three major obstacles often cited by both primary and secondary school principals at all three educational levels in Hong Kong were: not enough copies of software for instructional purposes, insufficient time for teachers to prepare lessons in which computers are used and insufficient number of computers. The least important obstacles were: lack of support from the school's governing body or community, lack of interest/willingness of teachers to use computers and insufficient plans and/or resources to prevent theft and vandalism. A greater percentage of primary school principals believed that 'not enough training opportunities for teachers was an important obstacle. Secondary school principals found problems in scheduling enough computer time for different classes to be a greater obstacle than the primary school principals. Considering the fact that the ICT infrastructure in primary schools was poorer than secondary schools, this indicated that primary teachers are much less enthusiastic about using ICT for teaching.

Major Obstacles Perceived by the Technology Coordinators

Technology coordinators in primary and secondary schools perceived the top three obstacles to using ICT for teaching and learning in schools to be: not enough technical assistance (for operating and maintaining computers and/or solving technical problems with ICT), not enough copies of software for instructional purposes and insufficient number of computers (Appendix 4.12 to 4.14). In general technology coordinators in both primary and secondary schools did not find network-related problems like "too complicated to connect to the network", "generally the material found on the Internet is of poor quality" and "e-mail in-baskets are overloaded" to be a serious obstacle. It is also worth noting that a greater percentage of technology coordinators in secondary schools than in primary schools perceived that "slow or unreliable network performance" and "not enough connections can be made at the same time for a class to use" to be serious obstacles. A similar profile emerged in the international data. This finding may again indicate that secondary school teachers tend to use the Internet and email more, thus reporting more difficulties in these areas.

It is interesting to note that when comparing the obstacles encountered with hardware to those with software, both principals and technology coordinators found software related problems to be more serious. The greatest obstacle with regard to software is "not enough copies of software for instructional purposes". Over 80% of the primary and secondary school principals and technology coordinators saw it as a key problem. "Curricular incompatibility of imported instructional software" was another problem which was often cited by the technology coordinators across the three levels. "Too complicated software for teachers and/or students to use" was seldom mentioned. Obstacles cited by other countries in this Study show a similar profile. The main exception was that Singapore and Israel reported software not being adaptable enough as a major obstacle at both primary and secondary levels.

Major Obstacles Perceived by Teachers and Students

In the local survey, teachers were asked to indicate which were the obstacles they encountered in using ICT for teaching. Results shown in figure 4.15 indicate that both primary and secondary school teachers reported similar patterns of obstacles in implementing ICT in teaching and learning, with insufficient knowledge in IT as the most serious obstacle, followed by insufficient technical support and inadequate hardware and software. It is also noteworthy that for all the obstacles listed, secondary school teachers perceived the problems to be more serious than their primary school counterparts. Further, "materials found in the Internet is of poor quality" was the least major obstacle in affecting the implementation of IT in schools, barely reported by a few percent of all respondents. This again is possibly more a reflection of the low Internet usage in schools rather than a reflection of the quality of materials available on the web.

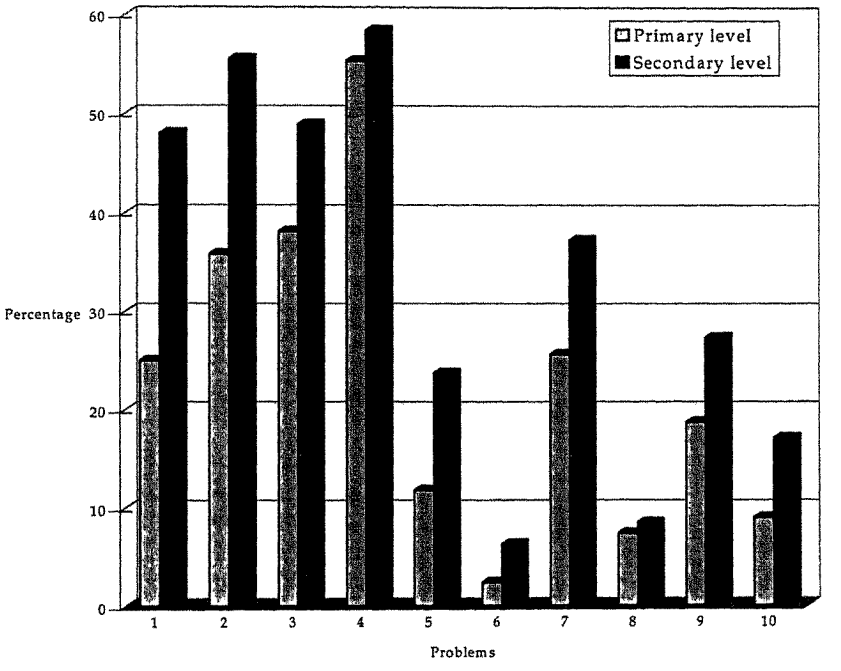


Figure 4.15
Obstacles encountered by Hong Kong teachers in using ICT in teaching and learning

In the local survey, students were asked to indicate the obstacles they encountered in learning ICT in schools. Just as the secondary school teachers perceived more serious obstacles to ICT use in teaching than primary teachers, secondary school students reported a higher percentage of obstacles encountered than the primary school students, though the kinds of obstacles met was similar. The top three obstacles reported were insufficient time for learning, insufficient number of computers and insufficient knowledge in ICT. Similar to the teachers' perceptions, "information overload" was also perceived to be the least important obstacle. It is interesting to note that students did not perceive "insufficient Chinese software" as a serious problem at all (more details discussion will be on chapter 6 and 8).

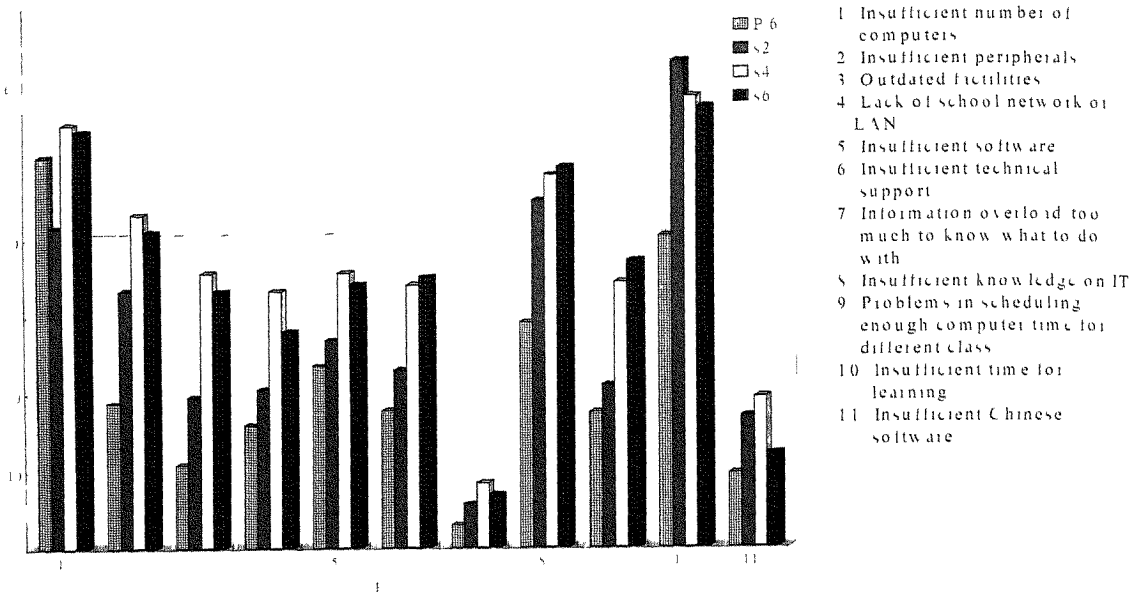


Figure 4.16
Problems encountered by the students in using ICT for learning purposes

Summary

As reported in the previous chapters, the introduction of ICT across the curriculum for enhancement of education quality was only formalized at the policy level in 1998. It is thus not surprising to find that at the time of the survey, the hardware, networking and software infrastructure provisions in Hong Kong schools were relatively poor in comparison to other countries, especially at the primary level. The only exception is in the area of the hardware configuration. Hong Kong schools ranks top with Singapore in terms of the high percentage of computers that were multimedia ready, using high-speed processors and advanced operating systems.

While the relative low provisions in infrastructure is understandable given the short history of ICT developments in Hong Kong schools, the relative scarcity or abundance of particular of particular categories of provisions may be indicative of the schools' priorities in the use of resources and the pedagogical practice paradigm that the schools subscribe to. Hong Kong schools has by far the greatest availability in all participating countries of video projectors and LCD-panels, the peripherals necessary for whole class presentations. On the other hand, devices for disabled students were not high even in special schools and entirely absent in non-special schools in Hong Kong. This finding is consistent with the finding that in comparison with other countries, Hong Kong schools placed greater emphasis on the traditionally important paradigm rather than the emergent paradigm.

In terms of perceived obstacles related to ICT infrastructure, it was found that while primary schools were significantly less well provided for in terms of both the student:computer ratio and the Internet connectivity compared to secondary schools in Hong Kong, the low provisions in these two areas were perceived to constitute a much greater obstacle in secondary schools than in primary schools. It is thus clear that at least for Hong Kong schools, the perceived severity of the obstacles relates more to the actual usage level and perceived importance ascribed to particular activities than the actual level of infrastructure provisions.

Reference:

Pelgrum, Wj, Schipper AT (1993) Indicators of Computer Integration in education. Computers in Education, 21, 141-49.

Chapter 5 Staff Development

This chapter reports a number of measures on staff development including the extent to which facilities for training teachers are available inside and/or outside school, the extent to which schools have adopted objectives with regard to staff development, and perceived problems, priorities and financial investments of schools in the area of ICT-related staff development. The results from the teacher survey conducted as part of the local extension of SITES in Hong Kong are also presented in this chapter.

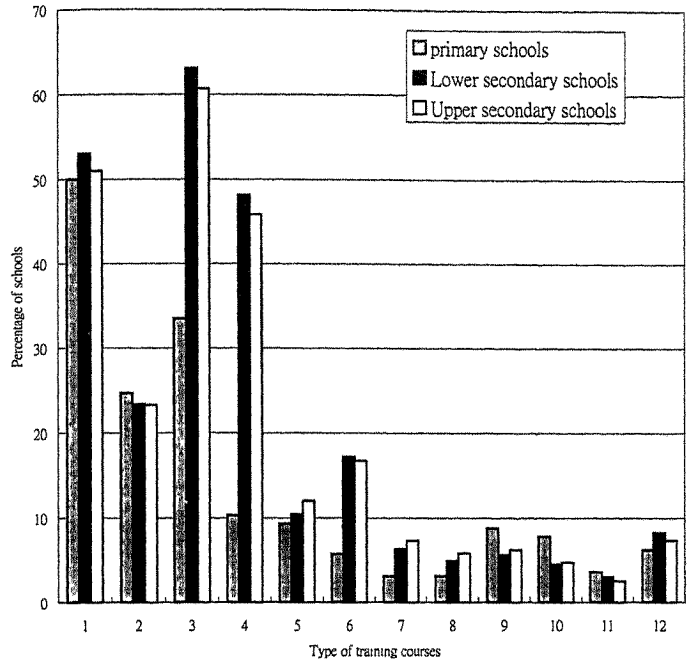
Introduction

Teachers play a crucial role in the adoption and implementation of ICT in education since teachers are the key to making learning happen. In the 1992 CompEd study, Pelgrum, Janssen Reinen, and Plomp (1993) found many teachers reporting a lack of knowledge and a need for further training in ICT. The introduction of computers in schools is much more than introducing new educational technologies. It is a complex innovation with considerable changes for teachers. Therefore, training of teachers and regular updating of their ICT knowledge and skills are important for the integration of technology into educational practice.

SITES has developed a number of indicators on staff development including the extent to which facilities for training teachers are available inside and/or outside schools, the extent to which schools have adopted objectives with regard to staff development, and perceived problems, priorities and financial investments of schools in the area of ICT-related staff development. This chapter also reports on the results from the teacher survey conducted as part of the local extension of SITES in Hong Kong.

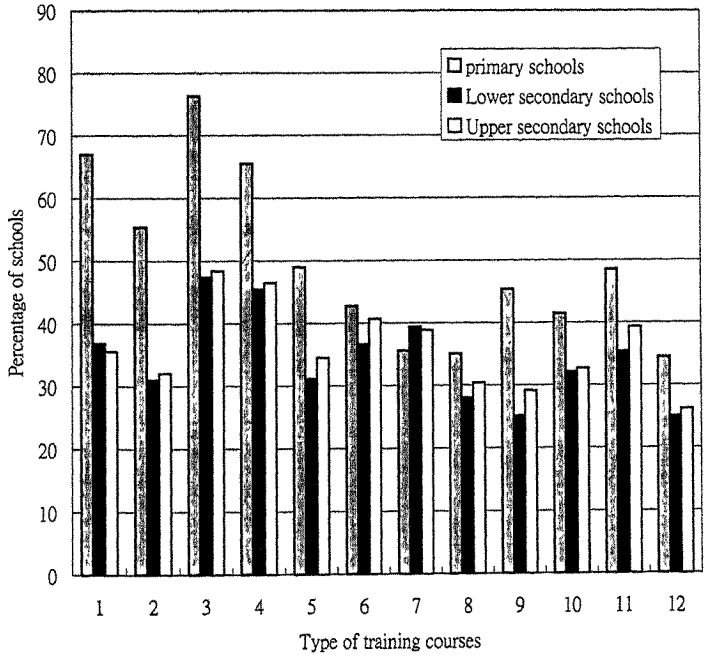
Availability of ICT Training Courses

Training courses improve teachers' knowledge and skills and enhance their competence in the use of ICT in education. The Technical Questionnaire inquires about the availability of different in-house or external courses. The results are presented in Figure 5.1 and Figure 5.2.



1 General introductory course (how to use a computer, principles of soft- and hardware, functions of mouse, printer)
2. General introductory course (history of ICT, relevance, consequences of computer use, etc.)
3. Introductory course for applications/standard tools (basic word-processing, spreadsheet, databases, etc.)
4. Introductory course for Internet use (retrieve information, send/receive emails, etc.)
5. Introductory technical course for operating and maintaining computer systems
6. Advanced course for applications/standard tools (e.g. advanced word-processing, complex relational databases)
7. Advanced course for Internet use (e.g. creating websites/develop a home page, advanced use of Internet, video conferencing)
8. Advanced technical course for operating and maintaining computer systems (e.g. networks, special equipment)
9. General course about didactical/pedagogical principles of computer use
10. Subject-specific training (with subject-specific learning software, e.g. tutorials or drill and practice software)
11. Programming course, where teachers can learn how to create their own software (also with authorware)
12. Special course with digital video- and audio-equipment

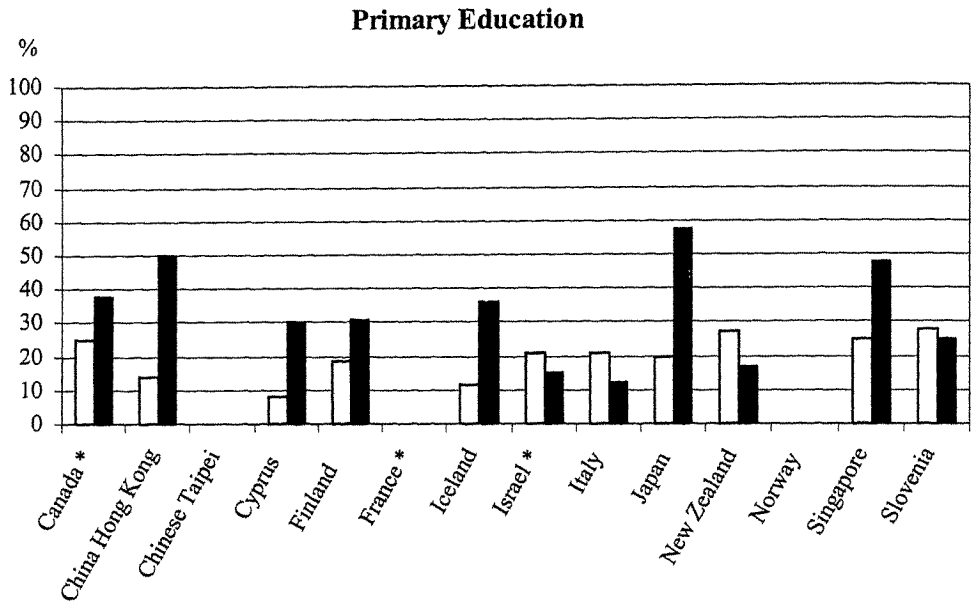
Figure 5.1
Availability of in house ICT teacher training courses in Hong Kong

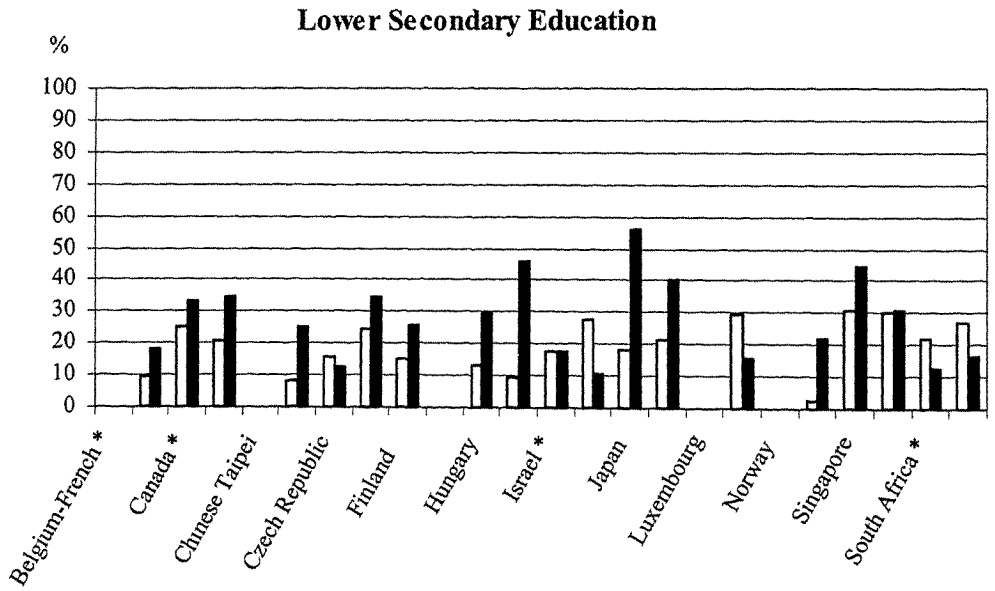


1 General introductory course (how to use a computer, principles of soft- and hardware, functions of mouse, printer)
2. General introductory course (history of ICT, relevance, consequences of computer use, etc.)
3. Introductory course for applications/standard tools (basic word-processing, spreadsheet, databases, etc.)
4. Introductory course for Internet use (retrieve information, send/receive emails, etc.)
5. Introductory technical course for operating and maintaining computer systems
6. Advanced course for applications/standard tools (e g. advanced word-processing, complex relational databases)
7. Advanced course for Internet use (e.g. creating websites/develop a home page, advanced use of Internet, video conferencing)
8. Advanced technical course for operating and maintaining computer systems (e.g. networks, special equipment)
9. General course about didactical/pedagogical principles of computer use
10. Subject-specific training (with subject-specific learning software, e.g. tutorials or drill and practice software)
11. Programming course, where teachers can learn how to create their own software (also with authorware)
12. Special course with digital video- and audio-equipment

Figure 5.2
Availability of external ICT teacher training courses in Hong Kong

It is clear from Figure 5.1and 5.2 that the level of external training provisions is generally higher in the primary schools than secondary schools in Hong Kong. In primary schools, there were significantly more introductory level courses than the more advanced or pedagogically oriented courses. Further, except for general introductory training (on computer operations, basic computer concepts and use of office suite applications) where 50% to 30% of schools have organized in-house courses, most of the training is offered by external agencies. In secondary schools, most introductory courses on basic computer operations, use of office suite applications and Internet use is provided by in-house courses, with about 40% to 60% of all secondary schools having such in-house courses available. Other types of courses, however, are available predominantly as courses offered by external agencies.





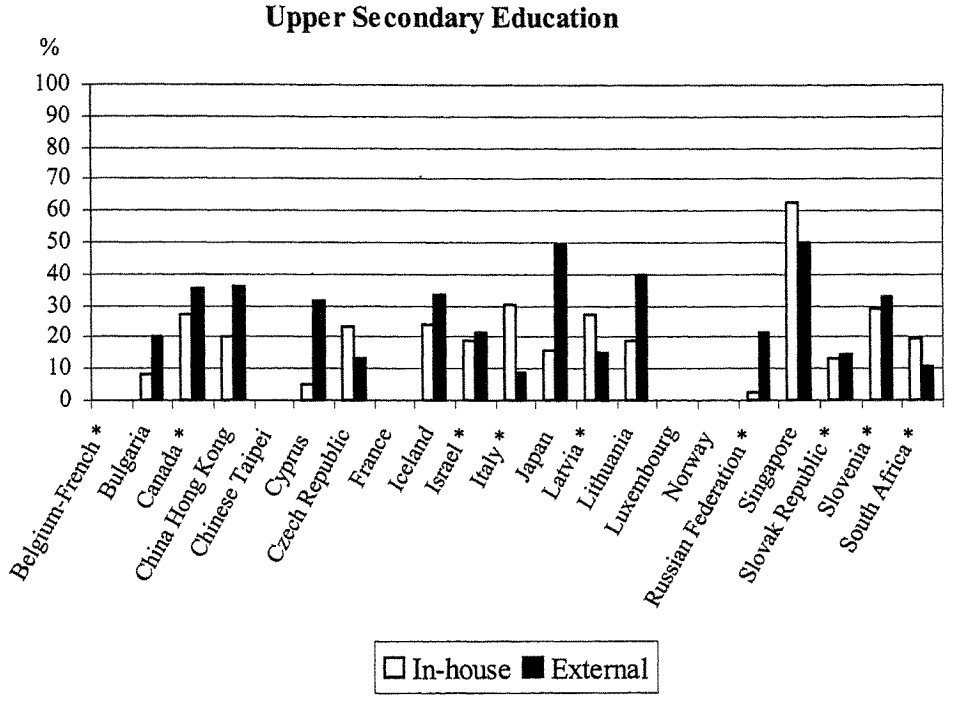


Figure 5.3

Average percentage across schools of available in-house and external courses from a list of 12 types of training at Primary, lower secondary and upper secondary levels.

Similar to Hong Kong, in most of the countries, the availability of external courses was greater than that of in-house training. There was a medium level of training opportunities for teachers in Hong Kong when compare to other countries. Singapore and Japan have the highest level of training provisions. At primary level in Hong Kong the training opportunities is also high.

Problems with Staff Readiness and Staff Development

In both the principal and technology coordinator surveys, there were questions about the respondents' perception of the major obstacles to the implementation of ICT-related goals. Items related to staff development include:

Principal questionnaire:

Teachers lack knowledge and/or skills of ICT-assisted instructional practices.
Teachers do not have enough training opportunities.

Technical (technology coordinator) questionnaire:

Teachers feel uncomfortable because some students are more competent with ICT than they are.
The quality of available teacher training courses is unsatisfactory.

Results from the Hong Kong study indicated that most school principals find that staff competence level and staff training opportunities were the major problems in ICT development. The problem was more seriously felt at the primary level. 76% of primary school principals indicated teachers' lack of knowledge or skills as a major problem and 80% of them considered the training opportunities to be inadequate. The lack of computers and software for instructional purposes was also expressed to a similar extent as amongst the most serious obstacles to ICT developments by primary school principals. Further, of all countries participating in the study at the primary level, Hong Kong ranked top as the education system where staff development was experienced as an obstacle to the most serious extent. Responses from secondary school principals reflected a lesser degree of concern, with just over 60% of respondents indicating that inadequate staff competence and lack of training were major obstacles to the schools' ICT development, which is within the middle range in comparison with other countries in the international study.

In general, staff competence was found to be a major obstacle to ICT development. The only countries where less than half of the respondents considered this to be a problem were Singapore and Iceland at the primary and lower secondary levels, and Chinese Taipei and Luxembourg at the upper secondary level. In nearly all countries, the lack of training opportunities appears to be a less serious obstacle than staff competence. However, Hong Kong seems to be the only exception where the reverse happens, and probably reflects the extremely earnest desire for teacher training courses at the time of the survey, which followed closely after the release of the Government's five-year strategy to support the use of ICT across the curriculum.

Another related issue of concern for Hong Kong in this area was the quality of teacher training. More than half of the technology coordinators in Hong Kong considered the low quality of available teacher training to be one of the major obstacles to ICT development at all three education levels. The only other countries expressing similar or higher levels of concern on the quality of teacher training were Cyprus and France at the primary level, South Africa at the lower secondary level and Cyprus, Israel and the Slovak Republic at the upper secondary level.

Staff development was one of the most prominent obstacles to ICT implementation in Hong Kong schools at all levels. However, the lack of interest from teachers did not appear to be a major contributing factor as it was considered an obstacle to ICT developments only by less than a quarter of the school principals at all three levels.The findings from SITES thus indicate that the lack of training opportunities and the low quality of available teacher training seem to be the major obstacles in implementing ICT in education.

Policies With Regard to Staff Development and its Realization

Priorities given to staff development and the extent to which these were realized were investigated in the study. About 95% of both primary and secondary school principals report that it was the policy goal of their schools to train all staff members in the use of ICT. Further, more than 80% of them consider this goal to have been partially realized in their schools while only 4% of primary school principals and 2% of secondary school principals described this goal as almost or fully realized. In fact, among all participating countries, Singapore is the only country where more than half of the principals reported having almost or fully realized their staff development goals, with percentages of 80%, 74% and 58% at the primary, lower secondary and upper secondary levels respectively.

Three questions were posed to school principals to investigated whether schools used any of the following strategies to encourage teachers to use ICT:

1. The provision of rewards for teachers who use ICT
2. The provision of incentives to teachers who use ICT
3. The assignment of non-teaching hours

The provision of rewards for teachers to encourage use of ICT was nearly non- existent. However, over 74% of principals at both primary and secondary levels reported providing incentives to teachers for using ICT. In terms of assigning non-teaching hours to teachers who use ICT, a slightly greater percentage was found in primary schools, totaling 72%, compared to 55% in secondary schools. The extent of realization of this policy strategy was also larger in primary schools, as indicated by 57% of primary school principals against 44% of secondary school principals reporting that their schools have partially or fully realized assigning non-teaching hours to teachers.

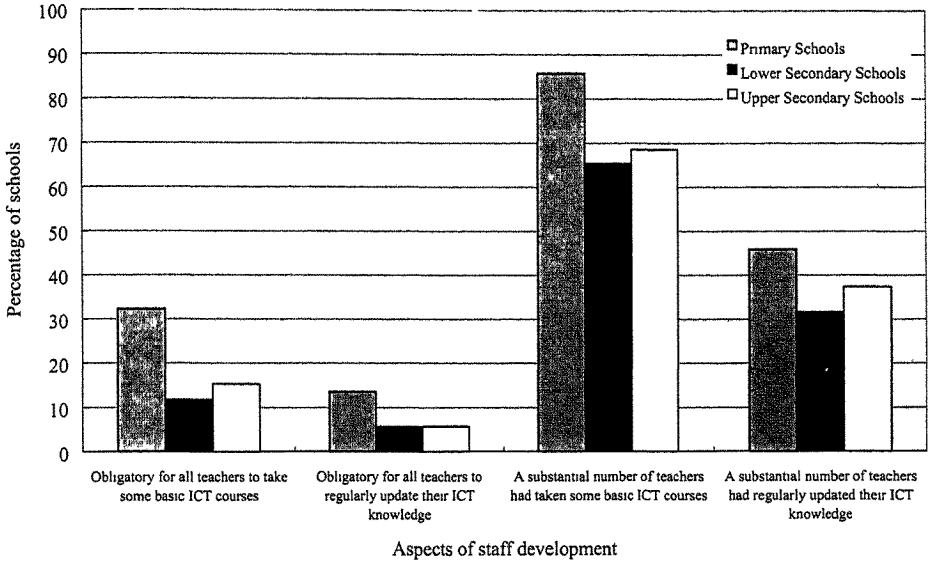


Figure 5.4
Percentages of Schools in terms of their Policies and Implementation of ICT-related Staff Development in Hong Kong

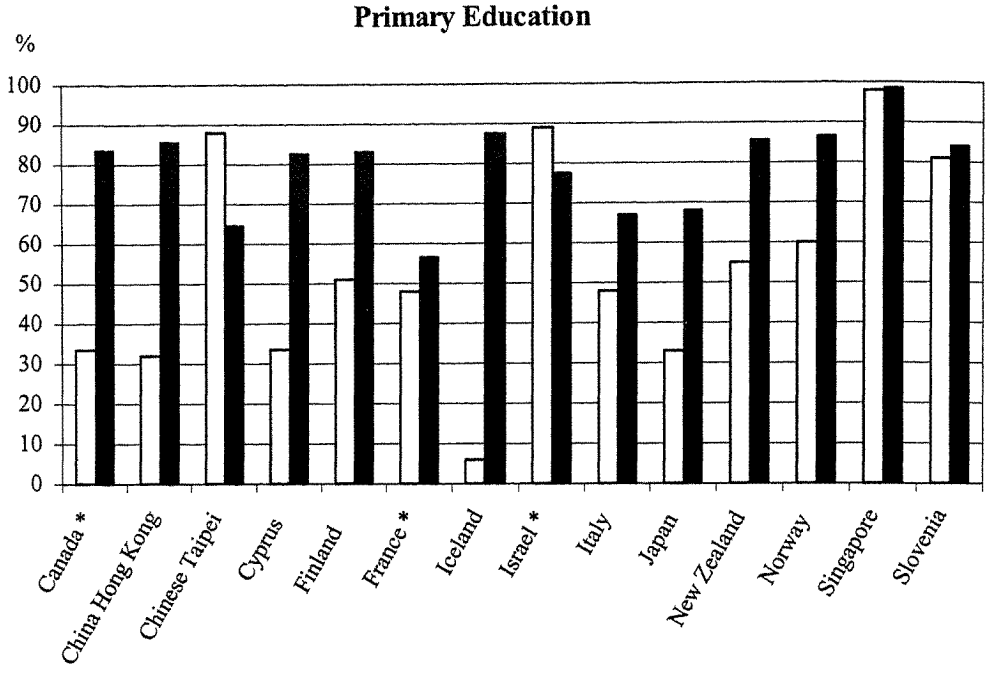
In order to find out more about school policies and implementation with regard to staff development, school principals were asked to indicate if it was obligatory that:

- All teachers take some basic ICT courses
- All teachers regularly update their ICT knowledge.

In addition, school principals were asked to indicate if a substantial number of teachers have actually :

- Taken some basic ICT courses
- Regularly updated their ICT knowledge.

It was found that while the training of all staff members in the use of ICT was a policy goal in 95% of schools in Hong Kong with explicit policies goals, only a low percentage of schools made it obligatory for all teachers to take some basic ICT courses or to update their ICT knowledge regularly. In fact, the level of compulsion on teacher training in Hong Kong is amongst the lowest in the world at all three levels. However, as Figure 5.4 indicates, a very large percentage of school principals reported that a substantial number of teachers in their schools had attended these two types of courses. It is interesting to note from Figure 5.4 that a substantially higher percentage of primary school teachers have taken ICT-related courses when compared to secondary school teachers, while less secondary school principals considered staff development to be one of the major obstacles to ICT development than their primary counterparts. This is possibly because computers have been used for the computing subjects for more than six years in most secondary schools, resulting in a higher level of computer literacy amongst secondary school teachers.


Primary Education
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New Zealand
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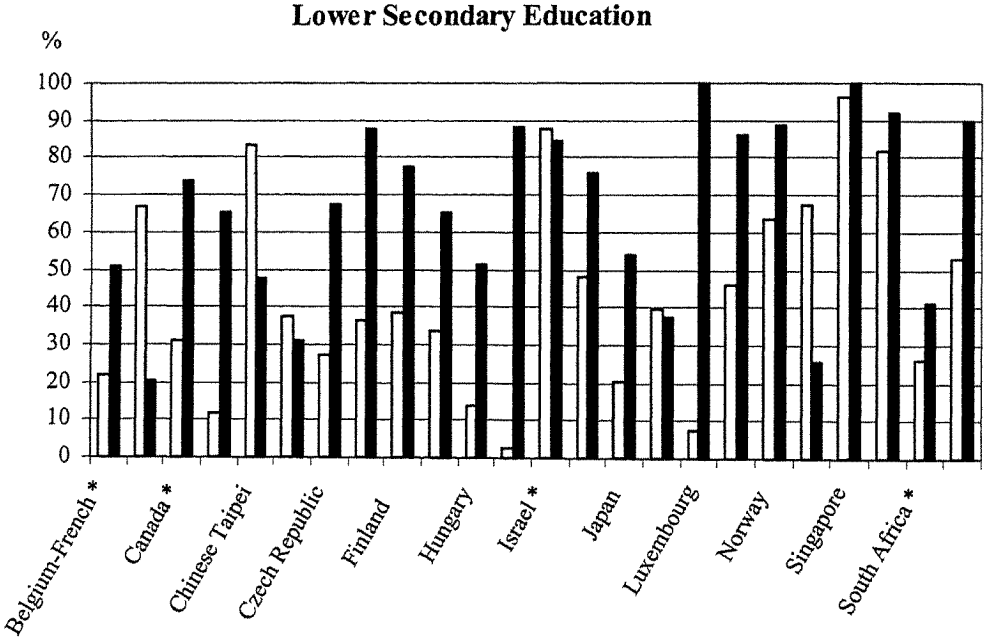
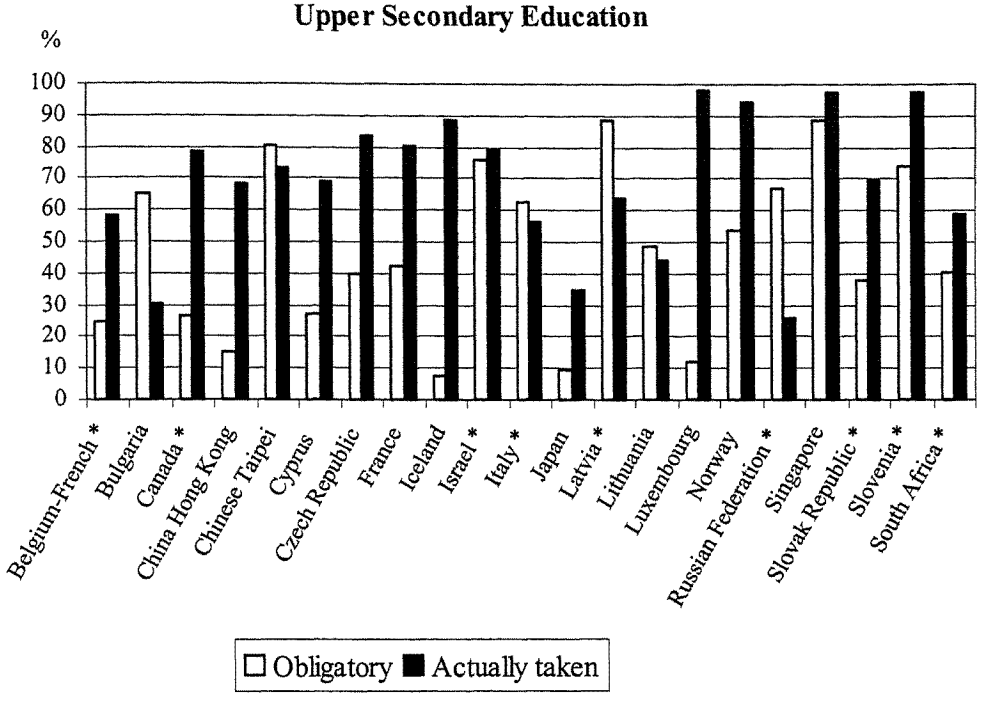
Singapore
Slovenia


Lower Secondary Education
%
100
90
80
70
60
50
40
30
20
10
0
Belgium-French *
Canada *
Chinese Taipei
Czech Republic
Finland
Hungary
Israel *
Japan
Luxembourg
Norway
Singapore
South Africa *



*: countries that did not satisfy all sampling criteria.

Figure 5.5

Percentages of schools where it was obligatory that all teachers take some basic ICT -course and percentage reflecting if a substantial number of teachers actually had taken such courses at the three educational levels

It can be observed in figure 5.5 that while the percentage of schools making ICT training for teachers obligatory was relatively low compared to other countries. The percentage of teachers having actually taken such course was relatively high internationally. This is consistent with the principals' perception that teachers' lack of interest was not a major obstacle, as reported earlier. Teachers in Singapore had the highest attendance in basic ICT course (98%) at primary level. At the lower and upper secondary levels, Luxembourg and Singapore were the countries with the highest attendance, with over 97% of teachers having attended basic ICT courses.

Self-reported Competencies of Technology Coordinators

Technology coordinators play an important role in the transfer of knowledge between teachers in a school. Yet to what extent do technology coordinators consider themselves adequately prepared for their work in supporting ICT activities within the school? They were asked to assess their own adequacy in the following areas:

General:

1. MS-Windows
2. Mac-OS
3. MS-DOS
4. Word processing
5. Databases
6. Spreadsheets

Instructional:

7. Subject specific applications
8. Application of student progress tracking software
9. Didactical and organizational integration of computers in subjects
10. Use of specific programs for subjects
11. Evaluation and selection of software
12. Individual learning programs
13. Multimedia application
14. Adaptation of software
15. Email for educational purposes
16. Internet and WWW for educational purposes
17. Making Presentations

The results presented in Figure 5.6 indicate that most technology coordinators consider themselves adequately prepared in terms of using general applications, especially MS-Windows and word processing. Primary school technology coordinators were in comparison less confident about using databases (primary 45%, secondary 85%), MS-DOS(primary 61%, secondary 89%) and spreadsheets (primary 60%, secondary 89%). The self-assessed competence was, however, much lower for the instructional aspects, especially in primary schools. In the instructional category, technology coordinators have greatest confidence in making presentations and multimedia applications (about 60%). At the secondary school level (72%), the technology coordinators were also relatively confident about Internet-related applications while primary technology coordinators (31%) were not.

Compared to their counterparts in other countries (appendix 5.1-5.3), technology coordinators in Hong Kong schools were more confident about their own competence in using general application but less so with pedagogical applications. This contrast is especially noticeable at the primary level. Only 24% of primary school technology coordinators and 31% of secondary school technology coordinators reported that they were adequately prepared for didactical and organizational integration of computers in subjects. This contrasts with the highest figures of 74% in New Zealand at primary level, 68% in Slovenia at lower secondary level and 67% in Singapore at upper secondary level.

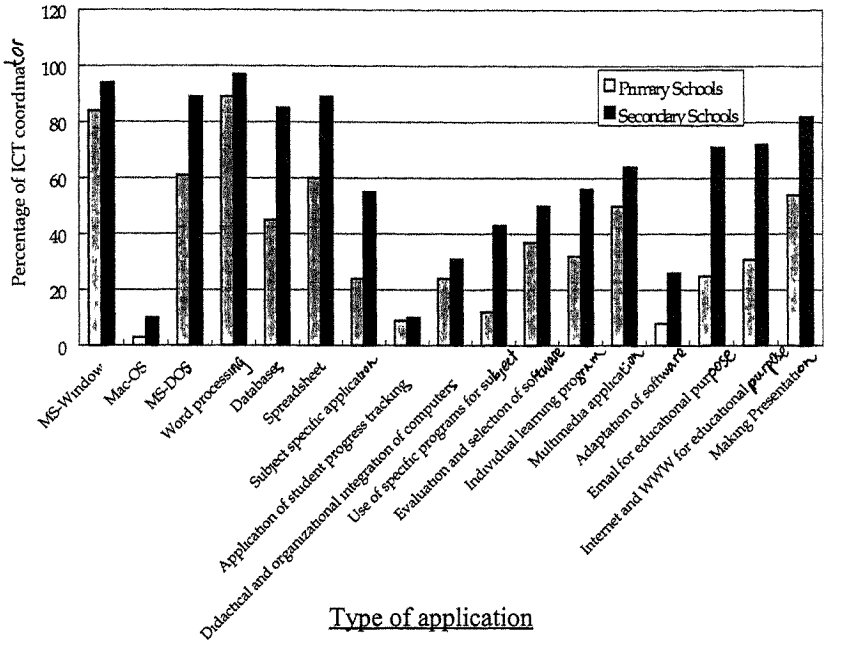


Figure 5.6
Self-reported competencies of technology coordinators in Hong Kong

Self-reported Competence of Teachers

To bring about change, teachers must have sufficient knowledge and skills to do the job. This factor is often called competence (Verspoor, 1989). A self-reported competence checklist was included in the teacher questionnaire. The items in the checklist were as follow:

1. Word processing
2. Spreadsheet
3. Database software
4. Presentation software
5. Monitoring students' progress in using software
6. Communicating and discussing with others through the Internet
7. Integrating the application of computer into teaching and learning
8. Assessing and selecting software for teaching and learning
9. Using computer for individual learning
10. Application of multimedia
11. Modifying software for its appropriate use in schools
12. Using email in teaching and learning
13. Using the Internet/WW in teaching and learning
14. Other areas of computer training

Figure 5.7 Presents the percentage of teachers claiming competence in a range of ICT applications. Figure 5.8 shows the box plots of self assessed ICT competence of teachers across schools.

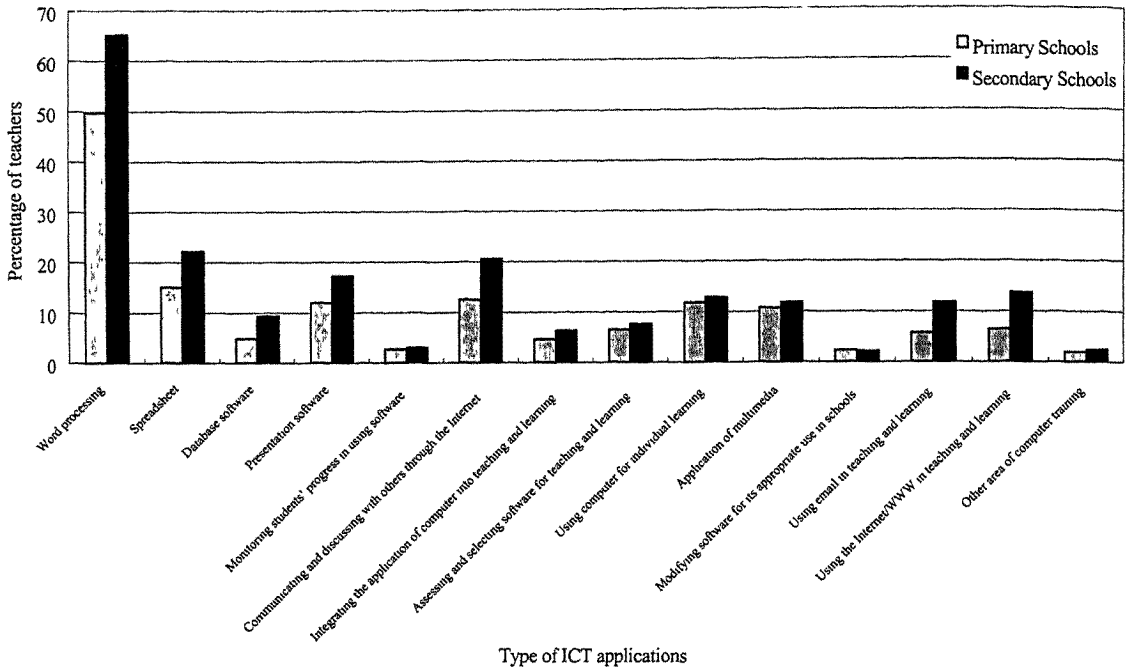
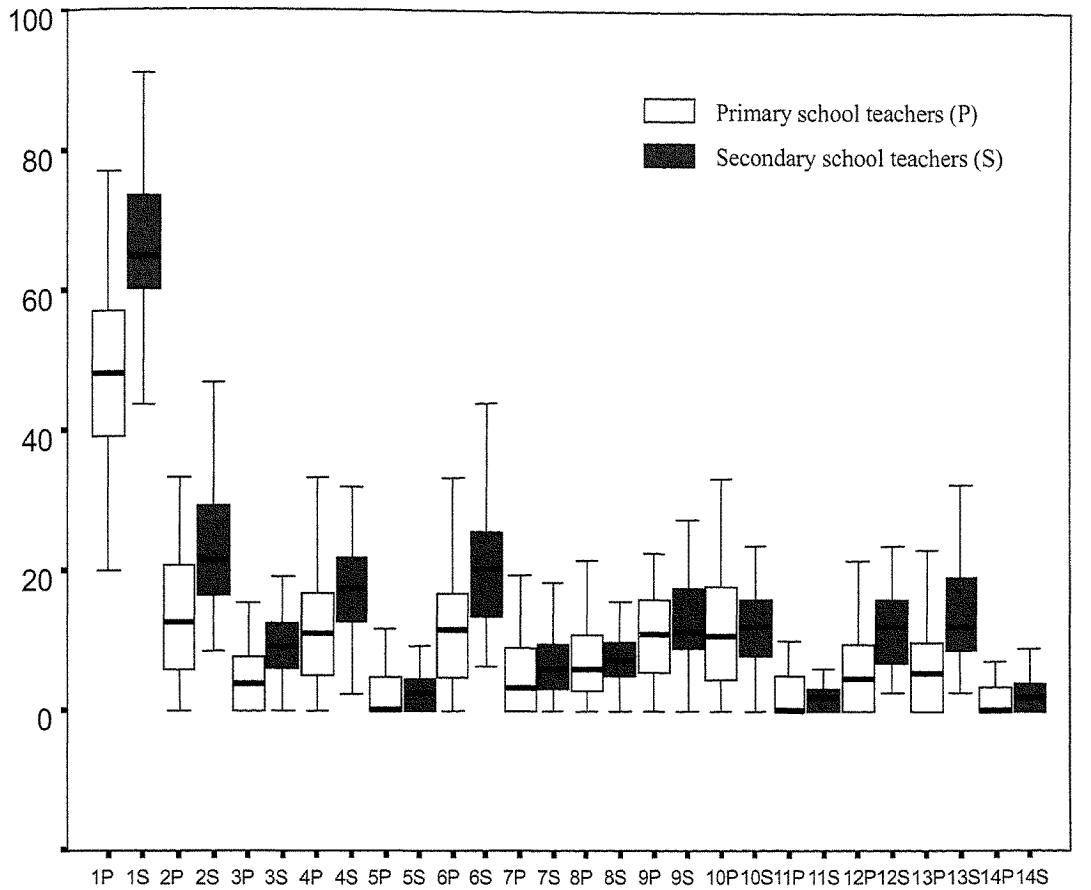


Figure 5.7
Teachers' Self-reported competence in ICT applications



1. Word processing
2. Spreadsheet
3. Database software
4. Presentation software
5. Monitoring students' progress in using software
6. Communicating and discussing with others through the Internet
7. Integrating the application of computer into teaching and learning
8. Assessing and selecting software for teaching and learning
9. Using computer for individual learning
10. Application of multimedia
11. Modifying software for its appropriate use in schools
12. Using email in teaching and learning
13. Using the Internet/WWW in teaching and learning
14. Other area of computer training

Figure 5.8

Box plot of Teachers' self-reported competence in ICT application across schools.

Figure 5.7 shows the percentages of teachers who felt that they have been adequately trained in each of the 14 areas of ICT applications. Secondary school teachers claimed higher competence across all types of ICT applications than their primary counterparts. Except for word processing, the general level of self-reported training sufficiency in all areas was rather low (mostly around 10%). For example, only 22% of secondary teachers and 15% of the primary teachers indicated that they had enough training in using spreadsheets. Very low percentages (less than 3%) of secondary and primary teachers indicated that they had enough training in using software to monitor students' progress and to modify software for appropriate use in schools. This might imply that the vast majority of teachers thought that they did not have sufficient knowledge in using ICT in education. Figure 5.8 shows that, in general, both primary and secondary school teachers were less confident about their own competence in various uses of ICT for teaching and learning (all less than 20% and mostly below 10%).

Many earlier researches found gender differences in the acquisition of computer knowledge and skills. In order to explore whether such gender differences exist in Hong Kong teachers, an ANOVA analysis was conducted. Results indicated that there was statistically significant gender differences ($F(1, 3467)=224.24$, $p<0.001$). In general male teachers had acquired more areas of computer knowledge (mean=2.66) than female teachers (mean=1.41). For the number of areas of training needed by teachers, there was no significant gender difference indicating that female teachers are probably as keen to learn as their male counterparts. ($F(1, 3467)=0.619$, $p<0.431$).

Needs and Opportunities in Staff Development as Perceived by Teachers

In Hong Kong, the Teacher Questionnaire also focused on staff development needs, opportunities and practices related to ICT and provides a good comparison to responses gathered from principals and technology coordinators. Teachers were asked the number of hours they had spent in attending different types of ICT training courses. As Figure 5.9 and 5.10 show, both primary and secondary school teachers spent the greatest amount of time in attending university/teacher training courses among all types of ICT courses. For teachers who attended any of the university/teacher training courses, more than 20% indicated that they spent more than 30 hours on the courses. Furthermore, primary school teachers also attended longer lengths of training in each of the courses than the secondary school counterparts.

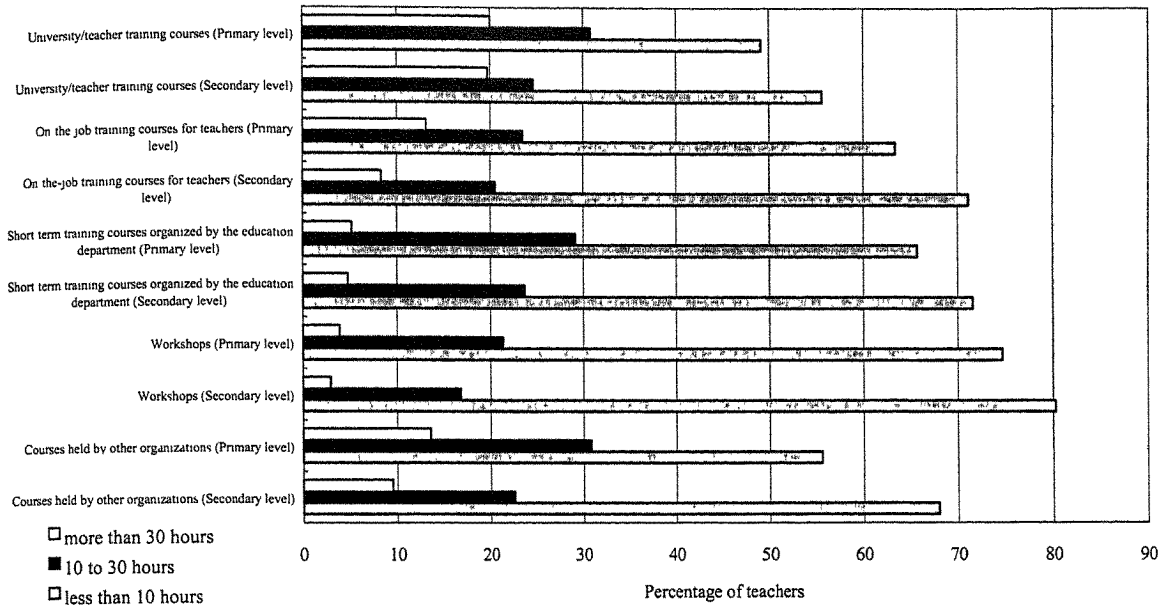


Figure 5.9

Time spent on attending different training courses by teachers who have indicated their attendance in the respective courses in Hong Kong.

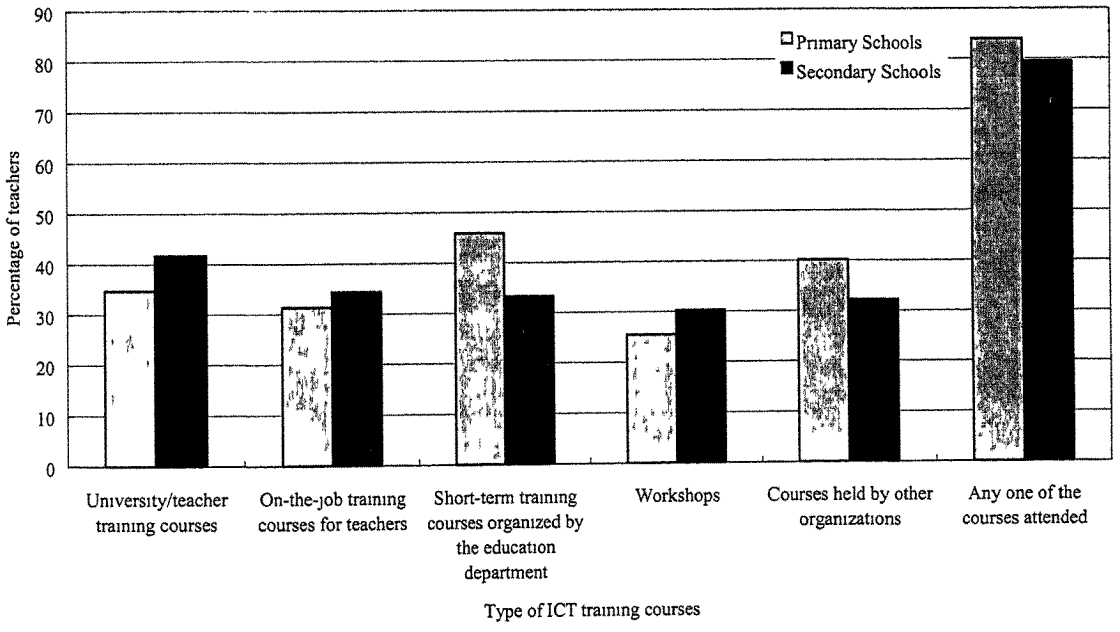


Figure 5.10

Percentage of teachers who have attended various ICT courses in Hong Kong

Teachers were asked to indicate their needs for further training in the various ICT application areas. A noteworthy observation is that the perceived needs for pedagogical oriented training were higher than those for general applications.

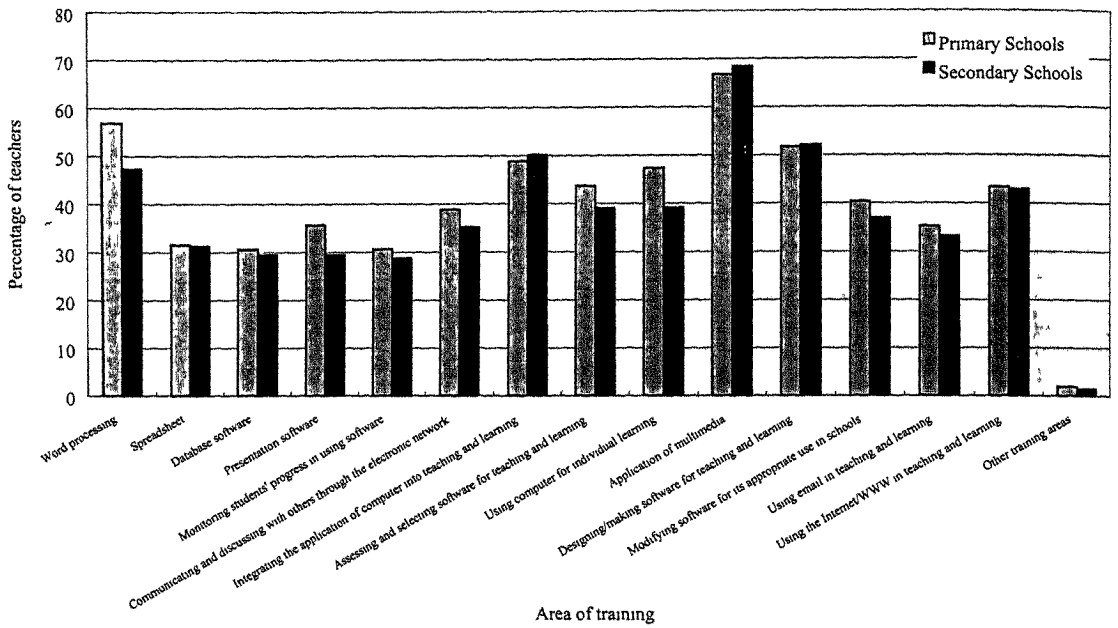


Figure 5.11
Further training required by teachers

Figure 5.11 presents the different kinds of training requested by teachers. The top three training needs areas reported by primary teachers were using multimedia in teaching (67%), using word processing (57%) and designing/making software for teaching and learning purposes (52%). For secondary teachers, training in the use of multimedia in teaching (68%), designing /making software (52%) and integrating the application of computers in subject teaching and learning (50%) were most frequently checked. It thus appears that teachers were more concerned about the use of ICT as a teacher's tool. On the whole there was not much difference in terms of the perceived training needs.

Ways of ICT Knowledge Transfer

Continual staff development has been found to be an important prerequisite for sustained innovation, especially when the use of ICT is involved. A set of questions in the technology coordinator survey investigated the extent to which the following mechanisms for facilitating the transfer of ICT knowledge among teachers within a school was used:

1. Via informal contacts
2. Via school ICT working group
3. Via teachers meeting about the use of ICT in education
4. Via regular newsletter
5. Via trained teachers further disseminating information within the school
6. Via courses offered by external agencies
7. Via courses within the school
8. Via technology coordinators
9. No organized structure
10. Other

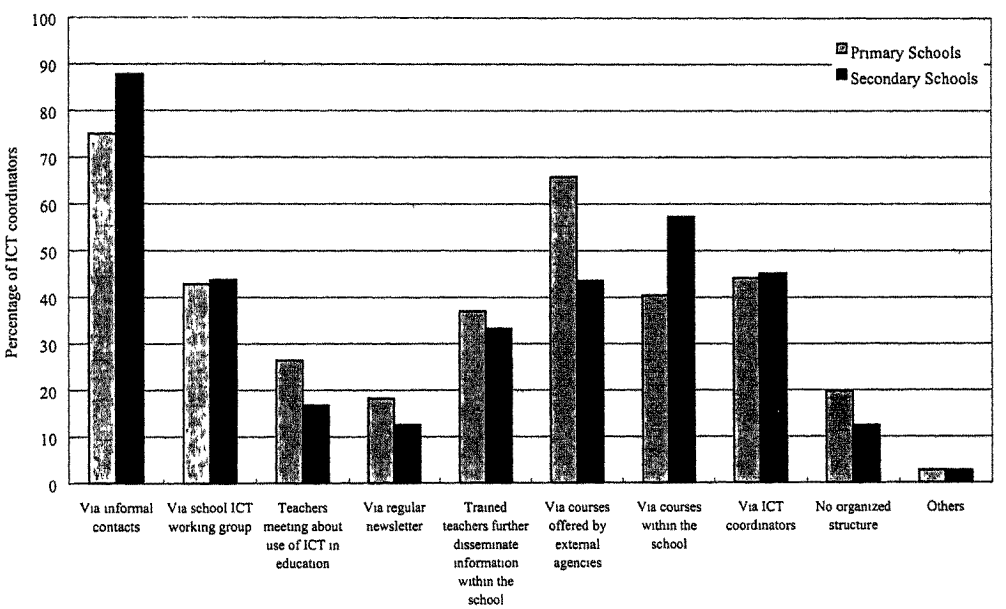


Figure 5.12
Ways of ICT knowledge transfer in Schools in HK

The results in Figure 5.12 indicated that in both primary and secondary schools, the most popular means for ICT knowledge transfer was informal contacts. The next most important transfer mechanism was via courses offered by external agencies for primary schools and via courses within the school for secondary schools. In fact, the results indicated that in both primary and secondary schools in Hong Kong, technology coordinators and school ICT working groups played important roles in ICT knowledge transfer in similar ways.

Major Sources of ICT Knowledge

Despite the fact that most teachers have taken courses on some aspects of ICT use, the majority of them indicated that their main source of ICT knowledge was self-learning (including help from friends and colleagues). Only 27% of primary school teachers and 14% of secondary school teachers considered training courses as their major source of ICT knowledge.

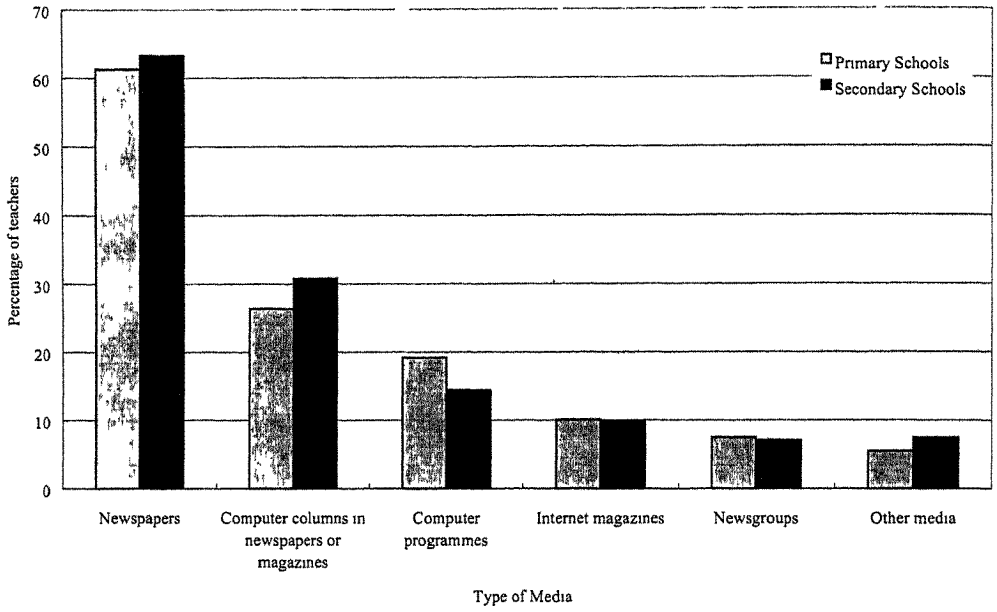


Figure 5.13
Percentages of Hong Kong teachers who indicated obtaining ICT knowledge from different media channels

Results from the survey indicated that newspapers were the most popular source of ICT information from media, with more than 60% of all primary and secondary teachers responding that they often obtained new ICT knowledge from newspapers. About 30% of teachers also indicated that they often gained new knowledge from computer columns in newspapers and magazines. Internet magazines, however, were only used by about 10% of the teachers as a regular source of ICT knowledge.

Sources of Assistance when Difficulties Arise

Teachers in Hong Kong mostly turned to friends and colleagues for help when they encountered difficulties (more than 60% for both categories). Computer teachers were also a popular source of help. It is important to note that the Internet/Usenet is the least popular source of help for teachers (6%), indicating that the culture of surfing the Internet and participating in Usenet groups for professional support is still not established within the teacher communities.

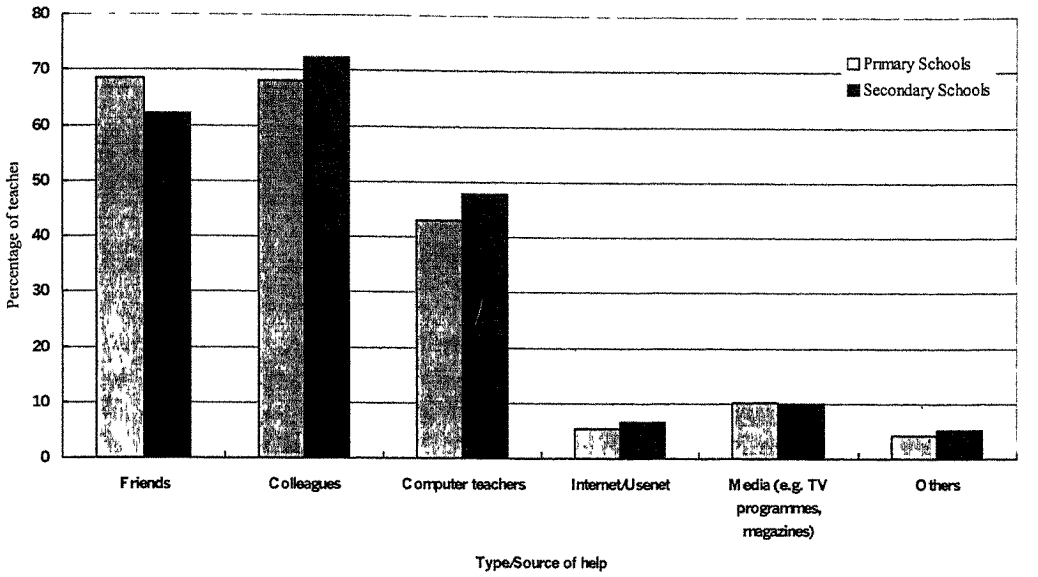
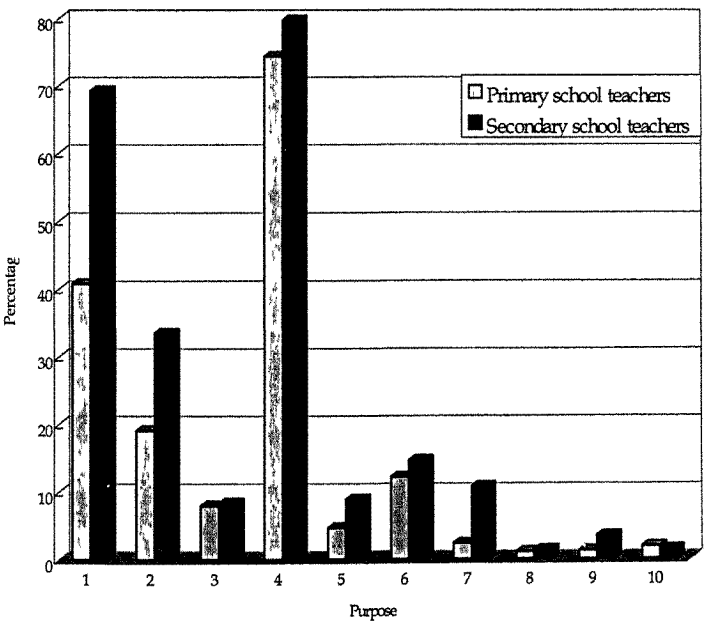


Figure 5.14
Sources of assistance used by Hong Kong teachers when difficulties arose

Computer Usage by Teachers

The successful integration of computers into teaching and learning depends largely on how teachers embrace and use computers. Figure 5.15 shows how teachers use computers in their daily activities as a teacher.



1. Preparing teaching notes and materials
2. Searching information and teaching materials of subjects
3. Discussing with other teachers on teaching and learing matters.
4 Making examination and test paper
5. Managing test, delivering and collecting students' homework
6. Designing class activities or homework
7. Using email to discuss and communicate with students
8. Using the Internet to carry out a collaborative project with other schools
9. Participating in electronic network activities related to teaching and learning
10 Others

Figure 5.15
Purposes of using computers for teachers

As can be seen in Figure 5.15, primary and secondary teachers frequently used computers in making tests and examination papers. A substantial difference was found between primary teachers and secondary teachers in using computers for preparing teaching notes and teaching materials. 69% of the secondary teachers reported that they had used computers in preparing teaching notes and materials while only 41% were found in primary schools. Less than 10% of teachers in both primary and secondary schools indicated that they had used computers for discussing teaching and learning matters with other teachers, managing tests and collecting students' homework, using the Internet to carry out a collaborative project with other schools or participating in electronic network activities related to teaching and learning. Obviously, computers were still not commonly used as a communication tool in teaching and learning among primary and secondary teachers.

Summary

In the survey, most school principals pointed out that teachers' lack of ICT knowledge and insufficient ICT related teacher training were the major barriers to ICT development in schools. In addition, over half of the technology coordinators considered the low quality of the current teacher training at primary, lower secondary and upper secondary levels the main obstacle to ICT development. The research also found that most teacher training courses focused on basic computer operations instead of, for example, advanced computer techniques and subject-specific pedagogical applications.

Technology coordinators, in particular those in primary schools, claimed higher pedagogical ICT competence than technical competence. Compared to other countries, primary school teachers in Hong Kong have lower self-assessed competence both in the application of ICT in teaching and in the use of the Internet, while secondary school teachers had lower confidence in the appropriate and integrated use of ICT in teaching and learning.

In general, teachers felt that, aside from word processing, they had not received sufficient training to allow them to integrate ICT into their teaching. Training most requested by over half of the teachers included using multimedia in teaching, word processing and designing and making teaching and learning software, indicating teachers' preference for using ICT as a teacher's tool.

Reference:

Verspoor, A(1989) Pathways to Change. Washington, D. C. : The World Bank

Chapter 6 Policies and Attitudes at the School Level

A transformation will not occur simply because the technology exists. What is more important is how people view the role of ICT. In this chapter, goals and policies regarding the use of ICT in schools will be investigated. In the process, teachers and students' attitudes towards the role of ICT will be examined. Lastly, problems perceived by teachers and students will be discussed.

Explicit Goals and Policies

The clarity of goals and policies has been identified as important for the success of innovations. Fullan indicated that "unclear and unspecified changes can cause great anxiety and frustration to those sincerely trying to implement them." (Fullan 1991, p70-71). In this section we shall report about whether schools have explicit ICT goals and policies and their contents.

Some questions in the principal questionnaire sought to identify whether schools had set explicit goals and policies regarding the use of computers. In Hong Kong, only 39% of the primary school principals and 42% of secondary school principals indicate that their schools have drawn up an explicit IT policy plan, a relatively low rate compared to the international averages of 52% and 50% respectively.

For schools that had explicit policies, they were asked to indicate which of the following issues were addressed in the policies:

1. Use of computers in current school year for teaching and learning;
2. Use of computers in the forthcoming school years for teaching and learning;
3. Plans for hardware replacement;
4. Plans for staff development with regard to ICT training;
5. Specifications for computer-related tasks and persons in charge;
6. Plan for software acquisition;
7. Equity of access;
8. Internet policy.
9. Others

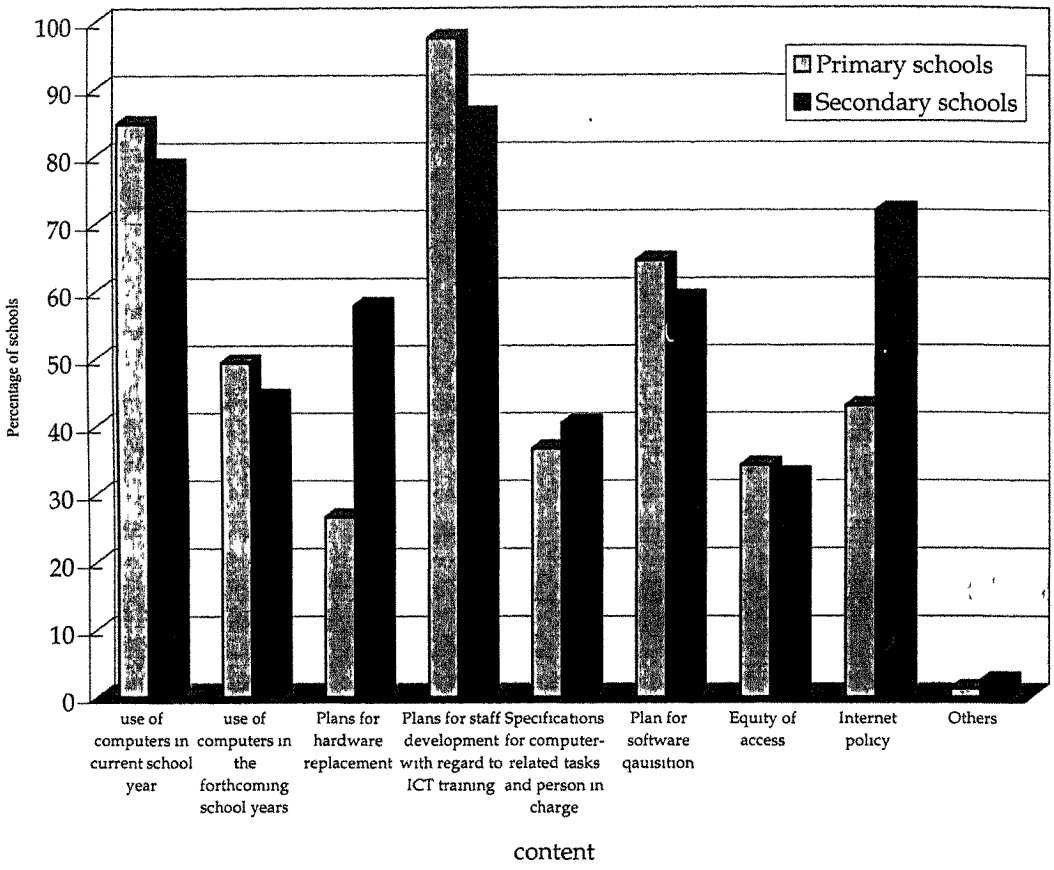


Figure 6.1
Percentage of explicit school ICT policies that addressed the policy issues surveyed.

Results presented in Figure 6.1 show that, among primary and secondary schools that have explicit ICT policies, the most common components in those policies were about "plans for staff development with regard to ICT training" (97%, 86% respectively) and "use of computers in current school year" (85%, 78% respectively). It also revealed that there was a great difference between primary and secondary schools in "planning for hardware replacement/ upgrading and Internet policy". Only 26% of primary school principals included in the schools" ICT written policy plans for hardware replacement whereas 58% of the secondary school principals indicated such inclusion. This may be due to the fact that even for the computer-using primary schools, most of them only installed the computers in 1998. The other remarkable difference between the two levels is about the inclusion of written Internet policies: 43% in the primary school policies and 72% in the secondary school policies. This may largely be a result of the low Internet connectivity available to primary schools at the time of the survey.

Of the eight policy items surveyed (excluding "other"), the mean number of items included in school policies differ greatly across countries. Appendix 6.1 shows that countries with higher hardware and software provisions tend to have a higher mean for the presence of ICT related policy items, indicating that schools in those countries have more developed ICT policies. At the primary level, Hong Kong ranked 6th among eleven countries while Japan, Finland and Cyprus ranked the lowest and Singapore, Slovenia, Canada ranked highest. The picture is similar at the two other education levels.

Principals' and Teachers' Views on the General Curriculum Goals of ICT Implementations at the School Level - A Common Vision?

The establishment of a common vision among the school leadership and teachers is an important factor for success in curriculum innovation. The principal questionnaire asked whether the development of a common vision among staff members had been included and realized in the development of the school ICT policy. The result is presented in Tables 6.1.

Table 6.1
Percentage of schools that had/wanted to establish a common vision of ICT use in the school, and the extent of its realization.

	Percentage of schools that has/want the development of a common vision	Realized		
		not	Partially	Almost or fully
Primary schools	94% (82%)	15%(29%)	75%(54%)	10%(18%)
Lower Secondary schools	94%(80%)	22%(35%)	72%(51%)	6.1%(13%)
Upper Secondary schools	94%(80%)	22%(35%)	72%(51%)	6.1%(13%)

Note: The figures in brackets indicate the respective international means.

Table 6.1 indicates that about 80% of the principals in primary and secondary schools in Hong Kong reported that their schools had at least partially developed a common vision on the use of computers. Such a strong alignment of vision as perceived by school principals across all three populations was only observed in Singapore (about 95%) and Chinese Taipei (~90% or higher). Appendix 6.2 gives the detailed figures across all participating countries at primary, lower and upper secondary levels.

A clear vision of purpose has been found to be necessary to drive a successful curriculum implementation (Fullan, 1991). The use of ICT at schools depends on how the change agents, namely the principals and teachers, perceive the goals of ICT in education. In chapter 3, we had reported on principals' perception about the roles of ICT in education. In this chapter, we are going to compare that with the views of teachers collected in the local survey.

In the teacher questionnaire, teachers were asked to indicate their views on some general curriculum goals related to ICT implementation. The following eight items were included and the teachers were requested to rate the importance of these items on a three point Likert scale, ranging from 'not important' (1) to 'very important' (3):

1. To prepare students for future jobs;
2. To promote active learning strategies;
3. To enhance the understanding of complex concepts;
4. To individualize student learning experiences;
5. To encourage more cooperative and project-based learning;
6. To enhance students' memorizing and answering techniques;
7. To make the learning process more interesting;
8. To satisfy parents' and community expectations.

Table 6.2
Mean scores of principals' and teachers' responses on the importance of various curriculum goals for ICT implementation.

	Primary school Principals	Primary school Teachers	Secondary School Principals	Secondary school Teachers
To prepare students for future jobs	1.84	2.18	2.27	2.23
To promote active learning strategies	2.52	2.17	2.47	2.25
To enhance the understanding of complex concepts;	-	1.97	-	2.00
To individualize student learning experiences	2.19	2.02	2.15	2.02
To encourage more cooperative and project based learning	2.03	1.96	2.12	2.06
To enhance students' ability in memorizing and answering technique	-	1.69	-	1.66
To make the learning process more interesting	2.63	2.36	2.36	2.33
To satisfy parents' and community expectations.	1.84	2.01	1.98	1.91

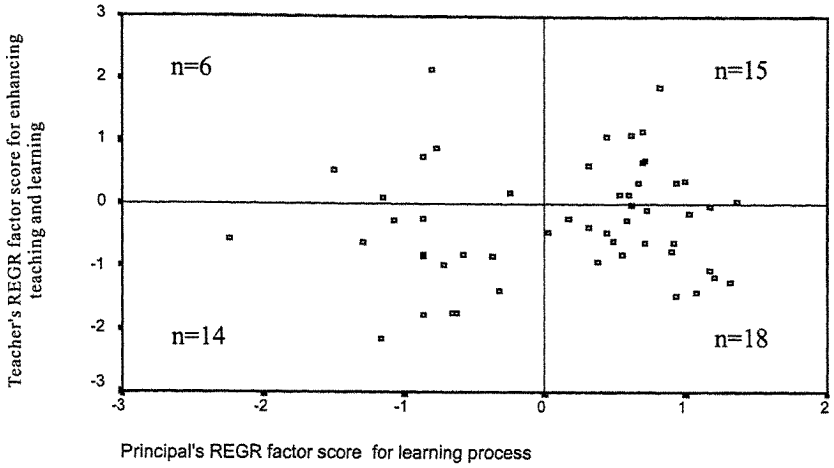
Table 6.2 lists the average scores for the general curriculum goals surveyed. There seems to be a consistent view among principals and teachers, at both the primary and secondary levels, that the most important curriculum goals of ICT were to make the learning process more interesting and to promote active learning strategies.

Factor analysis results (Table 6.3) indicated that for teachers, the goals can be reduced to two factors, namely, one related to enhancing teaching and learning and the other related to fulfilling parental/ societal expectations.

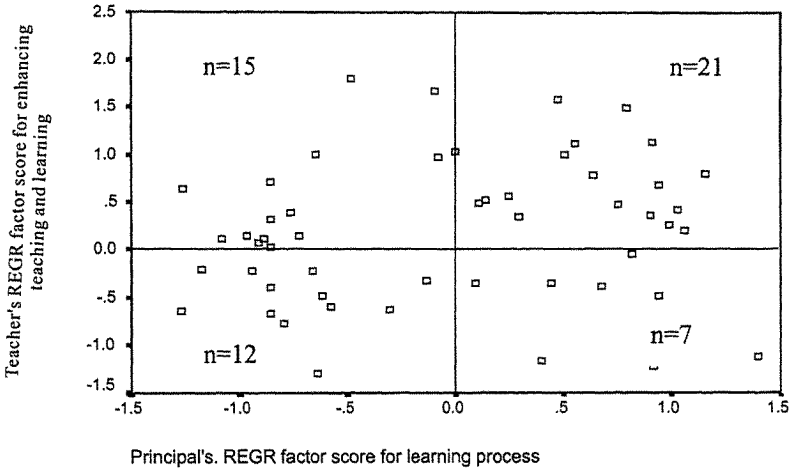
Table 6.3
Factor loadings for teachers' importance scores on the 8 curriculum goals surveyed

	Enhancing teaching and learning	Fulfilling parental/societal expectations
To promote active learning strategies	.786	7.860E-02
To enhance the understanding of complex concepts	.758	.134
To encourage more cooperative and project-based learning;	.690	-6.285E-03
To individualize student learning experiences;	.570	.240
To make the learning process more interesting	.456	.285
To prepare students for future job	.388	.302
To enhance students' ability in memorizing and answering technique	.320	.217
To satisfy parents' and community expectations	4.103E-02	.999

In chapter 3 we have reported that two similar factors have been identified among school principals when they respond to a similar question on ICT goals. A further analysis was done to find out how principal's and teachers' views related to each other within the same school. For every school, the mean factor score of teachers is computed and compared against the corresponding factor score of the principal of the school. Figure 6.2 shows the scatter-plot of the principal's score and mean teachers' scores on the factor related to the importance of ICT for enhancing teaching and learning.



Scatter-plot for primary schools



Scatter-plot for secondary school

Figure 6.2

Scatter-plot of the principals' scores and mean teachers' scores on the factor related to the importance of ICT for enhancing the learning process on a school by school basis.

Figure 6.2 indicated that there seems not to be a strong relationship between principals' score and the mean teachers' score in their schools, though there appears to be a slightly better alignment of principals' and teachers' goals at the secondary school level. Compared with information in Table 6.1, it is clear that the principals' perceived level of high alignment possibly was not realistic.

Among the cases of "non-alignment" (i.e. when one factor score is positive and the other is negative), at the primary level, the principals tended to see a greater importance in the goals of ICT for enhancing the teaching and learning process than teachers in their schools. The situation tended to go in the opposite direction at the secondary level.

An important point to note is that the alignment of goals between the principal and teachers in the same school may not necessarily be a positive indicator. While non-alignment may hamper implementation, complete alignment when both the principal and teachers in the same school do not see much importance in the use of ICT for teaching and learning would lead to complacency which is not conducive to change.

Regulation of Computer-Related and Internet Activities

In this section we are going to investigate measures schools have taken to regulate computer-related as well as Internet activities in the school.

Regulation of Computer-Related Activities

Principals were asked to check whether measures have been taken in the school to regulate the following aspects of computer-related activities:

1. Prevention of unauthorized system access or entry;
2. Honoring of intellectual property rights (e.g. software copyrights);
3. Prohibition of access to adults-only material;
4. Restriction of game playing on school computers;
5. Specification of compulsory student computer-related knowledge and skills;
6. Stimulation of local community (parents and/or others) access to school computers or the Internet.

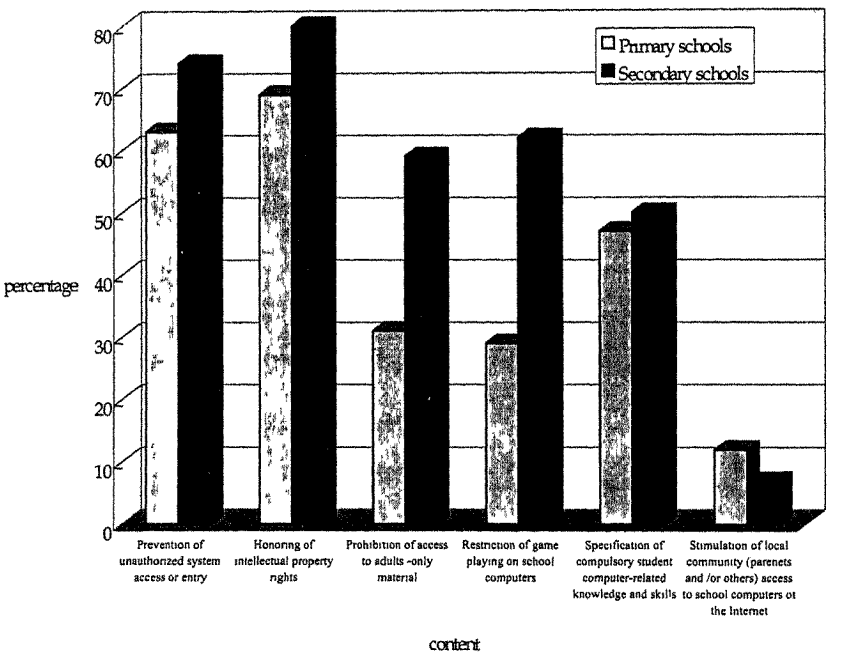


Figure 6.3
Percentages of schools which have taken measures to regulate computer-related activities

As can be seen in Figure 6.3, in general, higher percentages of school have taken regulatory measures at the secondary level than at the primary level in Hong Kong. Among the six measures, the most popular were "honoring intellectual property rights" and "prevention of unauthorized system access or entry" at both school levels. However, less than 15% of primary and secondary school principals indicated that they had set up measures to stimulate local community access to school computers or the Internet. Less than 31% of

the primary school principals indicated that they had set up measures on "prohibition of access to adults-only material" and "restriction of game playing on school computers". This might be due to the low Internet connectivity in primary schools.

From an international perspective, great differences were found among countries. Japanese schools have taken the least number of measure with regard to regulation of computer-related activities across all three school levels: 0.4 (meaning that, on the average a Japanese primary schools has policies/measures to cover 0.4 of these six issues about Internet usage) at the primary level, 1.0 at both the lower and upper secondary levels. On the other hand, schools in Canada, and Singapore had taken the highest number of regulatory measures at the primary level (3.4 or higher). At the lower secondary level, the highest number of measures was taken by Luxembourg, Canada and New Zealand (4.1 or above), and at the upper secondary level by Singapore, Canada and Luxembourg (4.2 or above). In Hong Kong, the number of measures taken is around the middle range internationally, varying from 2.5 at the primary level to 3.3 at the secondary levels. Further details can be found in Appendix 6.3.

Setting up Norms and Values on Internet Activities

Principals were asked to indicate whether their schools had in place the policy of paying attention to norms/values in using Internet/WWW. It was found that 71% of primary schools (much higher than the percentage of primary schools having internet connectivity 39 %) and 86% of secondary schools in Hong Kong had set up such goals. Principals were also asked to indicate the extent of realization of those goals and it was found that the level of realization at the primary level was much lower than the secondary level.

Table 6.4
Percentages of schools that had policy goals concerning norms/value using Internet and the realization of these goals

	Percentage of schools that have policy goals concerning norms/values in using internet	Realized		
		Not	Partially	Almost or fully
Primary schools	71% (68%)	71% (47%)	23% (29%)	6% (24%)
Lower Secondary schools	86% (75%)	38% (38%)	52% (35%)	10% (27%)
Upper Secondary schools	86% (75%)	38% (38%)	52% (35%)	10% (27%)

Note The number in the bracket represents the international average

Administrative Use of Computers

Principals were also asked whether they had set goals on the administrative use of computers and how they judge the extent of realization of these goals. In Hong Kong more than 75% of the primary and secondary school principals reported that they had set a policy on using computers to keep track of student data. Over two third of the principals in both primary and secondary schools pointed out that the realization of this goal was fully or partially realized.

Besides the goal of using computers to keep track of student data, the vast majority (over 98%) of principals in primary and secondary schools reported that they had set goals on using computers for other administrative matters. High realization rates were found at both primary and secondary levels. Less than 9% of the school principals in primary and secondary schools indicated that these policies had not been realized.

Specific aspects of administrative usage of computers were also investigated. Principals were asked to indicate the frequency of use per school year for each of the following activities:

1. Keep track of student's learning progress;
2. Updating the library database;
3. Creating and updating the lesson schedule;
4. Staff administration;
5. Financial administration;
6. Communication with parents and others outside school.

Item1 refers to the goal of monitoring students' learning and items 2 to 6 refers to the more general goal of using computers for other administrative and resources management matters. Figure 6.4 shows the percentage presence of these six activities in schools.

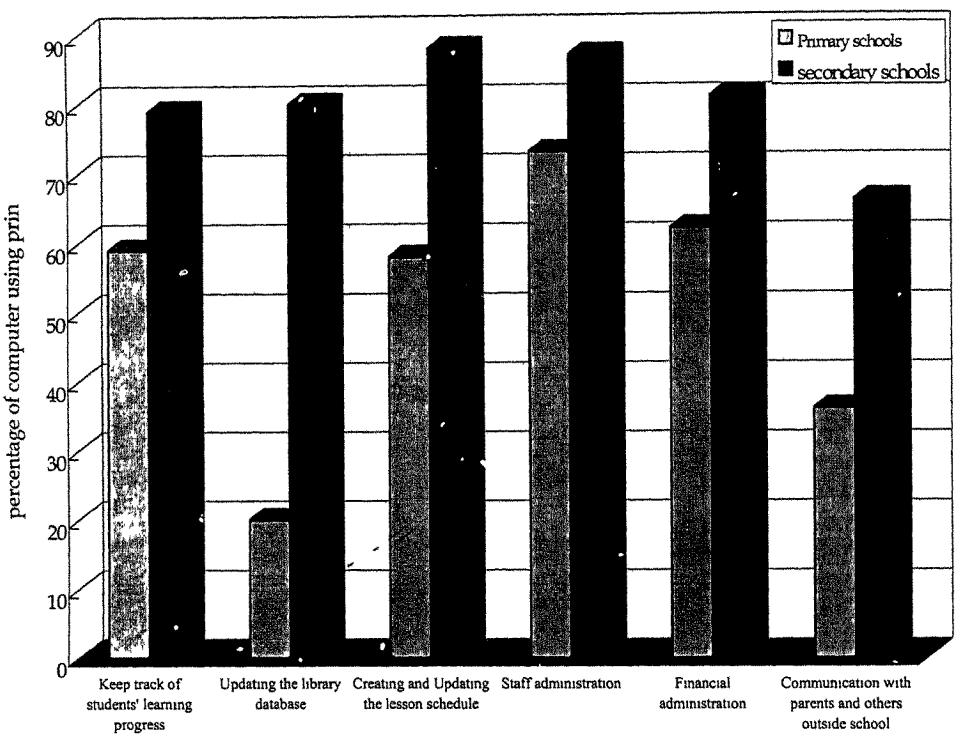


Figure 6.4
Percentages of students whose principals indicated computer use for particular administrative activities a few times or more during a school year at primary and secondary level in HK

Results from Figure 6.4 indicate that primary schools in Hong Kong seldom used computers for "updating library database" and "communicating with parents and others outside school". In fact, use of computers for "updating library database" in Hong Kong primary schools is remarkably low in comparison to other countries in the study. However, the level of usage for staff administration was very high. At the secondary levels, computers were frequently used in all six activities (over 65%). A high percentage (over 85%) was found in using computers for creating and updating the lesson schedule and for staff administration.

As 59% to 79% of Hong Kong schools are using computers for keeping track of student's learning progress, the tables in Appendix 6.4 reveal that there is variation among countries, and Hong Kong stands medium or high in the spectrum. A number of primary schools (ranging from 40% to 60%) in Cyprus, France, Italy and Slovenia had never used computers for keeping track of student data. On the contrary, more than 80% of the primary schools in Canada, Chinese Taipei and Singapore reported that they had used computers in this aspect. In the lower secondary level less than 60% of schools in Belgium-French, Bulgaria, Italy, Lithuania and Russian Federation indicated that they had used computers for keeping track of students' learning progress. However, over 90% of schools in Canada, Cyprus, Denmark, Finland and Singapore had used computers for this matter. The situation at the upper secondary level, is very similar to the pattern observed at the lower secondary level. Further details involving administrative use of computers can be found in Appendix 6.5.

Organization of ICT Coordination in Schools

The organization of ICT coordination in schools was also studied in the Principal Questionnaire. According to Figures 6.5 and 6.6, only less than 9% of primary and secondary school principals reported that no one coordinates the use of ICT in their schools. Others indicated that ICT is mainly coordinated by classroom teachers and their committees. More than 48% of primary and secondary school principals indicated that there is a committee for the coordination of ICT in the school, with an average of five members in such committees. About 12% of both primary and secondary principals reported that the school principal or other administrators participated the coordination of ICT activities in the school. Further, 15% of primary school principals and 8.4% of the secondary school principals indicated that they had employed a full time person for ICT coordination.

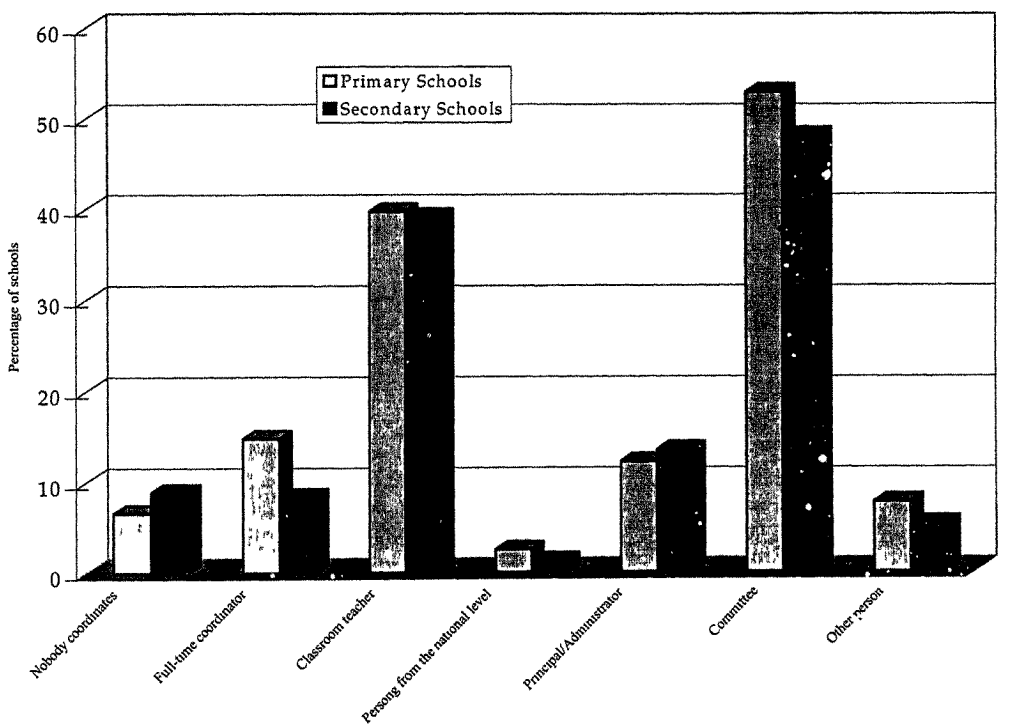


Figure 6.5
Organization of ICT coordination in schools

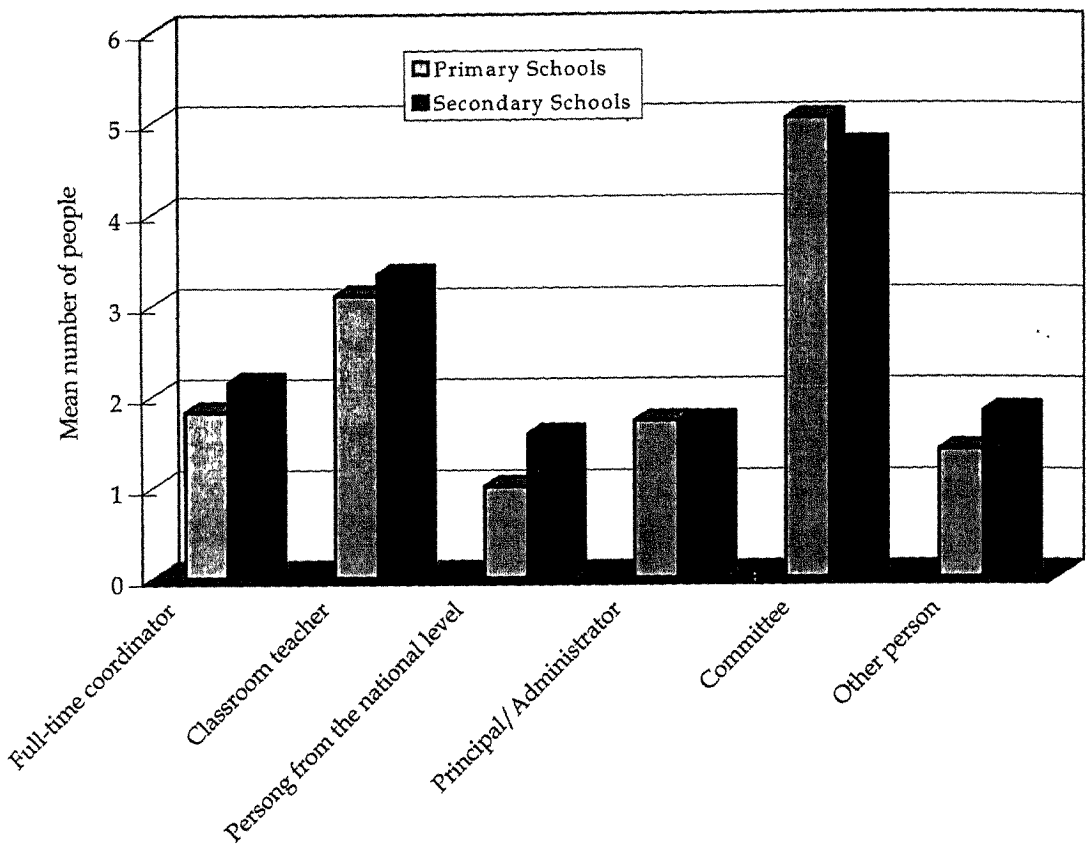


Figure 6.6
Mean number of people involved in ICT coordination in schools

Teachers taking part in the local extension study are also asked whether they have participated in ICT coordination of the use of computer software and hardware in their schools and whether they have assisted other teachers in using ICT for instructional purposes. An average of 7% of primary school teachers and 6.3% of secondary school teachers report that they have coordinated the use of computer hardware and software at school. On the other hand, 11% of primary school teachers and 13% of secondary school teachers indicate that they have assisted other teachers in using ICT for instructional purposes. Figure 6.7 shows the variation across schools in the percentage of teachers who take part in ICT coordination, and percentages of teachers who have assisted or trained their colleagues in using ICT in teaching. The findings indicate that a culture of collaborative practice is emerging in school in relation to teachers' learning and using of ICT.

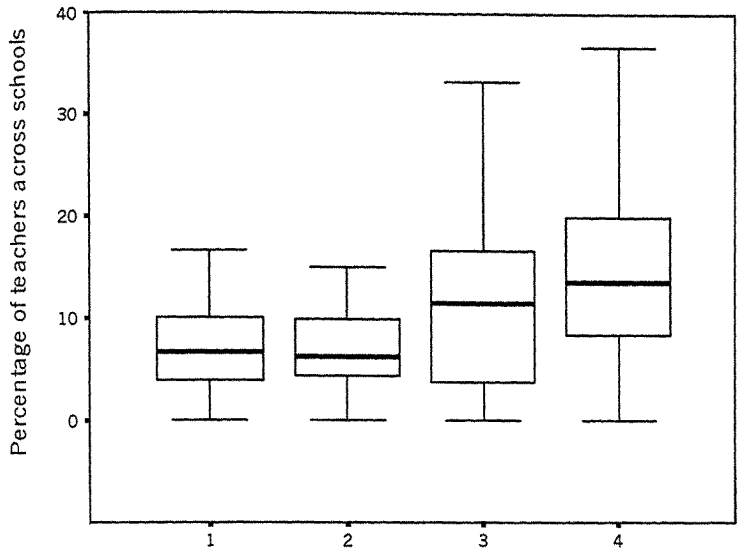


Figure 6.7
Box-plots of percentages of teachers involved in ICT coordination across schools in HK

Further Analysis about Attitudes and Beliefs of School Principals, Teachers and Students

In any curriculum change endeavor, the attitudes and beliefs of various stakeholders affect the implementation in very important ways. In this section, we shall further report on our investigation about the attitude and beliefs of principals, teachers and students about the use of ICT in education.

Principals' Attitude towards the Role of ICT in Education

The following series of statements was included in the Principal Questionnaire to find out their attitudes towards the role of ICT in education. (Table 6.5)

Table 6.5
Statements about the role of ICT in the Principal Questionnaire

1. Students are more attentive when computers are used in class
2. ICT improves the efficiency of the school administration
3. ICT improves the effectiveness of school management
4. ICT improves the evaluation of the functioning of the school
5. Every school should have access to the internet/www
6. Every student should learn about e-mail
7. Internet/WWW offers excellent opportunities for educational applications
8. ICT can effectively enhance problem solving
9. All teachers should have their own e-mail address
10. Computers are valuable tools to improve the quality of a child's education
11. ICT-based learning enables students to take more responsibility for their own learning
12. ICT can accommodate students' varied needs, preferences and leaning strategies by proving new tool for knowledge manipulation, expression and creativity
13. ICT can help teachers to attune to the learning level and pace of the individual student
14. ICT should be used more by teachers to create environment for students' independent learning
15. ICT improves the monitoring of students' learning progress
16. Computers help to teach more effectively
17. In service training courses on computers should be made compulsory
18. The achievement of students can be increased when using computers for teaching
19. The use of e-mail increase the motivation of students
20. Teachers should initiate more cooperative and /or project-based learning
21. ICT is a valuable support in solving problems that our school is confronted with
22. All teachers should acquire ICT certification
23. Using computers in class leads to more productivity of students
24. E-mail is an effective facility for disseminating information in the school.

A five point Likert scale, ranging from "strongly disagree" (1) to "Strongly agree" (5) was used to measure the strength of principals' agreement with these statements. A higher score represented a more positive attitude towards a specific role. Appendix 6.6-6.8 present the results for the principals' attitude scales[1] in different countries. Results from the international data shows that all these 24 items can be categorized into six attitude subscales:

1. The impact of ICT on achievement (five items: questions 1, 10,16,18,23);
2. The relevance of Internet (six items: questions 5,6, 7, 9, 19,24);
3. The impact of ICT on school management (five items: question 2,3,4,15,21);
4. The contribution of ICT to life long learning (six items: questions8,11,12,13,14,20);
5. The importance of in-service training courses on computers (single item 17)
6. The importance of all teachers acquiring ICT certification (single item: question 22)

[1] The sub-scale scores and the score of the complete list of 24 attitude items were calculated per country as follows:100%* (mean -1)/4=25*(mean-1).

In general, primary and secondary school principals in Hong Kong had a rather positive attitudes towards the use of computers in education. However, when compared with other countries, their attitude towards ICT in education were still low or below the average of their international counterparts, especially in relation to the three roles related to learning outcomes, namely the relevance of the Internet, impact on achievement and the contribution of ICT to life long learning. The detailed score for these three subscales are presented in Table 6.6.

Table 6.6
Principals' scores on the attitude subscales related to the role of ICT for learning: HK Vs. International

Attitude subscale	Primary level*	Lower secondary*	Upper secondary*
Relevance of the Internet	75 (81)	79 (81)	79 (83)
Contribution of ICT to life long learning	75 (80)	74 (78)	74 (83)
Impact of ICT on achievement	70 (76)	65 (75)	65 (75)

*The figures in brackets indicate the international mean for the attitude subscales for the respective education levels.

A factor analysis conducted on the Hong Kong of the Hong Kong data reveals that principals' responses to these 21 items (excluding items 9,17, and 22 which were concerned with teacher training) fell into 4 factors. These were "impact of ICT on the learning process" (items 23, 19, 18, 21, 16, 8, 10, 24, 1), "impact of ICT on monitoring students" progress" (items 13, 12, 15, 11, 14), "impact of ICT on school administration" (items 2,3,4) and "impact of ICT on emerging educational practices" (items 5,6,7, 20). The average scores were calculated for all items belonging to each aspect. Results are shown in table 6.7.

Table 6.7
Principals' attitudes towards ICT

	Primary educational level Mean score (S.E.)	Secondary educational level Mean score (S.E.)
impact of ICT on learning process	3.73(4.03E-02)	3.54(3.403E-02)
impact of ICT on monitoring students'	4.00(4.433E-02)	4.04(3.458E-02)
impact of ICT on administration	4.28(4.552E-02)	4.13(3.653E-02)
impact of ICT on emerging educational paradigm	4.13(4.281E-02)	4.30(2.686E-02)

As mentioned earlier, in general, both primary and secondary school principals had a rather positive attitudes towards the use of computers in education in all the four aspects identified. An ANOVA analysis on the factor scores indicates that at the primary level, principals had a stronger positive attitude towards the impact of ICT on the learning process and administration than the principals at the secondary level, ($F(1,469)=18.002$, $p<.001$, $F(1,469)=6.176$, $p<.05$ respectively). On the other hand, the mean factor score for impact of ICT on emerging paradigm at secondary level was significantly higher than the primary level, $F(1,469)=48.312$, $p<0.001$. This indicates that secondary school principals were more positively inclined towards harnessing the power of Internet/WWW and to implement some new pedagogical approaches such as project based learning than their primary counterparts. There is no statistical significance between the mean factor scores for the impact of ICT on monitoring students' progress at the primary and secondary levels.

In addition, Table 6.8 shows the correlation between the four factor scores principals' attitude towards teacher training and providing teachers with their own e-mail accounts. It reveals that principals' attitude towards teacher training was positively correlated with all the four factors (range from .145 to .409). Highest correlation was found between principals' attitude toward teacher training and their perception about ICT impact on learning process.(r=.409). Moreover, it was found that principals' attitude towards teachers having their own e-mail address was highly correlated with their perception about impact of ICT on emerging paradigm. (r=.630) and positively correlated with the other three factors (rang from .146 to.630)

Table 6.8
Correlation between principle's attitude scale scores related to role of ICT and their attitudes towards teacher training and teachers having their own e-mail address.

	Attitude towards teacher training	Attitude towards teachers having their own e-mail address
ICT impact on learning process	.409**	.257**
ICT impact on monitoring students' progress	.145**	.204**
ICT impact on administration	.148**	.146**
ICT impact on emerging paradigm	.232**	.630**

** Correlation is significant at the 0.01 level (2 tailed)

Teachers' Attitude towards the Role of ICT in Education

Apart from principals' views on ICT in education, teachers' and students' attitudes towards the role of IT in education were also investigated. A five point Likert scale, ranging from "strongly disagree (1) " to '"Strongly agree (5)" was used to measure the strength of their attitudes towards the statements about the role of ICT in learning listed in Table 6.9 below.

Table 6.9
Statements about the role of ICT in the Teacher Questionnaire

1. ICT improves the efficiency of the school administration and the effectiveness of school management.
2. Every school should have access to the internet/www
3. Internet/WWW offers excellent opportunities for educational applications
4. ICT can accommodate students' varied needs, preferences and learning strategies by providing new tools for knowledge manipulation, expression and creativity
5. ICT can help teachers to attune to the learning level and pace of the individual student
6. ICT should be used more by teachers to create environments for students' independent learning
7. ICT improves the monitoring of students' learning progress
8. Application of ICT should be enhanced in the Hong Kong local curriculum
9. Using ICT helps minimize gasp across different subjects
10. Applying ICT contributes to the effective use of space and time.

Results of the factor analysis highlighted two underlying factors (Table 6.9). these were teachers' attitude towards the impact of ICT on enhancing the general learning processes and administration (items 1,4,5,7,8,9,10) teachers do not distinguish the two and that towards the impact of ICT on the emerging paradigm (2,3,6). This contrasts with the 4 factors identified in the response by principals.

This is possibly a result of the fewer number of items in the Teacher Questionnaire. Also it is perhaps not too surprising that teachers do not distinguish the fewer differences in roles that ICT may play in the various school activities, especially in relation to administration functions. However, it is clear from the factor analysis that teachers like principals also distinguish the role ICT in emergent pedagogical paradigm from roles of ICT.

Table 6.10
The means item scores of teachers' attitudes towards the impact of ICT

	Primary teachers Mean score(S.E.)	Secondary teachers level Mean score(S.E.)
ICT impact on generals learning processes & administration	3.57(2.040E-02)	3.45(1.894E-02)
ICT impact on emerging paradigm	3.81(2.475E-02)	3.93(1.655E-02)

Note: T-test: significant different between emergent & learning process for both levels

Table 6.10 shows that the mean scores for the impact of ICT on the emerging paradigm were higher than that for the impact of ICT on general learning process at both primary and secondary levels. This implies that teachers at both levels have high expectations on the possibility of using Internet to change the way of teaching and learning, and see that as slightly more important than to enhance existing practice with the technology.

Similar to the differences found between primary and secondary school principals, attitudes towards the impact on general learning processes and administration was significantly higher at the primary level than the secondary ($F(1,123)=38.745$, $p<0.001$). While the reverse was true for the attitude toward the impact of ICT emergent paradigm.($F(1,123)=45.610$, $p<0.001$). This seems to indicate that the secondary teachers have a stronger tendency to see the possibility of using Internet to change pedagogical practices, and to see that as more important than the enhancement of existing practice.

Table 6.11
Correlation between ICT impact on learning process , emerging paradigm and attitude towards teacher training

	Attitude towards teacher training
ICT impact on general learning process & administration	.611**
ICT impact on emerging paradigm	.319**

**Correlation is significant at the 0.01 level (2 tailed)

Table 6.11 indicates teachers' attitude towards teacher training was highly correlated with their attitude about ICT impact on general learning processes ($r=.61$). However, it is interesting to note that the correlation between attitude towards teacher training and teachers' attitude towards ICT impact on the emerging paradigm is comparatively much lower. This may be due to current teacher training being mostly on ICT skills than the use of ICT for innovative teaching practice, or that this group of teachers would prefer other ways of professional development than the attending of training courses.

Students' Attitudes towards the Role of ICT in Education

Students' responses to the statements on the role of ICT in education Table 6.12 lists statements in the Students questionnaire related to the role of ICT in learning.

Table 6.12
Statements in the student questionnaire about the role of ICT in students' questionnaire

Q13. Please indicate how strongly you agree or disagree with the following statements relating to the role of computers and other Information and Communication Technologies.

d. Every school should have access to the internet/www
e. Internet/WWW offers excellent opportunities for educational applications
f. ICT can accommodate students' varied needs, preferences and learning strategies by providing new tools for knowledge manipulation, expression and creativity
g. ICT can help teachers to attune to the learning level and pace of the individual student
h. ICT should be used more by teachers to create environments for students' independent learning
i. ICT can enhance learning interest.
j. ICT improves the monitoring of students' learning progress
l. Application of ICT should be enhanced in the Hong Kong local curriculum
n. Using ICT helps to minimize the gaps across school subjects
o. ICT can help break the limitation of time and space

Results, as shown in Table 6.13, indicate that both primary school students and secondary school students had a positive attitude towards the use of ICT in general. A very positive attitude was expressed towards the use of ICT to enhance learning interest by primary students. Secondary students on the other hand had the strongest positive attitudes towards "school should have Internet access" and to a less extent "ICT can enhance interest of learning".

Table 6.13
Students' attitude toward the use of ICT in education

	primary students		secondary students	
	Mean	Std. Dev.	Mean	Std. Dev.
13d. Every school should have access to the Internet/WWW	3.86	.3961	4.20	.1672
13e. Internet/WWW offers excellent opportunities for educational applications	3.44	.28447	3.59	.1320
13f. ICT can accommodate students' varied needs, preferences and learning strategies by providing new tools for knowledge manipulation, expression and creativity	3.69	.2980	3.71	.1388
13g. ICT can help teachers to attune to the learning level and pace of the individual student	3.60	.2821	3.48	.1449
13h. ICT should be used more by teachers to create environments for students' independent learning	3.79	.4175	3.78	.1342
13i. ICT can enhance learning interest	4.18	.2706	4.00	.1425
13j. ICT improves the monitoring of students' learning progress	3.57	.2496	3.40	.1649
13l. Application of ICT should be enhanced in the Hong Kong local curriculum	3.93	.3323	3.91	.1445
13n. Using ICT helps to minimize the gaps across school subjects	3.38	.2338	3.33	.1199
13o. ICT can help break the limitation of time and space	3.65	.4015	3.61	.1473

Students' expectations on the implementation of ICT in schools

In order to get a better understanding of students' expectation of ICT implementions in schools they were asked to rate 13 items on a 5 point Likert scale. The range was from strongly disagree (1) to strongly agree (5). Table 6.14 summarizes the results.

Table 6.14
Students' expectation of ICT implementations in school

	primary level Mean	secondary level Mean
14a. Teacher should use ICT in preparing and conducting lessons	4.02	3.86
14b. Use ICT to complete homework	3.60	3.69
14c. Use ICT for group discussion	3.76	3.54
14d. Use e-mail to communicate with friends	3.97	3.99
14e. Collaborative project between school via internet	3.67	3.83
14f. Participate in bulletin board and newsgroup	3.64	3.66
14g. Gain support from internet when problem encountered	3.92	4
14h. School should have their homepage	4.16	4.24
14i. Students should have their e-mail account	3.61	3.84
14j. Students should have their homepage	3.46	3.30
14k. Encourage clubs to use ICT for exchanging data with others	3.66	3.83
14l. Set up CDROM database	3.72	3.74
14m. School library should be computerized	4.19	4.33

It was evident from the result that the vast majority of the responses were in the favorable range. Students in both primary and secondary schools had a strong desire of having a computerized library and a school homepage. However, the expectation of having a personal homepage was relatively low. Result from the factor analysis indicated that the above items fell into two factors. They are expectation of 'using ICT in general' (items a, b, c, d, f, g, h, i, j, l, m) and expectation of 'using ICT in communication aspects' (items e, k). The mean value of the factor score for the expectation of using ICT in general was in primary schools tends to be higher than that in the secondary, however the difference is not statistically significant ($F(1,121)=1.747$, $p=.189$). The mean value of the factor score for the expectation of using ICT in communication aspects was significantly higher in secondary than in primary $F(1,121)=19.194$, $p<0.001$. It is interesting to note that for secondary students, the expectation that teachers should use ICT in preparing and conducting lessons only rank fifth. The top four most wanted uses were for using ICT to support students' self-learning and for communication purposes.

Problems perceived by principals, teachers and students related to organizational support

In chapter four we had mentioned that principals, teachers, students and ICT coordinators were asked to indicate problems that they encountered in the implementation of ICT in the curriculum. Of those problems, the ones related to organizational support are discussed in this section.

Problems Perceived by Principals.

Principals were asked whether they perceived the following problems related to organizational support (The number in the following list refer to the number in Appendix 4.9-4.11 the other items in the same question were discussed in chapter 4 and 5):

Table 6.15
Organizational problems listed in the Principal Questionnaire.

4.	Insufficient time for teachers to prepare lessons in which computers are used;
5.	Difficult to integrate computers in classroom instruction practices;
7.	Problems in scheduling enough computers time for different classes;
8.	Difficult to use Internet/WWW with low-achieving students;
9.	No time in the school schedule for using the Internet/WWW;
10.	No time in teachers' schedules to explore opportunities for using the Internet/WWW.

Principals in Hong Kong indicated that the most serious problem was insufficient time for teachers to prepare lessons in which computers were used. The percentages were 80%, 83%, 81% at primary, lower secondary and upper secondary levels. On the contrary, less difficulty was found in using Internet/WWW with low-achieving students and the percentages at the three levels were 30%, 24%, and 23% respectively. The percentages for the other problems varied from 50% to 73% at all three levels.

When compared with other countries, principals in Hong Kong perceived greater problems with regard to organization than their counterparts in other countries. A vast majority (over 70%) of principals in Hong Kong and Cyprus reported that there was insufficient time for teachers to prepare lesson in which computers were used at all three educational levels. This was also a problem in most countries. Further, the difficulty of using Internet with low achieving students was also not perceived as a major problem in many countries. (Percentage of each item could be referred in Appendix 4.9-4.11)

Problems encountered by teachers and students

Inadequate technical and maintenance support was found to be the most serious organizational support problem for teachers reported by 39% of primary teachers and 48% of secondary teachers. Only 19% of primary school teachers and 28% of secondary school teachers indicated that there was insufficient administrative support or encouragement at the school level.

From the students' perspective, at both primary and secondary levels, insufficient time for learning with ICT was the most serious problem. Difficulties arising from lack of technical support and not having enough computer rooms were both reported by 18% of primary students and 30% of secondary students.

Problems perceived by technology coordinators

Lack of technical assistance reported by technology coordinators in Hong Kong ranked highest among participating countries at all levels (83% for primary, 83% for lower secondary and 85% for upper secondary): ranking first at primary and upper secondary levels and second at lower secondary level. Not enough copies of software was another major obstacles often cited by ICT coordinators. (81% for primary, 84% for lower and upper secondary).

Summary

It appears from the results of the survey that Hong Kong is reasonably developed in the use of ICT for administrative purposes, reaching the international average on many of the related indicators. However, the use of ICT for teaching and learning across the curriculum only just begun. The survey have found that at all levels, the attitudes of all stake holders were positive toward the use of ICT for teaching and learning even though many schools had not developed implementation plans or written policies. It is encouraging to see that overall, in terms of attitudes, principals, teachers and students at all levels were more inclined towards the use of ICT for emergent practices. However, the diversity across schools is large and the perception of having achieved a common vision on ICT by most principals does not seem to be substantiated by the survey findings. The problem of inadequate technical assistance and maintenance support is an extremely serious problem that need to be looked at very urgently.

Reference :

Fullan, M. (1991) The new meaning of educational change. London: Cassell.

Chapter 7 Home Ownership and Access to ICT

To gain a more comprehensive picture of computer access and connectivity, one should also look at access to ICT at home. In this chapter, both teachers' and students' home ownership of computers and various peripherals as well as Internet access are presented. In addition, the correlation between home ownership and IT competence is examined.

Home Ownership of Computers

In the questionnaire, both teachers and students were asked whether they had a computer at home. The results are presented in Figure 7.1. It was found that 51% of P6 students, 72% of S2 students, 82% of S4 students, 91% of S6 students, 87% of primary school teachers and 91% secondary school teachers responded that they owned a computer at home.

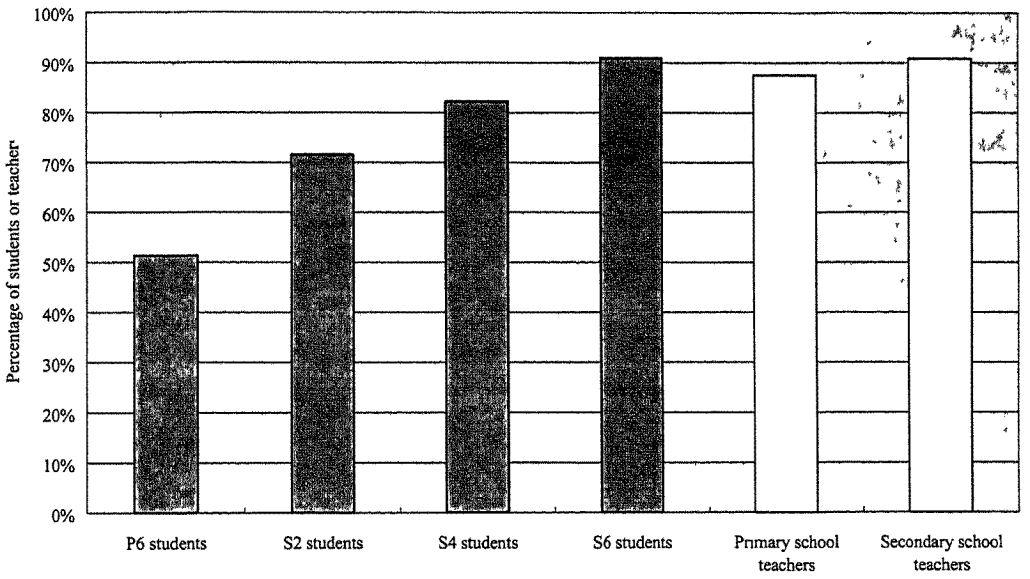


Figure 7.1
Percentage of home ownership of computers for students and teachers

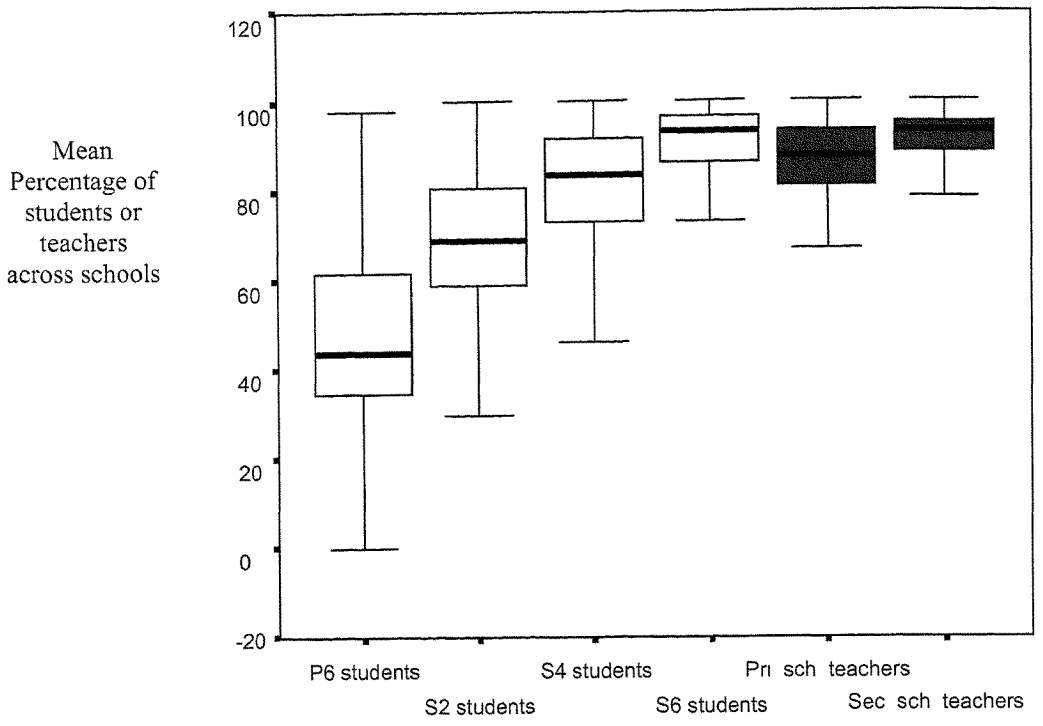


Figure 7.2
Box plots of the mean percentages of home computer ownership for students and teachers across schools

Figure 7.2 shows the box plots of the distribution of average percentages of home computer ownership across schools. It is apparent from these figures that secondary school teachers and students at higher grade levels had better opportunities to use computers at home. On the other hand, we find a large dispersion in the mean home ownership across schools, especially at lower grade levels. At P6, the mean percentage of home computer ownership varied from 97% to 4.2%. One important factor that is expected to contribute to this diversity is the variation in social economic backgrounds of students across schools in different geographical locations. The same pattern of wider dispersion in mean home computer ownership across schools for primary teachers compared to secondary teachers was also observed. This however, is probably not related to the social economic background of teachers in different schools but to differing levels of teachers' ICT literacy and attitude towards using ICT. Correlation coefficients among the percentages of home computer ownership for teachers and students at each grade level of the same school were computed and is presented in the correlation matrix in Table 7.1. No significant correlation was found between the home ownership of computer for teachers and students of the same school. This increase in percentage home computer ownership and decrease in dispersion with increase in grade level indicates that students at higher grade levels were more able to convince parents or find means on their own to achieve computer access at home. If diversity in home ownership is a potential source of inequity between students, then the situation should be most closely looked at, especially for the lower grade levels.

Table 7.1:
Pearson Correlation coefficients between the percentages of home ownership of computers for teachers and students of the same school

	P6 Students	S2 Students	S4 Students	S6 Students	Primary School Teachers	Secondary School Teachers
P6 Students	1.000	.a	.a	.a	.066	.a
S2 Students	.a	1.000	.558**	.345**	.a	.133
S4 Students	.a	.558**	1.000	.408**	.a	-.022
S6 Students	.a	.345**	.408**	1.000	.a	.063
Primary School Teachers	.066	.a	.a	.a	1.000	.a
Secondary School Teachers	.a	.133	-.022	.063	.a	1.000

** Correlation is significant at the 0.01 level (2-tailed).
.a Cannot be computed.

Internet Access at Home

Respondents who answered that they owned a computer at home were further surveyed on the availability of Internet access at home. The results are shown in Figure 7.3. Among those students having a computer at home, 37% of P6 students, 49% of S2 students, 58% of S4 students, and 67% of S6 students further responded that they had access to the Internet at home. For teachers, 63% and 71% at primary and secondary school levels respectively of computer owning teachers indicated that they had access to the Internet at home. These figures show that students at S6 and teachers teaching secondary schools had better home access to the Internet than primary school teachers.

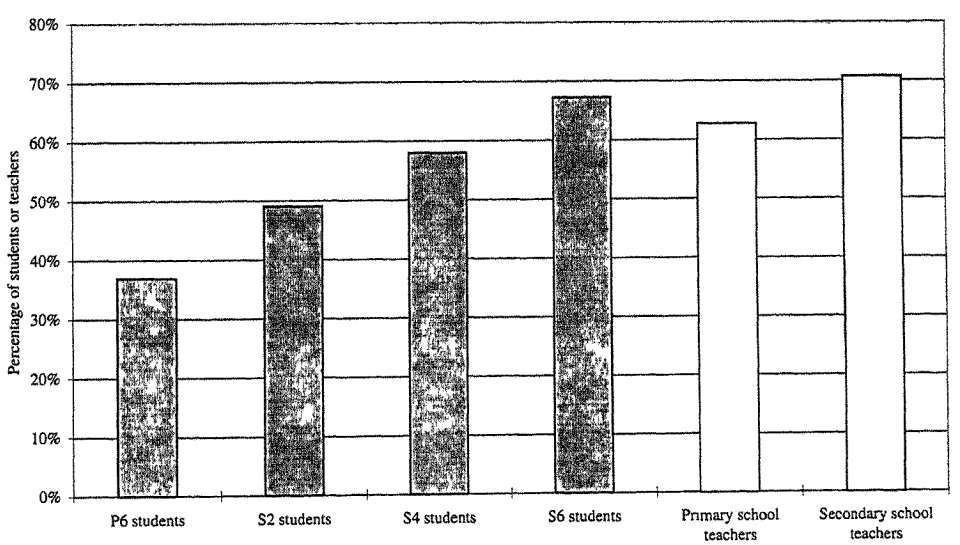


Figure 7.3
Internet access at home for students and teachers owning computers at home

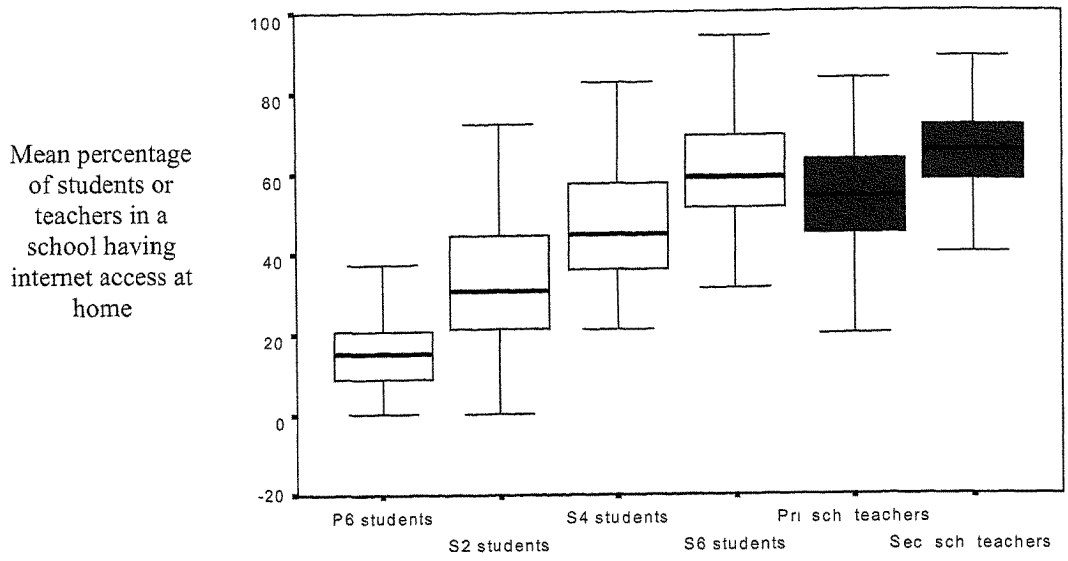


Figure 7.4

Box plots of the mean percentages of students and teachers across schools having Internet access at home (absolute percentage)

Figure 7.4 shows the box plots of the mean percentages across schools of students and teachers having Internet access at home. It was found that the median value increased while the dispersion decreased with increasing grade level of students as well as teachers.

Ownership of Peripherals

In addition to home computer ownership and Internet access, the home ownership of various computer peripherals was also investigated. The types of peripherals surveyed included Printer, CDROM, Scanner, and Modem. The percentages of both students and teachers having different peripherals at home are presented in Table 7.2 and Figure 7.5.

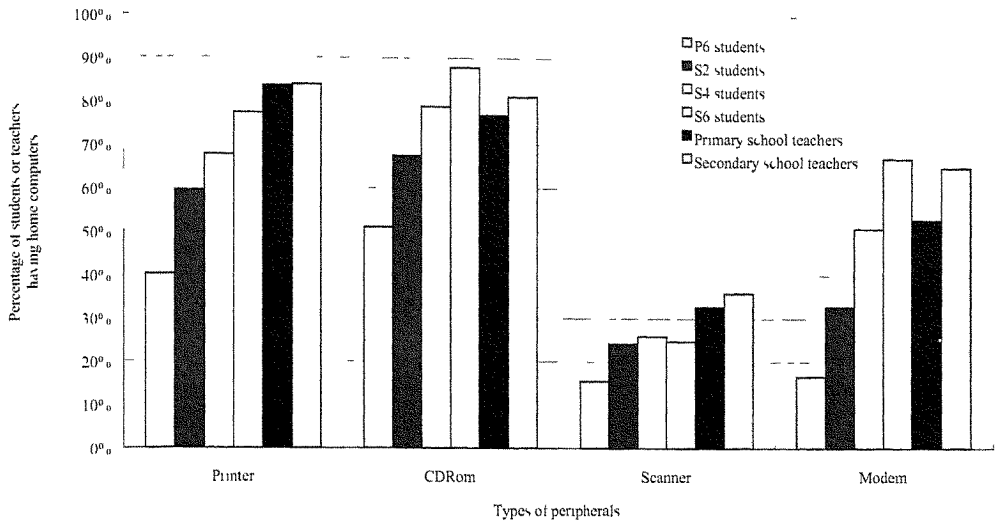


Figure 7.5
Home Ownership of Computer Peripherals for Students and Teachers (absolute percentages)

Table 7.2
Percentages of home ownership of peripherals (absolute & relative percentages)

	Printer		CDRom		Scanner		Modem	
	absolute	relative*	absolute	relative*	absolute	relative*	absolute	relative*
Students (P6)	40%	73%	51%	79%	15%	28%	17%	31%
Students (S2)	59%	81%	68%	86%	24%	33%	33%	45%
Students (S4)	68%	81%	79%	92%	26%	31%	51%	61%
Students (S6)	77%	84%	88%	96%	25%	27%	67%	73%
Teachers (Primary)	84%	95%	77%	88%	33%	37%	53%	61%
Teachers (Secondary)	84%	92%	81%	89%	36%	39%	65%	71%

*Percentage relative only to those who own computers at home.

As can be seen from Table 7.2 and Figures 7.5-7.7, the most popular peripheral among students at all four grade levels was the CDROM, while the most popular peripheral among teachers was the printer. In SITES M1, the availability of a CDROM is regarded as an indicator that the computer is multimedia ready. It thus appears that multimedia capability was more important than printing for students while the reverse is true for teachers. It was also found that the scanner was the least popular peripheral among both primary and secondary school students and teachers.

Box plots of the average percentages of home ownership of peripherals across schools are presented in Figure 7.6. An overall increase in the median values of mean percentages was found with increasing grade levels for both teachers and students. Regarding home ownership of various types of peripherals, greater diversity across schools was found among teachers at the primary school level.

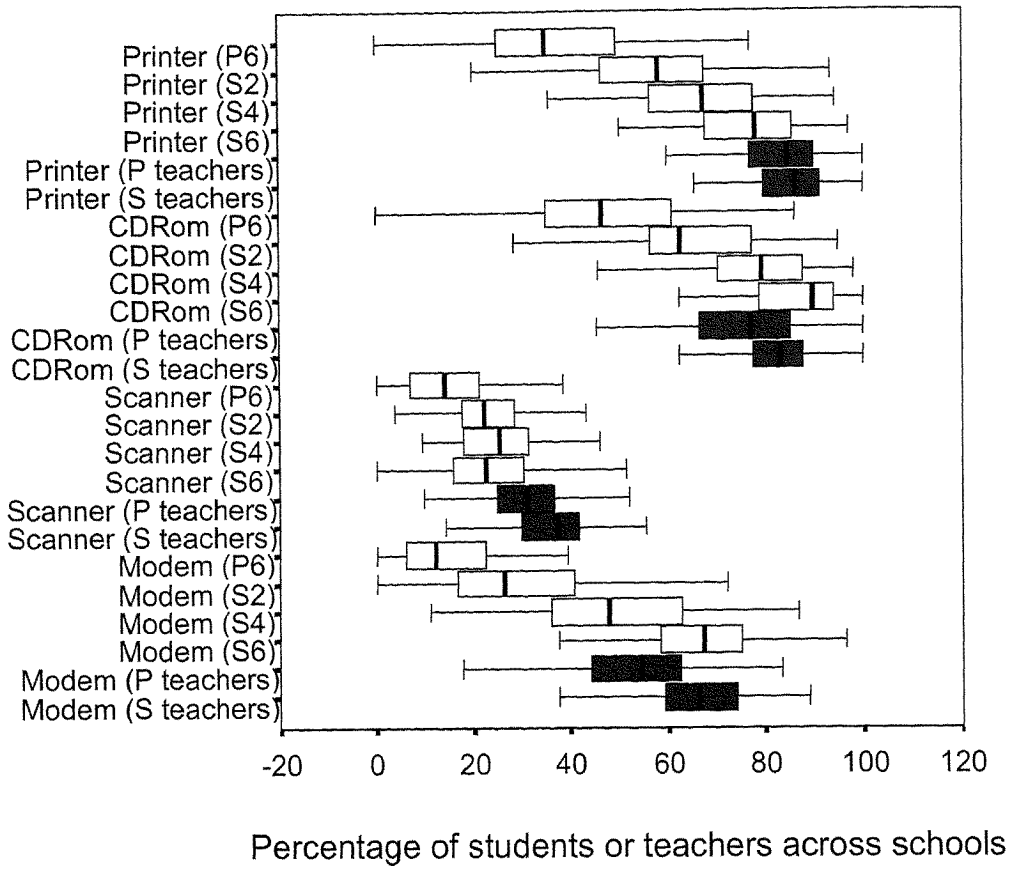


Figure 7.6

Box plots of the absolute percentages of home ownership of various peripherals for students and teachers across schools.

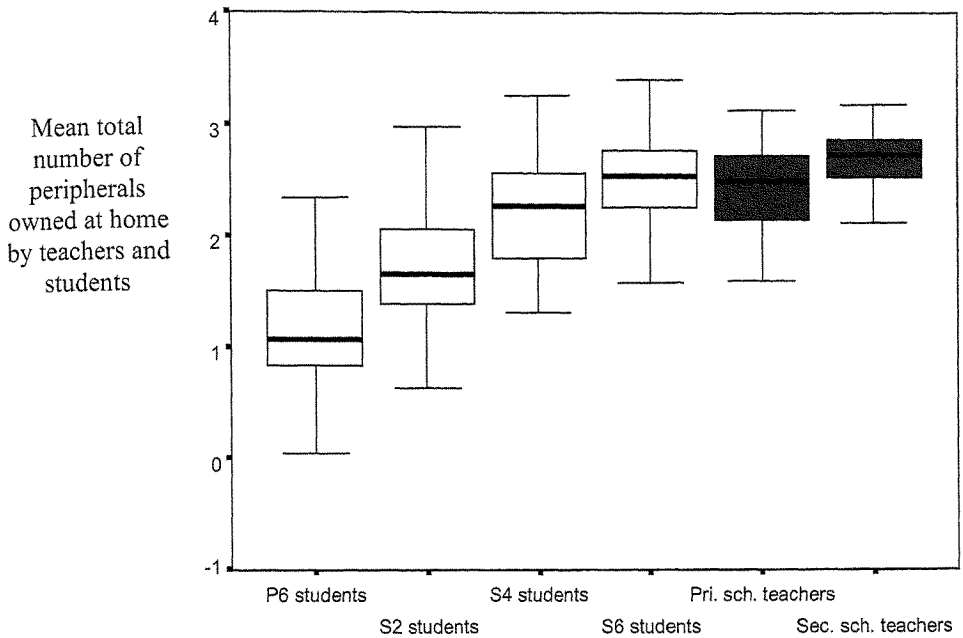


Figure 7.7
Box plots of the means, total number of peripherals for students and teachers having home computer ownership across schools

Home Ownership and Self-proclaimed Competence

Correlation between home computer ownership and various kinds self-proclaimed ICT competence was computed for teachers and students. Teachers' self-proclaimed competence was gauged through teachers' indication that they already had sufficient training in particular ICT skill areas. Students' self-proclaimed competence was gauged by their indication that they had already mastered particular ICT skills.

Table 7.3
Pearson correlation coefficients between home computer ownership and self-proclaimed competence for teachers

Areas of Self-proclaimed Competence	Primary School Teachers	Secondary School Teachers
Word processing	.240**	.169**
Spreadsheet	.109**	.109**
Database software	.048	.047*
Presentation software	.107**	.091**
Monitoring students' progress in using software	.026	.017
Communicating and discussing with others through the electronic network	.109**	.108**
Integrating computer applications into teaching and learning	.006	.033
Assessing and selecting software for teaching and learning	.048	.055**
Using computer for individual learning	.073**	.075**
Application of multimedia	.100**	.071**
Modifying software for its appropriate use in schools	-.017	.011
Using email in teaching and learning	.049	.082**
Using the Internet/WWW in teaching and learning	.067*	.044*
Other area of training	-.019	-.138**

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 7.4
Pearson correlation coefficients between home computer ownership and self-proclaimed competence for students

Areas of Self-proclaimed Competence	P6 Students	S2 Students	S4 Students	S6 Students
Basic operation	.287**	.401**	.375**	.380**
Word processing	.270**	.360**	.276**	.347**
Graphical presentation	.184**	.230**	.173**	.142**
Spreadsheet	.210**	.277**	.174**	.116**
Simple programming	.229**	.142**	.115**	.089**
Use of ICT for problem solving	.153**	.113**	.096**	.075**
Email communication with teachers and students	.189**	.245**	.243**	.225**
Using and searching information via WWW	.246**	.238**	.231**	.213**
Using and searching information via electronic database	.247**	.237**	.197**	.175**
Using computer for presentation	.139**	.193**	.140**	.134**
Other IT skills	.054*	.022	.012	-.009

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 7.3 reveals a small but significant correlation between home computer ownership and self-proclaimed competence in general computer applications such as word processing, spreadsheet, presentation software and communicating and discussing with others through the electronic network for both primary and secondary school teachers. The correlation between home computer ownership and competence to use the Internet/WWW in teaching and learning (primary: r=.067, p=.015, secondary: r=.044, p=.036) was rather weak. No significant correlation was found in areas of integrating computer usage into teaching and learning, and in modifying software for its appropriate use in schools. This may be due to the generally how level of occurrence of such activities in schools.

For students, it was interesting to find big and significant correlation between all areas of self-proclaimed competence with home computer ownership at all grade levels. However, the correlation with the use of ICT for problem solving remained relatively low among students at all levels. Such high correlation between home computer ownership and ICT competence may lead to equity problems when ICT is generally integrated into the curriculum.

Home ownership and the school curriculum

A most significant finding in this context is the fact that the existence of specific ICT implementation plans in the curriculum lead to higher home computer ownership by student. While teachers' home computers ownership did not have a high correlation with their self-proclaimed ICT competence, such ownership did correlate significantly with whether they had used ICT in their teaching (Person Chi-square significance: <0.05 (primary level) <0.01 (secondary level)). Further, it was found that there was significantly higher have computer ownership by students at P6 and S6 in schools that had developed explicit ICT policies.

Summary

The median percentage of home ownership of computers and various peripherals as well as home Internet connectivity were found to increase with students' grade levels. The variation across schools became smaller as grade levels increased. Secondary school teachers generally had better home access to computers and the Internet compared to primary school teachers.

Generally speaking, the correlation between teachers' home computer ownership and their self-proclaimed competence in various areas of ICT skills was weak though significant and correlation was found in general application areas such as word processing, and presentation software but not in the integration of ICT use into teaching and learning among teachers.

High and significant correlation between students home computer ownership and students' self-proclaimed competence in nearly all ICT skill areas is an observation which deserves greater attention. Measures need to be taken to address possible equity issues in ICT use in education.

Chapter 8 Competence and Personal use of Computers

This chapter reports on students' self-proclaimed competence in computers and ways of acquiring ICT knowledge. Apart from that, how computers are being used in teaching and learning and ways of seeking help were also examined.

Student's Self-Proclaimed Competence in Using Computers

Students' ICT competence affects their ability to take part effectively in teaching and learning activities that make use of ICT. On the other hand, such competence may also be part of the learning outcome desired from ICT use in the school curriculum. In the local extension of SITES-M1, the student questionnaire included a question that required students to indicate the ICT skills that he/she had already mastered. Table 8.1 shows the percentage of students who proclaimed that they had mastered the respective ICT skills.

Table 8.1
Students' self-assessed ICT competence.

ICT skills	P6(%)	S2(%)	S4(%)	S6(%)
Basic computer operations	75	83	84	88
word processing	20	33	44	66
Graphic presentation	27	24	23	22
Spreadsheet	22	27	27	30
programming	11	18	27	22
Use ICT to analyze and solve problems	6.7	7.2	8.5	9.6
Use e-mail to communicate with teachers and students	9.1	26	35	49
Use and search information via WWW	11	24	33	46
use and search information via electronic data base	13	19	24	29
Use computers for presentation	7.1	15	15	20
Others	3.1	4.1	6.2	4.5

It was found that a relatively high percentage of students at all the four educational levels indicated that they had competence in basic computer operations. (75%, 83%, 84% and 88% in P.6, S2, S4 and S6 respectively). However, only 6.7% in P 6, 7.2% in S2, 8.5% in S4 and 9.6% in S6) reported that they had experience in using ICT for problem solving. As expected, the self-assessed ICT competence of students increased with the educational level. The greatest improvement in self-assessed ICT competence across the educational levels was observed in the use of e-mail and information search via the Internet, both being important skills for life in the information age.

Integrating ICT into Curriculum

In order to find out a little more about how computers were used at schools, as perceived by students, they were asked to indicate the subjects other than computer subjects that had used computers for learning activities in their schools.

Figure 8.1 illustrates that in most of the schools the percentages of ICT use in the teaching of subjects remained very low. Figure 8.1 also reveals that the predominant subject areas where this occurred was mathematics and science and the least predominant area was Chinese.

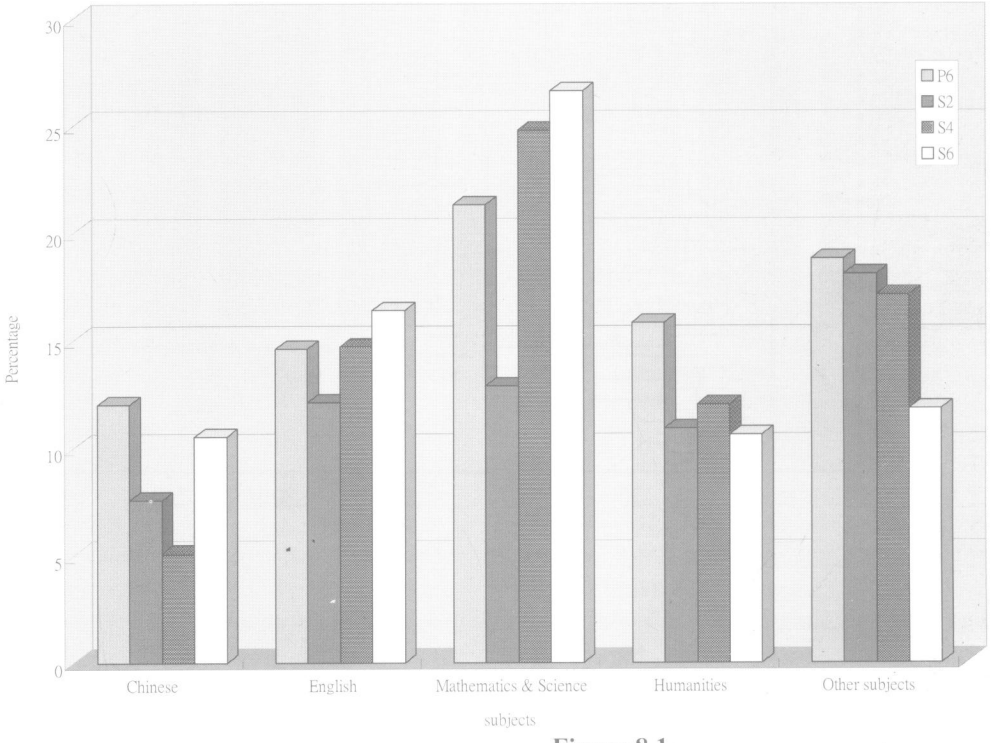


Figure 8.1

Levels of ICT usage for teaching and learning in different subject area as reported by students

Students' Computer Usage

An important indicator for the integration of ICT into teaching and learning was how computers were actually used by students in their everyday activities. Figure 8.2 shows that there was considerable variation with respect to the use of computers. It indicates that game playing was the most popular activity among students at all levels. Clear differences between primary and secondary students were found in the use of computers for homework and for communication. At the primary level, the usage was lowest for communication purposes. On the other hand, regarding the use of computers for doing homework, there was a large variation (ranging from 0% to 80%) across among secondary schools, especially at S4 and S6. Generally speaking, the data indicates that the higher the grade level, the greater the usage for entertainment (music appreciation and video watching), learning and communication purposes. Another pertinent observation in this regard is the very large diversity across schools in relation to the usage for learning (homework and information search) and communication purposes, indicating important impacts of the school curriculum on students' ICT usage patterns.

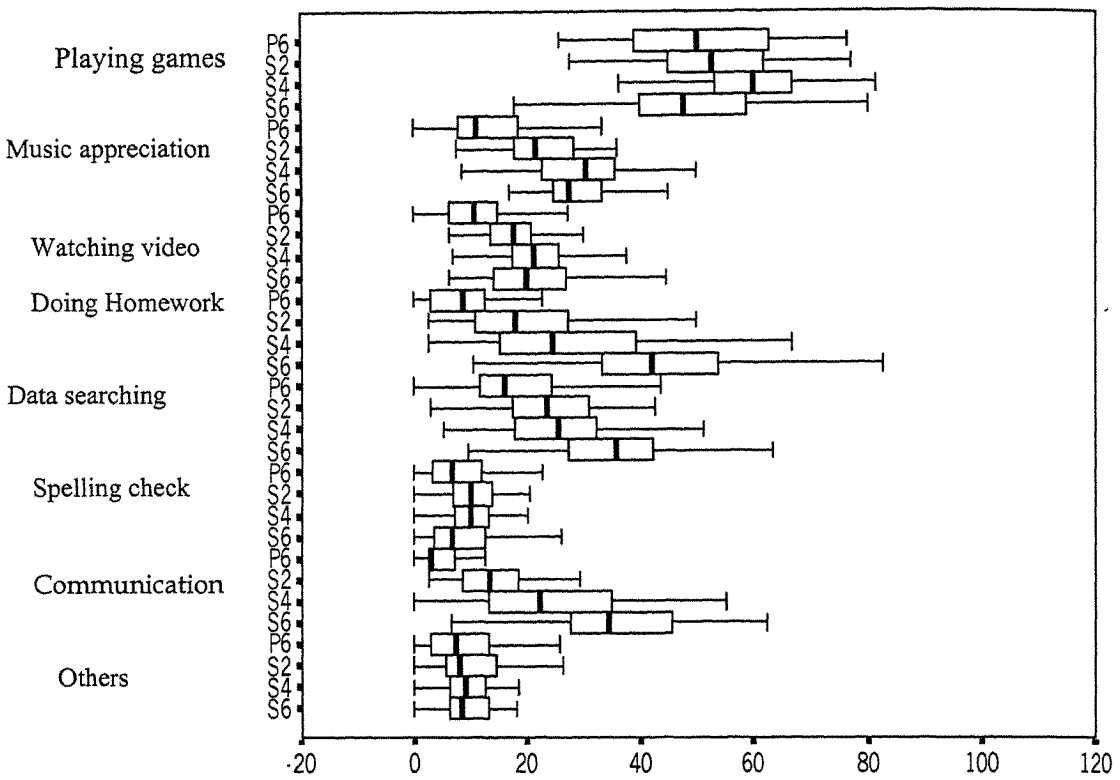


Figure 8.2
Students' Purposes for using computers

Internet Activities

Apart from the activities mentioned above, two kinds of Internet activities, namely newsgroups and ICQ, were examined in greater detail. These serve as indicators for students' purposes in using the Internet.

Newsgroups

As shown in Figure 8.3, participation in the various newsgroups was generally higher for secondary students. However, participation rates peak at S4 and dropped slightly at S6. It is unclear whether this is due to the higher public examination pressure experienced by S6 students. Only 12.7% of P6 students, 10% of S2 students, 11.6% of S4 students and 16.6% of S6 students reported that they had participated in newsgroup discussions. The data also indicate that students mostly subscribe to newsgroups related to entertainment and news.

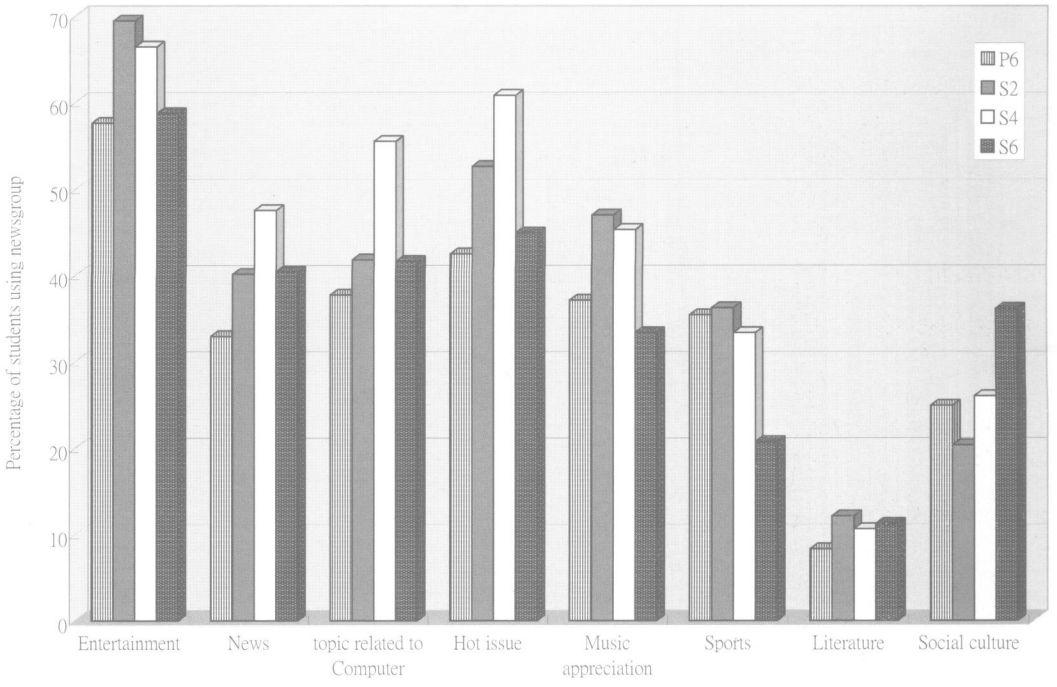


Figure 8.3
Relative percentage of different kinds of newsgroups subscribed to by students

Use of ICQ

16% of P6 students, 30% of S2 students, 44% of S4 students and 56% of S6 students indicated that they had experience of using ICQ. Of those, over 65% of the students in each grade level indicated that the main purpose for using ICQ was for chatting. Over 55% expressed that they use ICQ to get to know people. Over 30% reported that they used ICQ to send files, less than 15% indicated that they used it for other purposes.

The above findings indicate that much of the students' use of Internet communications was for entertainment and personal communication purposes.

Students' Perceived Needs for Further Training

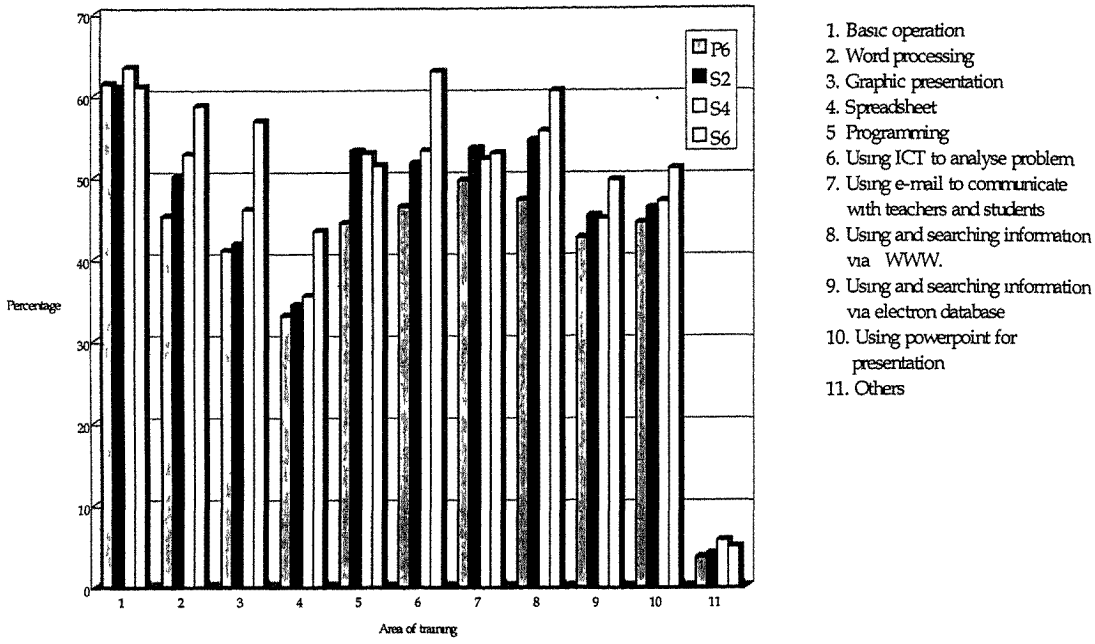


Figure 8.4
Further ICT training require by students in Hong Kong

Concerning the kinds of training needed, Figure 8.4 shows that, apart from basic computer operations, students at all four education levels studied wanted training on how to utilize IT in problem solving, information search via the web and communicating with teachers and friends using e-mail. There were thus differences between students and teachers in term of their priorities for further training and students had a slightly lower demand than teachers in learning to use ICT as a presentation tool.

Sources of Knowledge and Help

Sources of Knowledge

Apart from the training, students were also asked to indicate the means by which they acquired ICT knowledge. Figure 8.5 below shows that, overall speaking, the top three sources were "friends and relatives", "school" and "self-learning". At the higher grade levels the percentage of students acquiring ICT knowledge via "friend and relatives", "commercial training centres" and "self-learning" increased.

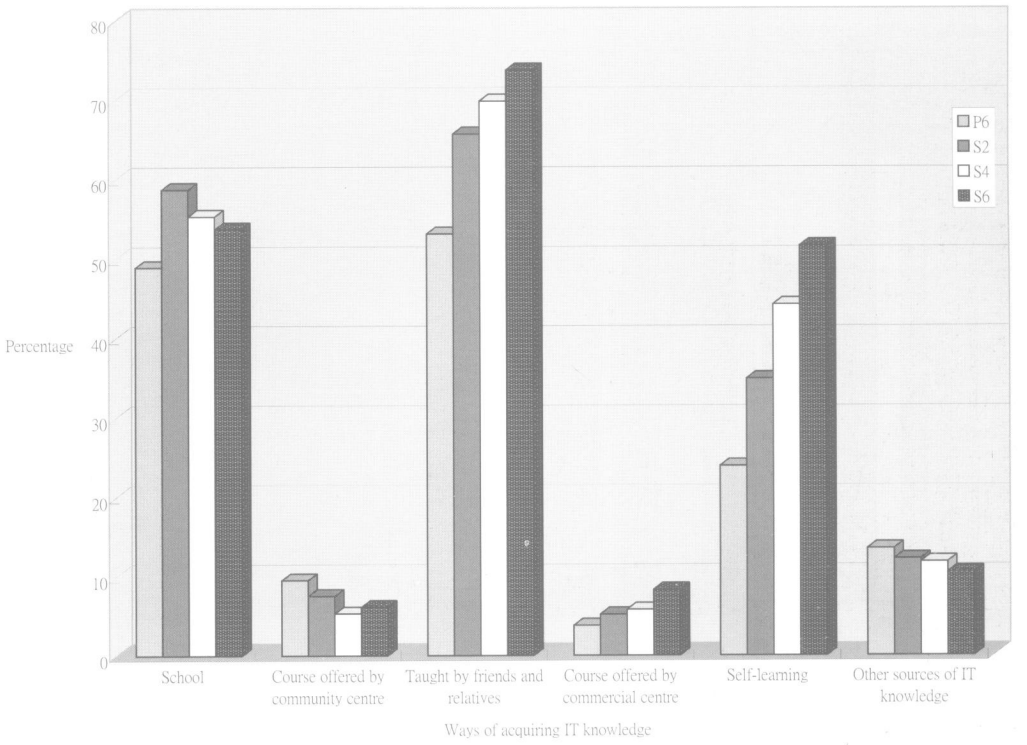


Figure 8.5
Students' ways of acquiring IT knowledge

Students were also asked to identify the kinds of media through which they obtained ICT knowledge. As Figure 8.6 indicates, at P6, TV programs constituted the most important media. This was followed by newspapers, computer magazines, Internet magazines, newsgroups and others. At S2 and S4, the picture was similar but the relative importance of media other than TV programs increased. At S6, newspapers became the predominate media as a source of ICT knowledge, followed by computer magazines and TV programs. This increase in popularity of newspapers and magazines and decreased popularity of TV programs with education levels as a popular source of ICT knowledge is a healthy one.

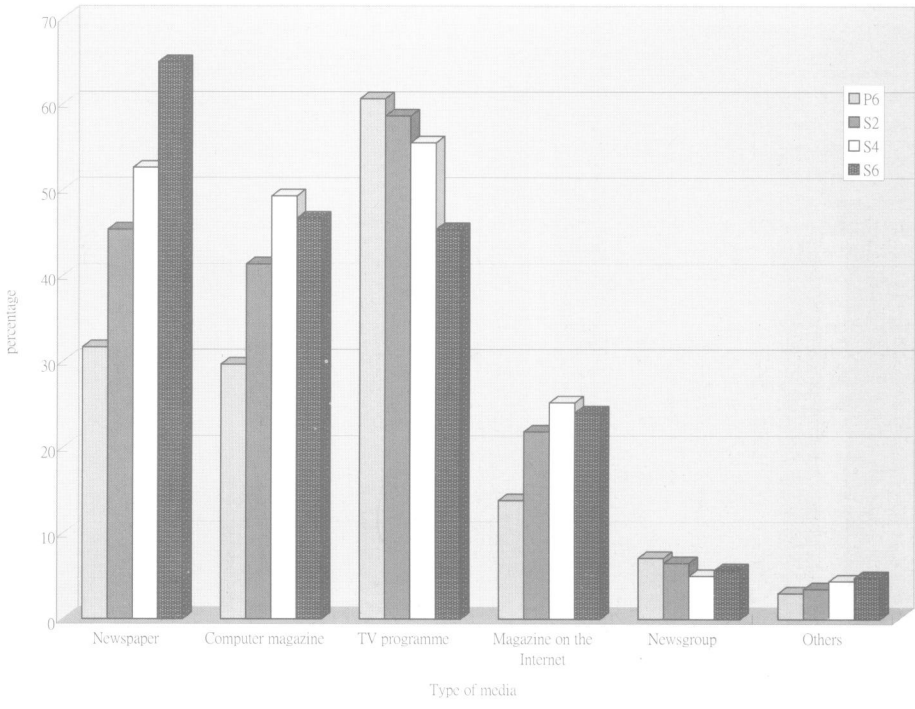


Figure 8.6
Obtaining ICT knowledge from media

Difficulties Encountered and Ways of Seeking Help

In the local survey, students were asked to indicate the obstacles they encountered in learning ICT in schools. Secondary school students reported a higher percentage of obstacles encountered than the primary school students, though the pattern of obstacles was similar. The top three obstacles reported by primary students were insufficient number of computers (51%), insufficient time for learning (40%), and insufficient software (24%). The top three obstacles reported by secondary students were insufficient time for learning (57% or above) insufficient knowledge in ICT (45%or above) and insufficient number of computers (41% or above). At all levels (less than 9%), "Information overload" was perceived to be the least important obstacle. It is interesting to note that students did not perceive 'insufficient Chinese software' (less than 20%) as a serious problem at all.

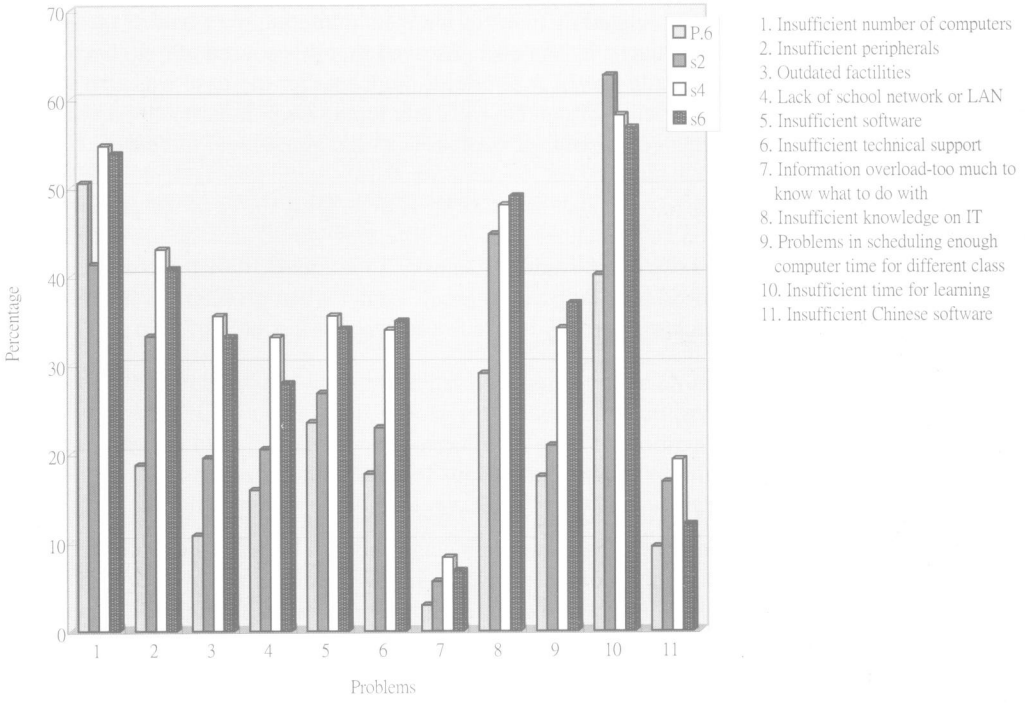


Figure 8.7
Problems encountered by students in learning with ICT

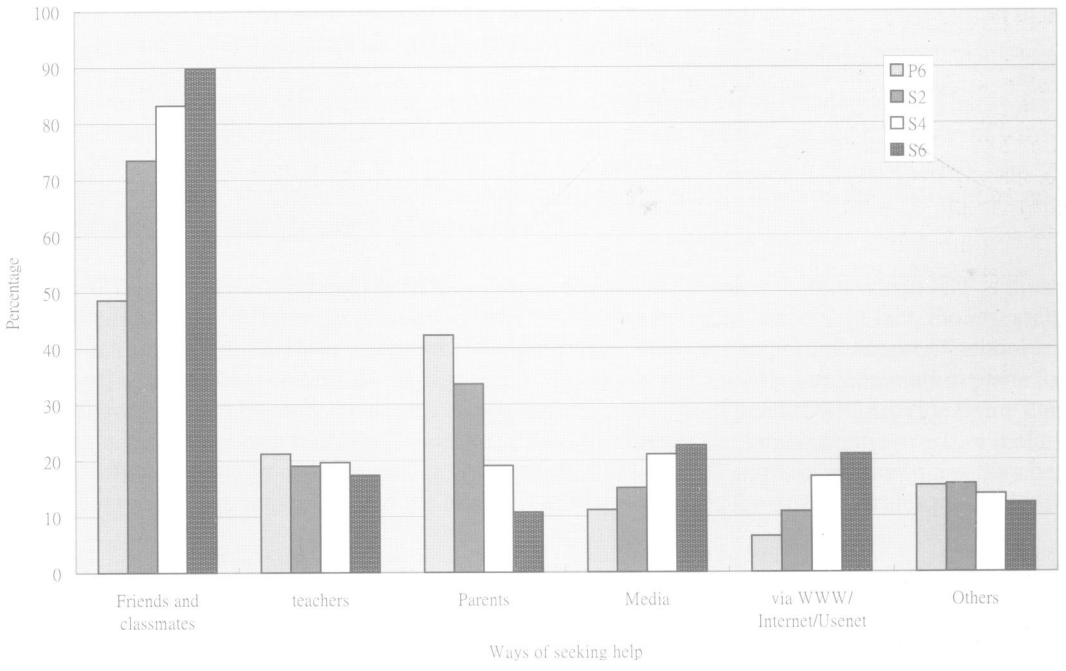


Figure 8.8
Sources of help used by students for ICT related problems

Students were also asked to indicate whom they would turn to when encountering problems related to ICT. Figure 8.8 clearly shows that when ICT related difficulties were encountered, over half of the students would seek help from friends and classmates. It was also observed that this source of help became even more popular with students at higher grade levels. A similar though smaller increase was also observed in the use of media and the Internet as sources of help. On the other hand, the popularity of parents and teachers as sources of help on ICT-related knowledge decreased as the grade level increased.

Of special interest is the popularity of the Internet as a source of help. Only 5.3% of the primary schoolteachers and 6.6 % of the secondary teachers indicated that they would seek help through the Internet/Usenet. On the other hand, 6.5% of P6 students, 11% of S2 students, 17% of S4 students and 21% of S6 students indicated that they would seek help via Internet/Usenet when problems were encountered. This indicated that students were much more ready to use the Internet as a source of help and knowledge than teachers.

Summary

With respect to the findings depicted above, the use of ICT for enhancing teaching and learning was still at a primitive stage, especially in humanity and language subjects. This can be reflected from students' patterns of everyday usage of ICT and the findings elsewhere in this report on the low level of ICT integration into the school curriculum. There was a difference in priorities for further ICT related training between students and teachers. It was apparent that teachers' computer usage and priorities was geared more towards empowering themselves with better presentation skills in the classroom than as an empowering tool for student learning. On the other hand, students were more keen to learn to master ICT for the purpose of problem solving and information search. With regard to the use of Internet/ Usenet, the results indicated that students were far more ready to use the Internet as a resource for knowledge acquisition and support than teachers. In all, it does appear that while both teachers and students were positively disposed towards the use of ICT in education, the younger generation seems to be more ready to step into the information age than teachers.

Chapter 9 Recommendations

Results from the Hong Kong SITES M1 Study gives ample evidence that leadership is of paramount importance in the achievement of the vision that Government has set up for the implementation of ICT in education: educating the younger generation for effective functioning in the information age. This chapter will begin by highlighting evidences for the impact of leadership on implementation and relating these to a systems model of leadership for IT in education. Based on the survey findings and the model, specific recommendations are made in relation the key implementation factors.

As mentioned at the beginning of this report, many countries have already drawn up their master development plans for ICT in education, whose emphasis was to cultivate in their citizens the abilities to undertake life-long learning and collaborative problem solving, competencies required of citizens in the information age. The successful cultivation of such competencies requires the establishment of renewed curriculum goals as well as new pedagogical practices, such as new ways of organizing classroom learning, new roles for teachers and new evaluation procedures. Hong Kong is a late starter in establishing such a vision, addendum policy guidelines and implementation strategies. Nonetheless, it is heartening in this Study to find evidence of changes in schools and that there are indications of emerging pedagogical practices resulting from the implementation. There are several prominent observations one can make from the results of the SITES M1 survey in Hong Kong pertaining to the current status of development in Hong Kong.

First of all, there is overwhelming evidence that leadership is of paramount importance to the direction and rate of development, and this leadership can be distinguished at two levels: the system level and the school level. At the system level, both the role and contents for ICT in the intended curriculum strongly influences school policies that determine the implemented curriculum. System level policies on resourcing, infrastructure support and professional development frames the overall context within which all schools operate. By comparing the overall status of ICT development in Hong Kong schools with those in other countries, system level policy impacts can be readily discerned.

Whilst the development in many schools are very much constrained by the inadequacy of hardware and other infrastructural factors, the results of the Study clearly points out the just the provision of hardware resources alone does not help promote the kind of pedagogical paradigm shift desired. There was extremely low and insignificant correlation between the mean attitude of teachers towards the emergent paradigm in a school and the computer:student ratio of the school.

The large diversity between schools in terms of the pedagogical paradigm within which ICT is thus not explainable just by the differences in infrastructure provisions between schools. In fact, the research findings highlight the importance of school level leadership. One very important aspect of school leadership is whether the school has established explicit ICT policy goals and specific implementation plans for the current school year and beyond. This affects even the extent to which parents will provide home computer access to students. Research findings also indicate that priorities in the kinds of infrastructure including hardware/software acquisition, networking, etc., and the kinds of ICT implementation plans may be very much influenced by the principals' and the teachers' attitudes towards the different roles played by ICT.

Obviously, individual teachers' own attitudes, beliefs and willingness to learn about new technologies and new pedagogies are important for what takes place in individual classrooms. However, we are highlighting the importance of leadership, as teachers' attitudes and practices can be greatly influenced through curriculum changes, staff development and organizational support.

To summarize, there are three levels of factors contributing to the quality of the learning outcomes achieved by a student. At the education system level are the policies that guide developments in curriculum and assessment and at the school level are the implementation factors and the roles of various stake holders and community partners. School level implementation is influenced by leadership factors at both the education system and school levels as well as the physical and human resources available in specific schools. Besides education system and school level factors, students learning outcomes are also dependent on their family background and personal characteristics. This systems model of leadership for IT in education (Law et.al. 1998) is presented more clearly in Figure 9.1.

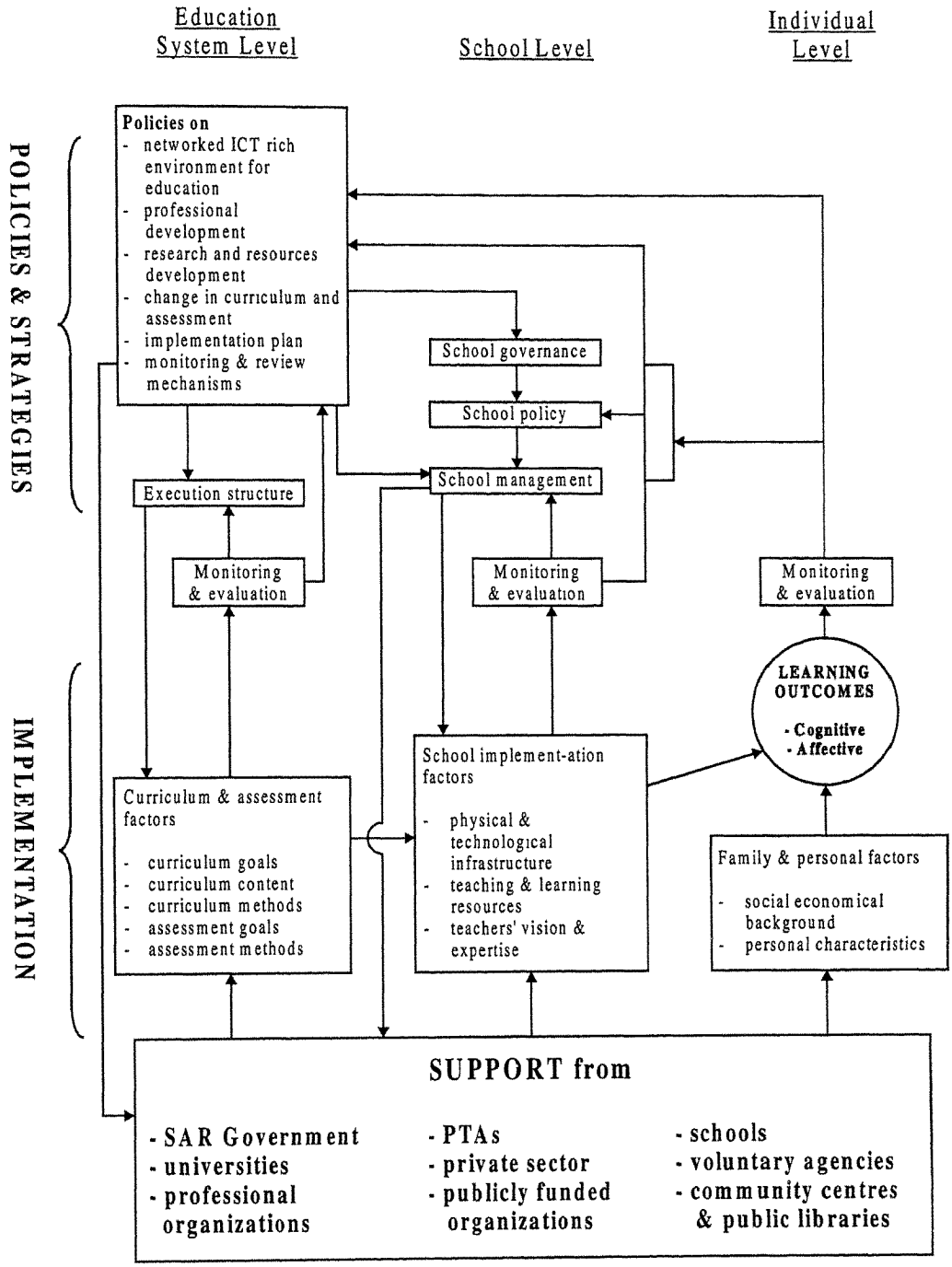


Figure 9.1
A systems model of leadership for IT in Education (Law et. al. 1998)

Reference:
Law, N., Chow, C., Ki,W. W., Yuen, A.& Wong, K.S. (1998) *Education for the Future: Policy Recommendations for Information Technology in Education.* Hong Kong.

In the next section, with this systems model of leadership as a framework, we will describe the status of development and propose specific recommendations on several key aspects of ICT implementation in Hong Kong on the basis of the research findings.

Curriculum

Status of development

- Emerging pedagogical practices were reported to have happened more in ICT-using classrooms than non-ICT-using ones. This is heartening, indicating the possible start of a pedagogical paradigm shift developing in tandem with ICT implementation in Hong Kong schools. However, the overall usage of ICT in schools is low and there is a greater tendency for teachers to use ICT for multimedia presentations than other modes of usage. Another feature is that there is a large diversity between schools in terms of pedagogical paradigm and this difference is widened to a much greater extent in terms of the pedagogical paradigm practiced when ICT is used.

Recommendations

- In order to bring about the emerging pedagogical paradigm, a major curriculum reform is in fact necessary. It is thus very opportune that the Hong Kong Education Commission is undertaking a major curriculum review of the entire school curriculum with the key goal of developing the life-long learning abilities of the younger generation. We recommend that the curriculum review should take into account the role that ICT should play in the reformed curriculum.
- It is expected that in the EC's curriculum review process, new ways of organizing classroom activities, new roles of teachers and students, and new assessment methods which can encourage students to learn cooperatively and collaboratively to best develop students' capacities in self-learning, problem-solving, information searching and analyzing. We recommend that both in the conceptualization of the intended curriculum as well as in the provision of support for implementation, the integration of ICT should be a key consideration on the agenda.
- Schools should be supported and required to develop curriculum plans that clearly integrates the use of ICT in the achievement of the key curriculum goals of the school.
- The schools that are more advanced in using ICT for emerging practices should be encouraged and supported to share their experiences in order to speed up the process of school based curriculum change.

Physical, Technological & Information Infrastructure

Status of development

- The level of computer:student provisions, networking facilities and internet access in Hong Kong schools are rather low, especially at the primary level. On the other hand, the quality of the equipment are rather high and Hong Kong has an outstanding ratio of LCD and video projectors fit for presentations but extremely week on special devices for disabled students. Further, most of the computers are placed in computer rooms and most students do not have easy independent access during lessons in normal classrooms. Results indicate that priorities in resource allocation are influenced by the pedagogical practice that teachers intend to use ICT for. Further, subject/education specific software is very much lacking. Networked-based information infrastructure to support teaching and learning is still at a primitive stage of development.

Recommendations

- We recommend that the pace of improving ICT infrastructure provisions in schools be accelerated so that Hong Kong can reach the international average as soon as possible. In particular, the networking and internet facilities should be a major priority as this is crucial for conducting learning activities involving the emergent paradigm.
- Further, attention should be given to the installation of computers in normal classrooms and other curriculum rooms so that students have easy access to them for various learning activities during the school day.
- The government, in its provision of resources to schools to improve its technological infrastructure should provide guidelines to schools that would encourage and support more student-centred and collaborative work.
- The installation of ICT facilities for students with disabilities and special needs should be a priority area.
- The government should encourage the development of ICT related curriculum resources as this is a serious needs area. However, as these are generally resource-intensive developments, great care must be taken to ensure that the software so developed would not be designed to support the traditionally important paradigm but rather the emerging paradigm.
- Some tertiary institutions and more recently the Education Department have developed on-line databases and networks to provide curriculum resources to teachers as well as support teacher collaboration. However, how such networks can promote the emerging paradigm shift should be seriously looked into.
- Appropriate, supportive information infrastructure should also be developed to serve the student community to support, self-access/self-directed learning, independent enquiry and collaborative learning.

Staff Development

Status of development

- Hong Kong principals and teachers generally have a positive attitude towards that use of ICT for teaching and learning. Further, they tend to have a more positive attitude towards the use of ICT for the emerging paradigm than the traditionally important paradigm. However, while the attitudes of teachers have shifted somewhat towards the emerging paradigm, the realization of paradigm shifts as actual pedagogical practice in classrooms is still rare. Teachers still tend to use multimedia presentations for whole class teaching and prefer learning to use computers as a teacher's tool more than other usages.
- The provision of ICT teacher training opportunities especially in the form of external courses are relatively high in Hong Kong. This contrasts with the fact that the principals' perception of the greatest obstacle in ICT implementation being the lack of sufficient training opportunities and the fact that most teachers felt inadequately prepared for pedagogical applications of ICT. Technology coordinators perceived the low quality of training programs to be the greatest obstacle to ICT implementation in the school. Survey findings also reveal that training courses tend to focus on basic computer operations and general applications rather than more advanced ICT techniques or pedagogical applications.

Recommendations

- All staff development programs, even for technological oriented ones, should try as far as possible relate the training to pedagogical applications or impacts that the technology would/can bring to teaching and learning.
- There is a great need for pedagogically oriented ICT-oriented teacher professional development programs. These should focus on ways of organizing teaching and learning activities that makes use of ICT tools to bring about the development of the kind of learning outcomes required for life-long learning. Such training should also focus on helping teachers understand and to make the role change that is required to realize the emerging paradigm.
- Teacher training courses should not just be providing knowledge or know-how. Staff development should be tightly coupled with efforts to develop school-based ICT development policies and plans and to bring about the kind of institutional change that is normally coupled with major curriculum reforms and paradigm shifts.
- Staff development programs should incorporate examples and case studies of actual ICT implementations where the technology empowers the learner and brings about students-centred learning. One important factor that contributes to the contradiction between teachers having a more positive attitude towards using ICT for the emerging paradigm and yet having a tendency to use ICT as a teacher's tool is probably the lack of adequate role models and examples of ICT use in concrete emerging practices.
- Staff development should be coupled with encouragement and support for developing a collaborative culture amongst teachers and to foster the formation of ICT-mediated and ICT-enabled teacher professional communities.

School Policies and Organizational Support

Status of development

- Possibly due to the short history of development, less than half of the computer-using schools in Hong Kong have explicit ICT policies. Those that have developed specific implementation plans for the school year and beyond were far fewer. On the other hand, the development of policies and plans are important milestones in a school's efforts to integrate ICT into the school curriculum in a more coordinated and systematic manner.
- On the other hand, nearly all schools have assigned personnel to coordinate technology developments and often such coordination is done via a committee consisting of several members most of whom are teachers. 12% of Hong Kong schools include their principals or senior administrative personnel in ICT coordination, indicating the importance of ICT development to the school leadership in those schools.

Recommendations

- All schools should be required to development explicit ICT policies and implementation plans to ensure that all students have the opportunities to benefit from the use of ICT in their learning. Further, schools should be guided and supported (possibly through staff development provisions) to develop such policies and plans that can take account of the school's specific contexts and be able to keep the goal of eventually bringing about a paradigm shift through the use of ICT in the school curriculum.
- As school leadership is most crucial to school level implementations, special professional development programs should be organized specifically for school principals in order to help them take up the challenge of taking on a leadership role in the information age. In addition, all principalship training should have a mandatory component on ICT which is curriculum and pedagogically oriented to help principals to understand and take up their role as a leader to bring about a paradigm shift in the school.

- As is apparent from the research findings, principals in Hong Kong have an unrealistic and over-optimistic perception that there is good alignment of expectations among staff about ICT use and development in the school. To bring about the necessary institutional change and to establish the collaborative culture that is characteristic of the information age, schools should explore models of collaborative leadership.
- There is no indication that schools with good ICT provisions have a greater inclination to using ICT for emerging practices. This is a disturbing finding. Proper monitoring, evaluation and pedagogical guidance and staff development support should be given to these schools so that the resources and efforts would not be wasted.
- Mechanisms should be set up to facilitate sharing between schools so that schools can learn through each other's successes and failures, accelerating education developments in Hong Kong. In particular, it is apparent that some schools have already accumulated some experience in using ICT for emerging practices. Effective sharing will narrow the widening gap between schools, accelerating institutional renewal in the process.

Home & Community Support

Status of development

- It is apparent that the social economic background of students affects greatly the students' opportunities to take full advantage of ICT for their learning. This problem of inequity is most acute at the primary and lower secondary level when students are most reliant on their families for resource provisions as well as learning support. About 40% of students at those levels report seeking help on ICT from their parents. It is expected that students coming from poor economic backgrounds do not only have problems in having computer and Internet access at home. They also suffer from the lack of intellectual and technical support from home.

Recommendations

- Government and schools are recommended to put more resources to address the inequity issue. For example, government can consider the provision of a computer purchasing subsidy scheme for the economically less favored students, providing more computer and Internet accesses for students in community centres, public libraries or youth centres. Schools can consider opening the school computer facilities for student access at night.
- As the inequity is not confined to the issue of access, various forms of community-based support should be established to provide technical and learning facilitation support to students who come from deprived family backgrounds.
- The issue of learning and facilitation support to students should also be incorporated into plans for establishing Internet-based information infrastructures for students mentioned in an earlier recommendation.

Research and Evaluation

Recommendation

While the Government has put in a lot of resources into hardware infrastructure, networking, teacher training, school development programs, software and web-based educational resource development in the last couple of years, to-date there is apparently no efforts or plans for research and evaluation on these various efforts. While Hong Kong is a late starter in the use of ICT for teaching and learning across the curriculum, our ability to pursue a fast course of development that lead to our desired vision relies critically on our ability to continually evaluate and learn from our efforts so that we stay on an effective course in the right direction.

APPENDICES

Appendix 4.1

Alternative indices of student:computer ratios in primary ,lower secondary and upper secondary levels. See notes for explanation.

	Primary Education					Lower Secondary Education					Upper Secondary Education				
Country	Stud.:comp. ratio country aggreg.	Stud.:comp. grade range using stud.	Stud.:comp. ratio grade r. all stud.	Student:comp. ratio whole school	% using students (whole school)	Stud.:comp. ratio country aggreg.	Stud.:comp. grade range using stud.	Stud.:comp. ratio grade r. all stud.	Student:comp. ratio whole school	% using students (whole school)	Stud.:comp. ratio country aggreg.	Stud.:comp. grade range using stud.	Stud.:comp. ratio grade r. all stud.	Student:comp. ratio whole school	% using students (whole school)
Belgium~French	~	~	~	~	~	* 25	8.4 (0.6)	15 7 (1.1)	29.7 (1.6)	43 (1.8)	* 26	2.9 (0.2)	6.0 (0 7)	33.2 (2.4)	42 (1 9)
Bulgaria	~	~	~	~	~	238	8.2 (0.4)	28.5 (1.0)	80.5 (2.7)	33 (1.0)	54	14.3 (0.7)	36.5 (2.6)	74.3 (4.4)	31 (1.5)
Canada	* 8	2.5 (0.1)	3.6 (0.2)	11.1 (0.2)	93 (0.5)	* 7	2.1 (0.1)	3.0 (0.1)	8.8 (0.1)	75 (0.9)	* 6	1.7 (0.1)	3.6 (0.1)	8.0 (0.1)	77 (0.9)
China Hong Kong	25	9.2 (0.9)	36.2 (5.8)	53.0 (5.0)	39 (3.1)	23	20.3 (0.9)	26.9 (2.7)	35.5 (0.5)	77 (1.0)	22	7.9 (0.3)	15.4 (0.3)	35.5 (0.5)	77 (1.0)
Chinese Taipei	81	7.6 (0.7)	67.7 (3.8)	74.3 (6.2)	42 (1.9)	25	11.1 (0.4)	35.9 (1.2)	35.3 (1.8)	43 (1.2)	9	3.4 (0.3)	28.9 (7.7)	14.7 (0.7)	67 (1.7)
Cyprus	183	24.0 (4.3)	32.7 (4.8)	49.5 (4.5)	64 (6.7)	216	112.2 (8.5)	222.0 (10.9)	210.1 (10.3)	71 (3.7)	18	12.9 (0.3)	26.9 (1.9)	22.3 (0.3)	59 (0.7)
Czech Republic	~	~	~	~	~	34	12.6 (0.6)	15.8 (0.6)	43.7 (1.4)	45 (1.8)	10	2.6 (0.1)	8.9 (0.4)	17.4 (0.7)	79 (1.5)
Denmark	~	~	~	~	~	9	3.8 (0.1)	3.8 (0.1)	11.7 (0.4)	93 (0.8)	~	~	~	~	~
Finland	12	8.7 (0.4)	8 5 (0 4)	16.3 (0.6)	89 (1.4)	10	10.2 (0.3)	12.1 (0.4)	13.5 (0.4)	86 (1.1)	~	~	~	~	~
France	* 25	~	~	37.9 (2.3)	71 (1.9)	17	10.1 (0.5)	11.7 (0.5)	24.3 (0.9)	91 (1.3)	7	2.3 (0.1)	3.6 (0.2)	10.9 (0.7)	73 (1.7)
Hungary	~	~	~	~	~	25	2.8 (0.1)	8.1 (0.4)	35.6 (1.6)	48 (1.4)	~	~	~	~	~
Iceland	13	3.0 (0.3)	3.3 (0.3)	20.5 (1.0)	84 (2.3)	12	2.1 (0.1)	2.2 (0.1)	18.8 (0.5)	84 (1.7)	11	4.0 (0.3)	4.7 (0.3)	17.0 (0.6)	79 (1.9)
Israel	* 16	4.4 (0.8)	24.1 (6 9)	23.1 (2.5)	86 (2.7)	* 14	4.5 (0.4)	13.4 (1.3)	18.2 (2.3)	83 (2.6)	* 14	1.9 (0.2)	9.4 (1.0)	15.0 (0.8)	73 (2 4)
Italy	88	8.4 (0.8)	101.5 (9.6)	157.7 (14.4)	25 (2.2)	* 16	4 6 (0.3)	10.4 (2.0)	30.1 (6.4)	67 (2.4)	* 14	3.1 (0.4)	16.5 (2.1)	24.4 (1.9)	68 (2.5)
Japan	28	16.5 (1.5)	62.1 (6.0)	58.6 (4.6)	47 (3.2)	14	11.5 (0.7)	24.8 (2.5)	21.4 (0.9)	67 (2.5)	12	5.1 (0.6)	33.5 (6.0)	34.1 (5.4)	32 (2.1)
Latvia	~	~	~	~	~	~	~	~	~	~	* 33	9.0 (0.8)	12.6 (1.0)	52.9 (2.8)	32 (1.5)
Lithuania	~	~	~	~	~	90	10.6 (0.9)	37.5 (2.4)	133.5 (8.0)	28 (1.3)	76	8.5 (0.2)	14.8 (0.4)	136.9 (3.7)	27 (0.5)
Luxembourg	~	~	~	~	~	12	6.5 (1.1)	10.3 (1.6)	15.6 (0.8)	70 (4.1)	12	5.2 (0.8)	4.8 (0.6)	16.3 (0.9)	72 (3.5)
New Zealand	14	12.3 (0.6)	12.8 (0.7)	20.2 (1.0)	95 (1.1)	* 8	3.5 (0.1)	4.5 (0.2)	10.3 (0.2)	79 (1.2)	~	~	~	~	~
Norway	13	8.2 (0.2)	10.3 (0.3)	22.9 (0.6)	67 (1.0)	9	7.6 (0.1)	10.2 (0.2)	13.8 (0.2)	79 (0.6)	4	4.0 (0.1)	5.8 (0.1)	5.8 (0.1)	85 (0.6)
Russian Federation	~	~	~	~	~	* 121	6.5 (1.1)	44.1 (10.2)	127.3 (31.7)	25 (1.8)	* 121	12.5 (1.1)	22.4 (4.5)	131.6 (31 9)	24 (1.8)
Singapore	12	5.9 (0.2)	6.0 (0.1)	16.9 (0.4)	94 (1.2)	8	4.3 (0.1)	5.6 (0.0)	11.8 (0.1)	82 (0.4)	3	2.5 (0.1)	4.5 (0.4)	7.0 (0.0)	92 (0.3)
Slovak Republic	~	~	~	~	~	~	~	~	~	~	* 16	13.6 (0.5)	21.9 (1.1)	23.9 (0.8)	~
Slovenia	23	8.1 (0.6)	10.4 (0.6)	41.3 (2.0)	70 (2.7)	25	9.8 (0.5)	11.2 (0.8)	39.5 (1.7)	71 (2.4)	* 11	12.8 (1.0)	22.6 (1.7)	23.2 (1.7)	75 (2.2)
South Africa	~	~	~	~	~	* 123	3.5 (0.4)	9.4 (1.6)	41.6 (6.0)	47 (3.9)	* 111	1.3 (0.2)	6.1 (0.8)	35.3 (2.6)	43 (3.4)
Thailand	~	~	~	~	~	62	9.6 (0.5)	41.1 (5.8)	52.2 (1.8)	41 (1.3)	~	~	~	~	~

Calculations in each section:

Column1: total number of students divided by total number of computers in all schools in a country (computer~using as well as non~using)

Column 2. total number of students in the grade range USING the available equipment divided by total number of computers accessible for the grade range. Mean values per country across computer using schools Standard errors in brackets.

Column 3. total number of students in the grade range divided by total number of computers accessible for the grade range Mean values per country across computer using schools Standard errors in brackets

Column 4 total number of students in the school divided by total number of computers in the school Mean values per country across computer~using schools. Standard errors in brackets.

Column 5· Percentage of students using computers divided by the total number of students per school Mean values per country across computer~using schools Standard errors in brackets

Notes *: countries that did not satisfy all sampling criteria ~. no data collected Standard error (se) value ± 2*se provides 95% confidence interval for the population

Appendix 4.2

*Average percentages (and standard errors) of computers equipped with different processor types and different operating systems at the grade range-**primary education**.*

Country	% INTEL Pent.+Mac 103+higher	% 386/486SX/DX,Mac up to 68030	% 16-BIT Compat. AT/XT80286	% 8-BIT Compatible,APPLE2/2E	% Wind.95/98,WinNT,MacOS7,5+	% Wind.3.0/3.1,OS/2,Mac-OS <7.5	% MS DOS(3.1-7.0)without Wind	% Other Operating Systems
Canada *	52 (1.3)	36 (1.2)	6 (0.6)	5 (0.6)	58 (1.0)	36 (1.1)	9 (0.7)	11 (0.9)
China Hong Kong	91 (2.3)	6 (1.9)	2 (1.2)	1 (0.8)	95 (1.0)	13 (2.5)	1 (0.5)	1 (0.7)
Chinese Taipei	72 (3.0)	26 (2.8)	3 (1.2)	0 (0.0)	73 (3.2)	19 (2.8)	10 (2.0)	0 (0.0)
Cyprus	48 (5.5)	45 (5.2)	7 (4.6)	~	55 (4.1)	57 (3.4)	2 (1.2)	15 (8.9)
Finland	53 (2.2)	39 (2.1)	6 (1.0)	2 (0.7)	56 (2.3)	40 (2.4)	2 (0.6)	1 (0.6)
France *	~	~	~	~	~	~	~	~
Iceland	67 (1.8)	31 (1.7)	1 (0.2)	1 (0.4)	69 (1.5)	27 (1.5)	0 (0.1)	13 (1.7)
Israel *	51 (8.5)	38 (8.2)	8 (4.5)	4 (3.4)	49 (4.2)	59 (4.2)	15 (4.3)	12 (5.8)
Italy	73 (2.8)	20 (2.4)	4 (1.2)	3 (1.0)	77 (2.7)	20 (2.5)	5 (1.3)	1 (0.8)
Japan	44 (4.1)	27 (3.7)	20 (3.4)	9 (2.5)	49 (3.7)	26 (3.3)	25 (3.5)	10 (2.5)
New Zealand	50 (2.8)	40 (2.8)	5 (1.2)	5 (1.0)	58 (2.5)	24 (2.2)	3 (0.8)	14 (2.3)
Norway	39 (1.0)	55 (1.0)	4 (0.4)	2 (0.3)	52 (0.6)	46 (0.6)	6 (0.4)	3 (0.4)
Singapore	93 (0.0)	7 (0.0)	0 (0.0)	0 (0.0)	96 (0.0)	3 (0.0)	1 (0.0)	0 (0.0)
Slovenia	64 (2.7)	35 (2.7)	2 (0.7)	0 (0.1)	82 (2.4)	16 (2.3)	0 (0.2)	1 (0.7)

Notes: Percentage per school calculated as : (total number of particular type divided by total number of computers available at the grade range)*100. Standard error (se): value = +/-2*se provides 95% confidence interval for the population. *: countries that did not satisfy all sampling criteria, ~ :data not collected

Appendix 4.3

Average percentages (and standard errors) of computers equipped with different processor types and different operating systems at the grade range-lower secondary education.

Country	% INTEL Pent.+Mac 103+higher	% 386/486SX/DX,Mac up to 68030	% 16-BIT Compat. AT/XT80286	% 8-BIT Compatible,APPLE2/2E	% Wind.95/98,WinNT,MacOS7,5+	% Wind.3.0/3.1,OS/2,Mac-OS <7.5	% MS DOS(3.1-7.0)without Wind	% Other Operating Systems
Belgium-French *	35 (3 0)	50 (3.2)	9 (1.8)	6 (1.8)	40 (3.2)	40 (3.2)	19 (2.6)	1 (0.7)
Bulgaria	12 (1.0)	27 (1.3)	30 (1.3)	31 (1 6)	15 (1.1)	23 (1.2)	34 (1 4)	31 (1 6)
Canada *	48 (1.4)	40 (1.2)	10 (0.8)	1 (0.3)	55 (1.2)	38 (1.1)	17 (1.0)	8 (1.1)
China Hong Kong	84 (1.3)	16 (1.3)	0 (0.2)	0 (0.0)	81 (1.1)	18 (1.2)	5 (1.0)	1 (0.4)
Chinese Taipei	63 (1.9)	35 (1.9)	2 (0.6)	0 (0.3)	73 (1.9)	19 (1.7)	7 (1.0)	2 (0.9)
Cyprus	51 (8.5)	49 (8.5)	0 (0 0)	0	57 (6.1)	65 (6.3)	0 (0.0)	0 (0.0)
Czech Republic	32 (3.3)	59 (3.5)	6 (1.7)	4 (1.4)	47 (2.9)	55 (3.0)	16 (2.5)	6 (1.7)
Denmark	45 (2.8)	51 (2.9)	3 (0.7)	1 (0.5)	53 (2.1)	53 (2.1)	6 (1.4)	0 (0.3)
Finland	57 (1.3)	36 (1.3)	5 (0.6)	2 (0.5)	55 (1.7)	40 (1.6)	5 (0.7)	0 (0.0)
France	45 (1.6)	46 (1.6)	6 (0.8)	3 (0.6)	47 (1.6)	43 (1.6)	10 (1.1)	0 (0.2)
Hungary	48 (2.0)	43 (2 0)	7 (1.0)	2 (0.6)	46 (2.3)	46 (2 5)	17 (2.0)	4 (1.1)
Iceland	71 (1.8)	27 (1.8)	1 (0.2)	1 (0 3)	76 (1.6)	19 (1.4)	1 (0.2)	8 (1.6)
Israel *	42 (5.5)	48 (5.5)	7 (3.0)	2 (1.8)	44 (3.7)	56 (3.9)	14 (3.2)	7 (2.7)
Italy *	52 (2.6)	32 (2.4)	12 (2.0)	4 (1.2)	57 (2.5)	27 (2.3)	17 (2.1)	0 (0.3)
Japan	43 (3.4)	33 (3.4)	22 (2.9)	2 (1.2)	42 (3.2)	8 (1.9)	47 (3.3)	13 (2.6)
Lithuania	32 (2.3)	43 (2.3)	15 (1.6)	10 (1.5)	44 (2.3)	33 (2.2)	15 (1.6)	8 (1.4)
Luxembourg	75 (3.3)	24 (3.2)	1 (0.7)	0 (0.0)	69 (3.9)	31 (3.7)	1 (0.5)	0 (0.0)
New Zealand *	53 (1.6)	43 (1.5)	3 (0.4)	1 (0.2)	57 (1.6)	35 (1.7)	2 (0.4)	5 (0.9)
Norway	48 (1.2)	48 (1.2)	2 (0.3)	2 (0.3)	60 (0.6)	39 (0.7)	3 (0.3)	1 (0.2)
Russian Federation *	15 (3.1)	18 (3.6)	10 (2.8)	57 (4.8)	17 (3 4)	11 (2.8)	20 (3.8)	38 (4.6)
Singapore	96 (0.1)	4 (0.1)	0 (0.0)	0 (0.0)	95 (0.0)	18 (0.4)	0 (0.0)	1 (0.1)
Slovenia	61 (2 5)	37 (2.5)	1 (0.3)	0 (0.3)	79 (2.3)	21 (2.3)	0 (0.2)	2 (0.9)
South Africa *	40 (4.4)	43 (4.6)	13 (3.2)	4 (2 0)	49 (4 8)	21 (4.1)	30 (4.4)	0 (0.3)
Thailand	52 (1.6)	43 (1.6)	4 (0 7)	2 (0.5)	54 (1.6)	20 (1.3)	22 (1.4)	0 (0.2)

Notes: Percentage per school calculated as : (total number of particular type divided by total number of computers available at the grade range)*100. Standard error (se): value = +/-2*se provides 95% confidence interval for the population. *: countries that did not astisfy all sampling criteria, ~ :data not collected

Appendix 4.4

Average percentages (and standard errors) of computers equipped with different processor types and different operating systems at the grade range in-upper secondary education.

Country	% INTEL Pent.+,Mac 103+higher	% 386/486SX/DX,Mac up to 68030	% 16-BIT Compat. AT/XT80286	% 8-BIT Compatible,APPLE2/2E	% Wind.95/98,WinNT,MacOS7.5+	% Wind.3.0/3.1,OS/2,Mac-OS <7.5	% MS DOS(3.1-7.0)without Wind.	% Other Operating Systems
Belgium-French *	46 (2.6)	47 (2.6)	6 (1.1)	1 (0.4)	53 (2.9)	40 (2.8)	7 (1.3)	0 (0.1)
Bulgaria	10 (1.4)	24 (1.8)	32 (1.9)	33 (2.4)	16 (1.7)	20 (1.7)	38 (2.2)	30 (2.3)
Canada *	49 (1.2)	42 (1.1)	8 (0.6)	2 (0.3)	55 (1.1)	42 (1.1)	10 (0.7)	3 (0.6)
China Hong Kong	87 (1.0)	13 (1.0)	0 (0.1)	0 (0.0)	86 (0.8)	15 (1.0)	4 (0.8)	1 (0.4)
Chinese Taipei	72 (1.5)	26 (1.4)	2 (0.3)	0 (0.0)	79 (1.4)	5 (0.7)	14 (1.3)	0 (0.2)
Cyprus	41 (3.0)	51 (3.4)	7 (2.1)	~	32 (1.3)	62 (1.5)	8 (1.9)	20 (5.9)
Czech Republic	41 (2.7)	56 (2.7)	3 (0.8)	0 (0.0)	55 (2.3)	47 (2.5)	12 (1.8)	1 (0.8)
France	53 (1.6)	43 (1.5)	4 (0.6)	0 (0.2)	53 (1.7)	43 (1.7)	4 (0.6)	0 (0.1)
Iceland	86 (1.6)	12 (1.4)	1 (0.5)	0 (0.2)	81 (1.4)	13 (1.1)	1 (0.5)	2 (0.4)
Israel *	51 (4.6)	46 (4.6)	3 (1.2)	1 (0.4)	53 (3.0)	40 (3.2)	13 (2.8)	5 (2.3)
Italy *	58 (2.4)	33 (2.3)	8 (1.3)	1 (0.4)	65 (2.1)	25 (1.9)	11 (1.7)	2 (0.8)
Japan	47 (3.5)	35 (3.4)	17 (2.8)	1 (0.8)	50 (3.0)	20 (2.6)	38 (3.2)	7 (2.1)
Latvia *	47 (7.3)	34 (6.3)	8 (3.4)	11 (3.5)	66 (2.7)	42 (3.5)	16 (3.5)	15 (5.3)
Lithuania	27 (0.8)	45 (0.9)	13 (0.6)	14 (0.7)	41 (0.9)	33 (0.9)	15 (0.6)	12 (0.7)
Luxembourg	73 (2.8)	24 (2.8)	3 (0.9)	0 (0.0)	71 (3.4)	28 (3.2)	1 (0.4)	0 (0.0)
Norway	57 (1.1)	42 (1.1)	1 (0.2)	0 (0.0)	61 (0.9)	39 (1.0)	2 (0.3)	0 (0.2)
Russian Federation *	15 (3.0)	19 (3.7)	11 (2.7)	55 (4.7)	17 (3.3)	11 (2.8)	20 (3.8)	38 (4.6)
Singapore	83 (1.4)	17 (1.4)	0 (0.1)	0 (0.0)	92 (0.0)	7 (0.8)	0 (0.0)	1 (0.2)
Slovak Republic *	12 (5.9)	27 (10.3)	23 (5.4)	38 (10.1)	40 (1.9)	49 (2.5)	44 (2.5)	39 (16.2)
Slovenia *	58 (2.3)	40 (2.3)	2 (0.5)	0 (0.0)	82 (1.9)	16 (1.9)	1 (0.4)	0 (0.1)
South Africa *	39 (4.2)	47 (4.3)	12 (2.8)	3 (1.5)	45 (4.4)	34 (4.3)	25 (4.1)	5 (2.5)

Notes: Percentage per school calculated as : (total number of particular type divided by total number of computers available at the grade range)*100. Standard error (se): value = +/-2*se provides 95% confidence interval for the population. *: countries that did not astisfy all sampling criteria, ~ :data

Appendix 4.5

Percentages of schools possessed particular peripherals for use at the grade ranges-primary, lower secondary, and upper secondary education.

Country	Primary Education: 1. Laser printer	2. CD-ROM drive	3. Devices for disables students	4. Devices digital image processing	5. Color printer	6. CD-Writer	7. Graphic tables	8. Video projector	9. Scanner	10. LCD-Panel	% available periph. from list of 10	Lower Secondary Education: 1. Laser printer	2. CD-ROM drive	3. Devices for disables students	4. Devices digital image processing	5. Color printer	6. CD-Writer	7. Graphic tables	8. Video projector	9. Scanner	10. LCD-Panel	% available periph. from list of 10	Upper Secondary Education: 1. Laser printer	2. CD-ROM drive	3. Devices for disables students	4. Devices digital image processing	5. Color printer	6. CD-Writer	7. Graphic tables	8. Video projector	9. Scanner	10. LCD-Panel	% available periph. from list of 10
Belgium~French	~	~	~	~	~	~	~	~	~	~	~	* 29	70	2	10	49	4	6	15	36	10	23 (1.4)	* 50	86	0	9	54	6	6	17	46	16	29 (1.2)
Bulgaria	~	~	~	~	~	~	~	~	~	~	~	26	44	0	1	20	1	1	0	14	0	11 (0.5)	19	36	0	1	21	1	1	1	9	0	9 (0.7)
Canada	* 79	97	16	33	65	4	1	17	47	13	37 (0.5)	* 91	95	22	55	65	19	11	48	67	28	50 (0.6)	* 97	98	26	74	77	33	17	54	83	34	59 (0 6)
China Hong Kong	52	79	1	8	79	9	2	27	71	6	34 (1.4)	83	91	0	21	86	12	7	56	85	66	51 (0.7)	94	96	0	25	92	15	6	57	92	70	55 (0 5)
Chinese Taipei	24	44	0	1	50	2	2	4	14	0	14 (1.1)	44	57	1	5	75	6	0	12	40	0	24 (1.0)	42	70	4	6	69	11	6	34	46	8	30 (1.1)
Cyprus	5	93	0	0	88	0	0	8	17	0	21 (1.3)	8	56	0	0	77	0	0	5	0	0	15 (0.7)	99	99	2	0	26	0	0	28	40	6	30 (0.5)
Czech Republic	~	~	~	~	~	~	~	~	~	~	~	31	79	2	3	51	3	1	10	27	7	21 (0.9)	79	90	1	11	70	15	11	27	70	24	40 (1.1)
Denmark	~	~	~	~	~	~	~	~	~	~	~	96	98	9	65	78	21	2	18	94	7	49 (0.9)	~	~	~	~	~	~	~	~	~	~	~
Finland	79	98	13	25	73	7	2	9	58	1	37 (1.1)	99	98	8	43	87	19	3	19	91	4	47 (0.7)	~	~	~	~	~	~	~	~	~	~	~
France	* 20	80	0	8	71	1	2	5	40	0	23 (0 8)	37	97	1	27	90	15	23	13	77	9	39 (0.8)	68	98	2	27	85	19	30	33	75	32	47 (1.1)
Hungary	~	~	~	~	~	~	~	~	~	~	~	35	88	2	9	48	4	0	3	41	3	23 (0.8)	~	~	~	~	~	~	~	~	~	~	~
Iceland	80	89	16	23	65	2	0	77	65	1	42 (1.5)	86	93	15	24	70	1	0	75	74	1	44 (0.8)	100	95	26	25	60	25	0	71	70	0	47 (1 2)
Israel	* 28	77	9	9	87	3	4	16	58	3	29 (1.5)	* 42	90	10	19	91	9	11	36	78	6	39 (1.6)	* 49	89	13	16	91	17	6	56	76	6	42 (1 4)
Italy	20	76	16	29	73	26	7	13	66	4	33 (1.6)	* 55	89	15	36	77	42	15	55	74	21	48 (1.7)	* 63	92	17	48	85	56	24	61	84	20	55 (1 6)
Japan	38	68	0	30	71	5	9	32	57	4	32 (1.5)	63	79	4	43	76	12	14	50	70	6	42 (1.4)	84	87	0	35	66	21	6	43	66	5	41 (1 5)
Latvia	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	* 62	90	1	5	67	4	0	10	45	3	29 (1 1)
Lithuania	~	~	~	~	~	~	~	~	~	~	~	10	59	0	2	23	2	1	5	16	0	12 (0.7)	14	58	0	3	22	2	1	3	13	1	12 (0 2)
Luxembourg	~	~	~	~	~	~	~	~	~	~	~	100	100	0	45	86	34	39	94	100	74	67 (1.9)	94	98	0	41	84	35	36	91	94	74	65 (1 9)
New Zealand	33	98	21	48	91	6	1	12	52	1	36 (1.1)	* 92	94	16	53	66	10	10	29	74	9	45 (0.9)	~	~	~	~	~	~	~	~	~	~	~
Norway	58	86	34	15	72	2	4	6	37	3	32 (0.5)	82	89	28	26	72	6	2	21	65	12	40 (0.3)	96	92	37	43	77	30	23	66	85	62	61 (0.5)
Russian Federation	~	~	~	~	~	~	~	~	~	~	~	* 13	37	0	0	20	0	0	8	10	0	9 (1.2)	* 13	37	0	0	20	0	0	8	10	0	9 (1.2)
Singapore	44	100	0	52	98	16	1	75	72	56	51 (1.2)	82	99	3	56	97	34	7	82	96	44	60 (0 0)	96	96	0	82	84	61	30	98	100	67	71 (0 0)
Slovak Republic	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	* 42	87	1	6	56	1	2	8	35	16	25 (1.0)
Slovenia	72	84	1	22	79	6	8	29	53	46	40 (1.8)	75	92	3	25	89	11	14	36	61	54	46 (1.4)	* 97	100	0	23	85	14	2	47	77	82	53 (1.0)
South Africa	~	~	~	~	~	~	~	~	~	~	~	* 47	67	0	10	47	6	2	15	38	7	24 (2 0)	* 58	70	1	5	51	5	0	15	44	6	25 (1.8)
Thailand	~	~	~	~	~	~	~	~	~	~	~	19	52	1	18	34	4	0	15	22	9	17 (0.7)	~	~	~	~	~	~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria. Last column: average percentage (standard errors in brackets) of available peripherals across schools. Standard error (se): value ± 2*se provides 95% confidence interval for the population. ~ :no data collected

Appendix 4 6
Percentages of schools possessed software for school subjects for use at the grade range primary education

Country	1. Mathematcis	2. Physics	3. Chemistry	4. Biology/Life science	5. Earth Science	6. Language/Mother tongue	7. Foreign Language	8. Creative arts	9. History	10. Civics	11. Economics	12. Geography	13. Vocational subjects	14 Comp education/Informatics	15. Multidisciplinary projects
Canada *	87	7	6	44	47	56	24	36	41	5	3	64	3	22	40
China Hong Kong	59	10	5	10	30	53	37	18	35	15	~	17	~	37	10
Chinese Taipei	36	2	1	8	8	33	16	15	2	4	~	3	~	46	7
Cyprus	99	0	0	4	0	89	5	59	91	0	~	58	~	7	7
Finland	95	10	6	75	~	85	82	30	54	6	~	54	~	17	19
France *	72	1	0	29	25	78	9	20	28	10	~	40	~	6	8
Iceland	90	24	5	32	15	85	67	27	16	33	2	58	0	34	28
Israel *	67	9	3	44	32	65	58	19	23	9	~	37	~	8	24
Italy	40	3	2	25	18	51	46	36	32	10	~	32	~	16	31
Japan	69	~	~	~	~	54	~	59	~	~	~	~	~	27	17
New Zealand	86	5	4	30	31	65	8	47	42	4	~	51	~	20	33
Norway	95	13	5	24	5	95	56	31	34	39	5	63	1	7	11
Singapore	100	87	70	84	60	99	4	82	89	68	~	51	~	18	47
Slovenia	84	4	2	13	4	51	22	19	1	1	~	4	~	26	4

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix.4.7

Percentages of schools possessed software for school subjects for use at the grade range-lower secondary education

Country	1. Mathematcis	2. Physics	3. Chemistry	4. Biology/Life science	5. Earth Science	6. Language/Mother tongue	7. Foreign Language	8. Creative arts	9. History	10. Civics	11. Economics	12. Geography	13. Vocational subjects	14. Comp. education/Informatics	15. Multidisciplinary projects
Belgium-French *	52	13	10	29	15	72	36	6	10	0	8	20	23	36	6
Bulgaria	19	14	9	15	4	2	17	11	3	0	2	9	1	37	2
Canada *	77	29	26	50	33	39	32	34	36	9	12	57	27	53	31
China Hong Kong	44	37	24	31	9	36	30	15	23	14	7	23	6	63	6
Chinese Taipei	13	15	11	9	9	7	19	14	1	1	0	1	23	72	6
Cyprus	4	0	0	0	0	1	4	5	4	0	0	1	13	13	27
Czech Republic	86	75	67	71	11	75	67	17	40	7	2	78	7	49	4
Denmark	96	76	59	41	15	93	82	47	24	46	11	60	3	27	29
Finland	67	54	57	49	~	42	86	24	29	18	16	30	14	47	15
France	68	23	15	40	28	53	40	22	33	8	3	35	13	36	15
Hungary	44	36	30	26	11	21	44	23	23	3	1	29	2	52	5
Iceland	89	34	17	37	25	90	88	26	26	41	5	63	4	55	28
Israel *	79	51	28	58	39	59	66	25	47	15	5	47	22	23	22
Italy *	81	51	28	19	14	36	45	19	16	8	16	14	26	47	24
Japan	76	~	~	~	~	39	47	50	~	1	~	~	77	40	6
Lithuania	71	72	20	18	~	58	50	16	16	2	9	44	1	82	2
Luxembourg	53	18	15	23	~	15	0	13	8	0	3	54	18	43	18
New Zealand *	72	41	34	47	30	52	46	52	33	3	43	43	~	39	18
Norway	85	26	18	27	5	86	70	26	29	37	5	51	16	19	10
Russian Federation *	28	23	10	9	1	12	23	10	13	0	1	10	5	38	4
Singapore	99	99	99	91	74	98	13	72	98	63	~	98	64	66	43
Slovenia	69	91	70	71	70	85	74	38	40	2	2	57	13	48	13
South Africa *	51	18	16	26	11	24	6	5	16	0	1	24	17	27	12
Thailand	18	10	10	10	8	9	26	6	3	11	1	4	4	40	8

Notes. *: countries that did not satisfy all sampling criteria ~: no data collected

Appendix 4.8

Percentages of schools possessed software for school subjects for use at the grade range-upper secondary education

Country	1. Mathematcis	2 Physics	3. Chemistry	4. Biology/Life science	5. Earth Science	6. Language/Mother tongue	7. Foreign Language	8. Creative arts	9 History	10. Civics	11. Economics	12. Geography	13. Vocational subjects	14. Comp. education/Informatics	15. Multidisciplinary projects
Belgium-French *	55	29	32	30	12	38	39	11	20	2	31	27	38	41	13
Bulgaria	19	13	6	7	3	2	12	6	1	0	8	4	21	55	4
Canada *	79	61	58	68	35	46	39	61	44	11	25	64	39	75	43
China Hong Kong	43	47	30	37	7	30	26	11	19	12	6	26	5	69	6
Chinese Taipei	7	6	5	5	5	6	12	4	4	1	0	4	29	72	8
Cyprus	15	95	17	14	1	0	6	6	30	0	0	10	4	30	0
Czech Republic	42	38	29	24	4	33	64	9	23	7	38	31	34	71	8
France	56	50	39	45	37	25	42	19	27	6	30	28	65	50	12
Iceland	83	43	30	54	56	56	76	21	26	27	5	25	1	75	4
Israel *	60	55	39	45	21	31	49	24	38	21	9	25	17	16	25
Italy *	75	42	20	16	11	40	42	18	22	7	22	12	36	50	34
Japan	38	~	~	~	~	19	25	13	~	~	~	~	34	19	3
Latvia *	31	25	12	2	7	36	10	34	33	32	32	29	4	50	9
Lithuania	64	67	25	25	~	51	49	13	15	2	13	39	2	78	8
Luxembourg	81	61	67	27	~	21	6	0	7	0	48	17	35	30	22
Norway	49	52	34	27	5	58	59	20	13	47	38	15	42	47	11
Russian Federation *	38	30	19	15	3	11	22	14	15	1	10	14	3	69	3
Singapore	82	62	49	62	15	85	11	23	36	27	72	35	75	94	64
Slovak Republic *	25	35	23	10	3	12	39	7	6	1	22	25	44	76	9
Slovenia *	70	67	37	17	39	24	34	14	17	0	8	20	53	80	5
South Africa *	51	18	17	27	14	15	7	9	13	0	3	20	11	43	7

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix 4.9

Percentages of school principals reported that a particular problem was a major obstacle in realizing the school's ICT-related objectives for students in the grade range-primary education

Country	1. Not enough computers available	2. Not enough copies software	3. Not enough variety of software	4. Insufficient teacher-time	5. Difficult to integrate in instruc.	6. Not enough supervision staff	7. Scheduling comp. time	8. Difficult use low achieving stud.	9. WWW: no time school schedule	10. WWW: no time teach. explores	11. Not enough space to locate	12. Lack of interest of teachers	13. Teachers lack knowledge/skills	14. Not enough training opportun.	15. No plan prevent theft/vandalis.	16. Lack support school board	17. Telecom infrastructure weak	18. Major obstacles: other
Canada *	66	46	60	77	54	51	52	15	26	64	29	18	67	62	7	22	28	8
China Hong Kong	81	87	79	80	62	64	54	30	50	56	57	24	76	80	25	23	25	5
Chinese Taipei	83	67	50	58	60	67	56	27	34	33	42	23	56	59	29	28	26	2
Cyprus	86	58	70	89	79	49	86	22	37	28	52	27	66	17	18	15	20	0
Finland	67	44	46	54	36	54	52	16	22	53	23	31	72	43	5	19	18	6
France *	80	69	63	60	59	57	55	16	26	41	28	22	79	71	17	5	23	11
Iceland	71	39	47	52	27	44	67	11	41	55	36	25	45	38	3	11	24	4
Israel *	80	45	52	53	31	40	53	20	29	35	19	13	60	29	21	9	26	13
Italy	76	56	20	38	44	31	21	13	21	27	27	29	49	47	31	10	25	5
Japan	65	51	60	62	33	58	26	6	36	2	20	29	56	44	7	31	30	0
New Zealand	68	36	39	67	58	43	41	24	26	64	34	20	58	49	7	3	11	11
Norway	82	37	54	52	51	33	33	13	34	34	28	18	69	54	10	26	18	~
Singapore	56	37	63	66	37	45	66	26	54	63	70	21	38	11	22	1	27	7
Slovenia	75	45	63	27	47	45	54	45	50	34	35	20	64	13	6	1	16	5

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix 4.10

Percentages of school principals reported that a particular problem was a major obstacle in realizing the school's ICT-related objectives for students in the grade range-lower secondary education

Country	1. Not enough computers available	2. Not enough copies software	3. Not enough variety of software	4. Insufficient teacher-time	5. Difficult to integrate in instruc.	6. Not enough supervision staff	7. Scheduling comp. time	8. Difficult use low achieving stud.	9. WWW: no time school schedule	10. WWW: no time teach. explores	11. Not enough space to locate	12. Lack of interest of teachers	13. Teachers lack knowledge/skills	14. Not enough training opportun.	15. No plan prevent theft/vandalis.	16. Lack support school board	17. Telecom infrastructure weak	18. Major obstacles: other
Belgium-French *	85	75	55	47	67	65	60	16	56	51	37	27	73	37	19	1	22	4
Bulgaria	95	63	77	33	52	41	49	16	30	31	23	17	71	61	11	9	20	14
Canada *	69	46	55	69	57	41	68	12	21	61	27	21	64	62	8	17	32	6
China Hong Kong	80	88	77	83	57	59	73	24	56	60	58	21	62	69	26	14	31	6
Chinese Taipei	60	70	57	59	71	69	46	38	25	25	20	26	59	54	26	18	21	2
Cyprus	90	49	55	72	88	77	58	32	51	46	56	19	75	44	18	33	44	7
Czech Republic	83	36	52	57	67	52	52	13	34	32	28	45	69	19	14	29	11	12
Denmark	65	34	53	17	65	39	40	32	37	52	31	7	65	41	18	8	5	2
Finland	72	37	48	49	46	40	70	13	21	42	28	30	79	38	6	14	7	3
France	72	66	54	48	76	55	58	20	47	45	27	41	85	48	9	3	18	11
Hungary	70	55	56	46	57	44	49	13	35	39	26	18	68	41	6	0	29	8
Iceland	63	32	52	50	32	50	74	4	37	51	23	25	40	39	4	14	19	5
Israel *	65	62	67	60	42	42	65	20	45	32	28	26	63	29	33	8	28	7
Italy *	54	50	11	57	57	49	42	17	53	51	31	26	45	50	18	9	26	6
Japan	63	51	67	70	42	60	45	10	41	3	15	29	60	49	12	25	41	4
Lithuania	92	72	~	32	52	28	60	23	46	41	17	46	78	46	16	9	18	11
Luxembourg	65	33	14	41	81	83	62	53	70	23	46	59	80	29	22	17	9	26
New Zealand *	64	38	34	76	70	26	71	13	26	63	34	18	69	54	6	1	11	10
Norway	77	34	52	54	66	39	42	12	28	36	17	17	70	49	14	27	14	~
Russian Federation *	92	69	80	37	53	46	68	~	~	~	42	25	69	41	8	65	26	8
Singapore	63	46	76	78	43	62	66	15	57	66	44	18	42	17	23	1	21	5
Slovenia	71	52	64	37	39	47	63	37	54	36	33	15	60	14	6	4	17	5
South Africa *	76	64	57	59	58	51	42	45	40	29	52	57	58	34	11	14	9	4
Thailand	90	75	79	57	40	77	64	35	42	34	21	20	71	65	24	64	35	6

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix 4.11

Percentages of school principals reported that a particular problem was a major obstacle in realizing the school's ICT-related objectives for students in the grade range-upper secondary education

Country	1. Not enough computers available	2. Not enough copies software	3. Not enough variety of software	4. Insufficient teacher-time	5. Difficult to integrate in instruc.	6. Not enough supervision staff	7. Scheduling comp. time	8. Difficult use low achieving stud.	9. WWW: no time school schedule	10. WWW: no time teach. explores	11. Not enough space to locate	12. Lack of interest of teachers	13. Teachers lack knowledge/skills	14. Not enough training opportun.	15. No plan prevent theft/vandalis.	16. Lack support school board	17. Telecom infrastructure weak	18. Major obstacles: other
Belgium-French *	77	73	50	46	62	60	59	10	50	45	40	27	70	34	15	1	21	4
Bulgaria	95	58	78	29	53	35	46	16	28	24	16	16	62	64	10	5	17	17
Canada *	72	53	53	73	57	46	73	8	25	64	31	18	61	66	11	16	29	8
China Hong Kong	79	87	79	81	61	57	68	23	59	59	56	21	62	67	25	11	31	7
Chinese Taipei	38	45	45	51	72	48	46	24	21	19	28	23	45	51	18	17	11	2
Cyprus	78	44	60	90	81	58	66	30	57	46	27	53	94	70	10	26	49	9
Czech Republic	63	39	55	59	70	30	53	7	31	26	21	31	53	22	13	20	18	16
France	58	56	42	42	70	59	56	27	55	44	35	28	73	43	27	2	17	14
Iceland	80	61	61	46	34	64	51	2	26	29	39	8	56	49	0	11	10	0
Israel *	57	37	66	63	54	47	68	28	64	43	24	33	67	26	27	9	19	6
Italy *	55	51	13	54	65	56	40	17	51	49	26	26	54	47	19	4	27	2
Japan	51	39	49	58	34	56	48	8	37	1	19	29	53	55	9	18	40	3
Latvia *	87	79	73	67	48	48	62	22	34	48	32	6	78	39	10	27	33	19
Lithuania	93	76	~	28	53	28	61	28	42	45	17	49	75	42	17	11	17	14
Luxembourg	56	38	17	47	61	60	58	25	72	39	42	26	47	36	17	16	14	27
Norway	61	27	30	53	75	39	62	13	25	35	28	22	58	47	17	28	5	~
Russian Federation	92	69	80	36	53	46	68	~	~	~	43	24	69	42	8	65	26	7
Singapore	48	28	46	88	56	38	36	17	32	37	39	30	65	25	11	3	18	6
Slovak Republic *	92	68	77	47	61	36	44	15	45	44	37	22	57	44	27	17	21	8
Slovenia *	80	64	57	52	40	49	83	30	41	39	44	15	59	19	17	2	16	9
South Africa *	67	59	52	54	66	54	71	31	54	59	29	29	68	56	20	17	12	11

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix 4.12

Percentages of technology coordinators reported that a particular problem was a major obstacle in realizing the school's ICT-related objectives for students in the grade range-primary education

Country	1. Insufficient number of computers	2. Insufficient peripherals	3. Outdated local school network	4. Not enough copies of software	5. Software too complicated to use	6. Software not adaptable enough	7. Lack info about software	8. Softw. not in language instruc.	9. Software culturally incompatible	10. Softw. curriculum incompatible	11. WWW: not enough simult. acc.	12. WWW: slow netw. performance	13. WWW: complicated to connect	14. Materials WWW poor quality	15. WWW: Insuffic. techn. support	16. WWW: Difficult finding info	17. WWW: Information overload	18. WWW: mail baskets overload	19. WWW: not enough connections	20. Lack of technical assistance	21. Lack administrative assistance	22. Stud. know more than teachers	23. Quality teacher training too low	24. No plans prevent theft/vandal.	25. Weak infrastruct.(telecomm.,..)
Canada *	68	53	32	57	13	30	42	5	4	13	53	42	9	9	49	32	37	3	41	64	13	35	39	6	29
China Hong Kong	76	47	50	81	10	54	53	52	45	65	41	14	8	3	47	7	6	2	25	83	37	17	56	19	39
Chinese Taipei	74	63	50	81	9	35	35	18	5	34	40	62	6	20	21	12	9	1	32	42	26	2	17	13	57
Cyprus	67	66	71	72	19	33	31	49	29	47	53	8	5	5	23	5	11	0	30	68	10	44	47	3	53
Finland	69	53	24	56	14	17	31	13	12	13	48	21	4	20	35	36	36	4	58	56	26	12	28	4	24
France *	80	61	44	70	6	18	65	3	4	5	63	13	5	3	21	22	10	4	13	53	27	16	59	16	23
Iceland	59	35	33	38	10	16	31	34	8	10	39	23	4	7	34	29	21	3	44	37	33	24	21	4	27
Israel *	60	61	45	41	5	53	28	11	6	5	61	23	8	10	23	19	15	3	38	50	8	31	47	21	28
Italy	76	50	32	61	7	21	34	15	3	5	34	8	7	2	12	8	6	1	11	35	48	34	24	32	41
Japan	73	53	45	65	11	25	32	3	3	3	61	11	6	3	29	18	12	1	24	51	29	1	7	7	43
New Zealand	66	47	48	43	13	28	36	5	15	21	66	19	8	12	38	36	31	7	38	56	22	28	40	3	26
Norway	77	61	59	39	15	13	27	4	6	7	67	17	7	6	23	26	22	2	45	51	9	27	34	10	28
Singapore	58	55	63	26	9	56	25	6	37	52	71	43	11	6	31	26	33	18	34	42	22	32	37	30	52
Slovenia	60	39	43	35	3	26	44	26	22	20	54	31	2	6	15	14	17	1	47	23	7	37	32	6	36

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected

Appendix 4 13

Percentages of technology coordinators reported that a particular problem was a major obstacle in realizing the school's ICT related objectives for students in the grade range lower secondary education

Country	1 Insufficient number of computers	2 Insufficient peripherals	3 Outdated local school network	4 Not enough copies of software	5 Software too complicated to use	6 Software not adaptable enough	7 Lack info about software	8 Softw not in language instruc	9 Software culturally incompatible	10 Softw curriculum incompatible	11 WWW not enough simult acc	12 WWW slow netw performance	13 WWW complicated to connect	14 Materials WWW poor quality	15 WWW Insuffic techn support	16 WWW Difficult finding info	17 WWW Information overload	18 WWW mail baskets overload	19 WWW not enough connections	20 Lack of technical assistance	21 Lack administrative assistance	22 Stud know more than teachers	23 Quality teacher training too low	24 No plans prevent theft/vandal	25 Weak infrastruct (telecomm.)
Belgium-French *	73	56	53	66	6	26	55	12	10	22	65	23	16	6	25	32	20	3	31	38	5	34	25	17	33
Bulgaria	90	82	80	47	6	40	30	26	6	11	48	24	13	2	19	12	6	1	24	48	6	20	29	9	23
Canada *	62	42	29	53	13	30	36	4	4	15	40	52	8	10	51	21	32	3	26	68	16	49	48	13	33
China Hong Kong	66	56	67	84	12	51	42	44	37	61	66	52	9	8	59	17	16	3	54	83	39	20	51	24	50
Chinese Taipei	60	68	51	76	9	39	32	16	6	28	32	67	1	22	32	10	9	0	30	42	29	3	18	17	42
Cyprus	96	77	67	52	12	28	27	41	4	14	57	3	2	2	23	5	5	2	11	35	23	23	35	39	49
Czech Republic	76	66	41	35	5	14	35	7	2	2	59	24	10	2	15	5	6	5	29	30	3	39	13	9	21
Denmark	60	43	30	34	11	14	41	8	23	16	45	16	6	20	20	44	34	3	32	44	16	55	33	16	20
Finland	70	47	20	50	16	22	37	11	14	16	34	19	2	15	25	32	49	6	30	47	19	14	34	16	17
France	72	67	57	71	14	16	59	5	5	7	72	27	9	8	38	23	22	2	34	60	11	33	46	16	25
Hungary	66	58	49	69	4	27	40	30	12	17	35	18	4	6	45	12	3	1	36	47	6	17	19	8	34
Iceland	60	35	23	40	11	10	29	33	9	11	26	21	3	6	33	15	11	3	29	40	31	21	25	11	20
Israel *	62	54	45	43	8	54	28	10	10	11	57	34	11	12	28	24	17	3	37	45	6	35	47	32	30
Italy *	52	39	35	52	11	27	29	13	6	6	54	22	7	8	35	19	16	4	37	44	46	43	43	24	36
Japan	60	54	56	65	16	29	30	1	2	1	66	13	10	6	31	24	18	1	34	50	33	2	14	13	57
Lithuania	87	70	60	57	7	42	48	56	16	24	71	33	15	7	52	15	8	6	53	35	8	29	26	19	31
Luxembourg	55	32	30	38	0	0	41	20	12	18	24	0	0	9	29	12	29	0	24	72	11	28	20	43	15
New Zealand *	69	45	33	48	13	27	38	3	10	24	56	31	7	15	47	31	39	3	41	62	24	50	47	9	31
Norway	71	57	45	46	16	18	30	4	7	8	56	26	5	9	30	36	38	2	49	53	10	36	39	19	25
Russian Federation	86	91	65	53	4	35	37	14	8	15	~	~	~	~	~	~	~	~	~	63	20	18	13	5	30
Singapore	61	36	60	48	13	67	36	1	26	53	75	51	11	9	60	34	39	24	42	77	22	32	30	34	50
Slovenia	59	47	48	37	3	27	48	24	22	22	63	32	3	6	16	14	17	1	52	23	7	55	33	8	37
South Africa *	69	53	49	49	13	32	39	22	15	26	59	30	9	9	34	20	20	8	29	49	31	33	51	13	16
Thailand	91	89	76	76	22	27	45	32	14	24	62	33	16	6	43	20	7	3	33	70	31	6	16	23	35

Notes * countries that did not satisfy all sampling criteria ~ no data collected

Appendix 4.14

Percentages of technology coordinators reported that a particular problem was a major obstacle in realizing the school's ICT-related objectives for students in the grade range-upper secondary education

Country	1. Insufficient number of computers	2. Insufficient peripherals	3. Outdated local school network	4. Not enough copies of software	5. Sotware too complicated to use	6. Software not adaptable enough	7. Lack info about software	8. Softw. not in language instruc.	9. Software culturally incompatible	10. Softw. curriculum incompatible	11. WWW: not enough simult. acc.	12. WWW: slow netw. performance	13. WWW: complicated to connect	14. Materials WWW poor quality	15. WWW: Insuffic. techn. support	16. WWW: Difficult finding info	17. WWW: information overload	18. WWW: mail baskets overload	19. WWW: not enough connections	20. Lack of technical assistance	21. Lack administrative assistance	22. Stud. know more than teachers	23. Quality teacher training too low	24. No plans prevent theft/vandal.	25. Weak infrastruct.(telecomm.,)
Belgium-French *	67	57	50	70	4	25	52	10	9	20	66	23	18	6	25	34	21	2	34	38	7	42	26	18	32
Bulgaria	95	90	83	55	3	42	23	22	6	11	49	16	11	1	20	11	4	2	12	52	10	29	33	11	26
Canada *	61	48	24	56	14	33	44	3	9	20	38	51	6	9	57	25	41	3	27	72	15	50	53	19	31
China Hong Kong	65	56	67	84	11	50	43	42	35	58	68	51	10	8	60	17	14	3	53	85	41	22	53	22	49
Chinese Taipei	41	55	22	56	9	26	20	17	3	20	31	57	2	19	29	10	20	1	10	31	24	5	20	19	27
Cyprus	70	80	85	20	3	42	45	32	15	13	75	18	14	14	33	20	14	8	27	49	23	20	83	17	65
Czech Republic	56	55	36	42	7	19	23	10	1	1	56	35	9	3	18	10	9	6	41	25	8	30	17	11	22
France	46	48	50	56	12	18	52	7	5	9	65	32	10	6	43	33	27	4	38	70	14	34	45	24	21
Iceland	53	47	11	19	16	29	15	35	11	5	14	13	0	2	21	15	31	6	16	25	26	28	21	19	2
Israel *	55	53	33	32	12	56	32	18	14	21	48	27	9	8	19	31	27	4	31	32	10	45	55	36	26
Italy *	51	48	36	52	7	22	22	19	5	8	54	19	11	9	26	19	17	4	37	42	45	46	40	24	31
Japan	60	45	50	55	12	30	33	2	2	3	63	12	6	7	23	16	10	1	40	45	28	2	10	16	62
Latvia *	80	70	37	68	3	30	36	43	9	18	63	38	10	7	24	21	8	4	34	33	17	32	33	18	26
Lithuania	86	77	63	54	9	49	52	56	18	30	71	37	23	10	52	19	11	6	55	33	12	29	27	15	30
Luxembourg	58	41	32	43	8	5	37	15	4	16	27	0	0	8	30	16	27	0	22	72	12	49	42	47	19
Norway	49	41	36	39	16	12	17	3	5	9	23	38	3	8	21	33	38	3	15	43	15	42	34	21	18
Russian Federation	86	91	65	52	4	35	37	14	8	15	~	~	~	~	~	~	~	~	~	63	20	18	13	5	30
Singapore	45	40	33	21	10	57	38	0	11	54	47	46	5	10	52	27	65	32	44	43	17	31	49	20	40
Slovak Republic *	86	86	51	64	7	28	34	17	12	25	70	43	18	1	41	12	8	6	18	55	28	31	54	15	32
Slovenia *	69	71	50	45	4	33	40	27	14	21	55	37	12	4	33	16	21	6	42	45	15	45	37	30	34
South Africa *	58	54	48	51	9	25	31	21	8	22	66	34	7	6	24	13	13	6	34	44	34	36	41	18	17

Notes: *: countries that did not satisfy all sampling criteria. ~: no data collected.

Appendix 5.1
Percentage of technology coordinators from schools in primary education who indicated that they were adequately prepared with for supporting ICT activities in particular areas in the school

Country	1. MS-Windows	2. Mac Operating System	3. MS-DOS	4. Word processing	5. Data bases	6. Spreadsheets	7. Subject specific applications	8. Application student progress soft.	9. Didactical integration of ICT	10. Use specific progr. for subjects	11. Eval./select. instruc. softw.	12. Use for individualized learning	13. Use of multimedia applications	14. Adaptation of software	15. Use of e-mail for instruction	16. Use Internet for instruction	17. Use of softw. for presentations
Canada *	64	34	29	91	52	57	65	35	38	66	60	45	55	48	70	73	46
China Hong Kong	84	3	61	89	45	60	24	9	24	12	37	32	50	8	25	31	54
Chinese Taipei	94	4	85	99	57	81	49	36	52	58	66	58	79	27	85	91	71
Cyprus	90	8	55	97	47	62	56	17	60	44	49	24	36	47	53	53	46
Finland	82	6	49	89	31	47	67	11	41	78	59	27	48	17	68	70	28
France *	56	7	33	79	40	53	30	20	15	32	29	24	43	23	20	19	27
Iceland	79	31	43	96	53	64	46	42	41	58	50	62	69	46	80	78	58
Israel *	82	7	42	90	64	38	57	28	66	69	70	57	55	66	44	51	72
Italy	85	3	40	80	40	51	35	11	59	52	50	41	54	31	41	39	38
Japan	46	10	30	68	22	43	39	28	19	38	15	23	24	21	18	23	21
New Zealand	71	40	25	96	64	72	52	30	74	60	61	48	65	42	73	68	53
Norway	70	2	40	87	22	43	41	29	19	31	37	32	43	17	44	45	30
Singapore	100	12	48	96	48	68	79	38	50	78	93	71	81	71	81	83	96
Slovenia	96	6	76	98	52	86	70	29	67	76	55	54	62	58	83	86	69

Notes. ~: no data collected; *: countries that did not satisfy all sampling criteria;
Standard error: value ± 2*se= 95% confid. interval population; all statistics based on schools using computers .

Appendix 5.2
Percentage of technology coordinators from schools in lower secondary education who indicated that they were adequately prepared with for supporting ICT activities in particular areas in the school.

Country	1. MS-Windows	2. Mac Operating System	3. MS-DOS	4. Word processing	5. Data bases	6. Spreadsheets	7. Subject specific applications	8. Application student progress soft.	9. Didactical integration of ICT	10. Use specific progr. for subjects	11. Eval./select. instruc. softw.	12. Use for individualized learning	13. Use of multimedia applications	14. Adaptation of software	15. Use of e-mail for instruction	16. Use Internet for instruction	17. Use of softw. for presentations
Belgium-French *	88	6	75	94	62	74	23	18	20	24	26	22	43	28	59	57	39
Bulgaria	75	17	85	89	70	82	37	21	23	34	56	27	41	38	38	33	26
Canada *	80	30	56	95	74	82	61	46	39	55	59	41	68	55	78	87	70
China Hong Kong	94	10	89	97	85	89	55	10	31	43	50	56	64	26	71	72	82
Chinese Taipei	95	2	93	97	58	74	47	25	44	46	58	43	68	26	82	84	72
Cyprus	70	6	47	70	30	24	78	19	23	20	9	11	29	13	28	33	11
Czech Republic	89	8	79	93	50	78	58	29	33	43	57	49	53	33	36	35	28
Denmark	93	5	64	97	65	89	54	15	41	58	55	45	65	44	72	76	53
Finland	89	3	88	95	76	92	46	13	25	50	33	22	46	23	70	74	49
France	78	4	63	90	53	80	40	26	12	23	20	30	51	26	37	41	43
Hungary	96	4	95	98	74	92	64	69	53	40	59	67	66	41	53	57	51
Iceland	84	30	51	98	55	80	45	47	44	53	52	63	75	47	79	79	69
Israel *	77	8	55	91	79	60	48	37	56	53	53	50	62	64	50	52	77
Italy *	92	6	77	89	59	83	57	16	50	59	53	27	72	48	67	73	60
Japan	58	12	60	77	41	70	48	55	16	38	22	27	28	29	27	30	26
Lithuania	93	8	83	91	57	78	64	26	35	52	50	69	45	57	70	47	45
Luxembourg	88	0	89	87	69	87	27	12	18	21	27	5	24	34	78	81	69
New Zealand *	82	35	60	97	81	88	48	39	67	44	53	30	60	42	80	77	67
Norway	72	2	51	88	32	65	26	13	13	21	27	22	36	11	54	58	38
Russian Federation	70	7	76	88	73	87	54	35	36	50	67	66	29	48	26	20	28
Singapore	98	6	62	100	59	85	76	34	44	61	88	74	75	64	85	85	97
Slovenia	96	6	76	98	52	86	71	28	68	75	55	54	62	58	83	86	69
South Africa *	81	5	77	92	78	88	48	22	24	44	43	24	47	32	56	55	49
Thailand	63	4	53	68	37	50	18	4	4	4	9	19	10	10	10	11	23

Notes. ~: no data collected; *: countries that did not satisfy all sampling criteria; Standard error: value ± 2*se= 95% confid. interval population; all statistics based on schools using computers.

Appendix 5.3
Percentage of technology coordinators from schools in upper secondary education who indicated that they were adequately prepared with for supporting ICT activities in particular areas in the school.

Country	1. MS-Windows	2. Mac Operating System	3. MS-DOS	4. Word processing	5. Data bases	6. Spreadsheets	7. Subject specific applications	8. Application student progress soft.	9. Didactical integration of ICT	10. Use specific progr. for subjects	11. Eval./select. instruc. softw.	12. Use for individualized learning	13. Use of multimedia applications	14. Adaptation of software	15. Use of e-mail for instruction	16. Use Internet for instruction	17. Use of softw. for presentations
Belgium-French *	89	5	78	95	63	77	24	19	21	26	30	24	47	31	63	62	42
Bulgaria	75	10	85	89	66	80	39	20	25	39	48	27	30	36	27	24	21
Canada *	83	30	68	95	79	87	60	50	36	54	61	43	66	56	82	90	70
China Hong Kong	95	10	89	97	85	90	54	10	32	43	51	57	64	26	73	73	83
Chinese Taipei	98	6	96	96	80	90	56	23	41	50	60	38	76	41	93	95	90
Cyprus	93	16	88	96	93	93	69	28	23	13	28	32	64	37	45	42	55
Czech Republic	98	6	97	99	76	97	42	21	26	32	53	34	60	42	65	65	57
France	80	7	70	88	59	79	40	15	14	26	24	27	52	28	47	50	48
Iceland	100	36	97	100	95	100	35	63	48	55	53	36	60	67	75	80	85
Israel *	77	5	70	94	72	62	43	28	53	44	45	40	55	57	63	63	71
Italy *	94	8	79	88	62	85	58	20	53	61	54	24	67	46	58	62	56
Japan	59	8	60	74	46	71	32	47	18	22	17	18	20	29	27	28	22
Latvia *	87	8	57	89	58	74	29	24	26	32	33	35	48	38	48	51	56
Lithuania	93	7	82	95	57	82	65	28	36	52	50	68	43	55	66	46	44
Luxembourg	89	5	90	88	69	87	24	14	18	21	29	7	23	33	80	83	68
Norway	75	4	73	86	51	80	27	9	11	19	18	13	32	9	69	69	56
Russian Federation	70	5	78	87	72	86	53	34	34	48	67	66	29	48	25	20	27
Singapore	99	23	78	99	85	94	78	48	67	80	70	65	76	58	92	92	97
Slovak Republic *	92	9	90	98	86	90	27	17	27	32	18	37	49	47	55	51	31
Slovenia *	100	2	90	99	76	97	34	18	30	31	37	31	70	43	91	89	89
South Africa *	80	1	77	86	73	81	41	20	25	40	41	35	43	29	48	51	52

Notes. ~: no data collected; *: countries that did not satisfy all sampling criteria;
Standard error: value ± 2*se= 95% confid. interval population; all statistics based on schools using computers

Appendix 6.1

Percentage of principals indicated that their school has a written policy or statement with regard to the use of computers for educational purposes by students in the grade range, and the issues included – primary, lower secondary, and upper secondary education.

Final column in each education level: Average values and standard errors (between brackets) for number of policy issues included.

Primary Education

Country	Written policy available	1.Use of comp.current school year	2.Use of comp.next school years	3.Plans hardware replacem./upgrad.	4.Plans staff developm.ICT training	5.Specif.comp.related tasks/pers.	6.Plans for software acquisition	7.Equity of access	8.Internet policy	Mean number of policies (max.8)
Belgium-French	~	~	~	~	~	~	~	~	~	~
Bulgaria	~	~	~	~	~	~	~	~	~	~
Canada	* 55	93	68	64	77	57	63	59	78	5.6 (0.1)
China Hong Kong	38	85	49	26	97	37	64	34	43	4.4 (0.2)
Chinese Taipei	~	~	~	~	~	~	~	~	~	~
Cyprus	39	89	27	43	51	51	26	31	38	3.6 (0.8)
Czech Republic	~	~	~	~	~	~	~	~	~	~
Denmark	~	~	~	~	~	~	~	~	~	~
Finland	49	90	64	26	36	68	20	37	57	4.0 (0.2)
France	* 62	92	73	57	59	10	71	60	63	4.8 (0.1)
Hungary	~	~	~	~	~	~	~	~	~	~
Iceland	46	100	91	70	72	53	37	76	56	5.5 (0.2)
Israel	* ~	~	~	~	~	~	~	~	~	~
Italy	36	80	66	24	85	35	58	3	30	3.8 (0.2)
Japan	49	63	25	9	65	53	22	6	18	2.6 (0.2)
Latvia	~	~	~	~	~	~	~	~	~	~
Lithuania	~	~	~	~	~	~	~	~	~	~
Luxembourg	~	~	~	~	~	~	~	~	~	~
New Zealand	61	87	66	60	76	48	50	73	44	5.1 (0.2)
Norway	~	~	~	~	~	~	~	~	~	~
Russian Federation	~	~	~	~	~	~	~	~	~	~
Singapore	80	97	76	62	95	89	91	62	47	6.2 (0.1)
Slovak Republic	~	~	~	~	~	~	~	~	~	~
Slovenia	53	91	37	84	78	63	81	69	54	5.6 (0.2)
South Africa	~	~	~	~	~	~	~	~	~	~
Thailand	~	~	~	~	~	~	~	~	~	~

Lower Secondary Education

Country	Written policy available	1.Use of comp.current school year	2.Use of comp.next school years	3.Plans hardware replacem./upgrad.	4.Plans staff developm.ICT training	5.Specif.comp.related tasks/pers.	6.Plans for software acquisition	7.Equity of access	8.Internet policy	Mean number of policies (max.8)
Belgium-French	* 34	80	91	67	87	57	45	70	76	5.7 (0.3)
Bulgaria	50	79	79	57	58	53	35	45	69	4.8 (0.2)
Canada	* 67	84	59	57	62	52	51	52	96	5.1 (0.1)
China Hong Kong	42	78	44	58	86	41	59	33	72	4.7 (0.1)
Chinese Taipei	~	~	~	~	~	~	~	~	~	~
Cyprus	24	100	19	13	28	41	13	26	19	2.6 (0.7)
Czech Republic	26	87	51	75	52	62	40	32	30	4.3 (0.3)
Denmark	49	90	82	78	90	54	68	54	64	5.8 (0.2)
Finland	48	86	42	56	46	80	28	29	67	4.3 (0.2)
France	56	85	62	78	87	32	78	57	89	5.7 (0.1)
Hungary	74	75	69	57	74	44	58	35	51	4.6 (0.2)
Iceland	53	97	89	59	57	51	32	74	57	5.1 (0.2)
Israel	* ~	~	~	~	~	~	~	~	~	~
Italy	* 41	81	49	44	65	35	48	6	57	3.8 (0.2)
Japan	54	63	34	23	62	61	38	9	29	3.2 (0.2)
Latvia	~	~	~	~	~	~	~	~	~	~
Lithuania	24	77	67	56	58	36	52	41	40	4.3 (0.3)
Luxembourg	~	~	~	~	~	~	~	~	~	~
New Zealand	* 50	81	59	74	71	55	55	51	80	5.3 (0.2)
Norway	~	~	~	~	~	~	~	~	~	~
Russian Federation	* 55	43	38	26	32	24	22	19	11	2.2 (0.3)
Singapore	78	92	87	82	95	91	91	66	73	6.8 (0.1)
Slovak Republic	~	~	~	~	~	~	~	~	~	~
Slovenia	54	90	36	84	77	63	82	69	54	5.6 (0.2)
South Africa	* 22	80	85	85	60	50	65	35	55	5.2 (0.5)
Thailand	75	79	58	67	84	52	58	56	69	5.2 (0.1)

Upper Secondary Education

Country	Written policy available	1.Use of comp.current school year	2.Use of comp.next school years	3.Plans hardware replacem./upgrad.	4.Plans staff developm.ICT training	5.Specif.comp.related tasks/pers.	6.Plans for software acquisition	7.Equity of access	8.Internet policy	Mean number of policies (max.8)
Belgium-French	* 45	79	72	66	90	57	42	64	89	5.6 (0.2)
Bulgaria	48	84	72	52	49	43	38	28	48	4.1 (0.2)
Canada	* 63	89	59	66	64	59	58	57	94	5.5 (0.1)
China Hong Kong	42	78	44	58	86	41	59	33	72	4.7 (0.1)
Chinese Taipei	~	~	~	~	~	~	~	~	~	~
Cyprus	31	100	88	51	31	53	11	3	70	4.1 (0.6)
Czech Republic	38	80	42	77	49	65	49	41	65	4.7 (0.2)
Denmark	~	~	~	~	~	~	~	~	~	~
Finland	~	~	~	~	~	~	~	~	~	~
France	56	95	66	86	86	41	79	64	90	6.1 (0.1)
Hungary	~	~	~	~	~	~	~	~	~	~
Iceland	68	87	85	64	59	41	34	82	70	5.2 (0.2)
Israel	* ~	~	~	~	~	~	~	~	~	~
Italy	* 50	81	51	48	70	36	53	2	55	4.0 (0.2)
Japan	53	69	40	50	43	63	36	15	34	3.5 (0.2)
Latvia	* 59	86	65	81	76	44	45	45	64	5.1 (0.2)
Lithuania	29	73	52	65	65	32	55	44	55	4.4 (0.2)
Luxembourg	~	~	~	~	~	~	~	~	~	~
New Zealand	~	~	~	~	~	~	~	~	~	~
Norway	~	~	~	~	~	~	~	~	~	~
Russian Federation	* 52	72	59	57	57	47	48	31	19	3.9 (0.3)
Singapore	92	97	82	97	91	76	90	65	90	6.9 (0.1)
Slovak Republic	* 68	92	45	60	48	47	42	15	60	4.1 (0.2)
Slovenia	* 43	88	36	87	78	57	76	58	68	5.5 (0.2)
South Africa	* 25	87	70	73	61	68	55	50	50	5.1 (0.5)
Thailand	~	~	~	~	~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.2

Percentage of principals indicated that the development of a common vision on the use of computers respectively the attention to norms and values in using Internet/WWW is a policy goal, and the percentage of students whose principals indicated that these goals have not or only partially been realized – primary, lower secondary, and upper secondary education.

Country	Primary Education							Lower Secondary Education							Upper Secondary Education						
		Development of a common vision			Paying attention to norms/values using Internet/WWW				Development of a common vision			Paying attention to norms/values using Internet/WWW				Development of a common vision			Paying attention to norms/values using Internet/WWW		
		goal	realized		goal	realized			goal	realized		goal	realized			goal	realized		goal	realized	
		yes	*not*	*partially*	*yes*	*not*	*partially*		*yes*	*not*	*partially*	*yes*	*not*	*partially*		*yes*	*not*	*partially*	*yes*	*not*	*partially*
Belgium-French		~	~	~	~	~	~	*	79	46	49	82	26	36	*	81	44	50	80	25	35
Bulgaria		~	~	~	~	~	~		93	34	55	68	63	19		90	46	47	59	81	11
Canada	*	83	18	55	86	17	27	*	84	17	57	93	5	32	*	85	12	62	93	5	30
China Hong Kong		94	15	75	71	71	23		94	22	72	86	38	52		94	22	72	86	38	52
Chinese Taipei		93	7	59	73	27	46		95	12	64	81	25	46		98	1	60	86	10	49
Cyprus		50	31	53	52	51	27		53	90	10	37	82	14		82	41	56	79	37	41
Czech Republic		~	~	~	~	~	~		84	29	59	48	65	17		90	16	61	73	34	36
Denmark		~	~	~	~	~	~		58	34	60	73	21	44		~	~	~	~	~	~
Finland		91	26	67	95	13	51		89	32	63	98	6	67		~	~	~	~	~	~
France	*	77	55	41	54	82	5		79	57	40	78	51	23		76	43	48	82	39	26
Hungary		~	~	~	~	~	~		94	41	54	91	40	30		~	~	~	~	~	~
Iceland		88	41	44	76	50	39		86	44	47	81	44	39		83	29	61	77	31	43
Israel	*	73	39	43	57	68	18	*	75	36	50	74	49	20	*	73	34	55	88	32	35
Italy		75	36	50	46	55	16	*	69	41	50	72	34	34	*	82	36	54	76	33	25
Japan		72	37	54	41	82	12		71	46	46	47	68	21		70	40	54	52	59	29
Latvia		~	~	~	~	~	~		~	~	~	~	~	~	*	90	27	58	76	52	26
Lithuania		~	~	~	~	~	~		81	56	41	64	57	28		82	53	45	65	57	28
Luxembourg		~	~	~	~	~	~		92	22	61	86	31	24		90	21	63	85	34	23
New Zealand		92	14	56	73	21	43	*	89	11	62	88	9	45		~	~	~	~	~	~
Norway		69	60	31	57	74	19		69	58	35	74	51	40		64	47	47	79	32	56
Russian Federation		~	~	~	~	~	~	*	34	39	48	0	0	0	*	34	39	48	~	~	~
Singapore		99	5	49	80	30	36		94	7	56	83	29	48		96	3	43	96	3	35
Slovak Republic		~	~	~	~	~	~		~	~	~	~	~	~	*	16	24	59	40	40	31
Slovenia		92	13	72	91	18	40		93	15	67	91	16	40	*	80	23	61	83	25	53
South Africa		~	~	~	~	~	~	*	69	50	42	69	41	34	*	64	46	44	64	42	27
Thailand		~	~	~	~	~	~		91	5	45	66	24	41		~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria for this population

Appendx 6.3

Percentage of principals indicated that particular measures have been set up in their school – primary, lower secondary, and upper secondary education.

Final column in each education level: Average values and standard errors (between brackets) for number of measures indicated.

	Primary Education							Lower Secondary Education							Upper Secondary Education						
Country	1.Prevention unauthor. system acc.	2.Honoring intellect.property rights	3.Prohibition acc.adults-only mater.	4.Restrict.game play.school comp.	5.Spec.compuls.stud.comp.knowl.	6.Local community acc.to Internet	Mean number of measures (max.6)	1.Prevention unauthor. system acc.	2.Honoring intellect.property rights	3.Prohibition acc.adults-only mater.	4.Restrict.game play.school comp.	5.Spec.compuls.stud.comp.knowl.	6.Local community acc.to Internet	Mean number of measures (max.6)	1.Prevention unauthor. system acc.	2.Honoring intellect.property rights	3.Prohibition acc.adults-only mater.	4.Restrict.game play.school comp.	5.Spec.compuls.stud.comp.knowl.	6.Local community acc.to Internet	Mean number of measures (max.6)
Belgium~French	~	~	~	~	~	~	~	* 63	48	53	70	25	24	2.8 (0.1)	* 60	49	50	69	24	25	2.8 (0.1)
Bulgaria	~	~	~	~	~	~	~	67	31	38	62	63	15	2.8 (0.1)	69	22	32	63	75	13	2.7 (0.1)
Canada	* 75	75	76	77	47	20	3.7 (0.0)	* 90	79	87	89	42	26	4.1 (0.0)	* 95	84	88	87	38	26	4.2 (0.0)
China Hong Kong	63	69	31	29	47	12	2.5 (0.1)	73	80	59	62	50	6	3.3 (0.0)	73	80	59	62	50	6	3.3 (0.0)
Chinese Taipei	26	73	57	25	48	36	2.6 (0.1)	39	83	70	46	60	28	3.3 (0.1)	60	86	78	69	83	37	4.1 (0.1)
Cyprus	38	28	40	56	56	6	2 2 (0.4)	36	18	32	51	46	12	1.9 (0.2)	70	45	64	88	62	11	3.4 (0 1)
Czech Republic	~	~	~	~	~	~	~	63	64	53	21	40	12	2.6 (0.1)	77	81	68	42	65	13	3.5 (0 1)
Denmark	~	~	~	~	~	~	~	68	98	40	75	37	16	3.3 (0.1)	~	~	~	~	~	~	~
Finland	32	80	38	82	31	16	2.8 (0.1)	58	88	40	84	47	21	3.4 (0.1)	~	~	~	~	~	~	~
France	* 17	28	18	35	23	8	1.3 (0.1)	50	58	46	60	38	15	2.7 (0.1)	65	68	56	69	43	14	3.2 (0.1)
Hungary	~	~	~	~	~	~	~	55	43	46	46	72	29	2.9 (0.1)	~	~	~	~	~	~	~
Iceland	63	49	64	76	18	11	2.8 (0.1)	67	57	73	81	20	11	3.1 (0.1)	93	53	58	96	57	10	3.7 (0.0)
Israel	* 41	47	28	47	31	21	2.1 (0.2)	* 64	55	46	62	42	22	2.9 (0.2)	* 81	68	60	68	60	.28	3.7 (0.1)
Italy	17	23	16	11	5	5	0.8 (0.1)	* 52	53	43	57	18	12	2.3 (0.1)	* 52	51	47	60	31	19	2.6 (0.1)
Japan	2	7	5	7	16	3	0.4 (0.1)	8	17	16	19	34	7	1.0 (0.1)	18	16	14	20	27	9	1.0 (0.1)
Latvia	~	~	~	~	~	~	~	~	~	~	~	~	~	~	* 47	26	34	26	61	36	2.3 (0.1)
Lithuania	~	~	~	~	~	~	~	12	20	36	51	50	22	1.9 (0.1)	16	17	41	54	63	24	2.1 (0.0)
Luxembourg	~	~	~	~	~	~	~	83	77	73	97	75	47	4.5 (0.2)	79	75	72	95	71	44	4.4 (0.2)
New Zealand	61	56	52	70	33	14	2.9 (0.1)	* 91	73	76	88	42	41	4.1 (0.1)	~	~	~	~	~	~	~
Norway	39	33	23	43	19	6	1.6 (0.0)	59	44	36	59	23	15	2.4 (0.0)	83	50	36	72	29	16	2.9 (0.0)
Russian Federation	~	~	~	~	~	~	~	* 33	16	39	26	57	7	1.8 (0.2)	* 33	16	39	26	57	7	1.8 (0.2)
Singapore	78	77	41	76	56	15	3.4 (0.1)	73	66	56	77	68	16	3.6 (0.0)	95	91	88	83	63	28	4.5 (0.0)
Slovak Republic	~	~	~	~	~	~	~	~	~	~	~	~	~	~	* 61	41	47	57	45	16	2.7 (0.1)
Slovenia	55	72	44	66	23	18	2.8 (0.1)	68	85	52	72	28	22	3.3 (0.1)	* 74	64	23	45	47	23	2.8 (0.1)
South Africa	~	~	~	~	~	~	~	* 55	58	45	66	23	22	2.7 (0.2)	* 62	66	63	72	32	26	3.2 (0.2)
Thailand	~	~	~	~	~	~	~	27	32	32	42	29	19	1.8 (0.1)	~	~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.4

Percentage of school principals indicated to what extent computers are being used to keep track of students'learning process and for other student data – primary, lower secondary, and upper secondary education.

Country		Primary Education									Lower Secondary Education									Upper Secondary Education								
		Policy goal: using computers for student data	Using computers for student data			Frequency computer use to keep track of student's learning progress					Policy goal. using computers for student data	Using computers for student data			Frequency computer use to keep track of student's learning progress					Policy goal: using computers for student data	Using computers for student data			Frequency computer use to keep track of student's learning progress			
		yes	not	partially	fully	never	a few times	monthly	weekly/ daily		yes	not	partially	fully	never	a few times	monthly	weekly/ daily		yes	not	partially	fully	never	a few times	monthly	weekly/ daily
Belgium~French		~	~	~	~	~	~	~	~	*	98	1	13	86	51	40	6	2	*	98	1	13	86	52	37	8	2
Bulgaria		~	~	~	~	~	~	~	~		83	52	34	14	72	24	2	1		83	52	36	12	72	23	3	1
Canada	*	78	14	32	54	20	43	15	21	*	92	2	19	79	1	23	18	58	*	94	1	11	88	1	19	16	64
China Hong Kong		79	28	54	18	41	43	16	0		78	21	57	23	21	57	15	6		78	21	57	23	21	57	15	7
Chinese Taipei		70	20	66	14	17	61	20	2		97	2	35	64	11	20	31	38		100	0	27	73	8	17	25	50
Cyprus		74	42	31	27	50	48	3	0		87	0	4	96	9	57	31	3		95	5	4	91	3	56	21	19
Czech Republic		~	~	~	~	~	~	~	~		94	5	22	73	26	65	7	2		95	0	13	87	10	68	18	4
Denmark		~	~	~	~	~	~	~	~		97	1	10	89	8	73	12	6		~	~	~	~	~	~	~	~
Finland		97	11	23	66	26	65	6	3		100	1	4	95	10	49	23	18		~	~	~	~	~	~	~	~
France	*	90	22	33	45	44	43	8	6		97	2	20	78	18	50	25	7		99	2	20	78	27	51	10	11
Hungary		~	~	~	~	~	~	~	~		93	29	38	32	38	55	5	2		~	~	~	~	~	~	~	~
Iceland		94	19	51	30	21	42	22	15		98	17	44	39	15	42	26	17		100	0	10	90	1	18	11	70
Israel	*	72	36	40	24	39	43	13	4	*	90	10	36	54	15	40	32	13	*	94	8	28	64	8	40	32	20
Italy		86	18	23	59	64	27	6	3	*	97	3	19	78	45	39	10	5	*	97	2	17	82	39	38	13	10
Japan		41	47	47	6	~	~	~	~		76	8	50	42	~	~	~	~		84	7	58	35	~	~	~	~
Latvia		~	~	~	~	~	~	~	~		~	~	~	~	~	~	~	~	*	96	12	55	33	30	60	9	1
Lithuania		~	~	~	~	~	~	~	~		81	43	45	13	43	44	10	3		80	45	40	16	45	41	10	4
Luxembourg		~	~	~	~	~	~	~	~		100	0	21	79	43	57	0	0		100	0	23	77	43	57	0	0
New Zealand		73	11	54	35	22	45	12	21	*	95	2	45	53	3	25	20	52		~	~	~	~	~	~	~	~
Norway		95	6	23	71	~	~	~	~		95	5	33	62	~	~	~	~		100	0	6	94	~	~	~	~
Russian Federation		~	~	~	~	~	~	~	~	*	41	60	39	1	70	25	5	0	*	41	60	39	1	71	25	5	0
Singapore		98	2	30	68	5	67	20	7		97	3	44	53	1	72	20	8		100	0	6	94	0	44	20	37
Slovak Republic		~	~	~	~	~	~	~	~		~	~	~	~	~	~	~	~	*	12	3	32	65	16	76	7	2
Slovenia		96	6	42	52	39	48	10	3		97	4	42	54	34	53	9	3	*	100	2	39	59	5	64	28	4
South Africa		~	~	~	~	~	~	~	~	*	91	7	22	71	19	37	21	22	*	92	6	25	69	20	30	20	30
Thailand		~	~	~	~	~	~	~	~		96	1	37	63	32	40	23	6		~	~	~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.5

Percentage of principals indicated that in their schools computers are used for particular administrative activities a few times or more during a school year – primary, lower secondary, and upper secondary education.

Final column: Average values and standard errors (between brackets) for number of activities.

	Primary Education						Lower Secondary Education						Upper Secondary Education					
Country	1. Updating library data	2.Creating/updating less.sched.	3.Staff administration	4.Financial administration	5.Communic.with parents a.o.	Mean no.of activities (max.5)	1. Updating library data	2.Creating/updating less.sched.	3.Staff administration	4.Financial administration	5.Communic.with parents a.o.	Mean no.of activities (max.5)	1. Updating library data	2.Creating/updating less.sched.	3.Staff administration	4.Financial administration	5.Communic.with parents a.o.	Mean no.of activities (max.5)
Belgium~French	~	~	~	~	~	~	* 73	76	99	96	70	4.1 (0.1)	* 75	75	99	95	69	4.1 (0.1)
Bulgaria	~	~	~	~	~	~	20	42	54	50	26	1.9 (0.1)	18	38	59	60	15	1.8 (0.1)
Canada	* 73	62	85	92	89	4.0 (0.0)	* 88	79	94	97	87	4.5 (0.0)	* 93	87	98	98	90	4.7 (0.0)
China Hong Kong	20	58	73	62	36	2.5 (0.1)	80	88	87	81	66	4.0 (0.0)	80	88	87	81	66	4.0 (0.0)
Chinese Taipei	79	80	93	92	71	4.1 (0.1)	75	94	97	99	66	4.3 (0.1)	97	95	97	99	87	4.7 (0.0)
Cyprus	13	44	36	18	51	1.5 (0.3)	20	54	52	17	33	1.8 (0.2)	16	80	70	16	47	2.3 (0.2)
Czech Republic	~	~	~	~	~	~	30	47	94	83	74	3.2 (0.1)	58	72	98	99	91	4.2 (0.1)
Denmark	~	~	~	~	~	~	89	88	99	98	90	4.6 (0.0)	~	~	~	~	~	~
Finland	30	45	75	75	77	3.0 (0.1)	29	90	93	86	79	3.8 (0.1)	~	~	~	~	~	~
France	* 50	49	32	43	79	2.5 (0.1)	93	81	100	99	77	4.5 (0.0)	89	75	99	99	74	4.3 (0.0)
Hungary	~	~	~	~	~	~	49	47	86	82	57	3.2 (0.1)	~	~	~	~	~	~
Iceland	80	92	81	75	87	4.0 (0.1)	79	95	88	77	90	4.2 (0.1)	98	100	91	100	85	4.7 (0.1)
Israel	* 31	33	49	60	45	2.2 (0.1)	* 65	70	74	69	46	3.1 (0.2)	* 77	84	87	89	60	4.0 (0.1)
Italy	44	46	95	91	78	3.5 (0.1)	* 69	64	96	95	81	4.1 (0.1)	* 68	67	94	97	84	4.1 (0.1)
Japan	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Latvia	~	~	~	~	~	~	~	~	~	~	~	~	* 22	50	68	58	48	2.4 (0.1)
Lithuania	~	~	~	~	~	~	14	22	60	47	47	1.8 (0.1)	14	23	58	48	43	1.8 (0.0)
Luxembourg	~	~	~	~	~	~	93	93	100	100	88	4.7 (0.1)	93	90	100	100	85	4.7 (0.1)
New Zealand	83	65	92	90	68	4.0 (0.1)	* 99	92	99	99	83	4.7 (0.0)	~	~	~	~	~	~
Norway	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
Russian Federation	~	~	~	~	~	~	* 5	20	29	15	~	~	* 5	20	29	15	~	~
Singapore	98	81	98	100	87	4.6 (0.0)	100	89	100	100	81	4.7 (0.0)	100	81	99	100	96	4.8 (0.0)
Slovak Republic	~	~	~	~	~	~	~	~	~	~	~	~	* 45	83	94	91	53	3.6 (0.1)
Slovenia	93	54	99	98	73	4.2 (0.1)	94	59	99	98	73	4.2 (0.1)	* 97	90	99	100	89	4.8 (0.0)
South Africa	~	~	~	~	~	~	* 52	49	84	90	74	3.5 (0.1)	* 49	57	88	94	81	3.7 (0.1)
Thailand	~	~	~	~	~	~	48	66	84	92	57	3.5 (0.1)	~	~	~	~	~	~

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.6
Principals' attitude towards ICT in ***primary education****. Average values and standard errors (between brackets) for attitudes.*

Country	1.ICT impact on achievement	2.Relevance of Internet	3.ICT impact school management	4.ICT contribution lifelong learning	5.Make in-serv. ICT train. Compuls.	6.Teach. must acquire ICT certific.	Attitude towards ICT in the school
Canada *	74 (0.5)	85 (0.4)	75 (0.4)	81 (0.4)	83 (0.6)	69 (0.7)	79 (0.4)
China Hong Kong	70 (1.1)	75 (1.1)	75 (1.1)	75 (1.0)	77 (1.6)	66 (1.7)	74 (0.9)
Chinese Taipei	82 (1.2)	87 (1.1)	83 (1.2)	84 (1.2)	88 (1.3)	79 (1.6)	84 (1.2)
Cyprus	81 (2.3)	77 (2.8)	74 (2.8)	78 (2.2)	78 (3.4)	80 (3.2)	77 (1.7)
Finland	60 (1.2)	80 (0.9)	64 (1.0)	70 (0.9)	73 (2.0)	50 (1.8)	68 (0.8)
France *	67 (0.8)	72 (1.0)	71 (0.9)	72 (0.7)	75 (1.7)	68 (1.5)	71 (0.7)
Iceland	72 (1.3)	85 (1.1)	78 (1.4)	80 (1.4)	84 (1.7)	67 (1.9)	79 (1.2)
Israel *	87 (1.2)	86 (1.3)	85 (1.3)	90 (1.1)	95 (1.2)	71 (3.7)	87 (1.0)
Italy	88 (1.1)	84 (1.2)	88 (0.9)	87 (1.1)	85 (1.9)	82 (1.7)	86 (1.0)
Japan	75 (1.5)	69 (1.9)	65 (1.7)	77 (1.4)	80 (2.1)	56 (2.8)	72 (1.4)
New Zealand	71 (1.3)	80 (1.2)	81 (1.1)	81 (1.1)	79 (2.1)	71 (1.9)	79 (1.0)
Norway	69 (0.4)	76 (0.4)	72 (0.4)	75 (0.4)	92 (0.5)	73 (0.8)	74 (0.3)
Singapore	92 (0.7)	94 (0.5)	91 (0.7)	95 (0.5)	94 (0.8)	91 (1.1)	93 (0.5)
Slovenia	70 (1.3)	79 (1.0)	78 (1.1)	73 (1.0)	66 (2.0)	72 (1.9)	75 (0.9)

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.7
Principals' attitude towards ICT in ***lower secondary education****. Average values and standar errors (between brackets) for attitudes.*

Country	1.ICT impact on achievement	2.Relevance of Internet	3.ICT impact school management	4.ICT contribution lifelong learning	5.Make in-serv. ICT train. Compuls.	6.Teach. must acquire ICT certific.	Attitude towards ICT in the school
Belgium-French *	7 (1.2)	5 (0.9)	3 (1.1)	6 (0.9)	9 (1.7)	0 (2.1)	3 (0.8)
Bulgaria	5 (0.5)	4 (0.5)	6 (0.5)	2 (0.5)	9 (0.9)	9 (0.8)	4 (0.5)
Canada *	6 (0.5)	6 (0.4)	1 (0.5)	1 (0.5)	2 (0.7)	7 (0.9)	1 (0.4)
China Hong Kong	5 (0.5)	9 (0.5)	3 (0.5)	4 (0.5)	1 (0.8)	1 (0.8)	3 (0.4)
Chinese Taipei	8 (1.0)	6 (0.9)	1 (0.9)	2 (1.0)	4 (1.4)	0 (1.4)	2 (0.9)
Cyprus	3 (1.2)	4 (1.0)	6 (1.0)	3 (0.9)	2 (1.0)	3 (1.3)	6 (0.7)
Czech Republic	3 (0 9)	5 (0.9)	1 (0.7)	5 (0.8)	6 (1.7)	1 (1.2)	6 (0.6)
Denmark	4 (1.0)	1 (0.9)	0 (0.9)	9 (0.9)	9 (1.1)	7 (1.3)	3 (0.8)
Finland	7 (1.1)	2 (0.6)	0 (0.8)	9 (0.8)	6 (1.7)	7 (1.7)	9 (0.7)
France	7 (0.8)	2 (0.9)	1 (0.9)	4 (0.7)	8 (1.3)	3 (1.3)	1 (0.7)
Hungary	9 (1.0)	2 (0.8)	0 (0.8)	9 (0.8)	9 (1.6)	8 (1.6)	0 (0.7)
Iceland	3 (0.7)	8 (0.5)	0 (0.7)	0 (0.7)	4 (0.9)	9 (1.1)	1 (0.5)
Israel *	6 (1.2)	8 (1.1)	8 (1.1)	9 (1.0)	4 (1.3)	2 (3.0)	8 (0.9)
Italy *	4 (1.3)	6 (1.1)	8 (1.0)	2 (1.2)	8 (1.6)	9 (2.1)	5 (1.0)
Japan	8 (1.2)	8 (1.3)	2 (1.3)	8 (1.3)	2 (2.0)	6 (2.8)	6 (1.0)
Lithuania	6 (0.7)	6 (0.6)	4 (0.7)	2 (0.8)	6 (1.2)	6 (1.4)	4 (0.6)
Luxembourg	3 (3.2)	4 (2.5)	6 (1.9)	3 (2.3)	4 (4.2)	7 (4.1)	4 (2.3)
New Zealand *	4 (0.9)	2 (0.7)	3 (0.7)	1 (0.8)	9 (1.4)	5 (1.3)	0 (0.7)
Norway	7 (0.3)	9 (0.3)	1 (0.3)	3 (0.3)	1 (0.3)	0 (0.6)	3 (0.2)
Russian Federation	7 (1.3)	0	6 (1.4)	0 (1.4)	0 (1.7)	4 (2.5)	0
Singapore	9 (0.2)	4 (0.1)	9 (0.1)	2 (0.1)	2 (0.2)	5 (0.3)	1 (0.1)
Slovenia	0 (1.1)	9 (0.9)	7 (1.0)	3 (0.9)	6 (1.7)	2 (1.6)	5 (0.8)
South Africa *	8 (1.6)	7 (1.7)	4 (1.3)	1 (1.7)	6 (1.8)	0 (2.8)	0 (1.3)
Thailand	6 (0.6)	1 (0.7)	9 (0.6)	4 (0.7)	8 (0.8)	6 (1.0)	5 (0.6)

Notes: *: countries that did not satisfy all sampling criteria for this population.

Appendix 6.8
Principals' attitude towards ICT in ***upper secondary education****. Average values and standard errors (between brackets) for attitudes.*

Country	1.ICT impact on achievement	2.Relevance of Internet	3.ICT impact school management	4.ICT contribution lifelong learning	5.Make in-serv. ICT train. Compuls.	6.Teach. must acquire ICT certific.	Attitude towards ICT in the school
Belgium-French *	66 (1.2)	75 (0.9)	74 (1.0)	76 (0.9)	78 (1.6)	60 (2.0)	73 (0.8)
Bulgaria	85 (0.8)	85 (0.7)	87 (0.7)	81 (0.8)	80 (1.3)	80 (1.2)	84 (0.6)
Canada *	77 (0.5)	87 (0.3)	84 (0.4)	83 (0.4)	85 (0.7)	68 (0.9)	83 (0.3)
China Hong Kong	65 (0.5)	79 (0.5)	73 (0.5)	74 (0.5)	71 (0.8)	61 (0.8)	73 (0.4)
Chinese Taipei	79 (0.8)	91 (0.5)	86 (0.6)	84 (0.7)	86 (1.2)	76 (1.2)	85 (0.6)
Cyprus	84 (0.8)	90 (0.6)	90 (0.8)	84 (0.8)	94 (0.7)	96 (0.7)	88 (0.8)
Czech Republic	74 (0.9)	81 (0.8)	84 (0.7)	74 (0.8)	79 (1.6)	80 (1.4)	78 (0.6)
France	66 (1.0)	74 (0.8)	70 (1.0)	72 (0.8)	77 (1.3)	69 (1.4)	71 (0.7)
Iceland	73 (1.3)	91 (0.3)	84 (0.6)	74 (0.7)	80 (0.9)	53 (2.0)	78 (0.7)
Israel *	84 (1.2)	86 (1.1)	88 (1.0)	86 (1.0)	94 (1.0)	86 (2.3)	86 (0.8)
Italy *	66 (2.4)	72 (2.1)	73 (2.3)	67 (2.1)	69 (2.8)	69 (2.7)	70 (2.1)
Japan	67 (1.5)	70 (1.6)	67 (1.3)	67 (1.4)	69 (2.6)	50 (2.8)	67 (1.3)
Latvia *	79 (1.2)	83 (1.0)	85 (1.1)	77 (1.1)	91 (1.4)	74 (2.1)	81 (0.9)
Lithuania	86 (0.2)	85 (0.2)	83 (0.3)	83 (0.2)	87 (0.3)	74 (0.4)	84 (0.2)
Luxembourg	62 (2.9)	84 (2.2)	76 (1.7)	72 (2.0)	76 (3.7)	65 (3.8)	74 (2.1)
Norway	63 (0.5)	80 (0.4)	73 (0.4)	72 (0.4)	89 (0.5)	58 (0.9)	72 (0.4)
Russian Federation *	87 (1.3)	0	86 (1.4)	80 (1.4)	90 (1.7)	74 (2.5)	0
Singapore	87 (0.4)	95 (0.0)	92 (0.3)	95 (0.3)	96 (0.0)	76 (0.0)	92 (0.3)
Slovak Republic *	81 (1.0)	89 (0.8)	88 (0.8)	79 (1.1)	91 (1.2)	73 (1.6)	84 (0.9)
Slovenia *	74 (1.1)	83 (0.8)	80 (0.9)	74 (1.0)	71 (1.9)	70 (1.5)	78 (0.9)
South Africa *	80 (1.7)	79 (1.7)	87 (1.4)	83 (1.6)	82 (2.5)	72 (2.5)	82 (1.5)

Notes: *: countries that did not satisfy all sampling criteria for this population.

第二屆國際資訊科技教育應用研究(SITES)
香港特別行政區研究報告

香港大學教育應用資訊科技發展研究中心
羅陸慧英 袁海球 祁永華 李兆璋 李陽

香港優質教育基金贊助

第一、二章　　研究簡介及背境

第二屆國際資訊科技教育應用研究(SITES)，是一個國際性比較研究，共有多達26個國家/地區參與。是次研究由國際教育成就評價研究協會(IEA)主辦及贊助，香港方面的研究是由香港大學教育應用資訊科技發展研究中心負責進行，香港優質教育基金贊助。

香港的研究分作兩部份，一為國際比較部份，一為本港延伸部份。

國際比較部份的主要目的是在國際間收集有關資訊科技在教學應用上的資料，然後作全球性的比較研究，藉此衡量及闡明資訊科技在不同國家／地區內使用上之差異。本港延伸部份則旨在研究教師及學生使用資訊科技的情況及態度。研究所得的資料將對各國的學校、教育政策制訂者和政府教育機構有所裨益。

調查對象

國際比較部份的調查對象為全港有實施電腦教學的中、小學校的校長及資訊科技統籌人員。而本港延伸部份的對象則為上述中、小學的教師及小六、中二、中四和中六的學生。

調查樣本

在國際比較部份，我們向全港428間中學進行了一項普查，所發問卷的回收率為74%(317份)。至於小學方面，由於尚未全面實施電腦教學，所以研究先在全港829間小學作了一個篩選調查，問卷回收率為96%，結果顯示有310間小學曾用電腦作教學活動，它們也因此成為小學的調查對象，發出問卷的回收率為70%(218份)。

至於本港延伸部份的樣本，則是在完成國際比較研究部份後，我們從有交回問卷的學校中公開邀請他們參與本港延伸部份的調查，結果有104間小學及135間中學表示樂意參與。在這二百多間中、小學中，我們再以隨機抽樣的方式各抽出60間學校參與是次研究。教師問卷的回收率為72% (小學教師1398份，中學教師2370份)，學生問卷的回收率為92% (小六1646份、中二2238份、中四2281份及中六1702份)。

研究工具及資料收集日程

國際比較研究部份的研究工具包括兩份問卷。一份為「校長問卷」，另一份為「資訊科技統籌人員問卷」[1]。研究內容主要包括下列各項在小學、初中和高中施行的情況：

1. 校內資訊科技的基礎設施；
2. 硬件及軟件的需求和種類；
3. 有關資訊科技的資源分配、支援及需求；
4. 對資訊科技在教學上所扮演的角色及其價值的意見；
5. 校內有關使用資訊科技的現行目標和概況；
6. 推行資訊科技所遇之困難。

為了對國家與國家之間的情況進行比較，是次國際研究的問卷有部分內容將針對三個不同的教育階段作出調查。該三個階段為：

小學階段：研究範圍包括小三至小五
初中階段：研究範圍包括中一至中三
高中階段：研究範圍包括中四至中七

而本港延伸部份的研究工具則包括學生問卷及老師問卷，內容主要調查他們使用資訊科技的情況及態度。

校長問卷及資訊科技統籌人員問卷的回收時間由國際指導委員會劃一為 1998 年 11-12 月，而學生問卷及老師問卷的回收時間則為 1999 年 2 月。

[1] 資訊科技統籌人員在此國際研究中定義為在學校內有參與技術層面上統籌工作，並因而被校長指派填寫問卷的人員，與香港教育署近年設立的資訊科技統籌員職位的定義不同。

第三章　　資訊科技與學校課程

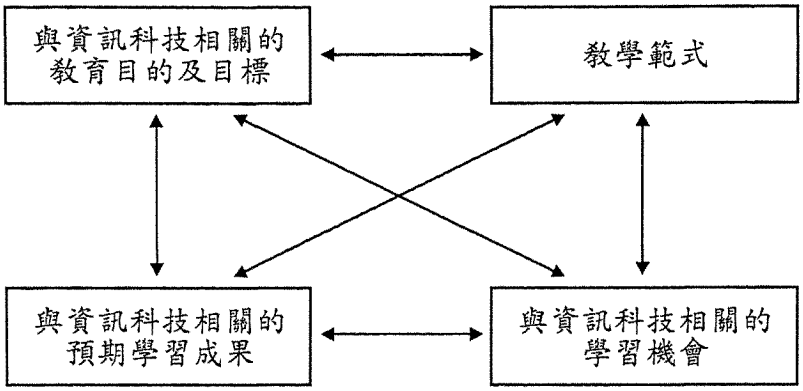


圖 一　資訊科技及學校課程的相互關係

現時許多國家已釐定有關資訊科技教育發展的總體規劃。這些規劃的重點在於培育資訊年代公民所須具備的能力，包括：終身自學的能力 (掌握自己的學習，自定學習目標、途徑及進程) 自主學習能力及能與同儕、專家等共同協作和溝通，進行開放式的學習活動。要達致上述目標，必須要有嶄新的教學範式轉移以作配合。例如：新的課堂組織方法，教師在課堂扮演新的角色以及新的評估步驟。培養這些能力正是「嶄新教學範式」的目標。

因此，本研究的一個重點就是了解資訊科技對學校整體課程的影響，並探討學校的教學範式會否在過程中有所轉移。「嶄新教學範式」是第一次作為國際比較研究的課題，它的定義仍屬初步，在本研究中，大致被理解為重視發展學生自學、解難、尋求及分析資訊、判斷以及利用網絡進行溝通、協作和學習的能力。

本研究已釐定一套指標，分辨「嶄新教學範式」與「傳統教學範式」，及資訊科技在兩種範式下的使用情況。

與資訊科技相關的教學目的及目標

研究結果發現香港的中、小學校長在教學上應用資訊科技所持的目的可分為三大類：提升教學水平、提供反覆學習的機會及滿足家長／社會的期望。而第一類目的則是校長們公認為應用資訊科技最重要的一環，至於對滿足家長／社會的期望的重視程度則中學較小學為高。

國際比較研究部份同時就學校有否制定資訊科技在教學上的具體政策目標進行調查。，結果發現各國在資訊科技的應用上和該國的學校及課堂文化有著很大的關係。香港、比利時、捷克、法國、以色列、意大利、日本、星加坡、南非、泰國及斯洛文尼亞的學校較多以「老師在教學上使用電腦」為目標；而有參與本研究的北歐國家，加拿大以及大部份歐洲國家的學校則較多選擇以「培養學生處理及分析資訊的技能」、「學生利用電子郵件通訊」及「學生連線至校外資料庫」為其校的政策目標。

此外，亞洲及東歐國家的學校較少以「讓學習上有困難的學生使用軟件」為它們的政策。

教學範式

教學範式是指學校的教學理念及其對學校整體教學活動所起的指導作用。是次國際研究希望探討各國在應用資訊科技時，是否同時施行「嶄新的教學範式」。

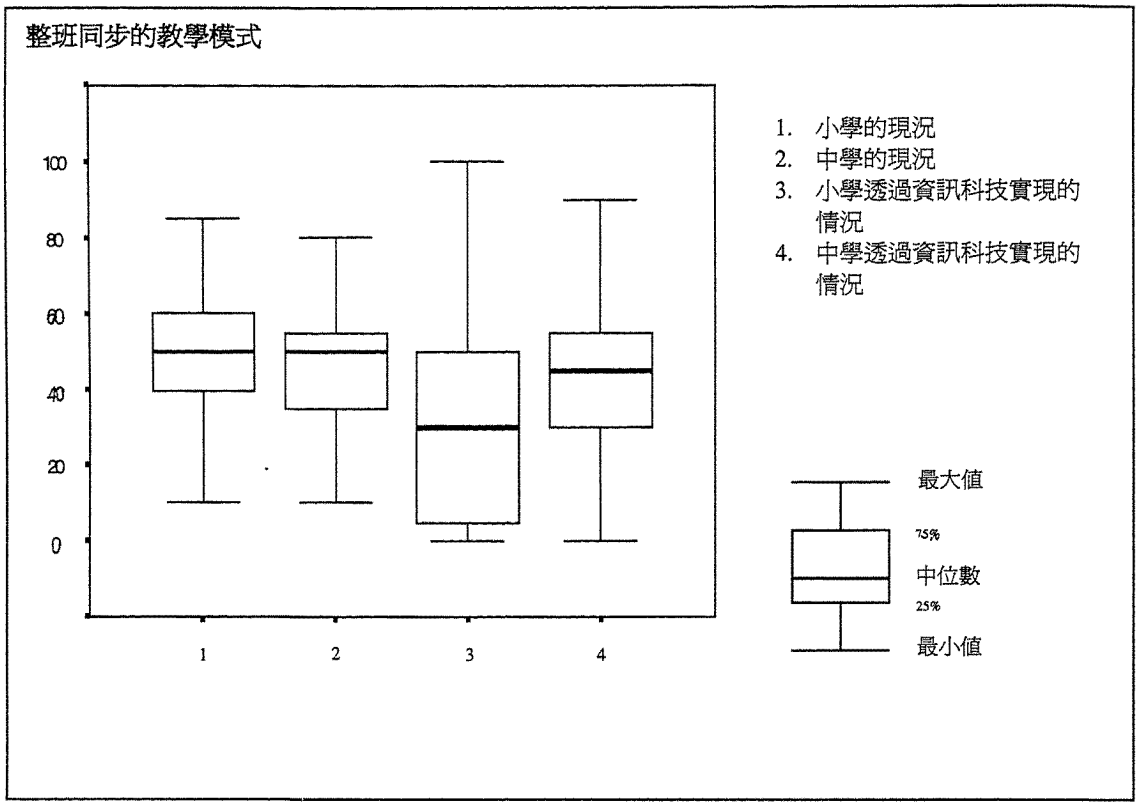
研究結果顯示就學校的整體教學範式而言，傳統的教學範式在一些國家/地區，如中國台北、芬蘭、香港、日本和星加坡等的小學階段較為流行，而它們之間都有一個共同特色，就是學校較多以「老師在教學上使用電腦」為其政策目標，而以「讓學習上有困難的學生使用軟件」為目標的則較少。除此之外，研究亦顯示大部份國家的中學較小學更多採用傳統的教學範式。日本和香港的學校在小學、初中及高中三個階段中，均較少採用「嶄新的教學範式」施教。

與資訊科技相關的學習機會

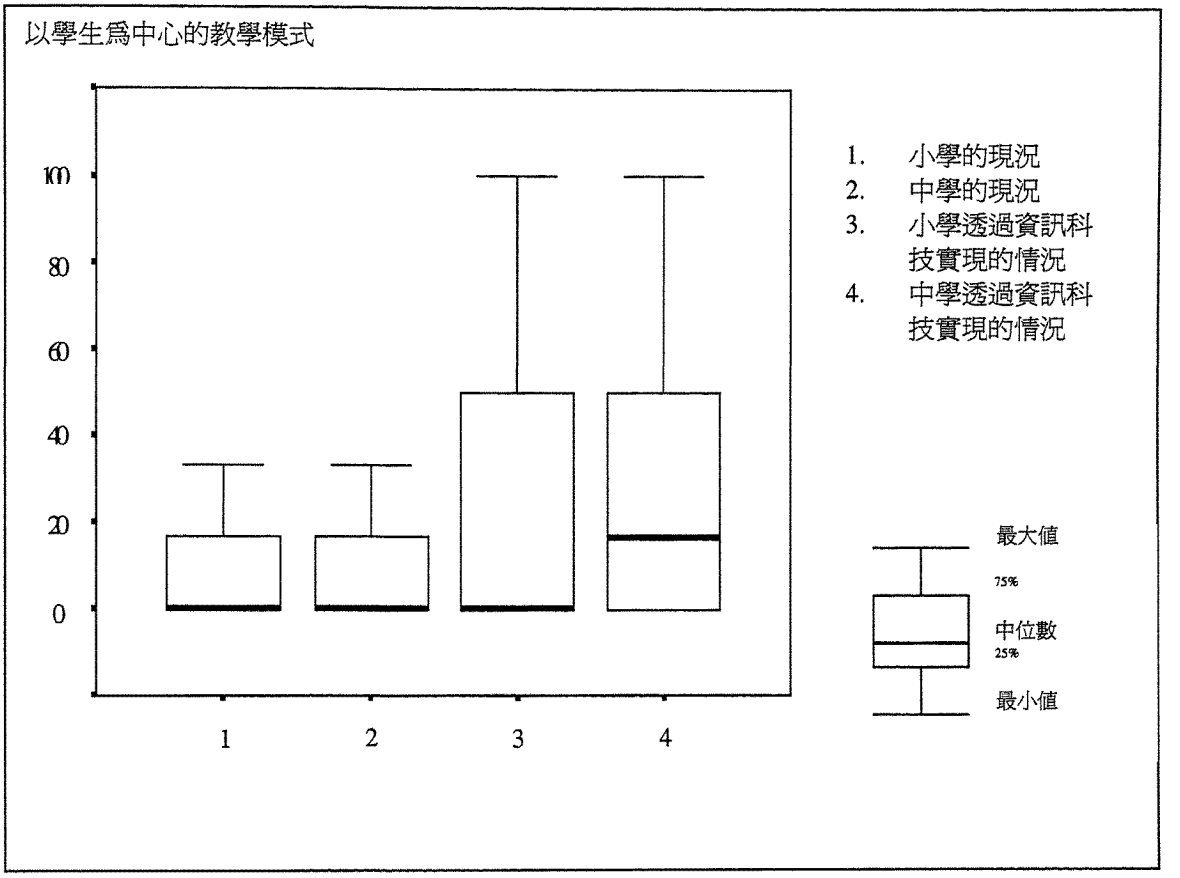
是次研究除了探討各國教學範式的現況外，還進一步了解資訊科技在實踐這些教學範式轉移所起的作用。

資料更顯示，整體而言，無論在國際層面或是在香港，有使用資訊科技的課堂，其活動屬「嶄新教學範式」類型的比例較其他課堂為高。這可以視為教學範式轉移的一個起步，屬於一個可喜的現象。進一步的數據分析顯示，香港中、小學校長的教學理念主要可分為兩大類型：分別是「整班同步的教學模式」，及以「學生為中心的教學模式」。 就香港的情況而言，一般學校主要都是採用「整班同步的教學模式」(例如學生根據相同的資源／進度學習相同的教材)，但透過資訊科技來實現這個目標的情況卻不常見。另一方面，在實踐例如「培養學生蒐集，處理及描述資訊的能力」及「學生在實踐中學習」等的教學目標時，一般學校甚少採用以「學生為中心的教學模式」，但透過資訊科技來實踐這種教學模式卻相當普遍，屬於一個令人鼓舞的現象。

此外，研究結果更顯示，學校之間對於應用資訊科技來推行的教學模式的差異極大，特別在利用資訊科技來實現「學生為中心的教學模式」這方面猶為明顯(從 0%至 100%)。



圖二 整班同步的教學模式在香港中、小學的現況及透過資訊科技而實現的情況之百分比分佈示意圖



圖三　學生為中心的教學模式在香港中、小學的現況及透過資訊科技而實現的情況之百分比分佈示意圖

預期的學生資訊科技學習成果

國際比較研究部份亦調查了中、小學校長預期學生能掌握的資訊科技能力。調查的項目包括：

1. 操作電腦(貯存檔案、列印、操作鍵盤)；
2. 用文書處理器編寫文件（打字編輯、版面設計）；
3. 用繪圖軟件作說明；
4. 用試算表進行運算（建立表項、運用方程式）；
5. 編寫簡單程式（例如 Logo, Pascal）；
6. 通過電子郵件與老師及其他學生通訊；
7. 傳遞、搜尋和使用電子資訊。

研究顯示各國對於較高年級的學生在資訊科技方面的技能期望較高，而且大部份國家都認為基本電腦操作是一項必須掌握的技能，即使對小學生的期望亦如是(全球有 60%的學校期望其小五學生懂得電腦基本操作)。文書處理亦為另一廣受重視的基本技能。除此之外，在小學階段可以使用「繪圖軟件」及「傳遞、搜尋和使用電子資訊」亦屬較受重視的技能。而在中學方面，校長對學生能「用試算表進行運算」的期望(約 40%)較小學(11%)為高。

各國對學生擁有各種資訊科技技能的整體期望上則有較大的差異。針對上述七項技能，加拿大、紐西蘭、星加坡等國對它們的小學生能夠掌握的項目多寡期望較大（多於 55%）(學生同時掌握七項技能為 100%），而日本、香港、冰島及挪威在這方面的期望則最低(少於 30%)。

在高中方面，盧森堡、星加坡及香港等地的期望則高於 80%。而日本則最低，約為 42%。

總的來說，在「嶄新教學範式」方面有較高百分比的國家，它們對學生擁有多少資訊科技技能的期望亦較大，但在七項資訊科技的技能中，對於學生能編寫簡單程式一項的期望則相對地低。

第四章　學校資訊科技基本設施有關的學習機會

電腦數目與學生人數的比例

學生人數與電腦數目的比例是一項可用來評估學校資訊科技基本設施的指標。研究結果顯示，大部份參與是次研究的國家中，中學的學生人數與電腦數目的比例較小學為低，而且國與國在這項指標上的差距甚大。加拿大、紐西蘭、星加坡、挪威等國家有較多的電腦，其學生人數與電腦數目的比例在小學為 18：1 或以下，而中學則為 15：1 或以下。而在俄羅斯及大部份東歐國家、中國台北、香港及日本的學生人數與電腦數目的比例則高很多（小學 50：1 或上；中學 30：1 或上），這情況在小學教育尤其明顯。

電腦設備的水平

另一個較為常用的指標就是這些電腦設施的質素。本研究收集了三項有關這個指標的數據，包括學校電腦硬件組合的級數、電腦具備何種操作系統及是否擁有多媒體功能。從這三個項目的資料來看，星加坡和香港擁有先進電腦設備的比率最為特出，兩地有超過 80%的電腦具有較高型號的組合、操作系統及具備多媒體功能。而大部份國家在小學、初中及高中階段的多媒體電腦數量的百分比只分別為 50%、40%及 25%。

然而，學生人數與電腦數目的比例在某些國家，如加拿大、紐西蘭、挪威等雖然很低，但他們使用的電腦則不及香港先進；以他們的電腦是否具備多媒體功能為例，這些國家只能達國際甚或以下的水平。星加坡是唯一一個既有先進電腦設備而學生人數與電腦數目比例亦低的國家。

周邊設備方面，香港的中學擁有投影器及液晶體顯示板的百分比均為 50%，遠遠高於國際水平的 30%及 15%，這反映香港中學教師較多傾向以電腦作全班演示教學。另一方面，在參與調查的 535 間香港的中、小學校中，只有四間小學備有專為殘障學生而設的周邊設備，顯示香港需要加強使用資訊科技，以協助有特殊需要的學生。

針對這方面，挪威是擁有最高百分比的國家，在小學、初中及高中的百分比分別為 34%、28%及 37% (國際的平均值在小學為 9%, 初中為 5.9%及高中為 6.2%)。

除了硬件配套外，電腦擺放的位置在某程度上也反映老師如何運用資訊科技來教學。研究得知，在香港的中學裡，約有八成電腦是放在電腦室內，其餘則放置在一些特殊用途的房間或課室中，手提電腦或其他可攜式電腦的數目則接近零。在小學方面約有五成電腦是放在電腦室內，而手提電腦或其他可攜式電腦的數目（約有 30%）則較中學(1%)為多，其餘的則放置在專用房間或課室中。研究亦顯示中、小

學老師中，只有約一成以下表示他們曾在電腦室或課室利用電腦進行教學活動。同時亦只有大約一成的學校表示，其校老師有使用電郵或互聯網作教學用途。

軟件配備

研究顯示，那些學生人數與電腦數目比例較低的國家，擁有較多不同類型的軟件。整體來說，香港學校具有的軟件種類比較其他國家/地區為少，而且只集中於一般應用的軟件，專為學科學習而設的軟件則很少。絕大部份的校長及資訊科技統籌人員都認為，推行資訊科技教育最大的阻力是教學軟件數量不足。

網絡設備

網絡及通訊設備亦為電腦教學重要的一環。香港大部份被訪的學校表示，他們的電腦並沒有連接上局域網絡。在小學裡，平均只有 17%的電腦有連上局域網絡，而初中及高中的比率則為 33%及 34%。與其他國家相比，香港的情況並不理想。冰島、斯洛文尼亞、加拿大、中國台北有八成的電腦已連接上局域網絡。而星加坡方面，在小學(14%)及初中(22%)已接上網絡的電腦比率則較少，但在高中接上網絡的比率卻高達 69%。

互聯網是一個有利於教學的寶庫。香港小學(約 10%)具有可接上互聯網設備的比率較其他國家(平均值 64%)為低，更令人憂慮的是，在接受調查的 218 間已應用資訊科技進行教學的小學中，其中未有接上互聯網設備的學校，仍有 34%表示他們不準備在 2001 年之前裝置上網設備。

研究得知，香港雖然約有七成的中學已設有學校網頁，但與其他國家比較，我們發現香港學校的網頁主要是作傳遞資料性訊息之用，而較少用來輔助教與學的活動。

第五章　　教師培訓

現有的資訊科技培訓課程

整體而言，現時為小學教師提供的資訊科技培訓課程，較給中學教師的為多。在這些培訓課程中，有關各種電腦軟件基本操作的課程在數量上明顯地多於其他性質的課程，例如高階電腦技術課程或涉及學科教學法的課程等。大部份小學教師的資訊科技培訓課程皆由校外機構主辦。中學方面，有較多學校會舉辦校內的培訓課程，這些課程主要為教師提供電腦基本操作、微軟辦公室軟件操作及瀏覽互聯網技術的訓練。

有超過76%的被訪小學校長及62%的中學校長認為，推行資訊科技教育其中一項最大的阻力，是來自教師的資訊科技知識貧乏及培訓課程數量不足。超過半數的資訊科技統籌人員更認為，目前提供予小學、初中或高中教師的培訓課程質素均欠佳，這對推行資訊科技教育造成極大障礙。與其他參與是次研究的國家比較，香港是唯一的地區有超過半數的資訊科技統籌人員認為，所有三個教育階段的教師培訓課程質素均欠佳。其他國家的研究顯示，即使他們的培訓課程有質素欠佳的問題，都只是限於某一階段，如法國在小學階段，南非在初中，塞浦路斯、以色列、斯洛伐克共和國及加拿大均在高中階段。

教師培訓政策

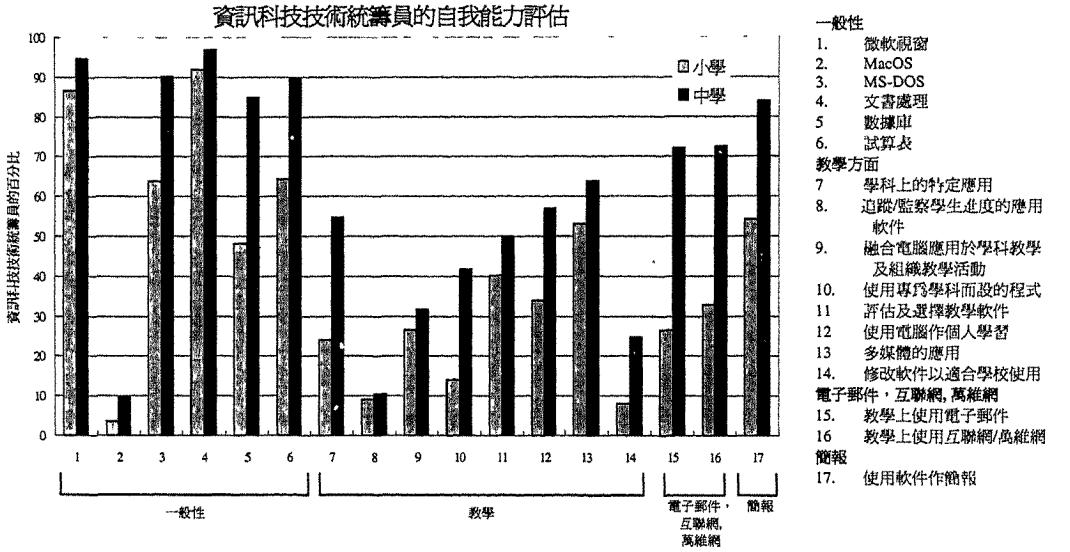
研究數字顯示，香港約有40%的中、小學備有具體的資訊科技政策條文,當中絕大部份(95%)的學校均要求所有教師接受資訊科技培訓。但整體而言，全港只有1%的中、小學設有獎勵機制，嘉許運用資訊科技於教學的教師。此外，硬性規定教師須接受基本資訊科技培訓的小學(約32%)較中學(初中約:17%、高中:15%)為多。而從中、小學校長的問卷調查結果卻看到，有86%的小學校長及大約65%的中學校長認為，其校大部份的教師均曾參與一些基本資訊科技培訓課程。雖然如此，與其他國家比較，香港教師在這方面的百分比只屬國際中等水平。

資訊科技統籌人員的自我評估

大部分資訊科技統籌人員均評估自己具備足夠的資訊科技水平，特別是有關視窗系統及文書處理軟件的操作(見下圖)。然而，小學資訊科技統籌人員的自我評估整體上較中學的較低，特別是在互聯網的操作方面，只有31%的小學資訊科技統籌人員認為自己有足夠的水平，而中學方面則有72%。在操作數據庫(小學:45%、 中學:85%)、MS-DOS(小學:61%、中學: 89%)、試算表(小學:60%、中學: 89%)及輔助個別學科學習軟件(小學12%、 中學:43%)等方面情況亦相若。

研究結果顯示，現時香港89%以上的中、小學資訊科技統籌人員均評估自己具備足夠文書處理技術。中學資訊科技統籌人員的簡報製作技術亦同樣接近國際最高水平(約82%)。

另一方面，香港的資訊科技統籌人員皆認為，他們對如何在教學上運用資訊科技的知識遠低於其技術水平，此情況在小學資訊科技統籌人員間尤其明顯。而有關運用資訊科技於教學的項目中，一般統籌人員對於製作簡報及應用多媒體比較有信心。只有約24%的小學及約31%的中學統籌人員認為，他們在如何把電腦應用融合於學科教學上有足夠的知識，與處於國際最高水平的紐西蘭(小學:74%)、斯洛文尼亞(初中:68%)及星加坡(高中:67%)比較，香港仍需加強這方面的培訓。



教師資訊科技水平的自我評估

在問卷的14項資訊科技技術中，有最多的教師認為他們已接受足夠文書處理的訓練。超過60%的中學教師及45%的小學教師表示，他們能夠運用電腦作文書處理。然而，他們在其他項目的自我評估水平都偏低，只有22%的中學教師及15%的小學教師認為他們已接受足夠的試算表操作訓練。只有約3%的中、小學教師認為他們有足夠訓練，可以應用監察學生進度的軟件及設計/編寫教學軟件。

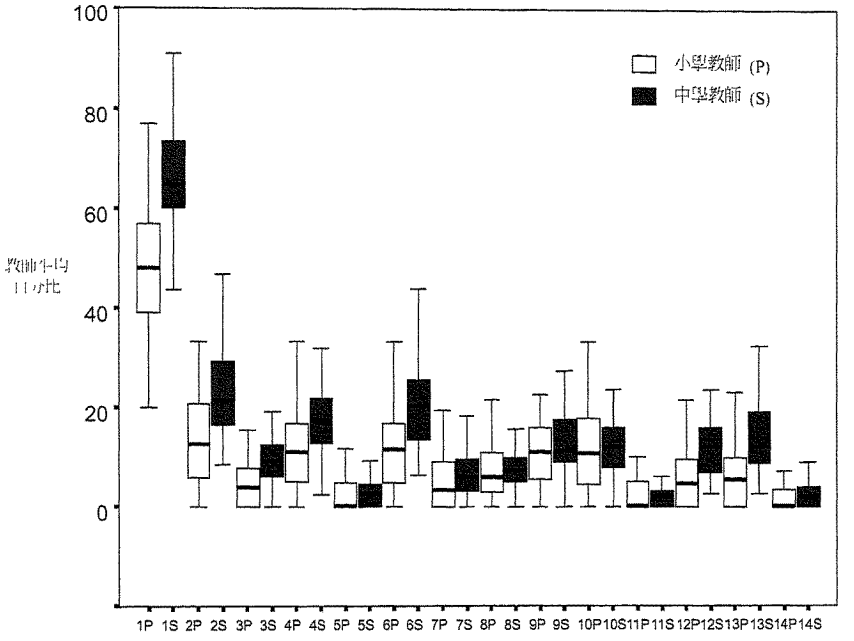
教師資訊科技技術水平的自我評估結果顯示，中學教師的技術水平比小學教師的為高，男教師的亦明顯地比女教師的為高。

教師對資訊科技訓練的參與及需求

中、小學教師一般都認為，除了文書處理外，他們所受的訓練尚不足以讓他們在課堂內自如地運用資訊科技來教學(見下圖)。他們認為自己最需要接受的訓練分別是：多媒體的教學應用(約 66%)、文書處理(57%)及設計/編寫教學軟件(約 50%)，由此可見教師還是比較重視學習電腦作為教學的工具。

整體上，中、小學教師對如何運用資訊科技於教學的自我評估卻普遍偏低(低於 20%)。

教師評估自己對資訊科技訓練的足夠程度：不同學校百分比的分佈圖



1. 文書處理
2. 試算表
3. 數據庫
4. 使用軟件作簡報
5. 應用監察學生進度的軟件
6. 利用電子網絡與別人溝通、討論
7. 融合電腦應用於學科教學及組織教學活動
8. 評估及選擇教學軟件
9. 使用電腦作個人學習
10. 多媒體的應用
11. 修改軟件以適合學校使用
12. 教學上使用電子郵件
13. 教學上使用互聯網 / 萬維網
14. 其他

校內教師資訊科技知識的溝通渠道

至於校內教師資訊科技知識的溝通，除了非正式的交流，一起參加校本或校外主辦的培訓課程都是中、小學教師交流資訊科技知識的渠道。與香港教師的情況相同，絕大部份參與是次研究國家的教師均是透過非正式的討論與同工交流運用資訊科技的知識。然而，在塞浦路斯、紐西蘭的小學及以色列和芬蘭的初中和小學，教師多是一起由資訊科技統籌人員教授電腦知識。在台北，意大利及星加坡的高中，教師則多是一起參加校本培訓課程來交流資訊科技知識。

教師現時電腦知識的來源及求助對象

被訪的大部分教師都表示，他們的電腦知識主要來自自學，這包括朋友及同工的協助。只有27%的小學教師及14%的中學教師表示他們的電腦知識來自培訓課程。至於如何獲得新的資訊科技知識，超過60%的中、小學教師都是從報章上獲得。在遇到有關電腦操作的困難時，大部份教師均是向朋友或同工求助。

教師使用電腦的情況

研究顯示，中、小學教師使用電腦作為編寫測驗、試卷及教材的工具情況最普遍。此外，只有低於一成的中、小學教師會使用網上交流方式與同工討論教學事宜、管理測驗、收發學生功課、利用電子郵件與學生溝通或討論，以及利用互聯網與其他學校進行專題合作活動。

第六章　　學校層面資訊科技教育政策及態度

資訊科技教育的目的

問卷調查顯示，香港大部份校長和教師皆認為資訊科技教育的主要目的在於提高學習過程的趣味性及提倡主動學習，多於回應職業或家長方面的需要。

校內推行資訊科技教育的情況

39%的小學校長及42%的中學校長表示，其校已制定一套明文的資訊科技政策。然而，相對參與是次研究的其他國家，香港有制定資訊科技政策學校的百分比仍屬偏低。在這方面擁有最高百分比的國家是星加坡(小學:80%、初中:78%、高中:92%)。

90%以上的香港中、小學校長回應表示，有發展校內使用電腦的共為其校的政策目標，並且已達成一定的共識。然而，將校長及教師的問卷調查綜合分析，即發現在超過一半的學校中，校長與教師對資訊科技教育個別目標的重視程度並不一致。這情況在小學方面尤其嚴重，小學校長對資訊科技教育的期望明顯地較教師的為高。

在本港中、小學的資訊科技明文政策當中，最常見的項目是關於教師培訓及如何在本學年將電腦運用於教學。這情況大致與其他國家相同，但相對而言，某些政策項目出現的比率仍偏低，包括小學階段的互聯網政策及保障學生使用電腦的機會均等政策，以及中學階段如何將電腦運用於教學的計劃。

有關使用互聯網的操守準則

71%的小學及86%的中學表示，已針對學生使用互聯網而可能引起的道德問題，制定及實行一些學校政策或措施，內容主要包括教授知識產權的概念、防止學生未經批准而進入系統的保安措施、防止學生利用學校電腦玩電子遊戲、防止學生瀏覽含色情或不雅內容網頁等。這些內容與其他國家的情況大致相若，然而，香港中、小學就如何透過學校電腦系統與社區及家長加強聯繫方面的重視程度，仍相對地偏低，只有12%的小學及6%的中學設有這方面的措施，與在這方面佔國際最高位置的中國台北(小學:36%)及盧森堡(中學:約45%)差距很大。而小學方面，比諸其他國家，香港較重視普及電腦知識及有關上網技巧，而有關防止學生利用學校電腦玩電子遊戲、防止學生瀏覽含色情或不雅內容網頁卻偏低。

行政用途

超過 70%的小學及 80%的中學有使用電腦記錄及監察學生的成績及作其他資源的管理。香港小學及初中在運用資訊科技於學校一般行政用途的程度，與其他參與是次研究的其他國家大致相同，在高中方面更達致偏高水平。然而，香港小學比其他國家的小學較少使用電腦管理圖書館。

資訊科技的統籌工作

從中、小學校長的問卷調查得知，有 93%的小學及 91%的中學有進行資訊科技統籌的工作。而超過 48%以上的中、小學校長表示，其校是由平均 5 人組成的資訊科技統籌小組來進行有關工作，這些小組的成員一般都包括教師。研究數字顯示，12%的中、小學校長表示，其本人或主要行政人員均有參與校內資訊科技統籌工作。另外，本港 15%的小學校長表示，其校聘有專門資訊科技技術統籌員，百分比較中學的(8.4%)為多。

同時，從教師問卷調查得知，有 7%的小學教師及 6.3%的中學教師表示，他們有參與校內電腦硬件及軟件的統籌工作。另外，有 11%及 13%的中學教師表示，他們曾經幫助同工運用資訊科技教學。

校長、教師和學生對資訊科技應用的態度

校長態度:

整體而言，香港中小學校長對於資訊科技為教育帶來的影響皆抱有正面的期望。尤其是資訊科技帶來教學範式的轉變。然而，相比參與是次研究的其他國家，香港校長對資訊科技期望的強烈程度仍只屬中等或偏低。若以 0-100 代表強烈程度，國際研究顯示香港對於如何推行嶄新教學範式，包括加強互聯網在教學上的應用(小學 75、中學: 79)及推動終生學習方面(小學: 75、中學: 74)的重視程度，都略低於其他國家(在教學上應用互聯網中、小學在國際的平均值為 81。至於推動終生學習方面小學為 80，中學為 78)，而星加坡的校長的非常重視以上項目，其強烈程度更有超過 90。

教師態度:

研究發現，香港教師對於資訊科技為教育帶來的影響皆抱有正面的期望,有 70%的小學教師及 73%的中學教師認為資訊科技可協助推行嶄新教學範式。

學生態度:

整體而言，香港中、小學學生對於資訊科技為教育帶來的影響皆抱有正面的期望。他們比較注意的是資訊科技能否提高學習過程的趣味性，以及能否為他們帶來自學的機會。在實施當中，他們最著重的是互聯網的應用及圖書館的電腦化。而在此兩方面，中學生的需求均比小學生的為大。

校長、教師、資訊科技統籌人員遇到的困難

調查發現，備課時間、學習時間、技術支援和軟件不足較其他問題突出，而教師沒有足夠時間準備電腦輔助教學的問題在國際間亦非常普遍。

第七章　　家用電腦及周邊設備

師生家中擁有電腦的概況

研究結果得知，比較小學生，中學生在家中擁有電腦人數的百分比較大。各級擁有電腦的學生人數百分比分別為 51% (小六)、72% (中二)、82% (中四)、91% (中六)。同時，學生就讀的年級愈高，擁有電腦人數的百分比就愈大。

另一方面，就學生是否擁有電腦的比例來看，學校之間的差距甚大，這情況在小學更加明顯。在小六階段，學校與學校之間在比例上最大的差別竟為 4.2%至 97%。

老師方面，小學教師擁有電腦人數所佔的百分比(87%)較中學教師的為低(91%)，而小學之間在這方面的差距，亦比中學的較大。

結果顯示，教師在家中是否擁有電腦與他們曾否利用電腦授課有明顯關係，而這情況在中學階段更為明顯（Pearson Chi-Square：significance level < .05（小學）；< .01（中學））。

在同一所學校中，教師與學生在家中擁有電腦的百分比並沒有明顯的關係。但是，在本學年有電腦使用計劃的學校當中，小六學生（$rf(1,19)=4.9, p<0.05$），及中六學生($f(1,26)=5.1, p<0.05$)在家中擁有電腦的百分比卻有明顯的關係。

師生家中的上網設備

在那些家中擁有電腦的師生中，有 37%的小六學生、49%的中二學生、58%的中四學生、67%的中六學生、63%的小學教師及 71%的中學教師表示，其家中的電腦可供他們上網之用。以上結果顯示，任教或就讀年級愈低的師生，家中擁有可供上網電腦的人數所佔的百分比就愈少。另外，學校與學校之間，師生擁有可供上網電腦人數的百分比差距很大，小學的情況則更嚴重。

師生家中是否擁有周邊設備

問卷亦調查了師生家中是否擁有光盤系統、打印機、掃瞄器等周邊設備。結果顯示，最多師生擁有的周邊設備為打印機和光盤系統，而最少人擁有的周邊設備為掃瞄器。

師生資訊科技水平與擁有家用電腦的關係

研究發現，在比較擁有及沒有家用電腦的教師時，前者對資訊科技的自我評估較後者的為高，尤其在文書處理、試算表、使用軟件作簡報、利用電子網絡與別人溝通及討論等方面(Pearson Chi-Square, significance level<.01)。而學生方面，這情況則更加明顯。研究顯示，家中擁有電腦的學生，其電腦及軟體基本操作技術的自我評估比沒有電腦的學生明顯為高。各年級學生在家中是否擁有電腦的比例與他們對各項資訊科技的自我評估皆有非常明顯的關係(Pearson Chi-Square, significance level<.01)。

第八章　　資訊科技水平及電腦應用

學生資訊科技水平的自我評估

在四個年級的學生中，大部分學生皆認為他們懂得基本電腦操作。在小六、中二、中四及中六，認為自己懂得基本電腦操作的學生百分比分別為 75%、83%、84%及 88%。另外，只有極少數學生曾運用資訊科技作為分析問題的工具，在小六、中二、中四及中六，曾運用資訊科技作此用途的人數百分比分別只是 6.7%、7.2%、8.5%及 9.6%。

學生對資訊科技訓練的需求

中、小學學生皆表示，除了基本電腦操作訓練，他們最渴求得到的訓練是如何利用資訊科技分析問題和選取解難的資訊、如何利用電子郵件與老師和其他學生通訊及如何通過萬維網來尋找和使用資訊。

師生資訊科技訓練需求的差異

師生對資訊科技訓練的期望均有所不同。學生最重視的是互聯網的應用，他們期望學會如何利用資訊科技分析問題(小學:47%、中學:約 55%)和選取解難的資訊(小學:42%、中學 45%)。而教師方面，他們對如何運用資訊科技於教學的自我能力評估都普遍偏低(低於 20%)，而他們最期望獲得的是有關使用多媒體資訊科技的訓練，有大約 67%的中、小學教師皆有此期望。

資訊科技知識的來源及求助對象

大部分學生都認為他們的電腦知識來自朋友、親人、學校及自學。愈高年級的學生，愈是傾向從朋友、親人、商業機構主辦的課程及自學來獲取電腦知識。此外，愈高年級的學生，從報章獲取電腦知識人數的比例也愈高，而從電視節目學習的人數比例則愈低。

學生表示，他們有困難時，會向同學及朋友求助。年級愈高的學生，愈是傾向透過互聯網或傳播媒介尋求協助，而愈不會求助於老師及家長。有 6%的小六學生、11%的中二學生、17%的中四學生及 21%的中六學生表示，當遇到困難時，他們會透過互聯網尋求協助，這比例遠較教師的(約 5%)為高，顯示學生比較傾向及習慣在互聯網上獲得知識。

資訊科技在學科教學的普及情況

在大部份被訪的學校中，資訊科技教育仍然不能普及至各個學科。綜合中、小學調查所得，數學及科學為最多教師運用資訊科技於教學的學科，而中文科則最少。

學生運用資訊科技學習的困難

中學生運用資訊科技學習的困難在於學習時間不足(59%)、電腦硬件不足(50%)以及資訊科技知識不足(47%)。小學生則表示，他們的困難在於電腦硬件不足(51%)以及學習時間不足(40%)。