# A Comparative Study on ICT Policy
# in Education in Korea and Japan

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**Abstract**
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Korea and Japan have been making a continuous effort to build information and communication technology (ICT) infrastructure in schools, and integrate ICT into curriculum by training teachers based on own ICT policies in education. ICT policy in education isparticularly diverse and challenging, in part because the rapid development of ICT continues to create new possibilities for use and demands the transformation of the ways we teach and learn. The present study is to analyze ICT policies of Korea and Japan, between 1980's and the present period, in a larger educational and historical context. The study reviews chronological changes in major streamlines of ICT policies of both countries, and discusses in detail changes in two aspects of ICT policies in education, that is, ICT infrastructure and teacher training. The paper points out convergence and diversity of ICT policies in two countries and concludes with a set of guidelines for ICT policy makers.

*Keywords* : ICT policy in education, ICT policy, comparative study on ICT, ICT teacher training

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# Ⅰ. Introduction

The rapid integration of information and communication technologies (ICT) into teaching and learning environments has raised many issues that demand serious attention from policy aspects. ICT policy in education isparticularly diverse and challenging, in part because the rapid development of ICT continues to create new possibilities for use and demands the transformation of the ways we teach and learn.

Korea and Japan are leaders in utilizing ICT for education in Asian countries. Both countries have invested a variety of resources including manpower, budget, time and efforts in building ICT infrastructure in schools (OECD, 2003). In the process of building ICT-based educational environment, Korea and Japan have also established and implemented related ICT policies to gain maximum benefits from the investment. ICT policies, unlike other educational policies, need to consider both technical and pedagogical aspects of school environment including hardware preparation, software development, intensive teacher training, and continuous supports. Also the policies require new visions for education in the newly emerging technology based knowledge society.

The present study is to analyze ICT policies in a larger educational and historical context of two countries between 1980's and the present period. The study will first critically review chronological changes in major streamlines of ICT policies both in Korea and Japan. Then it will analyze two main aspects of ICT policies - ICT hardware and software infrastructure, and teacher training - in detail. For the purpose of this study, official government documentsand authoritative documents were first reviewed and relevant data were collected. For the verification of the data, government officials and scholars of the two countries were interviewed as well. During the interviews, contextual information regarding the establishment and implementation of ICT policies were sought. The results of the study need

to be interpreted with a special attention to different uses of some same terminologies in each country. And in interpreting the study results, one needs to recognize that this study is done within three-month time framework. Even so, the results will help develop a better understanding of ICT policies in both countries and suggest more effective policy guidelines for the future.

# Ⅱ. Main Streamlines of ICT Policy Development

Here we examine important milestones for the development and implementation of ICT policies in education.

## 1. Korea: to become a leader in a digital society

### 1) Expansion in Quantity and Introduction of Basic AV Equipment

A substantial expansion in educationwas seen in Korea during the 1960s and 1970s, resulting in universal primary and secondary education which, in turn, gave rise to remarkable economic progress and changes in politics, society and culture (MOE, 2003). In addition, major reforms in student and teacher education were observed during this period and the Korea Education Development Institute (KEDI) was established in 1972 to lead reforms and new approaches in education. As one of new approaches, KEDI established a distance learning and correspondence high school. During this period, basic audio-visual equipment such as OHP and slide projectors wasintroduced under IBRD fund (Kim, 1994).

### 2) Focus on Quality and Establishment of Research Center for Computer Education

During the 1970s and 1980s, the number of students in secondary education had increased sharply, which gave rise to overkeen competition for places in

the higher education institutions. At the same time, in the 1980's, Korea introduced policies to improve the quality of education (Jung, 2001). The introduction of TV broadcasting for high school education in 1980 was one measure of the Korean government to improve the quality of primary and secondary education (http://www.ebs.co.kr/ Info/ infomation/ abt_ehis.asp). Another example was to establish a Research Center for Computer Education within KEDI in 1988 to initiate trial projects in developing and implementing computer-assisted instruction (http://eng.kedi.re.kr/).

## 3) Introduction of ICT in Schools and Establishment of Support Organizations

In the 1990s, Korea focused on the fulfillment of the public need for higher education and lifelong learning, and the effective use of ICT in schools. The government's plans and specific strategies for the use of advanced technologies, that is, ICT were first developed according to the suggestions made by the Presidential Commission on Education Reform since 1995. The use of ICT in education and research was adopted as a national policy during this period. However, the active implementation of that policy came with the establishment of the independent Bureau of Educational Information and Technology (BEIT) in 1996, and the Korea Research and Information Center (KRIC) and the Korea Multimedia Education Center (KMEC) in 1997.

## 4) Master Plan I and KERIS Support

Using government funds, KRIC established and/or linked many digital libraries and provided information services for academics in higher education. KMEC supported primary and secondary schools with digital materials and ICT teacher training. In addition, this institute conducted various activities such as researching the current use of technology in schools, implementing technology initiatives, developing online learning materials for teachers, students and parents, supporting schools in creating their homepages, and providing a comprehensive educational Internet service called EduNet (Lim,

et.al., 1996). In April 1999, KRIC and KMEC were united as the Korea Education and Research Information Service (KERIS). The Master Plan I for integrating ICT into education was began in 1998 and completed in 2000.

### 5) Master Plan II for Human Resource Development

The Master Plan II for integrating ICT into education was scheduled to be carried out between 2001 and 2005 (MOE & KERIS, 2003). The focus of this Plan II was on "maintaining an international competitive advantage in a knowledge-based society" by improving the quality of education system and "developing human resources through the use of ICT" (MOE & KERIS, 2003, p. 7). A great emphasis was placed on education reforms in various levels of schools and human resource development in the society.  The data during the last three years show that Korea has adopted four main strategies to implement the Master Plan II for integrating ICT into education.

- First, the government has promoted active involvement of several different levels or types of institutions MOE, local governments, schools, educational agencies such as KERIS, private sectors, and parents in implementing national ICT policies. While MOE sets the national ICT policy framework and provides ICT funds, local governments in collaboration with Provincial Offices of Education establish specific action plans and allocate funds to their projectsof interest.
- Second, the government has introduced a rather flexible ICT policy framework so that Provincial Offices of Education and schools could respond to the rapid changes of the society rather effectively and efficiently whenimplementing national ICT policies. Within the flexible policy framework, ICT-related decisions have been made at the local government and/or individual school levels.
- Third, the government has paid a special attention to issues related to digital divide. Several related policies have been established and various

types of national and local initiatives have been carried out to address the issue of digital divide between regions, families, genders, and generations.

· Finally, the government has begun to upgrade ICT hardware and software infrastructure in schools.

## 6) E-lifelong Learning Society via ICT

A new ICT policy direction for next coming years was discussed in a report called "National Human Resource Development Strategies via e-Learning: Beyond e-Learning Korea" in 2004 (MOE & KERIS, 2004a). A new ICT policy vision focuses on the establishment of e-lifelong learning society via ICT integration into education and human resource development. Four policy directions include: establishing a close tie between education and industry, employing bottom-up approach rather than government-led approach, lessoning the digital divide, and globalizing e-learning efforts. More specifically, directions to education utilizing ICT were discussed as follows (MOE & KERIS, 2004b).

· Online and offline modes of education should be blended to promote active learner participation.
· Digital contents should be specialized at a variety of levels to meet diverse needs of learners.
· E-learning should be developed and used as an environment to promote learning activities rather than as a mere information delivery mechanism.
· Effective instructional design strategies and standardized formats should be applied in the development of e-learning.
· Related laws and regulations should be reviewed to address emerging issues in collaborative uses of e-learning contents.
· Quality assurance mechanisms for e-learning should be in place.
· All the teachers should be encouraged to participate in e-learning efforts and share new e-learning culture.

## 7) Summary 5 Stages

Previous diffusion efforts in education tell us that it takes a long time to fully integrate an innovation in education. Introducing ICT in education is no exception. It has passed five diffusion stages.

The late 1980scan be called an innovation or experimental stage. During this period, computer technology was first introduced to education in Korea and a small number of innovators insisted the necessity of teaching computers in schools and used computers for their teaching. Various types of experiments with computers were carried out in schools. Computer-assisted instruction and computer-managed instruction were hot words during this period.

The early adoption or preparation stage came in between 1988 and 1997. During this decade, a series of ICT policy directions were developed and announced. Existing laws and regulations were reviewed and revised. Necessary organizational structures including the Bureau of Educational Information and Technology within the Ministry of Education were created. A comprehensive evaluation system of Municipal and Provincial Offices of Education which included evaluation of ICT efforts was launched. One ideological slogan evoked by the term "Information Society" in Korea during this period was "We were behind in the industrial society, but let us be a leader in an information society." This slogan, backed up by many scholars and mass media, exerted and still exerts a strong influence on all the decision making behaviors at the governmental level. Another slogan that guided educational policies was "Edutopia" a society of open and lifelong education to allow each and every individual equal and easy access to education at any time and place (Jung, 2000). To realize Edutopia, ICT use in education was strongly recommended.

The late adoption stage or the full scale implementation stage began in 1998 when the government implemented the Master Plan I for integrating

ICT into education. In 1998, MOE settled ten major tasks for the promotion of ICT in education. Among those tasks, the establishment of proper computer hardware and software infrastructure was on the top list. Teacher training was also included in those urgent tasks. KERIS, an organization dedicated to ICT implementation in schools, was re-created in 1999.

A more comprehensive implementation stage began with the beginning of the Master Plan II for integrating ICT into education in 2001. ICT use in education was linked to a broader human resource development framework. Active participation from all the stakeholders including private sectors and parents was also emphasized. ICT funding scheme was changed from hardware-oriented to software - and humanware - oriented. An effort to address the digital divide issue was made at this stage.

The Master Plan II ends in 2005. A new vision and policy directions are announced. This time, the term ICT use in education has changed to e-learning. The quality issue is taking a major portion of the new directions (MOE, 2004). Hardware is not a focus of ICT policy anymore. More professional terminologies such as instructional design and blended approach are appearing in the government plan. Moreover, a global perspective is introduced in creating and implementing e-learning. The issue of digital divide will be more aggressively handled in the future.

## 2. Japan: to be the most advanced IT country in the world

In 1985 the Ad Hoc Council for Education which was under the Prime Minister proposed "Action to Informatization" as one of core reform areas. The Council regarded the 21st century as information society where people needed to have ability to manipulate and dispatch information according to the development of soft science and technology not hard one. The aim of information education in schools was to cultivate "information literacy."

## 1) Before ICT - Audio-Visual Education

The report presented by the Council indicates two streams for recent development of ICT in education. One is audio-visual education which has been practiced in education since the 1950's. The other one is experimental use of computers in education since 1980's. In 1952, the Division of Audio-VisualEducation under the Bureau of Social Education in the Ministry of Education was established with a responsibility to diffuse educational films and educational broadcasting in schools. NHK started TV programs for schools in 1953 and the Educational TV was initiated in 1959. The purpose of producing films and broadcasting for education was to help students develop a betterunderstanding of educational contents. The objectives of audio-visual education wereto cultivate audio-visual (media) literacy, that is, to help educators and learners access to audio-visual materials properly, understand their meanings subjectively, and utilize them appropriately. While several councils on audio-visual education were founded as early as in 1950's, audio-visual education itself was notnecessarily a major policy issue in 1980's because of the spread of TV program use in schools. Almost all schools from elementary to secondary education equipped TV monitors by the middle of 1960's. The ratio of using TV in elementary schools reached 90% around 1970's and has steadily increased afterwards. The ratio of using TV in secondary schools peaked in the middle of 1980's, reaching approximately 70%.

Another stream came from computer. Research of computer-assisted instruction (CAI) such as PLATO or TICCIT in the U.S. gained such a high attention of Japanese researchers in the late 1970's, although actual use of computers in education was very much limited due to high price. A sense of crisis among Japanese researchers that Japan might have been behind of other developed countries in utilizing computers in education was observed during this period. The Grunwald Declaration on media education by the UNESCO in 1982 and OECD, Center for Educational Research and Innovation's Project on "Education and Information Technology" started in 1982 stimulated

Japanese government to take information education as a policy issue. The report entitled "the Use of Microcomputer in Education" was developedin 1985 and then "the Guidelines of Developing Educational Software" was proclaimed by the Ministry of Education, Japan. In the report, not only computer operation skills but also information manipulation abilities were recognized as indispensable in computer education. The latter abilities were derived from audio-visual (media) literacy skills.

AV-education and computer use in education played a key role in making informatization of education one of the key polices in educational reform proposed by the Ad Hoc Council for Education in 1985.

Since then, ICT introduction in Japanese education has passed four distinctive phases: the first phase between 1985 and 1993, the second between 1994 and 1997, the third between 1998 and 2000, and the fourth phase from 2001 to present.

## 2) Phase 1 - Introducing Microcomputers in Schools

Following the report from the Ad Hoc Council for Education, the Ministry created the Educational Reform Promotion Headquarters (which changed its name to the Educational Reform Enforcement Headquarters two year later) started "Action to Informatization" in 1985. The fastest way to implement the policy goal was to make information education one of prescribed subjects in the Curriculum Standards for Schoolsat the central government level so that each local government and schools had to adopt this policy.

When Japanese Ministry of Education introduces a new regulation such as the Curriculum Standards for Schools, three steps are usually taken: first, the government sets up a conference with researchers to discuss issues related to the regulation, then a council discusses the report from the conference, and finally the government introduces the new regulation and develop detailed regulatory frameworks based on another report from the council. The same

procedure was taken when a subject, information education, was introduced as a national curriculum. The Researchers' Conference on the "Idea of Elementary and Secondary Education in Information Society" was set up in 1985. This conference was said to be the first one which the Ministry set up regarding information education. Based on the report from the Conference in 1986, the Curriculum Council submitted another report in 1987. The Council proposed to create "Information Basics" as one of elective areas in the Technology and Home Economics subject. In 1989, the Curriculum Standards for Lower Secondary Schools were revised to create "Information Basics" within the Technology and Home Economics subject, and the Standardsfor Upper secondary Schools were also revised to allow academic high schools to create "Information" as a new subject area. Vocational high schools had been teaching "Information Processing" as their regular course.

After the reform of the Curriculum Standards, the Ministry published the report titled "Developing Informatization and Education" in 1990 and the "Guidelines of Information Education" in 1991 to promote information education in schools. However, only a limited number of schools introduced the new curriculum, and even in schools where information education was introduced, teaching focused on what information was or how to handle information in society. Limited number of computers in schools was a main reason for this low adoption of the new curriculum. The Ministry of Education started to provide financial support to local governments for microcomputers in schools in 1985. Teachers' lack of understanding computer skills and pedagogies provided another reason. We will discuss these matters in the sections below.

In the field of social education, "Action to Informatization" has also been key issue since 1995. The Council of Social Education proposed the "Idea of Using New Media in Education" in 1987. One key suggestion made in this report was to create online network linking all the public libraries. Even

though "Action to Informatization" was said to be an issue across the Bureaus, this matter was handled bythe Bureau of Lifelong Learning, while the matter of information education in schoolswas handled by the Bureau of Elementary and Secondary Education.

### 3) Phase 2 - Introducing Internet at Experimental Level

The Advanced Information Telecommunications Society Promotion Headquarters was formed in 1994, headed by the Prime Minister and composed of the full cabinet. The rapid growth of the Internet in Japanese society and its promises for the future led the Japanese government take ICT promotion in all sectors of the society as a policy issue.

In the field of education, the Ministry of Education formulated "the Implementation Guidelines of Informatization in the Field of Education, Academics, Culture, and Sports" in 1995 based of the report from a Round-Table Conference on Promotion of Education Policy in Correspondence with Development of Multimedia between 1994 and 1995. In the first report from the Central Council for Education in 1996, it was recommended that systematic implementation of information education was essential to improve the quality of school education. Information quality of education became the forefront in information education. Following this report the Researchers'Conference on Promotion of Information Education in Elementary and Secondary Education in correspondence with the Development of Infomratization was formed in the same year and submitted the its report in 1997. This conference was given a role to provide new ideasof information education by the time of the next revision of the Curriculum Standards in 2000. This report proposed to make information education subject as requirement.

In accordance with the spread of the Internet, the Ministry conducted a "One Hundred School Project" during 1994 and 1996 to distribute the Internet hub to schools free of charge. This project was later renamed as a

"New One Hundred School Project" in 1997. In addition, a "Konetto Plan" supportedby private companies such as NTT or HITACH, or other organizations started in 1996 to connect 1,000 schools through the Internet. Although the use of the Internet was experimental and project-based during the second phase, these projects resulted in the Ministry's "Program of Educational Reform" in 1997, proposing to connect all the public schools through the Internet by 2001 when the new curriculum began.

### 4) Phase 3 - Accelerating Use of Internet as National Strategy

On the basis of the final report from the Researchers Conference (started in 1996) in 1998, the Curriculum Council proposed that 1) learning practical skills to operate computers was placed in elementary schools in the "Period for Integrated Study," which was a newly created subject, 2) the "Information Basics" was placed in the Technology and Home Economics subject in lower secondary schools, and 3) the "Information" was required as a new subject in academic high schools. The Curriculum Standards were again revised in 2000. Although there was an idea to make information education subject as requirement at the time of the former revision of the Curriculum Standards, there was also a strong opposition arguing that the new subject might result in the decrease of teaching hours of other important subjects such as mathematics or science. Even though this idea of making information education as requirement was not realized during this phase, it was supported by the society in general.

The Researchers' Conference also proposed to improve informationand telecommunication network in schools, develop more high quality computer software, and improve teacher training system. These propositions were discussed in the Task Force among four Ministries under the Cabinet, called "Virtual Agency" which began to operate in 1998. The "Millennium Project: Informatization of Education" suggested by the Task Force in 1999 stipulated a new six-year improvement plan to equip all the classrooms in elementary and secondary schools with computers and the Internet by 2005.

In order to realize this plan, other projects such as expansion of LANs in public schools, improvement of teachers' information literacy, and development of educational contents and a portal site of educational resources were funded. The teacher training system called "Leaders of Promotion of Information Education" also started in 1999. The main goal of this training system was to help all the teachers be able to operate computer and a half of them be able to teach their subjects using computers. The National Information Center of Educational Resources (NICER) was reorganized in 2000 and began to operate an educational portal site in 2001. In this "Millennium Project," necessary plans for imformatization of education in every aspect were formulated.

In 2000, the former Advanced Information Telecommunication Society Promotion Headquarters was reorganized and became the Information Telecommunication Technology Strategy Headquarters (IT Strategy Headquarters). The Fundamental Law of Information Technology was promulgated. International movements to promote informatizatin such as the Cairn Summit in 1999, the G8 Meeting of Education Ministers in 2000, and IT Charter in 2000 (the Kyusyu-Okinawa Summit) strongly influenced Japanese government's decisions on the series of ICT-related reforms.

### 5) Phase 4 - Heading for 2005 Goal and Continuous Efforts of Implementing Policies

In 2001, IT Strategy Headquarters announced "e-Japan Strategy" in which Japan headed for the most advanced IT country in the world within five years. Since then "e-Japan Strategy" was revised every year from "e-Japan Priority Policy Program Plan," to "e-Japan Priority Policy Program Plan-2004," through "e-Japan Strategy II." The Ministry followed strategies specified and implemented related policies.

One of recent issues in ICT policy in education is how to integrate ICT into regular educational practices. Through introduction of information

education subject in schools, students' skills have been improved. However, beyond the subject, there still remains a challenge of ICT use in every subject to improve teaching and learning. Eventually, a priority of teacher training has shifted from "acquiring the skill of manipulating computers" to "practicing class activities by using ICT in every subject" since 2003. NICER has opened the "IT Class: Practical Navigation" on its web site. In this class, case studies of teaching and learning with ICT across various subjects were introduced in motion picture format.

As shown in Table 1, much more efforts have to be made to achieve the 2005 goals of 5.4 students per computer, 100% high-speed network connection in each classroom, and 100% teachers who can use a computer in instruction. ICT policy in education itself, however, has been elaborated and improved year by year.

Table 2 shows major stages in ICT policy development in Korea and Japan.

Table 1. Informatization of Education in Schools (Japan, MOE, 2004)

|  | Elementary | Lower Secondary | Upper Secondary |
|---|---|---|---|
| Number of computers per student(Average 8.8) | 11.2 | 7.7 | 6.7 |
| Ratio of classrooms connected school LANs (%) | 31.1 | 32.0 | 61.2 |
| Ratio of schools connected high-speed networks (%) | 68.0 | 72.4 | 88.1 |
| Ratio of teachers who can operate a computer (%) | 93.3 | 92.7 | 93.6 |
| Ratio of teachers who can use a computer in instruction (%) | 72.7 | 53.8 | 46.1 |

* This survey was conducted in March, 2004

Table 2. Changes in ICT Policy in Education

| Period | Korea | Japan |
|---|---|---|
| 1980s | **Innovation or Experimental Stage**<br>- Establish Research Center for Computer Education<br>- Carry out various types of experiments | **Introducing Microcomputers in Schools** (1985-1993)<br>- Ad Hoc Council for Education<br>- "Information Foundation" as a subject |
| 1988-1997 | **Early Adoption or Preparation Stage**<br>- Prepare new policy directions, laws, regulations, organizational structures<br>- Establish school computer hardware infrastructure | **Introducing Internet at Experimental Level** (1994-1997)<br>- Headquarters of IT Promotion in the Cabinet<br>- One Hundred School Project, etc. |
| 1998-2000 | **Full Scale Implementation Stage**<br>- Develop ICT Master Plan I<br>- Re-create KERIS | **Accelerating Use of Internet as National Strategy** (1998-2000)<br>- Millennium Project under tha Cabinet<br>- "Information Foundation" as a requirement subject<br>- Reorganization of NICE |
| 2001-2005 | **Comprehensive Implementation Stage**<br>- Develop ICT Master Plan II<br>- Focus on content development, human resource development, and digital divide issues | **Heading for 2005 Goal and Continuous Efforts of Implementing Policies** (2001-2005)<br>- e-Japan Strategy in the Cabinet |
| Future | **Global e-Learning Implementation Stage**<br>- Develop e-Learning strategies for Human Resource Development<br>- Focus on quality, digital divide, competitiveness | **Future Plan will come later** |

In the next section, we will explore infrastructure and teacher training policy in detail and examine certain barriers for ICT policy implementation.

# Ⅲ. ICT Infrastructure Policy

This part will discuss ICT policies for establishing hardware infrastructure in schools and developing software for educational purposes in Korea and Japan between 1980s and the present.

## 1. Korea: Towards ICT-integrated Educational Environment

### 1) Preparation Stage between 1988 and 1997

In the final report in December 1987, the Education Reform Committee officially suggested the introduction of computers to each and every school for the purpose of student skill training for thenew technology. One year later, in December 1988, the National Network Coordination Committee decided to support school computer education as one of the most important national tasks to implement (MOE & KERIS, 2004b).

In 1992, theEducation Reform Committee announced School Computer Education Promotion Plan. The plan was considered as the practical basis of ICT use in education in both primary and secondary schools. The plan announced that education on computing was not only for the vocational school students but for all the primary and secondary students Based on the 1992 plan, new ICT policy directions were formulated in 1993 and the government officially announced the support for ICT implementation in schools. Based on the line of precedents, in 1995, Informatization Basic Law was established.

In accordance with the Basic Law, in 1996, the independent Bureau of Educational Information and Technology was established within the Ministry of Education. The mission of the Bureau was to promote the active implementation of the national policy that focuses on the use of ICT in education and research. In the January of 1997, the MOE settled 10 major

tasks for the promotion of informatization in education. Among those tasks include establishing hardware infrastructure in schools and developing software to be used by teachers (MOE & KERIS, 2003).

The figures 1 through 3 show the results of hardware deployment during this preparation period and beyond. During the period of 1991-1997, the number of student per computer reduced from 54.8 to 23.1, 65.7 to 23.1, and 103.5 to 30.9 in elementary, middle, and high school respectively (MOE & KERIS, 2004b).

Software development, however, was very marginal in this period. A total of 2,497 programs were developed from the public sectorssuch as KEDI, Municipal and Provincial Offices of Education and KMEC. The budget for the software development was 3.4% of the total amount of ICT in education budget (Bang, 1998 p. 93).



Figure 1. Trend in number of students per computer in Korea: Elementary

연도별 컴퓨터 1대당 중학생 수 : 1991~2003

Figure 2. Trend in number of students per computer in Korea: Middle



연도별 컴퓨터 1대당 일반계 고등학생 수 : 1991~2003

Figure 3. Trend in number of students per computer in Korea: High

## 2) Full Scale Implementation Stage between 1998 and 2000 (Master Plan I)

The 3 year plan started in 1997 and was renamed in 1998 as the Master Plan I for Integrating ICT into Education. The main focus of the plan was to build the complete basic information infrastructures for elementary and

secondary schools for easy access to computers and the Internet.

This Master Plan I began in 1998 and supposed to end in 2002. But school infrastructure establishment was completed in 2000, two years earlier than planned, due to focused investmentfrom the central government and the strong political will of the nation's leader. Every classroom in all the elementary and secondary schools wasconnected to the Internet in 2000. 10,000 schools were connected to the Internet using broadband lines, 13,000 computer rooms were assigned and equipped with upgraded computers and facilities, 214,000 ordinary classrooms were equipped with multimedia facilities, and one pc was given to each of 340,000 teachersof all the primary and secondary schools.

During this period of implementing the Master Plan I, KERIS developed an educational web portal site called EduNet (www.edunet4u.net) for primary and secondary education and the Research Information Service System (RISS, www. riss4u.net) for higher education. Figures 4 and 5 show the trend of the number of users for those two portals. There were about 3 million users for EduNet and 200,000 users for RISS in the year 2000. The institute also
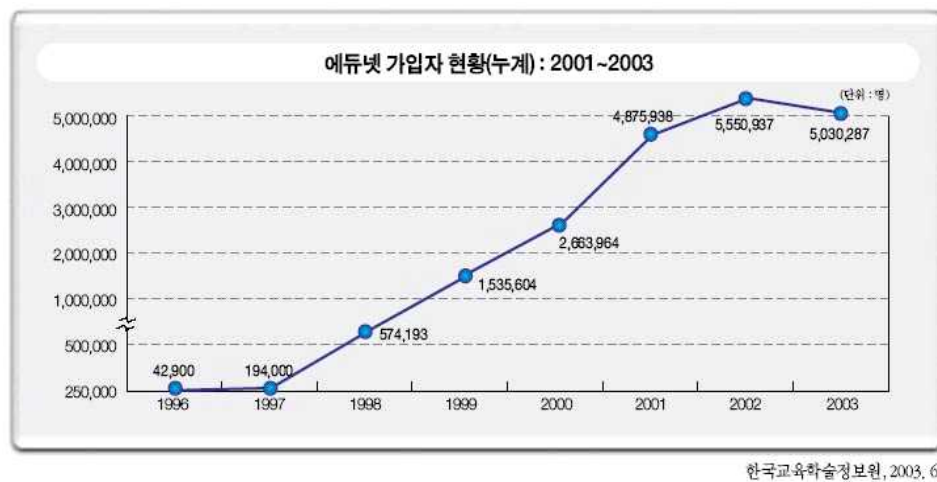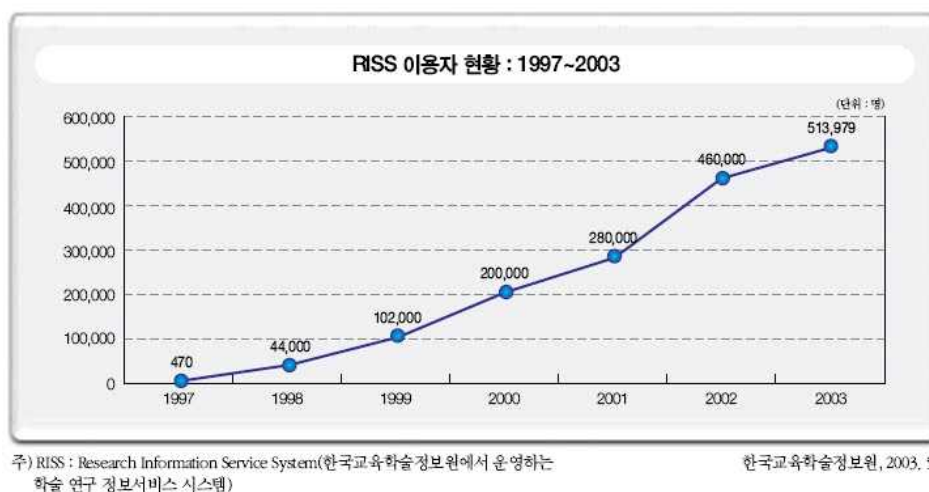


Figure 4. Trend in number of EduNet users

Figure 5. Trend in number of Research Information Services System(RISS) users

developed digital materials for teachers and students as well. Provincial Offices of Education and teachers in local schools also joined this effort of developing various kinds of educational software including websites.

During the period of 1998-2000, critical issues such as digital divide, obsolete infrastructure, and the quality of digital materials were emerged (Jung, 2000).

### 3) Comprehensive Implementation Stage between 2001 and 2005 (Master plan II)

The second Master Plan began in 2001 and supposed to end in 2005. Main focuses of the plan include upgrading existing hardware infrastructure, improving the connection speed, and supplying quality software to schools. Other tasks such as integrating ICT digital divide were also included in the plan. One distinctive feature of this Master Plan II was the strong suggestion for teachers to allocate at least 10% of their class time for the use of ICT(MOE & KERIS, 2003).

The plan is still in progress. The results in 2003show figures below.

- ·5.8 students per PC (5 students per PC in 2005)
- ·67% schools with over 2Mbps (E1) internet connection (100% in 2005)
- ·0.6 advanced system which integrates PC, TV and Projection TV per classroom

As for the educational software, a total of 8,847 were developed by public and private organizations between 2000 and 2003. In addition, 79,928 multimedia educational materials were developed (MOE & KERIS, 2004b). For teachers, a total of 25,649 ICT-integrated teaching and learning plans and 20,077 support materials were created between 2001 and 2003. Other digital materials such as materials for independent studies and test items were also developed by public and private sectors. KERIS has been evaluating the quality of private sector created educational software since 1998 and web materials since 2003 and provided quality accreditation marks for the better 100 materials per year. This accreditation information has been open to the public via EduNet.

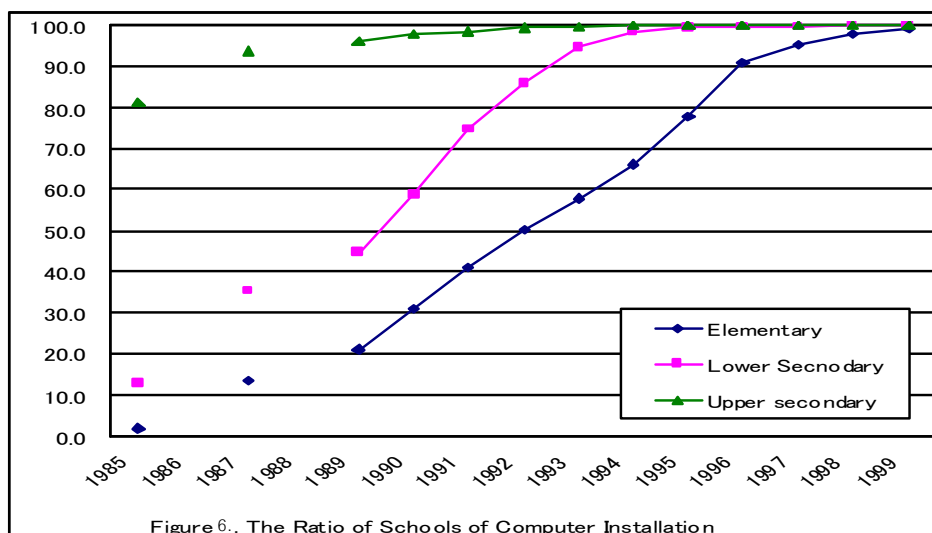## 2. Japan: From Stand-alone Computers to Networked Computers

Infrastructure in schools has been funded through two channels: 1) direct budget support to improve infrastructure, and 2) research projects in model schools.
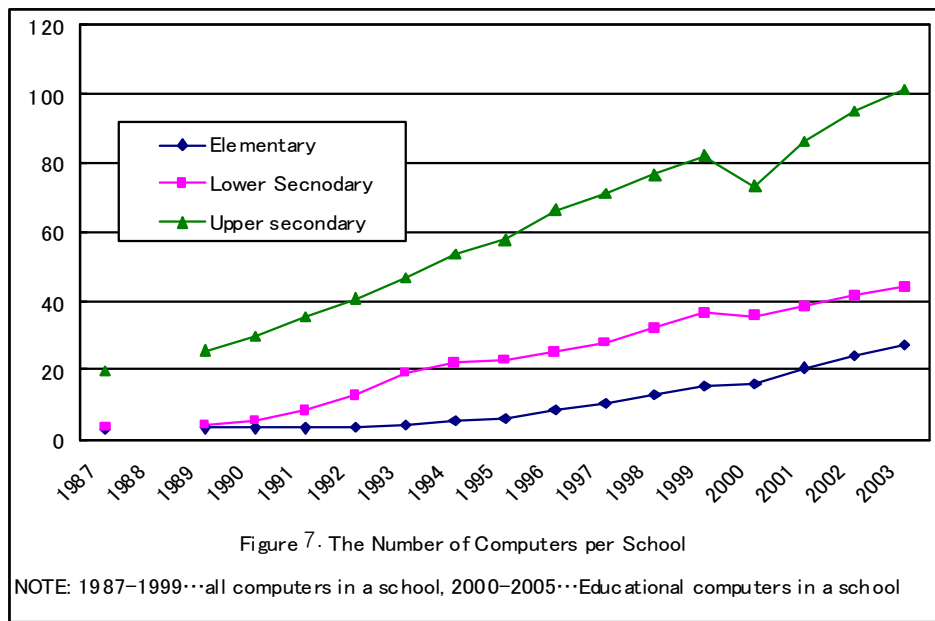
### 1) Budget allocation
As for the budget support, the Ministry started the Special Grant in Aid of Facilities for Developing Educational Method in 1985 based on the report from the Ad Hoc Council for Education. This was the first step to introduce ICT facilities into schools. The Ministry also started new expenditure for building computer rooms in 1989 and for equipping educational computers in schools in 1990. When the second phase started in 1994, the Ministry set up a goal that by 2000, each elementary school

would have 22 educational computers (a computer per two students), a lower secondary school 42 computers (a computer per student), and a upper secondary school 42 computers (a computer per student) in six years. After the first six year phase ended, the Ministry set up a new six year plan in 2000, targeting one computer per student in a computer room of all the public schools, two computers in an ordinal classroom, and six computers in a classroom for special purposes.

As shown in Figure 6, the ratio of schools which equipped computers had dramatically increased in the 1990's. Although elementally schools were behind in establishing infrastructure, they finally reached the goal in 1999. In 2000, there were 16.1 computers in elementary schools on average, 35.7 in lower secondary schools, 73.3 in upper secondary schools. These data show that the goal which was set up in 1994 was not achieved. Budget allocation system in Japan could explain this situation. The Ministry's budget for infrastructure is distributed to local governments as tax. In principle, local governments are supposed to spend this budget to build infrastructure in schools. But legally, local governments can use this budget at their own decision. Some local governments bought more computers for schools whereas



Figure 6. The Ratio of Schools of Computer Installation

Figure 7. The Number of Computers per School

NOTE: 1987–1999···all computers in a school, 2000–2005···Educational computers in a school

others did not. As a result, differences in the number of computers exist across local governments - e.g. 7.3 to 26.3 in elementary schools in 2000.

Figure 7 shows that even though almost all schools secured computers, the number of computers are still not enough in elementary and lower secondary schools. Again differences across local governments exist - e.g. 16.5 to 40.6 in elementary schools.

In 1998, it was planned that all the public schools could access the Internet by 2001 and a research project to introduce high-speed networks into schools began. The communication expenses or costs for network providers were paid by tax allocated to the local governments. In the Millennium Project initiated in 1999, all schools are planed to be connected to high-speed network by 2005.

Figure 8 shows the ratio of schools with the Internet connection. Almost all the schools were connected to the Internet by 2001 as planned. As shown

Figure 8. The Ratio of Schools of the Interent Connection



FIgure 9. The Ratio of Schools of High-speed Network

NOTE: High-speed Network···400kbps～
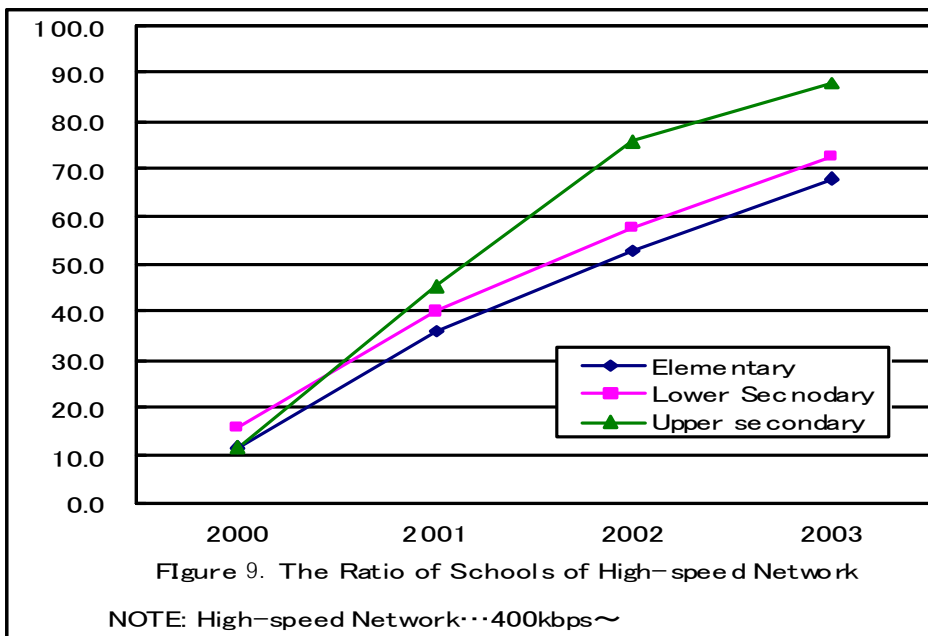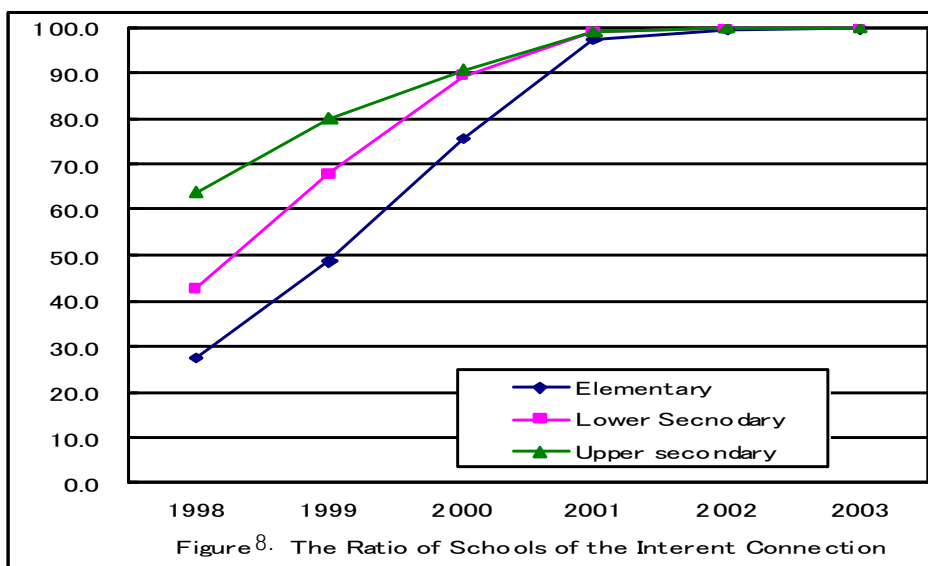
in Figure 9, the ratio of schools which connected to high-speed network has increased over recent years. There seems to be a high possibilitythat all the

schools be connected to high-speed internet by 2005.

**2) Fund for research projects**

Regarding research projects in model schools, the Ministry selected model schools to experiment use of computers in teaching and learning between 1986 and 1996. The number of schools selected increased from 15 in 1987 to 66 between1994 and 1995. The One Hundred Schools Project (1994-96), New One Hundred Schools Project (1997-99), and e-Square Project were also funded by the Ministry. By assigning research funds to schools, the Ministry could control those schools directly. However the number of schools funded was so small that it is difficult to say that these projects had some effects or influences on other schools' daily practices.

In 1986 the Ministry of Education and the Ministry of Trade and Commerce jointly established the Computer Education Center as a foundation to promote research, develop standardization scheme for educational computer system, support production of educational materials for teachers, and so on. In 1988 the Ministry established the Research Center for Learning Software

Table 3. Summary of Infrastructure Plans (Japan)

| Year | MOE Plan |
|---|---|
| 1985~ | Special Grant-in-Aid for Facilities for Developing Educational Method as tax allocation to local governments |
| 1990~ | Plan of equipping computers in schools by 1999<br>a computer per two students in elementary, a computer per student in secondary |
| 1994~2000 | Six-Year Improvement Plan for Hardware<br>a computer per two students in elementary, a computer per student in secondary |
| 1998 | Plan of connecting all schools to the Internet by 2001 |
| 2001~2005 | New Six-Year Improvement Plan for Hardware<br>a computer per student in computer rooms of all schools, two computers in ordinal classrooms, six computers in classrooms for special purpose |

Information to collect different kinds of educational software which schools had produced, and to distribute those software to other school.

# Ⅳ. ICT Teacher Training Policy*

## 1. Korea: All Teachers with ICT Competencies

The first ICT training for teachers was given to vocational high school teachers in 1972. Since 1988, the Ministry of Education and the Provincial Offices of Education have provided in-service teacher training for the use of computers in the classroom.

Between 1988 and 1996, all the primary and secondary teachers received 30 to 180 hours of basic computer literacy training. The training focus in the early years was on understanding computer technology, acquiring programming skills and developing computer-assisted instruction (Jung, 2003).

The first phase of a comprehensive ICT teacher training began in 1997 and ended in 2000. The focus was on teaching a variety of ICT skills. As a result, all 339,635 teachers received the first phase ICT training in 2000. During the second phase of ICT teacher training (between 2001 and 2003), the focus of training was changed to ICT-pedagogy integration in the classroom. About 11% of ICT teacher training courses were actually integrated ICT in their training process. All the teachers in Korea were to receive ICT training once every 3 years during this second phase. During the third phase, about 50% of ICT training courses will integrate ICT in their training process and a variety of pedagogical strategies will be explored (MOE & KERIS, 2003). Table 4 highlights key focuses of ICT teacher

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* A part of this section is from Jung, I.S. (2005). In-service training for teachers and ICT literacy program for students: A case of Korea. In T. Mizukoshi (Ed.). ICT and Media Education in the New Future. Tokyo: Tosho Bunka Publishers.

Table 4. History and Changes of ICT teacher training focus (Korea)

| Year | ICT teacher training focus |
|---|---|
| 1972 | First ICT Training for Vocational High School Teachers |
| 1988 - 1996 | 30 180 hrs of Basic Skill Training for All Teachers |
| 1997 - 2000 | First Phase of Comprehensive ICT Training for All Teachers  focus on a variety of ICT skills including CAI development |
| 2001 - 2003 | Second Phase of Comprehensive ICT Training for All Teachers  focus on ICT-Pedagogy Integration in Classroom |
| 2004 - 2006 | Third Phase of Comprehensive ICT Training for All Teachers  focus on a variety of pedagogical strategies |

training in Korea.

Recognizing the importanceof teacher training in the use of ICT in teaching and learning, many provincial offices of education have set the ICT Skill Standards for Teachers (ISST) and certified the ICT skills of teacher who meet the standards. However, in some provinces, no suchsystem has been employed and the digital divide among teachers in different provinces has been reported (MOE & KERIS, 2003). Recently, the Korean Ministry of Education developed a national ISST and training programs for all the teachers in the primary and secondary schools throughout the nation. This national level ISST suggests different skills for teachers depending on their school position such as a regular teacher, a teacher in-charge-of ICT, a vice principal, or a principal. The ISST also suggests ICT skills at several different levels of using ICT. In 1999, MOE created the plan for supporting the adaptation of the ICT Skill Evaluation Test for Teachers. Now each year, 10% of all the teachers in Korea must take this test to evaluate their use of ICT in teaching. The name of the Test has been changed to the "Certification of ICT Skills for Teachers." As of 2002, 292,621 (about 77% of all the teachers in Korea) have taken the test and 181,585 teachers have been certified (MOE & KERIS, 2003). The test results are reported in the

teachers' annual performance review.
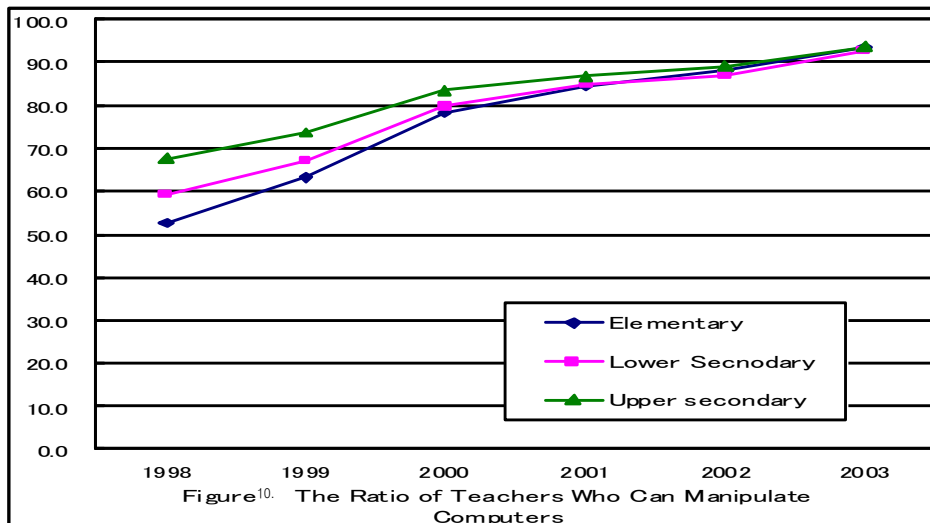
## 2. Japan: All Teachers using Computers in teaching

Teacher training is indispensable to promote information education, specifically after information became a required subject area.The Ministry policy has focused on training in-service teachers, not creating new programs of study for pre-service teachers in teachers colleges because teachers colleges have been downsized over the last twenty years or so. Thus the fastest way to introduce information education in schools was to train current teachers.
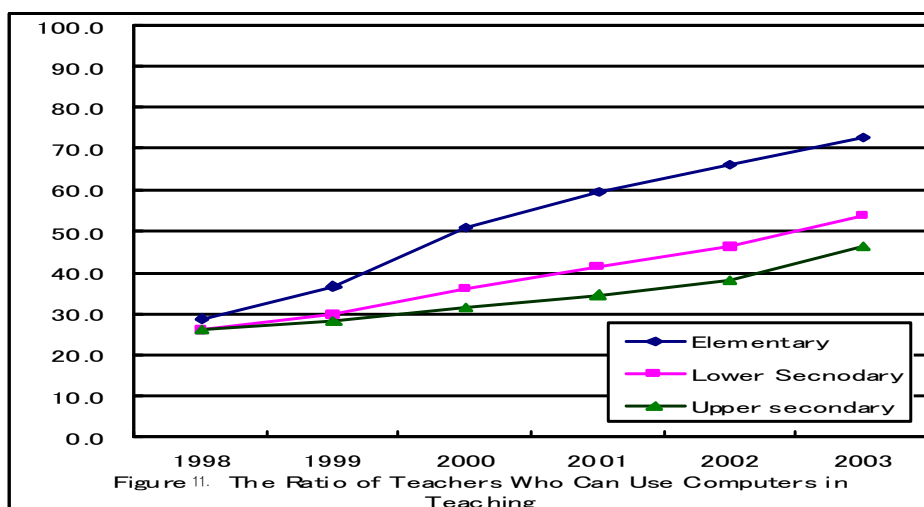
The Ministry has carried out professional training on information processing for vocational high schools teachers since 1970. Since the mid 1980's, the Ministry introduced basic training programs for secondary school teachers - mostly science or mathematics teachers. The number of teaches who took basic training was only 415 in 1989. The Ministry introduced a new system to employ people who had information processing certificates as part time teachers in 1994 and started fundamental computer training for all teachers with over 10 year experience, 20 years and so on in 1995. Even though computers were installed in schools, not so many teachers knew how to use them in 1990's. For example, only 19.7% of teachers could use computers in teaching. Teacher training was the most urgent task for ICT policy implementation in Japan.

In 1999, the Ministry made a plan that all teachers could manipulate computers and half of them could use computers in teaching by 2001. In order to achieve this goal, the Ministry reorganized teacher training adopting a cascading training approach: 1) the Ministry (the Teacher Training Center) trained prefecture (local government)leaders, 2) prefectures trained school leaders, and 3) schools trained all the teachers with help from school leaders. The Ministry also expended the training period or distributed educational materials for training to the schools. In 2002, the Ministry set

up a new goal that all teachers could use computers in teaching by 2005, admitting that teachers were not equipped with skills and knowledge needed for ICT use in teaching.

As shown in Figures 10 and 11, the goal to be achieved by 2001 could not be achieved. In 2001, the ratio of teachers who could manipulate computers was less then 90 % and those who could use computers in teaching was less than 40 % in secondary schools. It is interesting that the ratio of teachers who could use computers in teaching in elementary schools was higher than that of secondary school teachers, although infrastructure in elementary schools was inferior to that in secondary schools. In elementary school, one teacher is, in most cases, responsible for teaching all the subjects whereas in secondary schools, a teacher has his or her own subject. Computer use in secondary schools tends to be limited to specific subjects such as Technology and Home Economics or Information whereas in elementary schools, computer is more likely to be used across the subjects by an individual teacher. It is often said that teachers and students in upper high schools do not have positive attitude toward the use of computers in teaching because Information is not a subject for entrance examination of universities.



Figure 10. The Ratio of Teachers Who Can Manipulate Computers

Figure 11.  The Ratio of Teachers Who Can Use Computers in Teaching

Since 2001, the examination of Informatization of Education Coordinators has started. Those who pass this exam can get a certificate of Coordinators of Informatization of Education. This was the first socially recognized certificate in ICT in Japan. The number of coordinators were only around 150 in 2001. Over the last two decades the focus of teacher training has gradually shifted from computer manipulation to computer use in teaching.

To motivate teachers across the subjects, e-Learning self-training system for teachers has been developedsince 2003 and will open in 2005. According to the survey in 2002, the two biggest barriers to implement information education were: 1) having no time for teachers to receive training, and 2) taking much time for preparing for ICT use in class. These two barriers are related to each other because if a teacher gets enough training, she or he will be accustomed to using computer in teaching effectively and efficiently. This survey revealed the need for institutional compensation or support for teachers.

Another task related to ICT use in teaching is to verify the effectiveness of ICT-assisted teaching. According to the same survey mentioned above, teachers felt that effectiveness of using computers lied in improving students' motivation for learning and providing easy access to information collection.

Table 5. Policy Changes in ICT Teacher Training (Japan)

| Year | Policy |
|---|---|
| 1970~ | Expertise training of information processing in vocational high schools |
| the Middle of 1980's | Basic computer training for secondary schools teachers |
| 1994~ | Employ those who had certificate of information processing as part-time teachers in schools |
| 1995~ | Including IT training a part of ordinal teacher training |
| 1999~ | Systematic three layer training: national-local governments-each school |
| 2002~ | Goal of all teachers using computers in their teaching |

Not so many teachers, however, felt that they were able to make classes easy tounderstand and to tutor students individually. We still need more in-depth research on effectiveness of ICT use in classroom teaching.

# Ⅴ. Conclusions

The present study reveals that even though the policies integrating ICT in education intwo countries have been developed and implemented independently, there is convergence in policy directions. At the same time, the study shows there exists diversity in specific policy implementation strategies.The following discuss convergence and diversity of ICT policies in two countries. Some suggestions for policy directions in the future are also provided.

## Convergence of ICT Policy Directions

### 1) Developing ICT culture in schools

Both countries have continuously made an effort to develop a culture for ICT use in schools since the middle of 1980s. In this early stage, the

technology was seen as a supportive means for teaching. And the technology itself, especially the computer technology, was seen as the subject of study. The rationale for the adoption of ICT was preparing students for the forthcoming information society (MOE, 2003). Since the 1990s, a new concept of ICT use in education has introduced. Both countries have begun to emphasize ICT as an enabler of realizing lifelong knowledge society rather than as a mere supportive tool for teaching.

## 2) Adopting a systematic approach

From the analysis above, one can conclude that both countries have adopted a systematic approach in integrating ICT in schools. ICT policies in education have been developed in all the related areas including hardware infrastructure, software development, organizational structures, and capacity building. Policy decisions at the national level have been made to properly deploy hardware systems in schools, support teachers with digital materials, establish institutions, revise and create related laws and regulations, and train teachers and students to use ICT effectively for teaching and learning.

## 3) Emphasizing networking technologies

With the introduction of the Internet in late 1990s, both countries have switched their emphasis from stand-along computers to networking technologies. Among networking technologies, the Internet has been viewed as an important career of useful knowledge and as a tool for interaction with full of possibilitiesand educational opportunities. More efforts have been made in developing Web sites and e-learning programs. The Internet connection in schools and classrooms is considered to be a barometer of advanced ICT infrastructure for education.

## 4) Making policy-driven efforts

ICT integration in education has been policy-driven, government-led efforts in both countries. A top-down, rather than bottom-up approach has been

adopted in implementing ICT policies. Even though some variations are observed, the basic structure of the flow seems to be identical.

## Diversity of ICT Policy Implementation

### 1) Adopting different diffusion approaches

Korea seems to have taken a progressive, multifaceted approach as a strategy for disseminating ICT in education whereas Japan has adopted a rather conservative, research-based approach. Korea has carried out all the related policies such as installation of hardware and networks, teacher training, establishment of laws and regulations, organizational changes, e-learning trial projects, and software development simultaneously. Whereas, Japan initiated trial research projects such as 100 school project first to verify effectiveness of ICT for educationand thus ensure public accountability for dissemination ICT in schools, then comparatively slowly has begun to implement other policies. Korea's multifaceted progressive approach seems to reduce the adoption period of ICT use in education remarkably.

### 2) Gaining different levels of political support

A strong support from a nation's political leader can accelerate any innovation diffusion process. Korea's efforts to integrate ICT in education have received strong political supports from the nation's president whereas Japan's efforts have received less supports from the political leaders. Recent presidents of Korea have been rather prone to the diffusion of ICT in the society and especially in schools and sought full administrative and financial supports from all the Ministries. Especially the former president Kim Dae Joong (1998.2-2003.2) was a great advocate of ICT in schoolsand thus made an every effort to complete the Internet connection in all the classrooms in the year of 2000.

### 3) Adopting different implementation strategies

Korea and Japan, both having a limited power in implementing policies, seem to adopt different strategies to lead local governments and provincial offices of education to carry out actual ICT policy implementation. Whereas Korea has adopted a competitive evaluation system where ICT integration in schools is regularly evaluated and rewarded based on the integration results, Japan has depended more on voluntary efforts of local governments and schools in adopting ICT.

## Policy Suggestions for Future Improvement

### 1) Build a policy network at governmental level

Efficiency and effectiveness of ICT policy making and implementing in both countries can be improved bybuilding a collaborative policy network of information exchange at the governmental level. This network will provide a formal channel for sharing best policy practices, sharing research results, and consulting each party with regard to pedagogical ICT policy in education.

### 2) Develop a professional network at institutional level

Both Korea and Japan established ICT-related institutions with similar aims and goals. Such institutions include the Korea Education and Research Information Service (KERIS), the National Institute of Multimedia Education in Japan (NIME), and the National Information Center of Educational Resources (NICER). Those institutions can benefit from developing a professional network for exchanges of information, resources, and personnel. Digital materials for teachers can be shared as well through this network.

### 3) Put more emphasis on teacher training

Teacher training lies at the very heart of ICT policy implementation. Without teachers who are devoted to teaching with proper tools including ICT, there is no guaranteefor quality improvement. Whether ICT use improves

student learning depends on how teachers use ICT for their teaching. Both countries need to accelerate their efforts to make ICT training system more effective, efficient, and attractive to teachers.

## 4) Develop national evaluation standards for ICT utilization

The evaluation process reflects valuable information on the reality. Both countries should consider developing and adopting ICT evaluation criteria at various levels of implementation in education. The criteria should be developed in such a way that they reflect the reality transparently. Without having correct information on reality, the probability of making inefficient policy decisions will be increased.

## Acknowledgements

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