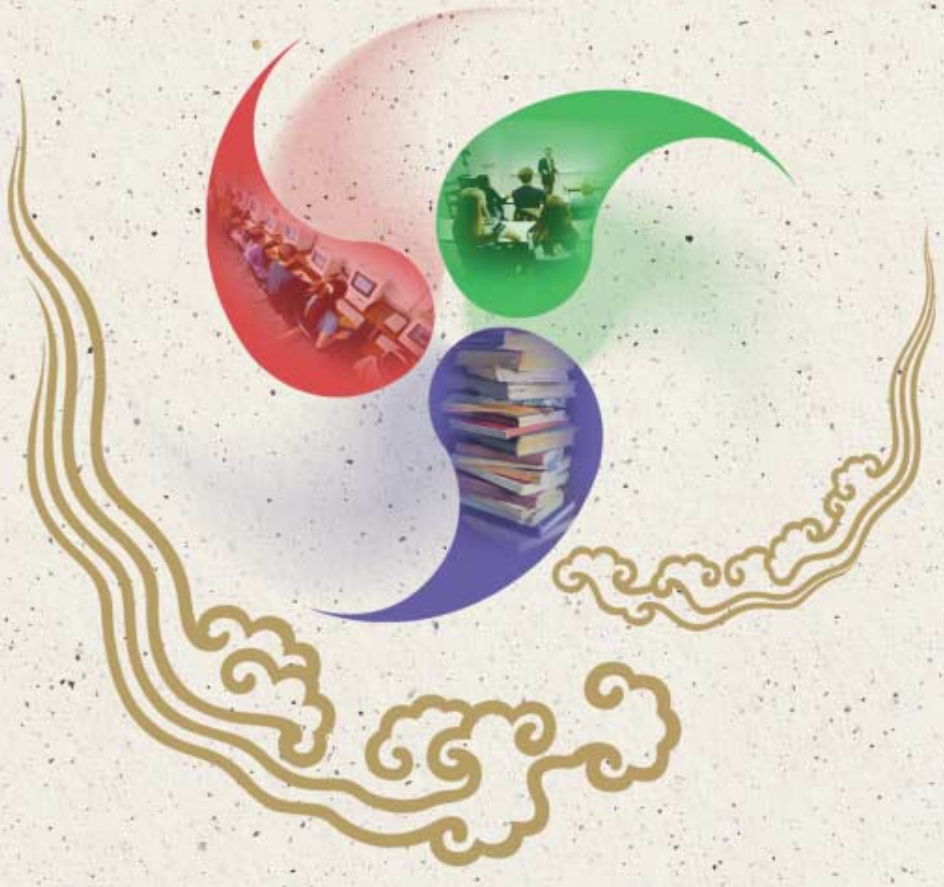
2000
Adapting Education to the Information Age

A WHITE PAPER



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KOREA EDUCATION & RESEARCH INFORMATION SERVICE

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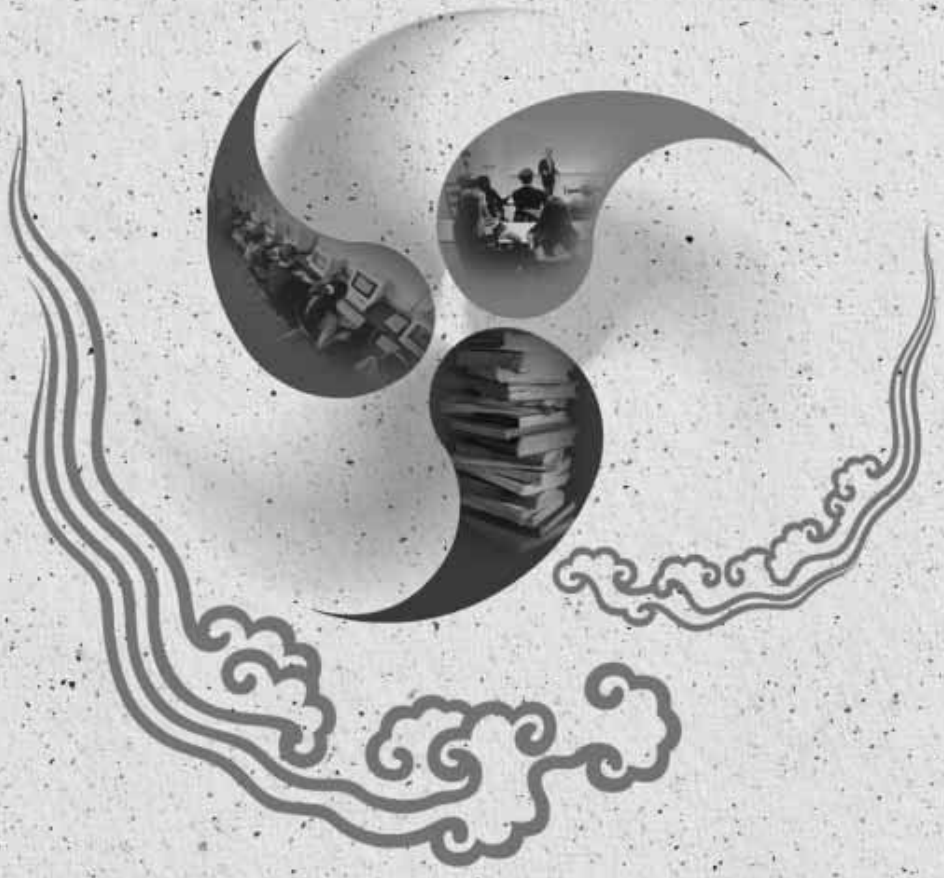

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Foreword

In the knowledge-based society of the 21st century, intelligence based on human originality will determine the survival and prosperity of individuals, organizations and countries. Our educational system served us well in the industrial society but requires a radical reorganization for the new knowledge-based society. Therefore, this country has been undertaking significant educational reform in order to cultivate creative human resources through open education and lifelong learning. The implementation of these educational reforms is based on Information and Communication Technology (ICT) in education.

In his New Year address this year, the President clarified that he would complete the comprehensive plan to build the infrastructure began in 1996, and would give much more importance to adapting education to the information age. The physical resources of ICT in education will be available in each elementary school and junior high school within this year. But infrastructure is only part of the program. ICT in education cannot be realized until the national comprehensive plan is established and implemented effectively and continuously. This includes the spread of computers, the building of in-school networks, the development and spread of educational data and information, the readjustment of related institutions, and the training of teachers and people in charge of adapting education to the information age. Effective use of the invested base with new educational tools is a key consideration. Adapting education to the information age is a new and developing process that requires flexibility in strategies and priorities to effectively cope with the requirements of a fast-growing environment. Continuous monitoring and evaluation are necessary to ensure that the reform continues to be based on accurate results.

The 2000 White Paper on adapting education to the information age, the second edition since 1998, identifies the purposes and subjects of ICT in education in the knowledge information society, describes the transition of internal ICT education, gives the status of projects relating to ICT in education, and outlines the policy and new vision of adapting education to the information age in the future. Adapting education to the information age is integral to our national competitiveness, and provides the way to cultivate the human resources required for a new society. This White Paper on adapting education to the information age also covers this important project in detail.

In conclusion, I thank those who made every effort to publish this White Paper from the bottom of my heart. Especially, special thanks go to Dr. Marv Westrom in university of British Columbia, Canada, who sincerely reviewed all pages of this paper. I expect this White Paper to be helpful for those who wish to understand the progressive policy and the status of ICT in education. I look forward to receiving your expressions of interest and advice so that the White Paper can contain even more valuable data in the future.

December 2000

Suh, Sam Young
President & CEO
Korea Education and Research Information Service

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PART 1

Adapting Education to the Information Age in the Knowledge and Information Society

CHAPTER 1

Introduction

Faced with a rapid change in our environment and educational structure, the 21st century can be characterized as a knowledge-based society that values collection, utilization, and production of important knowledge and information. In education sector alone, efforts are made to develop human resources through the enhancement of essential Information and Communication Technology (ICT), and to reduce the information gap among individuals. On one hand, a variety of supporting policies are formulated and carried out systematically to change the perceptions and attitudes in accordance with the educational paradigm shift. On the other hand, some educational measures are under preparation to prevent the dysfunctions that could arise in the rapid change during the transition into an information society.

1 New Educational Environment

In the information society, the ability to collect, develop, exchange, store and manage information from various and dispersed data, along with the ability to generate additional information of value are essential.

The information society requires manpower with creativity and individuality. Accordingly, schools need to fundamentally reform their educational system to foster students' individuality and distinctive qualities. This new educational system must ensure efficiency with a sound management system, an effective teaching-learning process, and appropriate record system of students' school life.

In knowledge-based society, individuals need to learn continuously and develop their potential skills over a lifetime. The everlasting changes in the structure of the economy no longer permits an individual to stay in the same career for a lifetime. One must continuously arm himself/herself with newer knowledge and skills even if one stays in the same industry.

In knowledge-based society, both society and individuals need an ongoing learning system. However, since there are only limited resources to provide education, it is necessary for government to provide reasonably-priced high-quality education at the learner's convenience. In the present environment, it is not easy for learners with a job to attend classes at a specific time and place. There are limitations to the number of physical buildings that can accomodate learners. The educational

environment also demands reinventing so that individuals have the opportunity to learn conveniently and inexpensively.

We need a new educational environment where anyone can learn at any time and at any place. In addition, the new educational environment should provide quality education at a low price.

ICT education can meet the requirements to provide high quality education inexpensively to anybody. For adapting education to the information age, it is necessary to use ICT and creat learning opportunities in cyberspace, and to provide good educational content for various teaching-learning methods. At the same time, teachers should be prepared to give assistance whenever learners need help in the real world as well as in cyberspace. There are some prerequisites in order to effectively utilize cyberspace as a field of education and training. The following conditions should be met to do so:

First, a nationwide super-high-speed information communication infrastructure has to be built. Cyberspace is a new environment created by computer and communication technology; communication infrastructure must be constructed first in order to build and utilize ICT. A high-speed communication infrastructure is a prerequisite for transmitting multimedia contents such as moving images and animation. Simple text or data cannot satisfy individuals' educational needs for visual and auditory sources of information.

Second, individuals must be equipped with communication technology tools to access the super-high-speed communication infrastructure. Whenever and wherever they are (workplace, home, school, training organizations), people should have easy access to the super-high-speed information communication infrastructure and be able to search and utilize data, get lectures, discuss, and perform tasks cooperatively in cyberspace.

Third, it is important to secure good quality data, information and content for educational training. Therefore, a national educational training information management system should be established. Many people are engaged in educational training and have created numerous and various sets of informative materials in the form of reports and textbooks that could be shared with others. Many of these have been accumulated, but, unfortunately, they are not duly utilized. Unnecessary efforts have been made repeatedly in creating knowledge and information already developed by others. In other words, doing the same job without knowing that the information already exists. The wasted time and resources could have been reallocated in creating new knowledge and information. Therefore, it is important to establish a management system to store, control, and utilize our knowledge and information effectively. In order to extend opportunities and enhance the quality of education, active develop ment of good educational resource and information is important, as long as it is managed systematically for effective utilization.

Fourth, qualified professionals in charge of educational training, such as teachers, trainers and counselors, who can access to the super-high-speed communication technology and the instructional contents to the learners, are required. In the knowledge and information society, the quantity and quality of the individuals' knowledge and information are

the foundations of the national competitive power. Creating new value, continuing education and training are getting more attention than ever before. Mobilizing cyberspace will contribute to increase access to education to everyone at a low price, at their convenience, without limitations of time and place, and provide a place where people can exchange information and ideas. Individuals should not only have the tools necessary to access cyberspace, but also have the knowledge and skills to use them.

Finally, to ensure success, the relevant rules and institutions need to be restructured:

- Individual learners must have ready access to cyberspace. All barriers to access should be removed.
- Learners' access to all necessary educational materials should be secured. Systems for the protection of individual privacy must be in place.
- The rights and interests of the holders of copyrights must be protected while the rights of consumers to access needed information are established.

2 Education for Information and Communication Technology

At the G8 Summit meeting held in July 1999 in Okinawa, Japan, the Digital Divide was addressed as an important issue to be resolved. Digital tools are widening the disparities between rich and the poor societies, between industrialized and developing countries, and between access of haves and have-nots of information. The Summit concluded that it was necessary to step up the joint efforts of nations to narrow the Digital Divide worldwide.

Solution to the Digital Divide or information gap should start by enabling each individual to improve their awareness and skill in using ICT. Information Literacy consists of the skills to utilize ICT, the ability to access, compare, analyze, evaluate, select, and process data in daily life, and awareness of information ethics. The education to cultivate individuals' Information Literacy is called Information Literacy Education or Education for ICT. Education for ICT can be categorized by components: education on ICT themselves, and education on effective use of these technologies.

1. Education on ICT

Education on ICT denotes training individuals to aware ICT, to use ICT, and to have appropriate attitudes to ICT. Education for ICT focuses on having individuals solve various problems using ICT appropriately in everyday life. Acquiring the skills to use ICT such as computers is not sufficient by itself; knowledge about ICT must be transferable to other problem solving activities.

An important consideration in ICT education is information ethics. Concerns about problems caused by the introduction of ICT and creating a sound culture in using ICT are receiving more and more attention from ICT users. Education for ICT will help make our new activity space healthy and useful. Topics for information ethics education include: use of appropriate words and behavior, protection of

privacy, protection of intellectual property rights such as copyright, and prevention of illegal activities such as hacking and unauthorized use of other ICT or data.

2. Education on Using ICT

The core of the ICT is the computer. The current trend in the development of ICT is centered on computers, and this trend has become more intensive with the advent of multimedia computers. There are two ways of using ICT one as media and the other as tools.

A. Using ICT as media

A typical educational activity of using ICT as media is Computer Assisted Instruction (CAI). Computers are used as media in the communication between the teacher and the students in CAI classes, and several phenomena that are not probable in a traditional classroom can occur. In the CAI classes, like in the traditional classroom, direct communication between teachers and students still occurs. But with the introduction of new communication paths through computers, new teaching-learning experiences are being developed.

Recently, more educational training is being provided through cyberspace. Web-based education is a good example, and Cyber Universities and cyber training institutes are buoyant, especially targeting adult learners, enterprises and universities. These leading cyber educational institutions offer programs with a variety of contents and methods. Adult learners need retraining to survive in the rapidly changing society, and cyber education can meet their needs at a low cost regardless of space and time. Cyber education for adults is a marketable business for institutions because demand is increasing from adults who are able to pay the tuition.

B. Using ICT as Tools

Tools are the instruments and apparatus used or manipulated to create a certain modality from materials. Tools are used in performing operations in the process of achieving goals of users. Compared to media, which is used to deliver the existing content, tools are used to change and create the content to meet the users' needs.

Using computers as tools in education is analogous to using pencils as tools in writing. But users often need help to learn how to use computer as a tool. Using computers as tools means the efficient process of solving problems using computer applications such as word-processing, database, spreadsheet, graphics, sound, and communication programs.

The use of ICT including computers is becoming a part of everyday life in schools and workplaces. In the process of collecting, analyzing and processing information and sharing ideas with others, ICT serve as essential enabling tools. Therefore, it is important to know what ICT is and how to use it. But it is essential to be able to utilize ICT effectively in the process of practical problem solving and task performance.

Education for ICT enables individuals to utilize the ICT for their own learning, including continuous self development, job performance and problem solving in their

careers, leisure activities, solving problems in daily life, art activities, literary creation, and higher creative intellectual activities such as research and development. All of our citizens deserve the right to information literacy. No one should be left on the wrong side of the Digital Divide.

3 Changing Attitudes

Adapting education to the information age does not identify a single activity; it requires a change in the whole national education system. Adapting to broad change is not easy. Drawbacks and negative impacts are not uncommon in the process of coping with these changes. Among these difficulties include a need for changes in attitude. Attitude changes include changes in perceptions, values, and behavior accompanying the shift of the educational paradigm.

Many countries worldwide are concerned about the crisis of cultural identity resulting from the international openness of information services. Information is unlike other commodities in that it does not have a national boundary. With the progress of the information age, the influx of heterogeneous cultures can only increase and this may precipitate a crisis of national cultural identity. Such a crisis would cause a serious social problem, because it undermines the identity of society as a whole. To mitigate the impact of the influx of foreign information, schools are advised to nurture students' ability to cope with heterogeneous cultures and the perceptions of individuals in society broadened.

Learners must play an active role in learning process. A teacher's main role in teaching with the assistance of a computer network is not focused on delivering knowledge to learners, but rather helping students find their own ways to knowledge and information. In the information age, enhancing learners' autonomy and ability to learn is more important than acquiring simple knowledge. Teachers will have to change their roles from being lecturers to being guides, monitors and facilitators.

Cultivating new moral attitudes in an information society in which the opportunities to access information are ever increasing. All the members of society need to abide by accepted ethical standards for accessing and using information from various sources. Failure to follow the rules and ethics in the information society can lead to serious social hazards. Being aware of potential social problems now, we can make technical and institutional arrangements to prevent them from arising.

4 Dysfunction of Adapting Information to the Current Society

There are various ways of defining the term 'Adapting Information to the Current Society'. In general, it can be defined as 'enhancement and spread of usage of ICT'. The ultimate goal of adapting information to the current society is to promote better life of people.

As far as adapting information to the current society concerned the spread of ICT, leads to increased affluence and convenience in people

lives. In a sense, the effect of adapting information to the current society is positive. However, if adapting information to the current society does not contribute to the improvement of people's lives, raises unexpected problems or disturbs public order. Then adapting information to the current society is dysfunctional.

1. Types of Dysfunction of Adapting Information to the Current Society

The types of dysfunction of adapting information to the current society can be categorized as follows:

- Distribution of inappropriate information and computer viruses through the communication networks
- Violation and destruction of information or communication systems
- Support of illegal activities such as fraud, gambling, and prostitution
- Infringement of intellectual property rights.
- Dissemination and/or misuse of personal information
- Mediation of cyber sexual activities or violence

Three selected representative types of dysfunction of adapting information to the current society that are closely related to school-aged students are discussed below.

A. Distribution of Inappropriate Information

Inappropriate information can be divided into two types. The first is flow of obscene or violent information. Obscene information disseminates distorted information about sex. Violent information glorifies or beautifies essentially violent activities or scenes. Obscene and violent information can cause a serious emotional impact on adolescents who are working to develop a self-identity through self-reflection to become a sound and productive citizen.

Presently many schools have LANs and are connected to internet, so the possibility for students to be exposed to improper information through the internet is greater than ever before. According to a recent study, only 1.7% of schools participating in the study are equipped with software to screen out improper information.

A second type of improper information is groundless rumors and false reports that have anti-social or anti-national content. Circulation of slandering remarks and spreading false information against individuals or specific public figures such as politicians and entertainers may damage the targeted person's reputation as well as impeding social order.

B. Infringement of Copyright

Infringement of copyright means the use of copyrighted material without permission of the holder. Strictly speaking, it is illegal and immoral to take and use information property of other people without proper permission. Uploading and downloading of programs through the internet without the author's permission, as well as illegal reproduction, transmission, and trade of software, are all activities of copyright infringement. Computer users can easily upload software from the internet, and through e-mail and chat rooms, commercial software is traded and distributed illegally.

According to a recent report by the Commission on Protection of Software Property Rights in 1998, 67.4% of the software installed in the PCs in our country was illegally reproduced. Compared to 27% in the USA and 32% in Japan, our illegal use of software reached at a serious level. Because internet connection is a part of our daily lives, issues involving the infringement of copyright draws great attention.

C. Cyber Sexual Violence

With the pervasive use of ICT and the internet, cyber sexual violence becomes another issue with a negative effect on the internet culture. Cyber sexual violence involves verbal or visual sexual violence and stalking on the network. Cyber sexual violence does not involve necessity real contact among subscribers, but all the virtual sexual harassment or violence directed at specified or unspecified people through e-mail or chat rooms are on the increase. Some patterns of cyber sexual violence include inducing a sense of sexual shame or using abusive language. Others involve indirect sexual violence, bantering with a specific person or sending obscene text or images to a public bulletin board.

2. Coping with the Dysfunction of Adapting Information to the Current Society

The efforts to cope with the dysfunction of adapting information to the current society that come with the development of ICT in the society can be explained in three dimensions: Legal and institutional, technical and educational measures.

A. Legal and Institutional Measures

The Information Communication Ethics Committee was established to apply sanctions against the distribution of improper information. The existing rules and regulations are applied to the activity of distribution of obscene information, especially to protect adolescents from unhealthy information. New and complementary regulations are also under enactment.

In order to reduce the damage caused by the infringement of copyright, significant penalties against illegal reproduction were introduced in 1998. Laws for the protection of copyright on the internet are in the process of revision.

Current laws prohibit cyber sexual violence with penalties of up to one year of imprisonment or a fine not exceeding 2,400 US Dollars. However, there is no mesaures against cyber stalking, but effort is underway to introduce a bill at the National Assembly.

B. Technical Measures

Development of a screening software program is one of the efforts underway to prevent the distribution of improper information to adolescents. About 10 screening programs are available on the market. One of these is 'NCA Patrol 1.0', which was developed by National Computerization Agency at the request of the Information Communication Ethics Committee.

Technical measures against the infringement of copyright are progressing in two directions, the development of special distribution techniques for digital material, and the development of digital watermarks. 'Digital distribution technique' is a special encoding

process that transmits digital material such as music, images and text so that it can be retrieved only by authorized persons (usually people who have paid). Digital watermarks introduces subtle hidden but identifiable marks in the digital material which can be retrieved and used in proving copyright violations, claiming ownership, or censoring illegal distributors.

As a technical measure to tackle cyber sexual violence, software programs to cut off unwanted communication are under development. The information communication industries have been asked to provide protection for personal information in e-mail and personal home pages, and efforts are being made to introduce sanctions against entrepreneurs who violate these protective measures.

C. Educational Measures

Both legal and technical measures are important and necessary to cope with the dysfunctions of ICT, but these measures all have limitations. More pervasive and practical measures can be achieved through education. Education of information ethics education is one of the educational measures introduced to reduce the effect of dysfunction of adapting information to the current society. The goal of information ethics education is to instill sound values to enable members of the information society to be good citizens.

Even though ethics education is the fundamental measures for coping with the dysfunctions of adapting information to the current society, education for ICT taught in official schools is composed mainly of skills for utilizing ICT.

In contrast, organizations related to adapting information to the current society and social education institutes are initiating programs to expand information ethics. For instance, the Research Center for Korean Youth Culture, the Information Communication Ethics Committee, and the Korea Information and Culture Movement Committee are exemplar organizations that take leading role in this movement.

CHAPTER 2

Goals and Main Tasks for Adapting Education to the Information Age

In the knowledge and information society, the ability to produce new knowledge is recognized as a more valuable skill than simply acquiring new knowledge. So, the policy for adapting information to the current society concentrates on fostering creative human resources through implementation of open education, lifelong learning, and a cyber learning system. The specific efforts to intergrate ICT in the elementary and secondary education include construction of the physical information infrastructure as a foundation for enhancing human capital, reinforcement of ICT utilization, and development and distribution of educational information that reflects the educational consumers' needs. In the higher education and research fields, introduction of educational systems such as Cyber University and construction of the academic research information sharing system are in progress. Enhancement of administrative efficiency through smooth information exchange among educational organizations and consumer-oriented adapting administration to the information age are the main tasks in the educational information project.

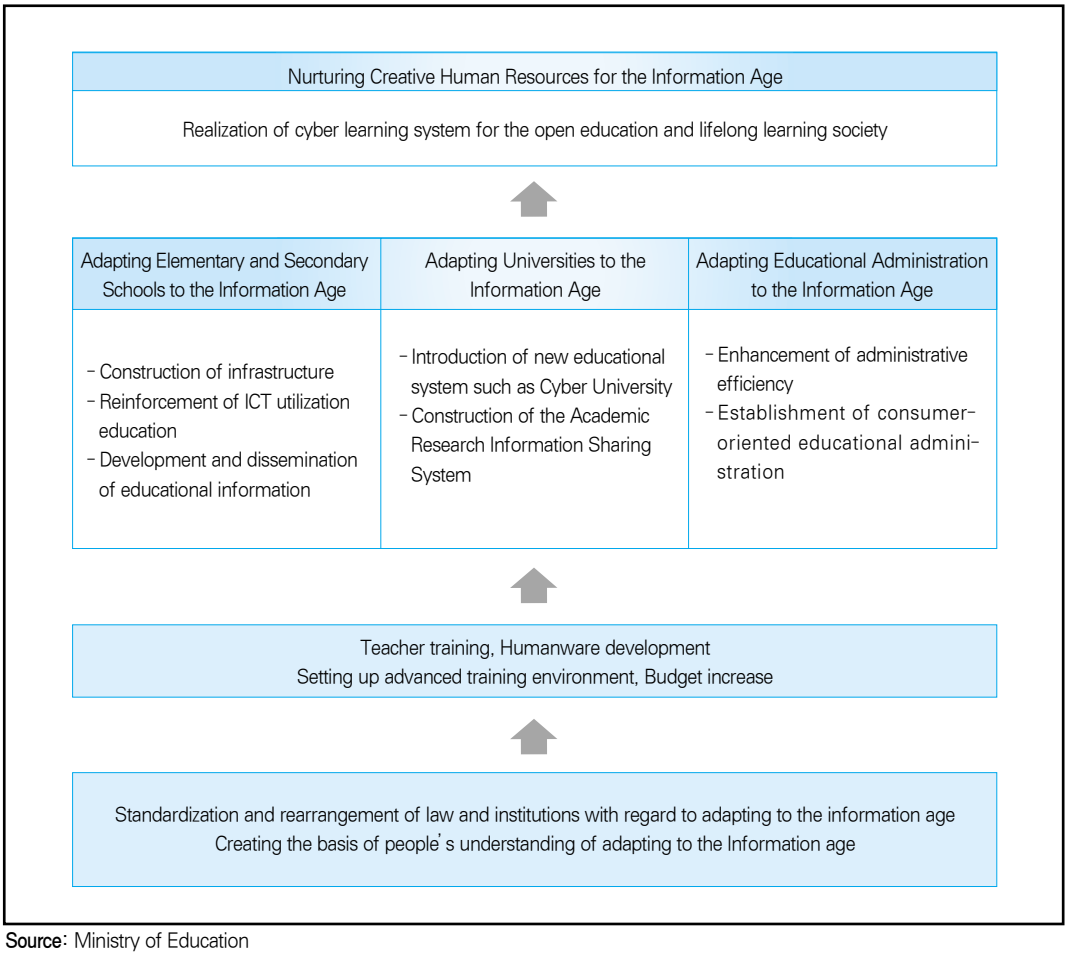
1 Goals and Characteristics of Adapting Education to the Information Age

1. Goals of Adapting Education to the Information Age

The image of a competent man has been changed in a knowledge and information society. Human needs are more individualized, diversified, and specified; information and knowledge expand continuously. The image of a competent person changes as society itself changes over time. Abilities deemed essential in an agrarian or an industrial society are not the same as those required in an information society. A competent person in the information society is creative, autonomous, open and cooperative. It is expected in an information society that huge amount of information in various forms can be easily obtained at any place and at any time. Our economic activity, social life, and values are changed accordingly. The most salient change is that the ability to use and create knowledge, rather than acquisition of knowledge, is recognized.

Adapting education to the information age does not identify a specific activity, but it implies a total change in content, methods, and topics for the educational system. Adapting education to the information age is the reform of the educational system for the new society through ICT. Furthermore, it is a comprehensive and systematic activity to realize flexible, productive, and efficient education by changing education-related rules, institutions, and customs, and by changing peoples' attitudes to adapt to the information society. The vision of adapting education to the information age is one of the building blocks of an 'Edutopia'. That is, an open and continuing education society based on ICT, where everyone can get into system, but rather by complementing and reinforcing it, building on its substantial nature.

The project for Adapting Education to the Information Age was started at the end of the 1980s. In the early 1990s state-level policy was outlined by the Framework Act on the Promotion of ICT, and in July 1997 the Enforcement Plan for Adapting Education to the Information Age was fomulated. Adapting education to the information age has been



Source: Ministry of Education

〔Figure 1-2-1〕 Goals of Adapting Education to the Information Age

accelerated under this enforcement plan. The plan is composed of six main tasks. The goals of each task are summarized and shown in Figure 1-2-1.

As can be seen in Figure 1-2-1, on the basis of people's understanding of adapting education to the information age and re-organization of the relevant laws and institutions, teacher training, humanware development, and setting advanced training environments should be promoted. This project will be carried out in the three fields: adapting elementary and secondary schools, universities, and educational administration to the information age. The ultimate goal of adapting education to the information age is to nurture creative human resources for the information age through realization of cyber learning system for the open education and lifelong learning society.

The adapting education to the information age progressing under these goals provides a significant new educational opportunity. However, in order to get the best out of this project, we should be prepared for the counteractions or side effects of adapting education to the information age.

First of all, information ethics is a fundamental requirement to protect privacy and intellectual property rights, prevent hacking, and impeding circulation of obscene material that could rise with the expansion of ICT. Information ethics should be systematically established through reinforcement of information ethics education.

Second, we should work hard to reduce the information gap caused by an inequality of opportunity to get equal education for ICT in different socio-economic status. Economic status can reinforce the information gap by making it easier for some people to effectively use ICT. It is necessary to insure that all people have an equal opportunity to have full access to the educational information provided through ICT education project by reducing costs such as purchasing computers and software and paying for communication.

Third, the development and utilization of an index to monitor and evaluate the nation-wide efforts for adapting education to the information age will help to ensure that the project meets its expected goals. Many countries are investing enormous social resources in adapting education to the information age, but adequate measures are not taken to enable assessment and evaluation of the outcomes of the adapting education to the information age. In consideration the characteristics of education, it takes time to realize and observe the effects of change. It is not easy to measure the extent of the effect of the ICT. However, efforts to develop and use the index to evaluate the result of the adapting education to the information age are essential.

Last, we need a clear vision and goals for adapting education to the information age. Adapting education to the information age is not limited to a simple subject or means of education. Through the progress of adapting education to information age, our fundamental educational system can be reformed. Our vision of education and academic research should be at the heart of the project of building up a new educational system and research environment. Through adapting education to the information age we can realize 'Edutopia' when anyone can learn and do academic research with minimum expenses and without

limitations of time and place, and everyone can develop his or her creativity and ability to realize his/her full potential.

2. Characteristics of the Project for Adapting Education to the Information Age

Differing from other projects promoted by the Ministry of Education, characteristics of project for adapting education to the information age are listed below:

The school-level and state-level projects are closely related, and some projects are planned and operated with some redundancy. With regard to building the infrastructure for the project for adapting education to the information age, distribution of PCs for education, installation of LANs, and construction and operation of the educational computer network projects are being carried out simultaneously. The computerization of school activities records for the management of admissions, transfers, reinstatements, and maintenance of school achievement records for college entrance exams are in progress. Therefore, it is necessary to establish a standardized and comprehensive supporting system.

All projects are closely related one another. With regard to the construction of infrastructure, distribution of PCs for education, installation of LANs, and distribution of equipment for improving the teaching environment are in progress. In relation to the development and dissemination of educational information, the EDUNET information service system is set up and running. Concerning human resource development, various undertakings in teacher training, management of educational curriculum, and deregulations of law and institutions are underway. These projects need to be carried out under a comprehensive plan.

The rate of access to the education information network is increasing by four-fold yearly. With an explosive increase in the need for the project for adapting education to the information age, budgetary measures for limiting access as well as ensuring allocations are needed.

The Windows operating system is upgraded every other year, and the number of internet users has increased to 14 milion. Appropriate measures to cope with the rapid development of technology and the increase of the internet users are needed.

2 Main Tasks for the Project for Adapting Education to the Information Age

The main tasks for the project for adapting education to the information age are being carried out with three projects: adapting elementary and secondary schools to the information age, adapting universities to the information age, and adapting educational administration to the information age.

The project deals with adapting elementary and secondary schools to the information age involves the curriculum, the construction of a school information infrastructure, reinforcement of ICT utilization education, and development and dissemination of educational

information.

The adapting universities to the information age are related with two projects: introduction of new educational systems such as the cyber university and construction of the academic research information sharing system.

It is expected that the adapting educational administration to the information age will contribute to enhance the administrative efficiency and establish consumer-oriented educational administration.

1. Adapting Elementary and Secondary Schools to the Information Age

The main task of adapting elementary and secondary schools to the information age is to enhance the information literacy and skills of utilizing ICT of teachers and students. Its goal can be defined in two dimensions. For students, it is to enhance information literacy (knowledge of ICT, information ethics, etc.) that is necessary as a citizen in the information society. For teachers, it is to reform their teaching methods, incorporating ICT.

The steps taken to accomplish the adapting elementary and secondary schools to the information age are: integration of information literacy into the educational curriculum, early construction of infrastructure for adapting education to the information age, reinforcement of information training for teachers and prospective teachers, and the continuous development and dissemination of educational information.

A. Adapting the Educational Curriculum to the Information Age

Adapting the educational curriculum to the information age is well underway on two directions. One is the cultivation of students' information literacy by introducing information-related content into the curriculum in the public education system. The other is for learners who have left formal education. An information literacy certification system is provided through which they can evaluate and certify their level of information literacy.

Information literacy is reflected in the regular educational curriculum, as an elective, and as a special curricular activity. Vocational and science high schools, from the 5th grade of elementary school to the 1st grade of middle school provide it as a compulsory regular course. From the 2nd grade of middle school to the 3rd grade of high schools, information literacy is included as an elective course. Computer-related courses can be selected as a special activity. Specifically, at the 5th and 6th grades of elementary school total, practically 12-hour is allocated to this course and at the 1st grade of middle school an 11 hour course in the Technology and Home Economics is available. For the vocational and science High Schools, information and communication related professional courses are offered. As an elective, computer (or information industry) courses are provided at the schools' discretion. In the 1st term of 1999, 48.2% of the total middle schools (1,321 schools) and 55.1% of the total high schools (651 schools) offered computer courses as a part of their elective curriculum.

A information literacy certification system is

used to evaluate and identify students' skill of information literacy. The result of this certification is recorded and used as one criteria of the college entrance exam. There are four tracks to be certified in information literacy:

- Taking more than 2 units of computer related courses in high school
- Taking more than 34 hours of education for ICT as an extracurricular activity or specialty education activity
- Passing the information literacy certification exam held by the Korea Education and Research Information Service (KERIS), and
- Passing qualifying exams held by private institutions approved by KERIS

B. Construction of Information Infrastructure

Establishing the information infrastructure consists of the distribution of computers for student and teacher use and the installation of multimedia equipment, and the construction of a computer network which includes building an environment for internet utilization in the schools.

Building the information infrastructure is necessary to permit a smooth implementation of adapting education to the information age, and it requires significant administrative and financial resources to complete the project. Plans are to distribute computers for one computer lab in each school (2 labs in schools with more than 36 classes). Computers with less than 386-CPUs are to be replaced, and a total of 340,000 units, one computer for each teacher, will be provided by the end of 2000.

Advancement of the teaching environment is underway to improve the efficiency of education by providing multimedia equipment such as PCs, TVs, epidiascopes, etc. The new educational information infrastructure will be completed by connecting all the classrooms and schools together through the internet. At this point the exchange of information among classrooms and schools will be able to proceed smoothly.

C. Reinforcement of Education for ICT Utilization

The cultivation of professional teachers of education for ICT is accomplished through in-service programs and training prospective teachers with certification at the Department of Computer Education or the Department of Computer Engineering in universities of education and colleges of education.

Every year, in-service training is provided for approximately one quarter of all teachers, or 85,000 people. Training is also provided for 10,000 professional instructors, one from each elementary and middle school. Apart from direct training, indirect measures such as the support of organizations conducting research on computer-related subjects. The introduction of an evaluation system on ICT utilization skills is under consideration to encourage teachers' independent learning.

To enhance prospective teachers' ICT utilization skills, the Ministry of Education supported all 11 national universities of education with multimedia labs. This year the 13 colleges of education of national universities will receive substantial support.

D. Development and Dissemination of Educational Information

Educational software was developed and disseminated exclusively in the public sector until 1997. Starting in 1988, the private sector began helping to produce software and the number of participating organization is steadily increasing. Developers of educational information for the public sector include the Ministry of Education (through public contests for educational software), each city and provincial Office of Education, and the KERIS. To promote the development and dissemination of educational software in the private sector, purchasing expenses of educational software are supported for each school.

To help teachers choose the software they need, educational software exhibitions have been held and an 'Authorized Software Distribution Committee' was established. The Ministry of Education, city and provincial Offices of Education, and the KERIS are jointly holding educational software exhibitions in 4 regions on a nationwide tour. The Ministry of Education sponsors the Authorized Software Distribution Committee and it serves to encourage the secure purchase of authorized educational software in elementary and secondary schools.

2. Adapting Universities to the Information Age

The purposes of the adapting universities to the information age project aims at fostering academic research, cultivating high-quality human resources, and developing cutting-edge scientific technology. The project covers three main tasks: Management of educational networks, construction of the academic research information sharing system, and operating model cyber universities.

A. Management of Education Network

The Korean Education Network (KREN) is a nonprofit information network for supporting education and research activities by connecting government organizations, educational institutions, and other institutions related to education, and connecting these to foreign networks. By 2002, installation of LANs in all elementary and secondary schools and connecting these to a super-high-speed National Information Network will be completed.

The Education Network is composed of a network control center and nine regional network centers. The Network control center is set up and run at Seoul National University, and the nine regional network centers are at nine national universities, Chuncheon, Cheongju, Daejeon, Jeonju, Gwangju, Daegu, Busan, Jinju, and Jeju.

At the end of 1999, 1,333 institutions were connected to the internet through the Education Network, together with This included 197 universities and junior colleges, 972 elementary and secondary schools, and 164 educational administration institutions.

B. Construction of the the Academic Research Information Sharing System

The project aims to upgrade national competitiveness in academic and research activities, by providing research information promptly with low cost, and by establishing a

research information sharing system. At present, the KERIS is taking the lead in this endeavor.

Under the project of constructing and operating a research information service system, a comprehensive library consisting of catalogues from 154 universities in the country were integrated, resulting in a database of more than 20 billion items. The volume covers 5,250,000 bibliographies and 5,250,000 sources owned by the United States Library of Congress (LC). At present 18,000 bibliographies and 6,300 full-text services of doctoral dissertations granted overseas are available, and it is planned that by 2002 the full-text services of nationwide doctoral dissertations and masteral theses will be available in online database.

C. Operation of Model Cyber Universities

The traditional educational environment in the university, which has a physical campus and students who are learning through discussions or from face to face lectures from a professor is changing into customer-oriented individual learning. A new educational paradigm is emerging in which customers can plan and choose from various educational programs at any time and place. Applying the internet to education, opening of web-based on-line lectures and establishment of lifelong education institutions are a part of the efforts to adapt to the new educational paradigm of the information age. In particular, with the growing interest in applying the internet to education, Cyber Universities in various fields are being established.

Since 1998 a total of 80 Cyber Universities have been participating in the experimental operation. There are three types of Cyber Universities.

- There are a few stand-alone cyber universities such as the ones at Seoul National University and Sookmyung Women's University.
- Several universities formed a Cyber University consortium.
- Universities, information communication enterprises, and a mass media organization collaborated to form a consortium. An example is the Open Cyber University, composed of 19 universities, Samsung SDS, and Joong-Ang Ilbo.

3. Adapting Educational Administration to the Information Age

Adapting educational administration to the information age is necessary to improve efficiency and accuracy of decision-making. Its goal is to provide efficient and consumer-oriented educational administration.

This is a systematic and hierarchical project that ranges from the Ministry of Education down to each school. Its goal is to oversee the integrity and security of information throughout the educational system. The activities in the Ministry of Education and schools with regard to adapting educational administration to the information age are described below.

A. The Ministry of Education

The Ministry of Education is computerizing its administrative affairs with the objective of constructing a foundation for enhancing

administrative efficiency and productivity, sharing information through its LAN, and supporting the development and operation of administrative affairs within the Ministry.

The Ministry installed a LAN and established a homepage in 1997. It provided PCs for all officials within the organization and officials are able to receive information from the internet. With the LAN installation and in accordance with the effort for an electronic government, the Ministry introduced an electronic signature system in September 1997 and an electronic document processing system in March 1998. The electronic document processing system connecting the Ministry and the provincial Offices of Education simplified the stages of document processing from ten to four, resulting in significant savings of time and money.

In an effort to support adapting administrative aspects of university entrance exams for the information age, the Ministry developed a CD-ROM called 'School Activities Record for University Admission Screening'. This is a list of all 3rd year students in all high schools in the country, a total of 770,000 students and 1,953 schools. It was distributed and used by a total of 367 universities and junior colleges.

B. Elementary and Secondary Schools

In the elementary and secondary schools, adapting administration to the information age is being implemented through two projects, 1) computerization of school activities records and 2) construction of a comprehensive school information management system. Computerizing school activities records is to reduce the

〈Table 1-2-1〉 Comprehensive Information Management System for Elementary and Secondary Schools

Subsystems	Contents
Academic Affairs Support System	- Grading management - Student activities management - Register management - Teaching and learning materials management
Educational Information Circulating System	- Electronic document signing - Electronic bulletin board - Document sending and receiving - E-mail
School Management Support System	- Finance management - Personnel management - Facility management - Health management
Integrated Educational Information Service System	- Information location service - Link to educational statistics database - Central integrated information service

Source: Ministry of Education

job burden for teachers and enhance school administration services. This is one of the core parts of the education reform. The recording of school activities in computer form has been required since 1996. The computerization of school activities records is expected to contribute to realizing education reform in several ways, including the reduction of teachers' routine work, the quick retrieval of information for teaching and guidance, systematic information for educational policy making, and reference information for admission screening to upper schools.

The purpose of the comprehensive school information management system is to enhance the quality of educational administration by integrating several systems into one generic system.

The comprehensive school information management system includes four subsystems: the academic affairs support system, the educational information circulation system, the school management support system, and the integrated educational information service system. The specific content of each subsystem is shown in Table 1-2-1. This system will be completed and distributed for use at all schools across the nation by the end of 2000.

CHAPTER 3

History

Our ICT education program started under the name of computing education or computer education. Its foundation for expansion was the distribution of computers to the schools and the city and provincial Offices of Education, and the integration of computer education into the curriculum. In the early 1990s against a background of the spread of ICT in society and the construction of a super-high-speed communication network, plans regarding ICT education were set in place. Today ICT education is a core national project. According to a New Year's Policy Address by the President, a comprehensive plan for adapting education to the information age, concentrating on the completion of building up infrastructure in the elementary and secondary schools, will be completed by the end of this year.

1 Overview

The phrase adapting education to the information age and education for ICT were popularized after the announcement of the Education Reform Committee and the Comprehensive Plan for adapting education to the information age by the Ministry of Education in May 1995. As a follow up to this plan, the Commission on Education Reform was established in the mid 1990s.

Generally speaking, the history of ICT in education is divided into several phases, the exploration period (1960s), the embryonic period (1970s), and the period of development and spread (1980s). Full scale ICT education started in the late 1980s with the recommendation by the Education Reform Council on the reinforcement of computer education in preparation for the information society. In the Fifth Education Curriculum, computer education was introduced. Following is a detailed history of this subject.

The 1970s was the embryonic period for computer education, and was based on the 'Electronic Computer Education Plan' prepared by the Ministry of Education. Introduction of school computer education began during the 1980s decade. This was supported by 'Basic Plan for the Education and Research Network'. The Plan for 'Reinforcing Computer Education in Schools' was released in the mid-1980s and another plan, the 'Support and Implementation Plan for Computer Education in Schools' was announced public in late 1980s.

The 1990s has been an expanding period for adapting education to the information age. The 'Comprehensive Plan for Adapting Education to the Information Age' was formulated in mid-1990s and, as a new comprehensive plan, the 'Enforcement Plan for Adapting Education to the Information Age' was completed in July 1996 to promote adapting education to the information age in a rapidly changing environment. This comprehensive plan, originally intended as a three year implemen- tation plan starting from 1997, was initially delayed until 2002 due to the financial crisis of the International Monetary Fund monitoring. However it was completed by the end of 2000 as proclaimed in the New Year's Policy Address by the President in January 2000. At the same time, with the completion of the first phase of the comprehensive plan, the second phase is underway to prepare for the further development of ICT in education.

The Education Reform Council has served as a driving force for adapting education to the information age. It linked the emphasis adapting education to the information age in the 1980s with the development of the indigenous computer industry, the plan for a national information network, and other recommendations. The remarkable activity in the 1990s has been made possible by the construction of the information superhighway, the acceleration of the information society, and the adoption of the recommendations by the Education Reform Committee. But, as computer education in schools could not meet the increasing demands from society and the changing social environment, a new comprehensive plan, the Enforcement Plan for Adapting Education to the Information Age, was prepared.

The history of policy development concerning adapting education to the information age shows that the introduction and growth of educational change has been intimately related to several factors. These include the growth of the information and computer industries, the contribution of industry to the enhancement of national competitive power and the generation of national wealth, the increasing demand for computer literacy for all, the recommendations by the Reform Council Committee, the Education Reform, and other research institutions, the demands from all sectors of the society for the development of a computer industry, and the competition among countries in introducing computer education. In the late 1990s, many countries enforced integration of ICT into schools as a core national project in preparation for the knowledge and information society. In Korea, we seek ICT in education in order to get a lead in international competition. With the strong will of the President, the ICT in education sector began to expand.

2 History of Adapting Education to the Information Age

1. 1970s: The Embryonic Period

We can say the 1960s was a decade of recognizing computer necessity, leading to the Economic Planning Board introducing an IBM 1401 computer for the analysis of population census data at Sogang University. Three other universities also introduced computers for

educational use in 1969.

The next decade, the 1970s, was the embryonic period. Consulting with other central government agencies, the Ministry of Education announced the 'Plan for Electronic Computer Education' following the President's statement in July 1970 that "electronic, computer education is necessary at high schools and up". In August 1971, Ministry Order 289 by the Ministry of Education announced an education curriculum in which 'General Electronic Computer' was designated as a compulsory subject, and four other subjects, including COBOL Programming, were identified as elective subject. Along with this, the Korea Institute of Science and Technology (KIST) installed computer terminals in Seoul Doksu Commercial High School in December 1971. The high school introduced a CDC 3100 machine for training purposes. The Ministry of Education revised the high school curriculum with Ministry Order No. 350 in December 1974, adding 'Electronic Computer Systems' and 'Use of Electronic Computers' to the section on Electronic Computers in the subject of Technology. The change implied that computer education was recognized not only as a professional part of vocational education but as a common part of general education.

2. Early and Mid 1980s: The Developing Period

The Ministry of Education revised the high school curriculum through Ministry Order No. 442 in December 1981. In the revised Act 'Introduction to Electronic Computer' and 'Applications of Electronic Computers' sections were added to the general high school subject of Science and Technology. In addition, 'Order Charts and Algorithms' was added to Mathematics 1, and an explanation of the usage of computers in the information society was added to middle school subject of Technology.

In 1984, an Information Processing Department was established in Commercial High Schools and an IT Department in Technical High Schools. The Education Reform Council played an critical role in changing computer education from a vocational training curriculum to a general curriculum. In its final report, the December 1987 'Comprehensive Plan for Education Reform', the Council emphasized the need for computer education as a part of education reform and recommended the installation of computers in schools for the improvement of teaching and learning, for the promotion of science and technology education, and for the preparation for a future information society.

3. Late 1980s and Early 1990s: The Expanding Period

The Education Reform Council's recommendation recognized the need for a research and education network as a part of the national information network. Propositions by research institutes for introducing computers, and the demands from the computer industry and relevant government agencies were the justified the introduction of a computer education in elementary, middle, and general high schools in the Fifth Education Curriculum which was announced in December 1987. The Fifth Education Curriculum described the direction of education as 'actively meeting the

challenges of highly industrialized and information society as caused by rapid expansion of knowledge and development of science', which showed the increasing interest in computer education.

In combination with the integration of computers into education as suggested by the Education Reform Council, the Ministry of Education announced the 'Reinforcement Plan for Computer Education in Schools' in December 1987. This reinforcement plan called for effective computer education, which in turn would increase computer use in schools and promote the early realization of the information society. The plan suggested the expansion of opportunities for computer education, an increase in learning methods that utilize computers, and the computerization of school administration.

In December 1988, the Computer Network Coordination Committee gave top priority to school computer education and committed nationwide support to its implementation. When the 'Support and Implementation Plan for School Computer Education' was released in July 1989, school computer education began to be implemented as a state policy beyond the Ministry of Education level. This plan focused on specific measures for the dissemination of hardware and software, training of teachers in charge of computer education, and administrative and financial supports.

Thereafter, the Ministry of Education implemented the plan with minor revisions every year. These revisions were only necessary to meet changes in the computer education environment and the number of schools included in the program. The Ministry also worked on improving policy effectiveness in supporting schools for computer education and in preparing for the future information society.

The Sixth Education Curriculum, announced in 1992, included 'Computer Operation' and 'Writing with the Computer' sections in the subject of Practical Arts at the 5th and 6th grades of the elementary school, and allowed each school to organize computer class at the school's discretion. For middle schools, the topic of 'Computers' was included in the subject of technology and Industry, and an elective computer course was allowed. For high schools, an 'Information and Communication' section in the Technology course, and a 'Computer' section in the Commerce course were integrated and The Information Industry was included as an elective subject.

The late 1980s was a period of education reform all over the world. The United States, United Kingdom, Japan, the Soviet Union, and many other countries competitively pursued education reform for the information age by adapting ICT in education. In the context of international competition of education reform, the Education Reform Council was established as a consultative body of the President. The term was set from 1985 to December 1987, and its final report emphasized adapting education to the information age.

The 'Reinforcement Plan for Computer Education in Schools' released by the Education Reform Council made a significant contribution to introducing computer education as a common subject in elementary and secondary schools. The plan set the foundation, for spreading ICT in education.

4. Mid 1990s to the Present: The Adapting Education to the Information Age Period

The school computer education policy that began in early 1970s changed direction by adopting a new title, 'ICT education', under the people's Government. In an effort to substantiate state-level policy, the Government announced the 'New Directions for Information and Communication Policy'. The basic law on issues related to ICT, the 'Framework Act on the Promotion of ICT', was enacted in 1995 and came into effect on January 1, 1996. Based on this framework, the Commission on ICT education Promotion was inaugurated in April 1996 with the Prime Minister as its head. The Ministry of Education organized a sub-committee for ICT education Promotion in the same month, and created the Educational Information Management Bureau with two divisions and two officers in charge.

The Ministry of Education has taken two of the ten key national projects in the Enforcement Plan for adapting education to the information age as its share. These are the Construction of ICT education Infrastructure for fostering Human Resources in Information Society, and the 'Construction of the Environment for Utilizing Academic and Research Information for the Advancement of Knowledge Basis'. The implementation encompasses six main tasks. Four projects fall under the 'Construction of ICT education Infrastructure for fostering Human Resources in Information Society' are:

- Construction of infrastructure for ICT education
- Development and dissemination of educational information
- Reinforcement of ICT utilization in education
- Utilization of ICT in educational administration

The two projects fall that cover the 'Construction of the Environment for Utilizing Academic and Research Information for the Advancement of Knowledge Base' are:

- The advancement of academic and research information base
- Construction of the academic information database

The main components of the first task, Construction of Infrastructure for ICT education, are

- Providing computers for elementary and secondary schools for educational use
- Providing computers for elementary and secondary school teachers
- Infrastructure implementation for internet connections in elementary and secondary schools
- Advancement of school libraries with multimedia equipment
- Infrastructure implementation for education via satellite
- Operation of modeling open schools
- Updating rules and institutions related to ICT education

The development and dissemination of educational information task; takes establishment and operation of the Korea Multimedia

Education Center (reorganized as the Korea Education and Research Information Center in 1999), and development and dist-ribution of teaching-learning database and educational software. The reinforcement of ICT utilization in education task; consists of reinforcement of computer-related curriculum and expansion of computer training for teachers responsible for education for ICT. The utilization of ICT in educational administration task; focuses on the installation of infrastructure and construction of a comprehensive school information management system. The advance- ment of academic and research information base task; focuses on the construction of the national education network and LANs within the universities, and construction of the academic information database task; involves establishment and operation of the Korea Research Information Center, construc-tion of the academic information database, and computerization of the university libraries.

The Seventh Education Curriculum, announced in July 1997, included 'Computers' as one section in the Practical Arts subject of the elementary schools, and as an elective in the middle schools. For high schools, The 'Information Society and Computers' course was introduced as a general elective.

The People's Government, inaugurated in February 1998, announced that it would make every effort to forge the 10th most powerful nation in information and knowledge, and made a turning point in the promotion of ICT education policy. KERIS was established as an expert organization for ICT education, and the information literacy certification for high school students was introduced for the active promotion of the project. In the New Year's Policy Address in January 2000, the President proclaimed, "We will complete within this year Comprehensive Plan for adapting eduction to the information age, which was originally targeted for 2002. By helping young people enhance their information capabilities, they will serve as the main players in the information society".

The Korean government will establish a comprehensive and nationwide information and communication infrastructure to reinforce ICT in education and help grow the information and communication industry. The government will also provide additional resources for educational policy to enhance the people's information literacy in a bold vision to make the nation the most computer-literate in the world by 2002.

PART 2

Adapting Education to the Information Age: The Present Situation

CHAPTER 1

Support Systems for Adapting Education to the Informaion Age

1 Statutes Concerning Adapting Education to the Informaion Age

1. Overview of the Legislative System

One of the salient features of information society is that a great amount of information is produced, processed, and preserved at the society level. The increase of information is also remarkable in the field of education. This explosion of information demands corresponding growth in terms of human and material resources necessary for efficient information management. Thus the progress of adapting education to the informaion age goes with institutional change and development. While new institutions are established, old ones are restructured or reorganized. The institutional change or restructuring has to be supported by the change of statutes, which are necessary not only for promoting the adapting education to the informaion age but also for minimizing the inefficiencies and regulating the malfunctions.

The statutes concerning adapting education to the informaion age, like many other rules and regulations in the nation, have their legal sources in constitution, rules, decrees, self-regulating ordinances, and international agreements. In this regard, statutes concerning adapting education to the informaion age contain features of technical aspects as they are closely related to ICT. Those statutes are classified in three ways, that is, one from the perspective of positive law system, in view of the characteristics of the adapting education to the informaion age projects, and the last one according to the current issues relating adapting education to the informaion age.

First, we can categorize the statutes concerning adapting education to the informaion age from the perspective of the positive laws in effect as follows:

- Statutes concerning elementary and secondary education;
- Statutes concerning the basic elements of adapting education to the informaion age;
- Statutes concerning the institutions in charge of the enforcement of adapting education to the informaion age;
- Statutes concerning information sharing;
- Statutes concerning software development promotion;
- Statutes concerning copyright;

- Statutes concerning the promotion of the expansion and utilization of information Network;
- Statutes concerning electric and communication business;
- Statutes concerning researches on information and communication policy.

Second, the statutes concerning adapting education to the informaion age can be divided as follows when we emphasize the nature of adapting education to the informaion age project as a national project.

- Statutes concerning the goals and directions of the project;
- Statutes concerning the organizations in charge of the project;
- Statutes concerning the promotion of the project;
- Statutes concerning the evaluation of the project;
- Statutes concerning new school management as a practical task for the project;
- Statutes concerning education for ICT
- Statutes concerning the distribution and utilization of educational information.

Third, the statutes can be classified according to the issues and disputes:

- Statutes concerning copyright issues;
- Statutes concerning contract matters;
- Statutes concerning intellectual property disputes;
- Statutes concerning crimes using computers;
- Statutes concerning the freedom of communication and expression and the good morals and manners;
- Statutes concerning the right to know and the protection of privacy.

Though the statutes mentioned above constitute the main parts of the statutes concerning adapting education to the informaion age in Korea, there are some other statutes such as those concerning education within the school system and those concerning education outside the school system.

2. Guidelines for the Improvement of the Statutes and Institutions Concerning Adapting Education to the Informaion Age

An efficient legal and institutional support systems are needed for the successful and efficient promotion of the adapting education to the informaion age project. This implies that we have to pay continuous attention to revising the statutes and improving the institutions concerning the national project.

There are some considerations when we work on constructing efficient legal and institutional support systems. The legal and institutional support systems must keep up with the rapidly digitizing social environment while minimizing its negative aspects, such as the spread of crimes related cyberspace, the circulation of information against the moral values of society, and the information gap among social sectors. In addition, we must be attentive to the different socio-cultural factors when we import new measures and institutions from abroad. Those measures that function well in one country may not take roots in another country due to the differences in socio-cultural environment. It implies that we have to

be fully aware of the benefits and losses before we apply foreign measures and institutions in the domestic context.

There are two guidelines for improvement of the statutes and institutions concerning adapting education to the informaion age. One is to make the effort for adapting education to the informaion age bear fruit in the society, and the other is to constrain the negative aspects of adapting education to the informaion age, which appear to increase as the effort goes on. In other words, we have to bear in mind that the improvement of the statutes and institutions should help the education both within and outside the school system adapt to the changing information age while controlling the undesirable aspects.

2 Executing Institutions and Support Systems for Adapting Education to the Informaion Age

1. The Ministry of Education and Relevant Institutions

A. Task Force for Adapting Education to the Informaion Age, Ministry of Education

The Ministry of Education established the Education Information Management Bureau as a general organization to manage the adapting education to the informaion age in July 1996. It was exclusively responsible for the adapting education to the informaion age project in every school, city, provincial, and local Offices of Education. This organization changed its title to the Adapting Education to the Informaion Age Bureau when the Ministry of Education reshuffled in March 1998, and in June 1999, the Officer of Adapting Education to the Informaion Age took charge of the duties for the project within the Ministry of Education.

The Ministry of Education, magnifying the duties of the Officer of Adapting Education to the Informaion Age in May 2000, established the Task Force for the Promotion of Adapting Education to the Informaion Age for the completion the Comprehensive Plan for Adapting Education to the Informaion Age and the initiation of the second comprehensive plan. The Task Force is an organization for a limited term and has three subdivisions. Each of the Task Force subdivisions has the following duties under the leadership of Task Force Chief who is in charge of moderating the general duties:

Planning Team for adapting education to the informaion age:

- Drawing up the comprehensive plan for adapting education to the informaion age;
- Reshuffling statutes and institutions related to adapting education to the informaion age;
- Support for the management of research information sharing system;
- Support for adapting university education to the information age;
- Support for adapting libraries to the information age;
- Overview of HRD;
- Model project of the adapting information to the current society: e-book project;
- Support for the operation of the Educational Broadcasting System;

- Overview of the budget for adapting education to the informaion age project;
- Public relations for adapting education to the information age;
- General affairs for the Task Force.

Team for Adapting Schools to the Information Age:

- Distribution of PCs for teaching and learning;
- Support for the advancement of the teaching environment;
- Support for LANs and internet access in schools;
- Support for adapting low-income families to the information age;
- Support for the distribution of PCs for the population;
- Support for the development and distribution of educational software;
- Training of teachers for the information age;
- Support for research schools for multimedia application;
- Support for personnel for school computerization;
- Support for the operation of the KERIS
- Other duties related to adapting education to the information age at elementary and Secondary schools.

Team for Adapting Administration to the Information Age:

- Establishment and enforcement of comprehensive plans for adapting administration to the information age;
- Adapting the Ministry of Education to the information age (Operation of MOE homepage; electronic signature system; circulation of digital documents; LANs within the Ministry; computing center within the Ministry; the e-mail system; and computer networks within the Ministry);
- Support for the operation of educational computer networks;
- Construction of Information Networks in schools;
- Support for the computerization of school activities records;
- Business Process Reengineering (BPR);
- Operation of the contest for computerization development.

B. City and Provincial Offices of Education

Most of the city and provincial offices of education have exclusive organizations in charge of the duties for adapting education to the information age, following the organizational model of the Ministry of Education where the duties are streamlined around the Task Force for adapting administration to the information age. But the titles of the organizations appear different in accord with the different situations of the offices of education. Division for Adapting Education to the Information Age, Officer for Adapting Education to the Information Age, Information Science and Technology Division, Science and Industry Education Division are some of the different titles. Several city and provincial offices of education are operating organizations of limited term, such as the Task Force for the Planning and Promotion of adapting education to the information age or the Task Force for the Promotion of adapting education to the information age.

The city and provincial offices of education revealed their strong interests in adapting

education to the information age by their rearrangements for organizations in exclusive charge of adapting education to the information age in 1999. We expect that various duties for adapting education to the information age will be filled more effectively and efficiently by those exclusive organizations in the city and provincial Offices of Education.

C. The Korea Education and Research Information Service

The KERIS was established on April 22, 1999 in accordance with the Korea Education and Research Information Service Act (Law No. 5686, Jan. 21, 1999). It merged the former Korea Multimedia Education Center, which was an affiliated organization of Educational Broadcasting System, and the former Korea Research Information Center, which was an affiliated organization of the Korea Research Foundation. The main goal of the KERIS is to contribute to the advancement of the quality of education and research in Korea by collecting and producing information for education and academic research and by constructing and operating the academic information utilization systems.

The KERIS promotes the following activities:

- Adapting education to the information age at elementary and secondary schools:
  - Development and distribution of education contents;
  - Information literacy certificates for students;
  - Training of personnel in charge of adapting education to the information age;
  - Operation of mobile KERIS offices;
  - Construction and operation of the Comprehensive School Information Management System for elementary and secondary schools;

- Academic and research information services:
  - Construction of the Academic Research Information Sharing System;
  - Construction of the full-text service system of academic works;
  - Supply of foreign academic and research information;

- Development of the infrastructure for educational and academic information:
  - Construction of the nationwide information service infrastructure;
  - Improvement of the main and communication systems in accordance with the growth of the users in EDUNET and Reasearch Information Service System (RISS);

- Overseas research activities for adapting education to the information age:
  - Research on the current situation of adapting education to the information age and policy development;
  - Research on the standardization of educational and academic information and their distribution;
  - International cooperation and joint research for adapting education and academic activities for the information age (joint research with APEC and OECD);
  - Distribution of authorized software for elementary and secondary schools;
  - Development of guidelines for the 7th textbook revision and improvements to the

textbook order and supply system;
- Planning for public relations for adapting education and academic activities to the information age;

2. Other Related Institutions

A. National Computerization Agency

National Computerization Agency was launched as specialized to serve the government and public institutions in adapting to the information society and to develop appropriate policies for a nationwide effort to move into a knowledge-based information society. Its major missions are: to provide expertise in preparing and implementing initiatives and plans for the promotion of information society; to support information resource management in the public sector; to evaluate and audit the ICT projects and systems of the public sector; to develop the standardization criteria for public information sharing; to develop and maintain information service and connection systems; to develop and maintain the public information management systems; and to promote ICT culture. Its major activities for the year 2000 are summarized as follows:

- Development of information resource management systems;
- Evaluation of ICT projects;
- Development of e-commerce standards;
- Audit of ICT projects and systems;
- ICT standardization;
- Information technology services for the public sector
- Support for the promotion of the information society;
- Integrated information service network;
- Construction of next-generation internet infrastructure;
- Management of information super-highway

B. Information Culture Center of Korea

Information Culture Center of Korea was established to promote the use of ICT, reduce the information gap, and promote the information society at a nationwide level, especially by increasing people's information literacy, promoting a sound social environment for the information society, and conducting public relations.

The activities of Information Culture Center of Korea are conducted through several projects. The Project for Adapting the Nation to the Information Society intends to develop people's ability to use information and communication equipment. The Promotion Project for Information Life is mainly for enhancing people's knowledge and interest in the information society. The Support Project for the Local Information Center is an effort to assist local people to get access to the information they need. This effort also intends to reduce the regional gap in the use of information. The Information Country Project operates an exhibition center where people can experience the various aspects of ICT and enhance their understanding of the future information society. And lastly, Information Culture Center of Korea is supervising the general evaluation of the information ability of the general public.

C. Education Software Promotion Association

Education Software Promotion Association was established in 1995 as a non-profit organization with the approval from the Ministry of Information and Communication. It aims the promotion of the educational software industry and improving the quality of education. Its key functions include the promotion of the development of educational software and the building of educational databases.

Education Software Promotion Association held the first educational software evaluation and the internet competency test in 1996. As of September 2000, the educational software evaluation has been conducted seven times and the internet competency test twelve times. Education Software Promotion Association has also held the accounting information capability test nine times. The main projects of Education Software Promotion Association include the following activities:

- Research and promotion of the development of educational software;
- Development of the educational software database;
- Public enlightenment activities to increase the use of computer;
- Technical support for the development of the educational software industry;
- Operation of education centers in cities and provinces for the promotion of information education;
- Operation of software competency tests.

D. The Korean Society for Educational Technology

The Korean Society for Educational Technology was established in 1985 to promote the balanced development of theory and practice of educational technology. It designs theoretical frameworks and applys them to solving real problems in the field, and leading in the effort to adapt education to the information society in Korea. For this purpose, the Society is working on the following activities:

- Research and promotion activities for adapting education to the information society;
- Internet education activities for nurturing a mind set appropriate for the information society;
- Software development for computer education in schools;
- Projects for the activation of on-line distance education in business;
- Construction of multimedia database for the national information super-highway;
- Human resource development to improve education in businesses;
- Running a convention of researchers on the issues mentioned above;
- Publication and on-line service of the society journals and other publications;
- Other activities necessary for the realization of the purpose of the society.

E. Korea Database Promotion Center

Korea Database Promotion Center was established in 1993 for the purpose of assisting

the development of a database industry and promoting the public interest and participation in the information society. The Center has several activities for the purpose and the following special programs:

- Collection of information on database services;
- Policy research for development of the database industry;
- Standardization of database systems;
- Support for the database industry;
- Database construction;
- Operation of database centers.

F. Korea Institute of Multimedia Contents and Software

Korea Institute of Multimedia Contents and Software was established in 1998 to support software venture businesses, promote the multimedia content industry, provide technical support for businesses, and protect existing programs. The Institute is pursuing the following projects:

- Support for the foundation of software venture businesses;
- Establishment of software support centers in new areas;
- Image data digitalization;
- Information management systems for digital content;
- Support for the use of original software;
- Support for new software development;
- Policy recommendations for software development;
- Construction of software databases.

G. Korea Software Industry Association

The Korea Software Industry Association started in 1988 when 63 member businesses agreed to make common efforts for sound development of the software industry. Now the Association has more than 800 member businesses. The Educational Software Developers Association is an affiliated organization.

The activities of the Association are conducted through policy recommendations, institutional development; information management; promotional activities for member businesses; international cooperation; exhibitions; seminars; and publications.

H. The Federation of Korean Information Industries

The Federation of Korean Information Industries was established in 1983 as a civilian organization for promoting the development of the information industry. More than 200 companies from various fields such as computer hardware, software, communication, and semiconductor manufacturing have membership in the Federation. Its activities are carried out through promoting the use of computers in the society; making policy recommendations for the promotion of the information society; conducting industry research, promoting international cooperation and exchange; holding conferences; promoting information distribution; awarding prizes to information industries; and conducting enlightenment activities for the general public.

The Federation is managing several projects and activities in the following areas in the year 2000:

- Promotion of digital management support systems in the industries;
- Strategy and vision for the continuing development of the information industry;
- Enhancement of the knowledge and information basis and support for management innovation in the industrial sector;
- Enhancement of the peoples ' computer literacy and promotion of the information society in local areas;
- Development of human resources skilled in ICT
- Support for government and public institutions in their promotion of the information society.

I. Korean Council of Information Culture Movement

The Korean Council Information Culture Movement was founded in 1998 as a civilian organization for the promotion of the nationwide information society movement. The establishment of the Korean Council Information Culture Movement is based on the idea that the information society will be promoted more effectively when the people at every level in every field are interested in it. Thus Korean Council Information Culture Movement is composed of the institutions and organizations from all major fields of society. The Korean Council Information Culture Movement sponsors enlightening activities, information society campaigns, academic conferences, contests, and exhibitions in order to promote the acceptance of the information society among the general public.

CHAPTER 2

Adapting Education to the Information Age in Elementary and Secondary Education

1 Infrastructure for Adapting Education to the Information Age

Most of the countries have already recognized the importance of the adapting education to the information age and started to develop its infrastructure. In order to keep up with the global trend and to make the country ready for the future knowledge-based world, Korea has been pursuing a project to build the necessary infrastructure for adapting education to the information society since 1997. Its elementary goal is to prepare the material basis for the knowledge-based information society so that people have the ability to access and use the rapidly developing ICT.

The main content of the project consists of the installation of computer labs and LANs in all the schools in the nation, the installation of multimedia equipment in all classrooms, and the distribution of computers for all teachers of the nation. As the project is one of a large scale and it consumes the largest portion of financial resources and administrative support.

1. Proceedings

A. Distribution of Computers in Accordance With the Comprehensive Plan for Adapting Education to the Information Age in Elementary and Secondary Education and the Five-Year Educational Development Plan

The Three-Year Plan for Adapting Education to the Information Age in Elementary and Secondary Education aims at building infrastructure from 1997 to 1999. It was revised in June 1998 to the Comprehensive Plan for Adapting Education to the Information Age in Elementary and Secondary Education. The main goal of the revised plan is aimed at the enhancement of the utilization of information equipment for teachers and students. It also set several other goals: the comprehensive and balanced promotion of adapting education to the information age; consideration of end users in equipments distribution; readjustment of infrastructure priority; efficient budget allocation; development of various methods for training teachers for the information society; increases and improvements of educational software; regular field checks on the progress; guidance and supervision; and a new evaluation

system for teachers regarding equipment and software utilization.

The plan is carried out through the installation of LANs and computer labs in every elementary and secondary school; the distribution of multimedia equipment and computers in every classroom; and the distribution of computers for teacher use.

1) Distribution of Computers for Computer Labs in Elementary and Secondary Schools

The first-stage of this distribution plan is to supply a total of 433,500 computer to elementary, middle, and high schools from 1997 to 2000. When the distribution is complete, it is estimated that one computer will be available for every 17.4 students. The second-stage goal is to supply 100,000 additional computers to those schools to make a computer available for every five student. This distribution plan anticipates that the private sector will supply a total of 95,000 units (21%) in order to assist the development of the computer industry in the nation.

The private sector participates in this plan through the donation of computers and the transfer of surplus computers from businesses to schools. The donation option is based on the idea that the businesses donate computers for assisting regular classes and are permitted to run extra classes using those computers for a period of 1-3 years. The plan set the total number of donated computers to be 130,000 units in 1997, and 20,000 units in 1998 and 1999. But only 35,000 units were donated in 1997 and 19,000 units in 1998.

The main idea of the surplus computer transfer is that schools accept a total of 90,000 surplus computers from the businesses for educational use (30,000 units every year from 1997 to 1999). The number constitutes about 20% of the old 486-CPU systems replaced by businesses every year.

The plan, however, has been promoted without an adequate analysis of the hardware and software development trend, without an in-depth analysis of the interaction of the changing teachers ' information ability and the distribution plan. We need to be more attentive to these issues while distributing computers for schools.

2) Distribution of Computers for Teacher Use

The plan for the distribution of computers for teacher use intends to distribute a total of 343,000 computers for elementary, middle, and high school teachers from 1997 to 2002. Its goal is to provide every teacher with a PC. This plan includes the distribution of 107,000 personal computer systems for elementary school homeroom teachers, which is executed as a way for the Advancement of the Teaching Environment. But, the execution of the Advancement of Teaching Environment was deferred due to a financial shortage in 1998. This retarded the distribution of computers for elementary school teachers. This plan faces the same problems as the plan for distributing computers for computer labs as mentioned above.

3) LAN Construction in Elementary and Secondary Schools

The main objective of this plan is to construct LANs in every elementary, middle, and high school and to connect the schools to internet by 2002. The plan also intends to give every teacher and student an internet ID for internet access. Thus financial support is needed not only

for construction of the LANs but also for internet access and communication.

This plan is yielded to bring in the enhancement of the infrastructure for the improvement of teaching and learning methods, the enlargement of the utilization of computers and other equipment that is already in use, and the construction of the infrastructure for the school administration computerization system. However, the enforcement of the plan faces several problems like the shortage of matching funds from local educational offices, the lack of teachers 'skills in operating the communication network and equipment, and the financial burden caused by increasing internet communication. As for the measures for the solution of these problems, we recommend an increase in the financial support from the central government, more personnel for operating information and communication systems, the development of new training programs for teachers, and the discount of educational communication fees.

4) Advancement of Teaching Environment

The goal of the Advancement of Teaching Environment is to assist the realization of adapting education to the information society by installing multimedia equipment in more than 200,000 classrooms of the elementary and secondary schools from 1997 to 2002. The equipment to be installed by this plan are PCs, image devices (TVs, monitors, projection TVs), and VCRs. At first, the plan was supposed to be co-financed with 50:50 ratio by the government and provincial budgets respectively. The 1999 Five-Year Education Development Plan stipulated that the plan would be supported by the provincial budget only.

This plan also faces problems such as the delay in its implementation due to a budget constraint, the poor utilization plans of multimedia equipment, and the lack of teachers' skills in utilizing this equipment. Thus government need to take several measures to solve these problems. As a result, the transfer of financial responsibility from the provinces to the central government was proposed to effective implementation of the plan; to make efforts to reach the numerical goal in spite of the delay; to find the various utilization methods of multimedia equipment; and to develop new training programs to enhance teachers' abilities to develop teaching-learning materials by themselves.

B. The Completion of the First-Stage of the Comprehensive Plan for Adapting Education to the Information Age in accordance with the President's New Year Policy Address in 2000

The plans mentioned above were revised again to be completed in 2000 in accordance with the President's New Year Policy Address for a New Millennium. The following is a summary of the contents of the revision:

1) Early completion of the Comprehensive Plan for Adapting Education to the Information Society (2002 → 2000)

- Completion of LANs in all elementary, middle, and high schools (10,003 schools);
- Distribution of one personal computer to every elementary, middle, and high school classroom (214,083 classrooms) and every

teacher (333,197 teachers);
- Support for free internet access for all elementary, middle, and high schools for five years (2000~2004).

2) Distribution of PCs for Students from Low-Income Household Students and Assisting the Students to Adapt to the Information Age:

- Free education to use computers and internet for 500,000 low-income household students;
- Free distribution of personal computers and free internet connection for five years for 50,000 gifted students.

2. Current Status of the Infrastructure of Adapting Education to the Information Age and Its Next Steps

A. Distribution of Computers for Computer Labs and Teachers

1) Current Status

By the end of 1999, the distribution rate of computers for computer labs in elementary and secondary schools is 76%, and the rate for teachers is 70%. Specifically, the number of students per computer (486-CPU system and up) is 23.8 (See Table 2-2-1). Counting only the 586-CPU systems, the number is 25.6.

By 1999, the computer systems with 486-CPU or better will make up 92.4% of the total computers distributed. The computers distributed by the private sector constitute about 13.9% of the computers for computer labs.

The average number of teachers per computer is 1.4 (See Table 2-2-2). The average becomes 1.5, if we count only 586-CPU systems. Currently the distribution achieved about 70% of the target figure.

2) Next Steps

Following are some recommendations to improve the progress of computer distribution for elementary and secondary schools and school teachers.

First, the cities and provinces should contribute resources to match the financial aid from the central government.

Second, it is necessary to encourage active participation from the private sector and the operation of after-school classes in order to reduce the financial burden on the public sector.

Third, it is necessary to execute the plans on a systematic basis and to create synergy effects by establishing interconnections or sequences of separate plans.

Fourth, there should be systematic project management for effective and efficient execution of the distribution plan.

〈Table 2-2-1〉 Number of Students per Computer by School Levels (Unit: person, unit)

Classification	Elementary School			Middle School			High School			Total		
	Students	PCs	No. of Students per PC	Students	PCs	No. of Students per PC	Students	PCs	No. of Students per PC	Students	PCs	No. of Students per PC
Total	3,912,562	159,280	24.6	1,915,602	86,249	22.2	1,299,532	54,462	23.9	7,127,696	299,991	23.8

Notes: The number of computers is only for 486-CPU systems and up; trade high schools are not included.
Source: Ministry of Education, Statistics on Computer Distribution, February 2000.

〈Table 2-2-2〉 Number of Teachers per Computer by School Levels (Unit: person, unit)

Classification	Elementary School			Middle School			High School			Total		
	Teachers	PCs	No. of Teachers per PC	Teachers	PCs	No. of Teachers per PC	Teachers	PCs	No. of Teachers per PC	Teachers	PCs	No. of Teachers per PC
Total	134,954	100,565	1.3	90,399	60,987	1.5	107,844	71,765	1.5	333,197	233,317	1.4

Notes: The number of computers is only for 486-CPU systems and up.
Source: Ministry of Education, Statistics on Computer Distribution, February 2000.

B. Equipment Installation for the Advancement of Teaching Environment

1) Current Status

The project of the Advancement of Teaching Environment started in 1997. The basic idea is to provide all classrooms with multimedia equipment, such as TVs, VCRs, OHPs, screens, computers, and printers, and thus to enhance the teaching and learning environment in every school. By 1999, the installation was completed in 51.8% of total classrooms (see Table 2-2-3). The installation record shows some differences by school level. The installation rate is 57.0% for elementary schools, 48.2% for middle schools, 43.2% for high schools.

2) Next Steps

As the installation of multimedia equipment in classrooms is essential for enhancing the teaching and learning environment and for the national promotion of adapting education to the information society, it needs to be supported with sufficient resources. It is expected that the installation will be completed for the remaining 103,957 classrooms in 2000.

3. LAN Construction and Internet Access

A. Current Status

The LAN construction in elementary and secondary schools has been in progress since 1997 in order to develop the abilities of teachers and students in utilizing ICT and to enhance the quality of education by promoting the exchange of teaching materials and educational resources. At first, the LAN construction was promoted on the basis of a Six-Year Construction Plan. But, it has shown much faster progress than the original plan

〈Table 2-2-3〉 Equipments Installation for the Advancement of Teaching Environment (Unit: classroom, %)

Classification	Elementary School			Middle School			High School			Total		
	Target Classroom	Installed Classroom	Installation Rate (%)	Target Classroom	Installed Classroom	Installation Rate (%)	Target Classroom	Installed Classroom	Installation Rate (%)	Target Classroom	Installed Classroom	Installation Rate (%)
Total	113,487	64,691	57.0	49,106	23,647	48.2	48,982	21,175	43.2	211,575	109,513	51.8

Notes : Special schools are not included; the installation rate is the accumulated installation rate as of the end of 1999.
Source : Ministry of Education, Report on the Progress of the Advancement of Teaching Environment Project 1999, January 2000.

Notes: Special schools are not included; the installation rate is the accumulated installation rate as of the end of 1999.
Source: Ministry of Education, Report on the Progress of the Advancement of Teaching Environment Project 1999 , January 2000.

Notes: The number of computers is only for 486-CPU systems and up.
Source: Ministry of Education, Statistics on Computer Distribution, February 2000.

thanks to the efficient budget allocation and active support on the part of city and provincial Offices of Education. By the end of 1999, a total of 4,274 schools (42.7% of the target schools) completed LAN construction (see Table 2-2-4). This result was well over the original plan by 147%. However, there are some gaps among the cities and provinces in the extent of completion.

The project of connecting schools to the internet is promoted by connecting the schools to Korean Education Network (KREN), which is connected to the leased lines of National Computerization Agency's Pubnet or the very high speed national information network. As different rates are applied for different regions in internet service, each Office of Education may select the internet access system best suited to the schools under its jurisdiction according to economics and regional requirements.

B. Plan for Year 2000

LAN construction has progressed far better than originally scheduled. Following the President's New Year Policy Address for the New Millennium, this project is revised to be completed in 2000 by shortening the project schedule. The number of target schools for LAN construction is increased from 2,500 to 5,729, and more funds are allocated for early completion.

As for internet access in schools, the demands for fast internet access and more access lines are increasing with the growing distribution of computers to schools and classrooms. The Ministry of Education has already allocated more funds in its year 2000 budget in order to meet the growing communication expenses. It also plans to upgrade the speed of communication network in order to provide 10Mbps communication service for schools by 2005. To reduce the growing communication costs, an agreement has been reached with the Ministry of Information and Communication and Korea Telecom to provide free or low-rate communication service for schools.

4. Promotion Guidelines for the Future

The success of adapting education to the information society surely depends on the successful construction of the infrastructure. However its success requires more than the infrastructure itself. Information equipment should be installed at the outset, but it must also be used effectively for appropriate purposes. Those in schools and also the general public should have the ability to utilize a variety of information equipment. The global competitive power of the nation in the information age will be enhanced when all people in the nation are familiar with new ICT and equipment.

Since its inception in 1996, the project of adapting education to the information age has shown remarkable progress in terms of the infrastructure construction and the application of ICT. But, in retrospect, we assumed at first that the installation of information equipment

〈Table 2-2-4〉 LAN Construction in Schools by Office of Education (Unit: school, %)

Office of Education	No. of Target Schools	Current situation	
		No. of Schools	Percentage
Total	10,003	4,274	42.7

would automatically promote adapting education to the information age. We had scant ideas on how to use these resources to generate educational reform for the future. For example, we did not pay attention to the educational paradigm change; we started the project without a systematic framework that leads it from its initiation to final evaluation; we did not establish policy programs for continuation of adapting education to the information age through lifelong education; we failed to adjust our efforts in the international context of adapting education to the information age; and we did not have an adequate evaluation framework for the educational effects of ICT.

The Second-stage Comprehensive Plan for Adapting Education to the Information Age (2001~2005) should not repeat those problems. As we now have considerable material foundation and human resources for adapting education to the information society, we need to have well-defined visions and goals to promote the advancement of education through the utilization of ICT. In addition, we have to be attentive to the idea that the effort of adapting education to the information society should cultivate people's ability and contribute to national development.

2 Development and Dissemination of Educational Information

1. Overview

Since 1988 that educational software was developed in Korea. The software in the early stage was (at first contained) produced and disseminated on floppy disks. But thanks to the development of ICT and the diversification of the application environment, the devices holding educational software changed from floppy disks to CDs and Web-based programs. Much software is now being disseminated through the internet, especially after 1998.

Both the public sector and private software developers participated in the development of educational software. Individual software developers are increasing with the dissemination of an authoring tool like PASS 2000, which provides a system for low-cost software development.

The expansion of EDUNET services and the distribution of various teaching-learning information through EDUNET made a significant contribution to building up the foundations for internet-based education. EDUNET is now functioning as the main network for adapting education to the information age by disseminating educational information and software for various purposes.

With the construction of information infrastructure at every school, the demands for educational software and information are increasing. The Ministry of Education, city and provincial Offices of Education, and KERIS are eager to assist the development of educational software and information useful for teaching and learning. While disseminating the developed software and information through EDUNET, they also encourage teachers and schools to use authentic software by subsidizing their software purchases. There are also efforts for enhancing the quality of software. Educational software is evaluated and authenticated by an authentication committee.

Every year educational software exbibitions are held in major cities in order to assist teachers in selecting the software they need. Besides, the campaign for information sharing encourages the general public to use educational information free of charge so that they can keep up with the information society.

2. Current Status

Both the public and the private sector are involved in the development and dissemination of educational software and information. The public sector includes the organizations such as the Ministry of Education, city and provincial Offices of Education, and KERIS. As for the private sector information developers, business organizations were the main participants. The role of individuals, however, has been growing as many software tools become available for an individual to develop the software that fits with his or her own needs. More individual involvement in the software development leads to growing satisfaction in the practical application of new software. It also leads to an improvement in the quality of software by encouraging information and software exchange. Table 2-2-5 shows the trend and current situation of educational software development.

A. Educational Software Competition

As the demands for educational software increased with the expansion of computer education in schools, public contests for educational software have been held every year since 1992. The purpose of these competitions is to encourage teachers to have the ability to design the software they need in the field. The competitions are held in two levels. Preliminary competitions are held at cities and provinces under the supervision of each city and provincial Office of Education. National competitions are held under the auspices of the Ministry of Education and managed by KERIS

The software specialties in the competitions are divided into general software that are for individual use and web-based software that functions in the internet environment. Reflecting the increase of internet users, the numbers of entries of web-based software is increasing. There were 275 web-based software programs in a total of 550 entries in

〈Table 2-2-5〉 Current Situation of Educational Software Development (Unit: item)

Classification	1988 91	1992	1993	1994	1995	1996	1997	1998	1999	Total
Joint Development by Cities and Provinces*	234	90	90	90	90	90	-	-	-	684
Educational Software Contest	-	91	150	151	250	297	340	450	547	2,276
Softwares Developed by the Offices of Education	-	-	-	-	30	107	285	181	560	1,163
Softwares Developed by KERIS	-	-	-	-	-	-	111	84	60	255
Total	234	181	240	241	370	494	736	715	1,167	4,378

Notes: The softwares jointly developed by the cities and provinces are developed by KERIS with the sponsorship of the Ministry of Education and city and provincial Offices of Education.

Source: KERIS

the 2000 contest. Participation in the contest was restricted to teachers and professional educators at first. But in 1999, the Universities of Education students, who are preliminary teachers, were allowed to join in the competition in order to promote the development of better and diverse software.

The winning software is distributed through the EDUNET to every school and the general public after modification for the school levels or subjects. Among the software that had been accepted in the contests until 1998, KERIS selected a total of 1,668 software programs and distributed them on CD-ROMs to every city and provincial Office of Education, which in turn distributed the CD-ROMs to every school. As for the winning programs after 1999, KERIS distributes them through the EDUNET upon requests.

B. Educational Software Development by the City and Provincial Office of Education

A trend we notice in the educational software development since 1998 is that the software developers are diversified. The Offices of Education in cities and provinces are playing a role in maintaining this tendency. The Office of Education collects the demands, data, and resources from the schools in its district, develops new software, and distributes it to the schools.

A total of 1,156 software programs were developed from 1995 to 1999 and an additional 815 software programs are expected to appear in 2000. The number of new programs will increase to meet the demands that grow with the infrastructure construction for computer applications in schools. Among the 1,026 programs developed during the period from 1997 to 1999, 426 were for elementary schools, 256 for middle schools, 290 for high schools, and 54 for other purposes. As for the application environment of the software, the early ones developed before 1996 were applicable to the DOS environment. But, most of the software has been developed to function in the Windows environment by using various authoring tools since 1997.

C. Educational Software Development by KERIS

KERIS is a leading institution that promotes adapting education to the information age. This institution develops new software on its own or joins with other institutions to develop multimedia teaching-learning materials. It is especially interested in developing software that is not developed by the private sector due to low market demand, or software that is necessary for public benefit. It also collects the educational software developed by the private sector. The software collected and developed alone or jointly by this institution is distributed through the EDUNET.

The KERIS has developed and distributed a variety of educational software and information since 1998. The cyber learning material, virtual science lab, educational information for infants, experience in cyber learning, reference sites for middle and high school courses, teaching-learning materials for teachers, and PASS 2000, an authoring tool for software development, are the examples. The institution is extending its service to meet the demands of parents and university students beyond those of the teachers and learners in elementary and secondary schools.

D. Dissemination of Educational Software Developed by the Private Sector

It is not possible for the public sector institutions to meet all demands for educational software and teaching-learning materials at every school level. Even though the public sector developed 4,370 software programs before 1999, this was not enough to meet the growing and changing demands in the field. Thus 800 US Dollar per school on an average has been allocated since 1998 so that teachers can select the software they want with the fund.

One condition for the effective dissemination of the software is the availability of information regarding the kind, content, quality, and cost of software on the market. The KERIS provides the necessary information and recommends selected software by hosting educational software exibitions or by authenticating the quality of software. Private companies provide information on their educational software through the internet or other media. In November 1999, Authorized Software Distribution Committee for Elementary and Secondary Schools was organized to promote the use of original software and to provide schools with good software at low prices.

E. Joint Development of Multimedia Materials

One goal of the Seventh Education Curriculum is to raise the rate of the application of ICT to national common courses above 10%. The joint development of multimedia materials is pursued as a way for achieving this goal. The multimedia materials to be developed are images, dynamic images, graphics, animation, sounds, and music. According to the joint development plan, a total of 97 kinds of multimedia materials are to be developed from 2000 to 2002. For the year 2000, 58 kinds are to be developed.

The Ministry of Education, city and provincial Offices of Education, and KERIS are the main organizations participating in the joint development. Priorities are given to the textbook authors and editing institutions in order to reinforce the exchange between textbooks and multimedia materials. The participation of teachers in the field is also encouraged. It is planned that the multimedia materials will be disseminated through EDUNET.

3. Strategies to Promote the Utilization of Educational Information

A. Authentication of Educational Software

The evaluation of software is an emerging problem that arises with the increase of software used in the changing educational environment. A fair and objective evaluation is necessary and important to provide software users with reliable information before purchase and also provides the software developers with direction for development and improvement.

The KERIS has been enforcing the authentication of educational software developed by the private sector since August 1998. The educational software subject to evaluation for the authentication is that developed by the private companies and developed jointly by domestic and foreign companies. An Authentication Committee

makes the final decision. The experts on software design, development, and evaluation and the course specialists the committee in order to establish fairness, objectivity, and professionalism in evaluation. The committee makes the final decision as 'Acceptable' or 'Not-acceptable'. By August 2000, the Authentication Committee authenticated a total of 589 software programs as "Acceptable". For the software that failed to pass the authentication process, it seeks to assist revision and improvement process by providing the results of the evaluation to the authors.

B. Educational Software Exibitions

The Ministry of Education has been sponsoring a tour of the educational software fair in major cities since 1998. The exibitions are held to promote the utilization of educational software by providing the teachers with opportunities to use them. The exibitions show new technologies, introduce a variety of new software, and thus enhance the interests in educational software. Before the exibitions are held, a handbook of educational software is distributed to every school in order to help teachers select the software they wish to examine. A total of 82 software companies submitted entries to the exibitions held in 2000. About 950 software programs were exhibited and more than 18,000 viewers visited the exibitions.

C. Campaigning for Educational Information Sharing

The Campaign for Educational Information Sharing started for the purpose of enhancing the availability of educational information at homes and schools by encouraging the sharing of information and software that is circulated within a specific user group. The KERIS and Joong Ang Ilbo have been jointly sponsoring the campaign under the patronage of the Ministry of Education since January 1998.

This campaign is promoted through EDUNET The information or software that an individual or organization uploads to EDUNET is stored in a database and retrieved for use by everyone. The campaign accepts all kinds of information that can be used in education and that do not ask for copyright charge. Quarterly prizes are awarded for excellent information and software. As of November 1999, more than 23,000 items were provided by this campaign.

4. Next Steps

Public institutions were active in the development and dissemination of educational information and software. The KERIS and each of the Offices of Education in cities and provinces developed and disseminated educational information and software alone or jointly. Software developed by the private sector was promoted by several support methods such as financial aid for software purchase, software authentication, and software exhibitions. Significant progress has been made in building up the infrastructure and encouraging content development. Completion of the infrastructure for adapting education to the information society is expected soon, thanks to a concerted effort for the distribution of computers, and LAN and network construction. We must now prepare for the second-stage of

adapting education to the information society. We need to examine the tasks and directions for the future with regard to the development and dissemination of educational information and software.

A. Development of Diversified Educational Information

With the increase of internet users and the expansion of network infrastructure, there are growing demands for the development of more diversified and high-quality educational information. As the people in various fields need the education service that corresponds with their specific interests, educational information should be diversified, user-oriented and user-friendly. In addition, the educational information has to keep up with the development of ICT. As the information consumers want their demands to be met in an appropriate technological environment, more effort is needed to supply educational information in the context of changing technological environments.

B. Promotion of Educational Information Circulation

In general, not only the development of educational information but also its circulation is important for efficient information utilization. This means that the educational information consumers should have easy access to the information they need. Up to now the developed educational information was not often fully utilized by the users because of inadequate information circulation. Thus we must increase our efforts to promote the circulation of educational information. That is, we have to enhance the interaction between the development sector where new educational information is produced and the field where the information is applied to teaching and learning. For this purpose, we have to enhance the service that the EDUNET provides so that it can be a comprehensive system for educational information circulation for teachers and schools as well as information developers.

C. Promotion of the Role of Local Educational Institutions for Adapting Education to the Information Age

The efforts for adapting education to the information age will achieve its goals more effectively when the educational agencies and institutions in every region are committed to the efforts. It means that they do not just remain the passive objects but become the active subjects of adapting education to the information age. When the local educational institutions become more active in the development, utilization, and circulation of educational information, they will contribute to adapting education to the information society in a more integrated way. In this regard, it is recommended to develop policy measures that allow the local Offices of Education to play a central role in the efforts for adapting education to the information age in each city or province. In addition, we should provide an institutional basis by promoting the roles of the Ministry of Education and KERIS in linking the cities and provinces.

D. Improvement in Educational Software Evaluation

The evaluation of educational software is necessary for supplying better software for users, as well as providing motivation for the development of better software on the part of software developers. The KERIS has been playing a pivotal role in evaluating educational software in order to preserve its quality. While many kinds of software are subject to evaluation, the scope should be expanded. In addition, the objective evaluation criteria should be refined so that the evaluation results can function as a guide for quality software development.

E. Training-of-Teachers for Enhancing ICT Utilization

Teachers play a critical role in leading the success of adapting education to the information age. They are the main actors in the field in applying educational information and ICT to the real situation. Thus it is necessary to improve the teachers ' information literacy by enhancing their ability to make the most of various information and communication equipment in classes. In addition, it is also necessary to motivate the teachers to be committed to the efforts for adapting education to the information age and for the application of ICT in their job. It is thus recommended that various training programs be developed for teachers, including programs that will help them select educational information and software appropriate for their courses and classes.

3 Operation of EDUNET

1. History of EDUNET

The EDUNET aims at preparing actively for the rapidly changing information society; to enhance the international competitive ability of education; to provide the foundation for open and lifelong education; and to provide an effective communication service for educational information. EDUNET was first proposed by the Presidential Commission on Education Reform in May 1995 and its basic plan was prepared in April 1996 by the Subcommittee for ICT Education Promotion. It started its service in September 1996 under the Korea Educational Development Institute. The Korea Multimedia Education Center operated the system from March 1997, when it was established. Currently KERIS is responsible of EDUNET operation succeeded by Korea Multimedia Education Center in April 1999.

2. Goals and Operation of EDUNET

EDUNET is an integrated service network of educational information that aims to provide every education consumer with quality educational information at all times. In its operation, it has the following goals:

- To construct an effective educational information transmission system using computer communication;
- To provide an effective educational information network by interconnecting dispersed

educational information;
- To promote educational services on the internet;
- To construct the basis for an open and lifelong education system;
- To construct the basis for cyber education.

EDUNET has a total of 35 servers to provide various information services. There are seven user-connection servers, five database servers, three web-servers, and 20 other servers for services such as cyber learning material, web-based training, virtual experiment, retrieval, statistics, and authentication. The elementary EDUNET circuits consist of modem-connection circuits and internet-connection circuits. The internet-connection circuits are linked to the Education Network, Very High Speed National Network Internet, Korea Telecom IX, and Thrunet. The circuit capacities are over 202Mbps. As of June 2000, the EDUNET system has the capacity to provide services for over 10,000 simultaneous users.

EDUNET can now provide more than 335,415 items of information in twelve categories in the form of text service and web service. The categories of information are cyber learning material, question bank database, dictionary database, subject application database, information for university entrance exams, satellite educational broadcasting, research materials for teachers, teaching materials for teachers, training of teachers, information for lifelong education, information for parents, and other educational information.

The Ministry of Education designated ten schools as EDUNET research schools for a two-year term in 1998 for the purpose of developing and applying EDUNET -based teaching-learning methods. From the year 2000, the city and provincial Offices of Education are in charge of selecting EDUNET research schools. The experiences of these EDUNET research schools are expected to assist other schools in using EDUNET for teaching and learning and developing new EDUNET -based teaching methods.

3. Current Status

As of June 2000, the total EDUNET subscribers reached over 2 million. The membership has shown an average annual growth rate of 120% since the EDUNET service started in 1996 (see Table 2-2-6). The number of teacher subscribers reaches about 270,000 or 13% of total EDUNET subscribers. This means that 80% of teachers in the nation are registered with the EDUNET service, and about 13% of the total elementary, middle, and high school students or 1,090,000 students are

〈Table 2-2-6〉 Growth of EDUNET Membership (Unit: person)

Classification	Dec. 1996		Dec. 1997		Dec. 1998		Dec. 1999		June 2000	
	Total	Accumulated Total	Total	Accumulated Total	Total	Accumulated Total	Total	Accumulated Total	Total	Accumulated Total
Individual	42,900	42,900	151,000	194,000	380,193	574,193	961,411	1,535,604	492,760	2,028,364
Institution	-	-	4,437	4,437	4,353	8,790	18,511	27,301	330	27,631

Sources: KERIS

using EDUNET. They constitute 54% of total EDUNET subscribers. Additionally, 9,469 institutions (schools, special schools, educational and research institutions, colleges and universities, and libraries) are registered in EDUNET .

As the services of EDUNET are improving in terms of both quality and quantity, the subscribers are increasing at the rate of over 2,500 new members everyday. With this growth rate, the total membership is expected to reach 3,500,000 by the end of 2000. With the increase of EDUNET users, the average access frequency and access time are continuously increasing too.

4. Prospects of EDUNET

It is essential for EDUNET to improve its facilities and services in order to serve its ever-increasing number of users and to maintain its function as the comprehensive educational information network. We emphasize three aspects in this regard: system, circuits, and services.

A. System

We believe the following issues have to be addressed for the general improvement of the EDUNET system.

First, it is necessary to secure the funds for system expansion in order to meet the demands of growing subscribers and users. Though the subscribers are increasing at the rate of 120% annually, the EDUNET system capacity is not increasing fast enough to serve them all. Thus it is essential to secure the funds for long-term system expansion.

Secondly, it is necessary to increase the number of servers and to reallocate server resources so that the increasing EDUNET users can access the system without delay.

Thirdly, it is necessary to construct a double and decentralized server system in order to keep the EDUNET system operating 24-hours a day without system shutdown. As the present system is on a single server mode, it has to be shut down and cannot provide services when system errors occur. The construction of a double and decentralized server system is necessary in this regard.

Fourth, it is necessary to divide the application program and database servers to speed up the service. Currently the same server manages the application programs and databases. When the application program users and database users access the system simultaneously, it can cause system overload and reduce the service speed. The solution for this problem is to divide the application and DB server.

Last, it is necessary to install more high-capacity data storage. More than 3GB of data and information are added to EDUNET storage every day. The expansion of storage capacity is thus essential to the stable operation of EDUNET.

B. Circuits

The following are some ideas for the improvement of the EDUNET communication circuits.

First, it is necessary to make an improvement in the access speed. The doubling of EDUNET users and multimedia information causes circuit overload and reduces the communication speed. The speed of communication can be increased

by expanding the ISP and internet access circuits and shortening the access paths.

Second, it is necessary to expand the modem communication ports in order to enhance the rate of connection success and communication speed. The elementary solution is to increase the number of connection ports for the high-speed modems of 56Kbps and up.

Third, it is necessary to construct decentralized access paths by making city and provincial Offices of Education provide the EDUNET branching service. When each Office of Education functions as an EDUNET branch circuit for access, the network will be decentralized and access paths will be shortened.

Fourth, it is necessary to provide an error-free network service by installing major communication equipment and accessories.

C. Services

We need to consider improving the following EDUNET services.

First, it is necessary to reinforce the EDUNET channel service. Demands are rapidly increasing for new services and information with the increase of subscribers and access time. Thus additional personnel for contents and channel services are needed to actively meet the demand.

Second, it is necessary to develop specialized services to enhance the competitive power of EDUNET as an information service.

Third, it is necessary to reinforce customer service. More personnel and facilities are necessary for the enhancement of customer service such as responding to the questions regarding subscription and network access.

Last, it is necessary to establish an effective monitoring system for the stable operation of EDUNET and for the interception of harmful information.

4 Education for ICT Utilization

The human resource development is one of the elements for the success of adapting education to the information age in elementary and secondary education. The measures for human resrouce development regarding ICT utilization include the reinforcement of elementary and secondary courses ICT utilization, the training of teachers for ICT utilization, and the opening of new courses on ICT in universities of education and colleges of education for prospective teachers.

1. Reinforcement of Curriculum on ICT Utilization

The ability to use computer is now considered as an essential life skill for living in the 21st century. Recognizing the importance of the education for ICT utilization, the Ministry of Education has decided to reinforce the courses on computer in elementary and secondary education and changed the computer course from an elective course to a required course. That is, the Ministry of Education required that computer courses should be provided for the students from the first grade to the sixth grade in elementary schools for at least one hour per week. The specific courses will be open from 2001 and their content is to be defined according to the guidelines from each

Office of Education. The Ministry of Education is also considering reinforcing computer education in middle and high schools. It intends to extend the information literacy certification, which currently is in operation at the high school level, down to the middle school level.

The Seventh Educational Curriculum, that takes effect in 2000, sets 10% as the minimum rate for utilizing ICT in each course. The textbook writers and editors are advised to refer to the guidelines for ICT utilization and to include in their textbooks the ideas and methods for ICT utilization. The teachers' guide for ICT utilization in elementary, middle, and high school education is in preparation and expected to be distributed in 2001.

A. The Seventh Educational Curriculum and ICT

The Seventh Educational Curriculum reinforces acquiring of the ability to use and apply ICT in solving real life problems. The new Curriculum suggests that education should be carried out in the broad context of ICT beyond the limited context of computers. This leads to a change in the focus of education from function-oriented to application-oriented education.

There are three programs in which the education on computer and ICT is addressed in the Seventh Educational Curriculum. First, there are separate courses like the 'Computer' course in middle school and the 'Information Society and Computer' course in high school. Though they are elective courses, they deal directly with the subjects of computers and the information society. Second, some courses like 'Practical Arts', 'Technology', and 'Home Economics' contain sections related to computers and ICT. And third, other general courses, though not dealing directly with computers or ICT, have contents concerning the utilization of ICT.

For example, the Practical Arts course for the fifth and sixth grade elementary students allocates a total of twelve hours for subjects related to computers. The school is expected to arrange two hours per week for a total of 12 hours for these students to have their computer experience. At the middle school level, the Technology and Home Economics courses allocate 30 hours for computers and ICT. In addition, a separate computer course is available as an elective. General high schools have a course on Information Society and Computers as an elective. While Trade high schools and science high schools have compulsory courses on information and communication.

A policy for recognition of information literacy is in operation for high school students. This policy was introduced in 1999 for the purpose of encouraging students to acquire the ability to use computers and other information equipment. A student can get Information Literacy Certification by attending the regular courses on computer for more than 34 hours; by attending the extra course, the aptitude course, or the special skill course on computers for more than 34 hours; or by passing the Information Literacy Certification Test, which is managed by KERIS. About 380,000 students, or 52% of total high school freshmen acquired the Information Literacy Certification in 1999. The acquisition of Information Literacy Certification is marked in the student'

s school activity record. It is anticipated that universities will check its acquisition in their admission screening of new students starting in 2002.

B. ICT Utilization in Courses

Utilization of ICT in a course is intended to enhance achievement of goals of the course. It also facilitates to achieve other important goal to improve the students' abilities in solving real life problems by using ICT. There is a variety of technological instruments useful for teaching and learning. Thus the utilization of ICT can be carried out in various ways in accordance with the specific goals and content of the courses. The effects will be maximized when dynamic interactions are maintained between the courses and appropriate information instruments.

2. Training of Professional Teachers for ICT Utilization

There are two main paths in which teachers acquire the professional abilities to use ICT, the training program for in-service teachers, and the course on information society and ICT which prospective teachers take in the universities or colleges of education. Though training programs for teachers started in 1972, it was in 1988 that the program for learning to use computers was first offered.

A. Performance of Teacher Training

Since the introduction of the training program for using computers in 1988, a total of 481,158 teachers completed training on the program by 1999. The number of teachers subject to training in 2000 comes to 114,868, or 33.7% of total teachers. The content and courses have been changing in accord with the improvement in ICT. Since 1995, Microsoft Excel, the Hangul 97 word processor program, and communication programs and the internet have been the main subjects in the training. In addition, the courses on multimedia authoring tools are open in order to help teachers develop multimedia software programs. As the ability to use ICT is a requirement for teachers these days, new courses are also being developed to train teachers in the utilization of ICT for teaching and learning and for paper work.

B. Training of Professional Instructors

Professional instructors are necessary to train teachers in the cities and local provinces. Supervisory personnel are also necessary to guide computer education in schools. The training programs for professional instructors and supervisory personnel were introduced in 1992 and managed by the Korea Multimedia Education Center. The KERIS now manage these programs.

The training of professional instructors and supervisory personnel is carried out in five separate categories: education specialists in charge of education for ICT, multimedia courseware development personnel; internet instructors; multimedia information development personnel; and network managers. In 1999, training programs were provided to 370 professional instructors and supervisory personnel. A total of 2,014 persons finished these professional-training programs from 1992 to 1999.

C. Promotion Plan for Teachers' Information Literacy

According to the Promotion Plan for Adapting Teachers to the Information Age announced by the Ministry of Education in June 1998, the training for teachers is to be conducted at three levels. The basic level focuses on enhancing teachers' abilities to operate personal computers. The intermediate level emphasizes the ability to utilize educational software and other information retrieved from educational information networks and the internet for teaching and learning. At the advanced level, teachers acquire the ability to devise educational software and other educational materials for educational advancement by using various authoring tools.

As for the specific training plans, all teachers are required to acquire the basic level ability by 1999, when the program of one computer for one teacher achieves 79.1% of its proposed goal. The teachers will then be trained to have the intermediate level ability by 2000, and the advanced level by 2002.

The Promotion Plan for Teachers' Computer Literacy has been enforced since 1999. This plan intends to train at least one professional teacher in each school who plays the leading role in adapting the school to the information age. It also encourages teachers' self-training efforts by supporting the computer study groups. Conforming to the plans for promoting teachers' information literacy, 15 cities and provincial Offices of Education included information literacy as a factor in their evaluation of teaching staffs.

D. Number of Teachers in Charge of Computer Education

As of April 1999, there are 178 middle school teachers who majored in electronics. Among them, 170 teachers are in charge of computer courses. The number of qualified teachers is 213 for high schools, and 1,209 for Trade high schools. The number of students enrolled as of April 1999 in the 18 departments of computer education or computer science education of all four-year universities, are 426 freshmen, 563 sophomores, 411 juniors, and 250 seniors.

3. Web-based training for Teachers

A. Overview

The training services are offered for teachers during school breaks to avoid interrupting teaching the school terms. The training services are not provided for all relevant teachers owing to the limited capacity of training institutions. In addition, there are problems of budget waste, program redundancy, and program inequality since every Office of Education operates similar training programs on its own. Web-based training is an alternative to the regular training programs that can avoid these problems.

Web-based training for teachers is based on the idea that teachers can learn what they want at any place at any time. To meet the demands of the information society of the 21st century, this program is expected to become the foundation for a lifelong training system by enhancing the teachers 'professinal development, increasing their training opportunities, and reducing the training costs. The effort to construct the web-based training program began in October 1997.

KERIS opened the first web-based training program in August 1998 (see http://training.keris.or.kr).

B. Courseware

The trainees in the web-based training program get credits by finishing the courseware for which they register. Eleven general courseware programs were first provided in mid-1998. At the end of 1998, six common teaching courses were added to the training curriculum for the first-class elementary and secondary education teacher qualification. Two more courses for the training of internet instructors and network managers were developed in 1999. The details of web-based training courseware are shown in Table 2-2-7.

〈Table 2-2-7〉 Details of Coursewares

Training Classification	Course Classification	Course Details
First-class elementary education teacher qualification training	Common general courses (4 courses)	- Preparation for the future society - Understanding traditional culture - Information society and computer - Environment and education
First-class secondary education teacher qualification training	Common general courses (2 courses)	- The world and Korea in the 21st century - Enhancing public morality
Elementary education vice-principal and professional teacher general training	Common general courses (5 courses)	- Directions of educational reform and school reform - Information society and multimedia education - Human nature and creativity education - Theory and practice of open education - Education preparing for unification
First-class elementary and secondary education teacher qualification training	Common teaching courses (6 courses)	- Course and teaching design - Practice of class management - Practice of educational technology - Trend of educational reform - Educational statutes - On teachers
Internet instructor job training	1 course (30 hours; 8 subjects)	- Basic Internet - Information retrieval - Use of multimedia and internet in teaching - Web design - HTML and Namo Web editor - JAVA script - CGI Programming - Web server construction and management
Network manager job training	1 course (30 hours; 3 subjects)	- Network design - Network management I using Windows NT - Network management II using Unix

Sources: KERIS

C. Performance of Web-based training

KERIS provides free web-based training programs to 13 institutions. A total of 689 persons completed training from 1998 to January 2000. In 1999, eleven web-based training programs were organized once or twice for six courses and 455 trainees participated in those programs. As for the training schedule, the trainees of general training programs are allowed to take the cyber courses at home or work for about one week before they join offline courses. The trainees take the courses three hours a day for ten days.

4. Next Steps

A. Curriculum Reinforcement for Utilization of ICT

The educational institutions in Korea exert every effort for improvement of the educational curricula and teaching methods in order to develop ICT literacy of people who will be the pillars of the state with high ICT literacy. The Ministry of Education tries to institutionalize the utilization of ICT in every educational program. The Seventh Educational Curriculum, which is in effect from 2000, requires every general course to utilize ICT at least 10 percent of its teaching and that computer education be conducted beginning in first-grade elementary education. In addition, the Ministry of Education now plans to encourage the middle school students to acquire computer and information literacy by upgrading the scope of the Information Literacy Certification program in 2001. The program was first introduced in 1999 for enhancing the computer and information literacy of high school students. The Ministry of Education is also taking some measures regarding educational curriculum and textbooks, by exerting flexibility in curriculum operation, developing e-books and digitized educational materials.

B. Training of Teachers for ICT Utilization

It ws identified that aspiration and abilities of teachers have a significant effect on the successful promotion of adapting education to the information age. Thus it is important to develop and operate effective programs for training teachers training. Recently the Offices of Education in the cities and provinces are developing new training programs to meet the various demands of in-service teachers training. However, there should be continuous efforts to improve training programs and to develop new courses that accommodate changing educational environment and technology. Besides, the curricula of the universities and colleges of education should be revised by reinforcing the use of ICT accordingly.

5 Adapting Educational Administration to the Information Age

1. Computerization of Educational Administration

The main objectives of the computerization of educational administration aim at construction of foundation for the enhancement of administrative efficiency, promotion of

information sharing through LANs, and promotion of computerization of administrative affairs within the Ministry of Education.

The Ministry of Education computerized many of its daily routines by outsourcing. The following data and job duties were computerized from September 1998 to November 1999: college and university teaching staff management; university admission applicants management; educational corporation property management; college and university student enrollment management; degree holders management; overview of colleges and universities; inspection duties; educational budget allocation management; account settlement management; teacher training institutes management; management of university-affiliated lifelong education institutes; overview of elementary and secondary schools; elementary and secondary school teaching staff management; and system operation. In addition, the Ministry took preventive measures to cope with the Y2K problem. The Ministry distributed PCs for all officials within the organization and especially enhanced administrative efficiency by constructing an electronic document processing system between the Ministry and local Offices of Education.

The Ministry of Education continues to improve administration of information management including scope of the electronic document system integrating colleges and universities within the system in 2001, upgrading the improving server capacity in order to meet the growing demands of its homepage visitors.

2. Computerization of School Activities Records

The computerization of school activities records aims at reducing teachers ' job burden and to enhance the school administrative service by changing the method of recording from handwriting to entering data into computer.

All the entries of school activities records are supposed to be filled by using computers after 1997. For the enforcement of this change, new school activities record computer programs were developed and distributed. These programs are designed to secure the records from unauthorized use and to incorporate distinctions that are peculiar to each school level or school category.

A screening program for university admission has been developed and distributed to high schools. This program is designed to automatically select the information that university admissions office needs in screening new students from the school activities records. The high schools then send CDs that contain the selected information to the relevant universities. Each Office of Education provides technical advice for the new system for student records. For the efficient enforcement of these programs, the Ministry of Education has developed standard code systems for schools, departments, and subjects, and prepared new rules and regulations.

The Ministry of Education continues to promote the use of computers for keeping school activities records and develop an integrated information management system for elementary and secondary schools so that the schools can handle their academic and

administrative duties efficiently in an integrated environment.

3. Construction of a Comprehensive School Information Management System

The purpose of the Comprehensive School Information Management system is to reduce the teachers' daily routine, other than the teaching, by constructing an integrated and efficient system for handling academic and administrative affairs. The functioning of this integrated system is based on the LAN that is available in each school. After the basic plan for this comprehensive system was established in August 1996, computer programs for managing school activities records and other related programs have been developed and distributed. The comprehensive system consists of four subsystems: the academic affairs support system; the educational information circulating system; the school management support system; and the integrated educational information service system (See Figure 2-2-1).

The academic affairs support system is the computer program that is applied to facilitate the school activities records. It is developed to reduce the duties of teachers by assisting them in handling academic affairs on grading, student activities, registration, and using teaching-learning materials.

The educational information circulating system was developed to enhance the efficiency of educational administration by providing services such as electronic document signing, electronic bulletin board, e-mail, and electronic document sending and receiving. The introduction of the document processing system in March 1998 between the Ministry of Education and local Offices of Education forms a part of this educational information processing system.

The school management support system is another program designed to enhance the efficiency of educational administration. It helps school managers in managing the duties on personnel, budget, accounting, miscellaneous goods and equipment, and health care and meal service. The integrated educational information service system is the program for providing services on information location and database access. This system and the school management support system are operated only in selected schools.

There are four organizations responsible for: The Ministry of Education, KERIS, city and provincial Office of Education, and scools. For success of the Comprehensive School Information Management System, each of the main educational institutions plays different roles.

The Ministry of Education:

- Formulating of basic plans for the Comprehensive School Information Management System;
- Budget allocation for software purchase;
- Arrangements of statutes and regulations.

KERIS:

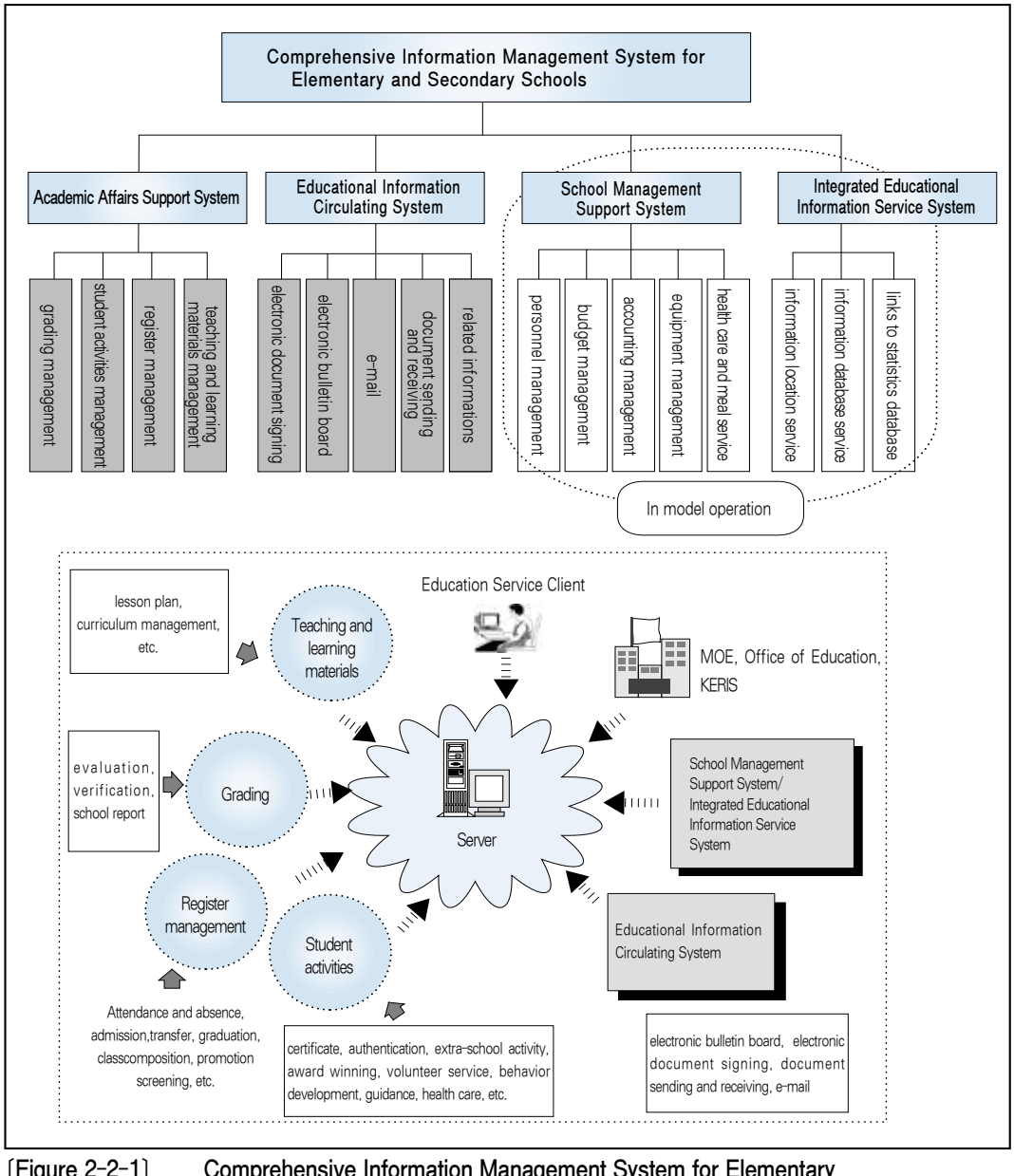
- Development and distribution of software for the Comprehensive School Information Management System and school activities record
- Support for the operation of the software;
- Evaluation.

City and provincial Offices of Education:

- Establishment of promotion plans and their enforcement;
- Securing of local budget for the infrastructure;
- Budget appropriation;
- Support for the appointment of expert teachers and training service for system managers

Each school at every level :

- Establishment of school-level promotion plans and their enforcement;
- Utilization of the Comprehensive School Information Management System;



〔Figure 2-2-1〕 Comprehensive Information Management System for Elementary and Secondary Schools (As of September 2000)

- Appointment of expert teachers and training of system users;
- Security management for computers and software.

4. Adapting Educational Statistics to the Information Age

The initial effort for adapting educational statistics to the information age was made in 1996. Policy makers and researchers, to promote the standardization and sharing of statistical data and to provide accurate data initiated it to meet the demand for various educational statistics. The Ministry of Education and the Korea Educational Development Institute (KEDI) collaborated to promote the project and created the first database for basic educational statistics in February 1998.

The statistics database is continuously updated and new data is added annually. The Ministry of Education and KERIS publish Educational Statistics Annual and other statistical databanks. Considering the diversified demands for educational statistics and data, these institutions also exert efforts to improve the database system to facilitate data retrieval, analysis, and sharing.

5. Next Steps

There has been considerable progress in terms of the infrastructure construction for efficient educational administration. The Comprehensive School Information Management System for Elementary and Secondary schools has promoted the use of ICT to facilitate academic and administrative affairs in each school and reduced routinary paperwrok of teaching staffs. For success of adapting educational administration to the information age, continuing efforts are needed in training the users and upgrading the infrastructure. Appropriate budget allocation and material inputs are important in this regard. However, it is also significant that each educational institution is committed to the realization of efficient educational administration in the information age. Each institution has to play its own role with developing strategy to promote the introduction of efficient management and administration systems such as electronic document processing and electronic document signing. There also should be efforts to revise or restructure the statutes and regulations relevant to educational administration and ICT.

6 Adapting School Libraries to the Information Age

1. The Necessity of Adapting School Libraries to the Information Age

School libraries are considered as one of the essential infrastructures in realizing open education and promoting the effort for adapting education to the information age. Libraries provide a variety of information available for teaching and learning purposes in schools. They also provide materials in various forms like print materials, videotext, and digital information. The libraries are served as places where students can get a variety of knowledge and information from books or

digitized sources. In this regard, libraries are critical places where students can develop their abilities while preparing their career in the knowledge-based society.

Students acquire knowledge and information by reading books or using other information resources in the libraries. The role of school libraries does not limit just providing knowledge and information. Students learn how to search and retrieve the information they want, how to evaluate the information they retrieve, and how to integrate and develop the fragmented knowledge and information into the properties for the society as well as the resources for themselves. School libraries have to provide students with the opportunities to develop such abilities. We have to emphasize these diversified functions of the school libraries in discussing the necessity of adapting school libraries to the information age.

2. Current Status

Generally speaking, the school libraries have shown regulatively low performance in meeting the demands of the information society. Most of the libraries have neither the hardware nor the resources enough to satisfy the information needs of the library users.

According to evaluation conducted by the Ministry of Education in August 2000, only about 30% of the items collected in all the elementary, middle, and high school libraries are listed in the database. As for the installation of computers in the libraries, each library has only one unit of computer system in average. The use of communication network is not active. Of all the 7,924 school libraries in the nation, 1,477 libraries (18.6%) are connected to communication network through dedicated or telephone lines. And 28.5% of the school libraries use exclusive book management software.

Though there are several school libraries that provide manifold services for students and teachers with better facilities and resources than the others, the examination results reveal that most of the school libraries are required to improve in order to meet the requirement of the information society. Compared to the university libraries which show a high rate (90%) of library network construction, the libraries of elementary, middle, and high schools seemed very regulatively slow to adapt the information age.

3. Strategies to Improvement

The volume of books per person is far below, compared to the school libraries in advanced countries. It is also true that the number of professional librarians, or the space of the library are fairly low. Considering the current situation, school libraries are not yet fully ready for assisting the library users in adapting to the information society. The installation of a LAN or computers in libraries does not mean that they are ready for meeting the demands of the information society. Without the basic collections and infrastructure that libraries should have, they cannot even fulfill their basic functions, to say nothing of the proper functions as libraries in the information age. Therefore, for the improvement of the functions of school libraries, priority must be given to expand their basic resources and to recruit more professional librarians.

4. Next Steps

The modality of learning is changing as we approach the full-fledged knowledge-based information society. While the importance of knowledge is increasing, the knowledge life cycle is becoming shorter. Thus the education in schools for a definite period is not enough to meet the changing demands for knowledge and information. As learning is required at every stage and every aspect of life, open and lifelong education becomes an important way of learning. The role of libraries is indispensable in supporting the open and lifelong education system. Libraries are supposed to function as the central institutions that meet the changing demands for knowledge and information in society.

Considering the changing roles of libraries, the school libraries will have to undertake more functions in assisting the teaching and learning process in schools. It is advised that school libraries must keep in mind matching the collections of the library with interests and life styles of young students so as to fulfill of its functions. The young students these days are growing up in the digital culture and enjoying digital games, movies, and music. Thus it is inevitable for school libraries to reinforce their multimedia service.

For the reinforcement of multimedia service of school libraries, the four specific tasks to be fulfilled:

- Computerization of each school library;
- Construction of a library network with an internet connection;
- Content development and distribution;
- Construction of a local library network and a local educational information center.

CHAPTER 3

Adapting Academic and Research and Higher Education to the Information Age

1 Adapting Academic and Research to the Information Age

1. History

Adapting academic and research to the information society is essential for enhancing national information power in today's information age. The effective collection, analysis, classification, and distribution of information from domestic and foreign sources contribute to the development of science and technology, the development of human resources, and the enhancement of the general quality of life. It was in 1967 that KORSTIC started its service as the first national institution in charge of the collection and distribution of science and technology information. The establishment of Education and Research Network Promotion Committee in 1986 accelerated the construction of the infrastructure for information exchange. Korea Research Information Center, established in 1996, promoted the database construction for science and technology information. KERIS succeeded to the services of this organization in 1999 and has been operating Research Information Service System (RISS), an integrated academic information network. In 1997, the government initiated the National Digital Library project in order to build a nationwide system for academic and research information exchange by connecting major libraries.

As of now, the efforts for adapting academic and research to the information age is conducted in two ways. One is the second-stage National Digital Library project, and the other is the computerization and connection of university libraries.

2. Scope and Utilization of Academic Information

A. Scope of Academic Information

The index for the size of academic information represents the collections in university libraries, which function as the information centers for academic research. However, the information stored in university libraries do not satisfy the needs and demands from researchers in terms of both quantity and quality. It is estimated that about 170,000 books written in English are published in the world every year. In Korea, each university library added 7,043

new overseas books in average to their collection from 1996 to 1997. The addition record goes down for the period from 1997 to 1999, showing about 7,200 new overseas books in average for each university library.

As for the collection of overseas periodicals, the performance is low. In average, each university library subscribed to 633 periodicals in 1999. The species of the whole overseas periodicals collected in university libraries is about 25,000 and the kinds of overseas periodicals currently in subscription is about 15,000. These numbers show that university libraries hold only a small portion of the periodicals in circulation in the world, the total number of which is estimated to be between 130,000 and 230,000.

B. Academic Information Database

Academic information databases are being constructed by several libraries and research institutions that take part in the second-stage National Digital Library project. The National Library of Korea is constructing the databases for Korean classics, old Official Gazettes, and the publications from the Ministry of Culture and Tourism. The National Assembly Library is constructing the databases for the inspection results of the government agencies, speeches of the Speaker of National Assembly, government publications, and publications of National Assembly. The Supreme Court Library is responsible the databases for law, civil law, lawyers, and court administration. Korea Research and Development Information Center (KORDIC) is in charge of the databases for the periodicals from the academic associations such as Korean Database Society, Korean Statistical Society, and Korean Geographical Society. KERIS is in charge of the databases for the periodicals and publications from Korean Mathematical Society. Korea Institute of Industry and Technology Information (KINITI) is handles the databases for the publications and periodicals on industry and technology. The Science Library of Korea Advanced Institute of Science and Technology (KAIST) is in charge of the databases for the theses and research papers produced in KAIST. Besides, a number of universities are providing separate database service for the theses that are produced by the respective university.

One problem that the database construction and service face is the copyright issue. KERIS has already suggested guidelines to help the libraries handle this problem. Another problem in the database service is the compatibility of data and information among the libraries and institutions. Many of the university libraries provide files in various formats like PDF, TIFF, XLS, or DVI. However, the diversity of file formats supported in the databases reduces the efficiency in information sharing and information utilization.

C. Utilization of Academic Information

Though we do not have valid data on the utilization of academic information in Korea, there is a general tendency that the researchers favor overseas information than domestic information. This is especially true in the field of natural science and technology. Domestic information and domestic journals are not frequently referred and researchers prefer foreign journals to domestic ones in their

contribution of high-quality research papers. As for reading rate of journals, a small number of journals are more frequently referred than others. This means that a lot of researchers conduct their researches by referring to a relatively narrow range of academic information and journals. We have to consider this tendency in the use of academic information while trying to adapt academic and research to the information age.

3. Adapting Libraries to the Information Age

A. Computerization of University Libraries

Computerized information management systems are installed in most university libraries. Library network is constructed in more than 90% of universities. Many libraries completed database construction for the books and periodicals they hold. Among 408 university libraries, 319 libraries have databases for books, 176 libraries have databases for periodicals, and 69 libraries have databases for article indices. More efforts should be exerted for the information exchange between libraries. About 100 university libraries have made interlibrary loan service system. However, generally speacking, it is anticipated that university libraries will discard manual library service soon and provide their service by using computerized systems.

B. Information Exchange between University Libraries

University libraries can enhance their quality of service and meet the demands of the library users better by sharing their information with other libraries. Interlibrary loan is such a system for information exchange between libraries. This system promotes not only the information exchange but also the division of labor among libraries in the sense that the libraries share their collections through this system while each library specializes in a specific field in its collection. KERIS has been promoting the establishment of this interlibrary loan system. In this system, a library user can search an integrated database for a book he or she needs and get the photocopies of the specific parts of the book by asking for copy service when it is located in a distant library. Currently 100 and some libraries are connected through this interlibrary loan system.

As the demands for academic information from foreign sources are increasing, it is also necessary to establish an information exchange system between domestic libraries and overseas information databases. Though it is technically easy to connect to and get information from the overseas databases in the internet environment, many of the university libraries in Korea are not active in utilizing the overseas science resources. It is partly because they do not have enough budget for such service and partly because they have little knowledge on the quality of overseas databases and no expertise in contract or negotiation. KERIS assists the university libraries by arranging the introduction and circulation of overseas science databases. In addition, it tries to establish an research information sharing system among the university libraries in order to promote active and efficient utilization of overseas science databases.

C. Construction of National Digital Library

National Digital Library was initiated by the Ministry of Information and Communication and designed by National Computerization Agency as a model project in order to build up the super high-speed national information infrastructure. The participating institutions are the National Library of Korea, which supervises this digital library system, Supreme Court Library, National Assembly Library, KORDIC, and the Science Library of KAIST, KERIS, and KINITI.

The information sharing between libraries is enhanced by the construction of National Digital Library. As a collaborative cyber library system, National Digital Library intends to serve the following purposes: equal access to information; convenient access to information; standardized information system; efficient use of information; popular use of information; and promotion of library information network. A digital library user can get access to any of these databases through the internet and retrieve the information lists, abstracts, or even texts. National Digital Library thus encourages information utilization and speedy information exchange. As one of the main infrastructures for effective information production, management, circulation, and sharing in the information age, the digital library also contributes to enhancing national prestige and power in the competitive world.

4. Academic Database Construction

The database construction on academic information aims: to assist research activities by providing researchers with proper information effectively; to enhance the competitive power of the country; to increase the utility of information by promoting information exchange and sharing through information network. The construction of databases on the items stored in the libraries of higher education institutions and the computerization of those libraries are the specific efforts made for these purposes.

As of April 2000, a total of 20,025,989 items (including 19,321,575 books, 601,322 periodicals, and the other items) stored in 154 universities are listed in databases. The items stored in universities and colleges will be included in the databases in the near future.

5. Next Steps

A. Creating Favorable Environment for Adapting Academic and Research to the Information Age

The effort for adapting academic and research to the information age will yield satisfactory results when there is a favorable social environment for the utilization of information in addition to the construction of effective information circulation network. The following is some considerations for the creation of such a favorable environment.

First, there should be a climate to encourage research activity. The fair and critical evaluation of research outcomes and the economic or social incentives for excellent researches will encourage researchers to produce high-quality research results. The researchers then will be more active in searching for reliable academic information for their researches. This will encourage a favorable social environment for

the utilization of information to settle in the academic community.

Second, more attention should be paid to the creative use of information in the courses of higher education. The contents of the courses determine what information students and professors use in what ways. As the creative ability to utilize information in solving problems is a requirement in the information society, the courses of higher education need to promote the development of creative problem-solving abilities. In this regard, the students have to play a more active role in classes and professors have to encourage the students to play such a role by introducing new teaching practices and new evaluation methods that emphasize the collection, analysis, and utilization of information related to the specific subjects.

Third, there should be a systematic training service for information end-users. The training may be conducted on various aspects of information retrieval. The information end-users can enhance their abilities on information retrieval by learning about the method of organizing specific information demand, the effective method of information retrieval, the indexes of science database, and the use of a library.

Last, there should be an effort to develop human resources on academic research information sharing and utilization. Professional manpower is essential for collecting and treating information and managing databases. Professional manpower is also necessary in order to train information end-users. Especially we need the manpower that has expertise on a specific field of science or technology, as the demand for specialized information is increasing these days.

B. Collection of Academic Information

The quality of library service depends on the size of information that the library holds. In reality, it is impossible for each library to collect all the information for all the users it intends to serve. Therefore, the ideal way is for each library, depending upon the budget, meets the information demand at the range of 50 to 80 percent with its own resources and meets 90 percent of the demand in cooperation with other libraries. Efforts should be made to secure the overseas information when domestic information are not enough to meet the demand. The following is the subject matters that we should be committed in collection of academic information.

- Book collection guidelines;
- Construction of cooperation system between university libraries;
- Construction of information exchange and sharing between university libraries;
- Construction of overseas science database exchange and sharing between university libraries;
- Division of labor in the collection of academic information;
- Construction of a digital sharing system for academic information;
- Service on the information that are not available in the country.

C. Standardization of the Academic Information Management System

Standardization of the Academic Information Management is essential for archiving, cataloging, efficient information retrieval, and

information exchange. We have to select one or a few file formats as the standard in storing information in the databases. Standardized metadata is available to many users for diverse purposes and thus increases the utilities of information. Standardized files reduce the burden of file transformation in information exchange and retrieval. We need to be foresighted in this matter when we are making digital archives of original texts.

2 Digital Library

1. Current Status of Digital Library

Digital library provides information service through information network. It greatly enhances the efficiency of information utilization as library users can get access to the digital library from any place at any time. In Korea, the construction of digital library has been in progress since the infrastructure for information superhighway was constructed. A representative digital library is the National Digital Library. Some university libraries and the libraries of private research institutions also have constructed digital library system.

A. National Digital Library

As a network of major libraries, the National Digital Library provides information on line to the general public as well as researchers. As of now, it integrates seven libraries. The National Library of Korea is responsible for the digital network. The other participating libraries are Supreme Court Library, National Assembly Library, KORDIC, and the Science Library of KAIST, KERIS, and KINITI. Digital library visitors can get access to any of the participating library through the internet and search the separate database of each library or the integrated database of the seven libraries for what they want. Its current status of information service is shown in <Table 2-2-8>.

Below is the present status of database construction in the libraries and institutions that participate in the National Digital Library system.

1) KERIS

KERIS provides several services for researchers. It collects information from domestic and foreign sources and provides them the researchers. Its main information services are the integrated academic data search service and the overseas academic database search service. The integrated academic data search is the search for books using the databases of university libraries in the country. Besides, it provides the thesis search service, interlibrary loan, and photocopy service.

KERIS also provides the overseas academic database search service. It coordinates the domestic universities in the lease or purchase of academic databases from abroad. It also creates cooperation between the universities in sharing the overseas information.

2) The National Assembly Library

The National Assembly Library provides services both for lawmakers and the general public. As a participant to the National Digital Library service, it has been active in construc-

ting digital databases on the major items and information stored in the library. Especially in 1999, this library constructed a database on lawmaking. This database provides comprehensive information that lawmakers and the staffs of National Assembly need in fulfilling their respective duties. And, in December 1999, it started to provide the on-line full-text service on theses and academic journals.

3) The National Library of Korea

The National Library is the national information center serve as the center of nationwide library network. As the central library, it plays a leading role in the database construction on books, the construction of library information network, and the construction of National Digital Library.

4) Supreme Court Library

Supreme Court Library provides a comprehensive information service on law and judicial affairs. It constructs databases on statutes, law books, judicial documents, Supreme Court regulations, domestic judicial precedents, and Japanese judicial precedents, and provides them through the National Digital Library system.

5) KINITI

KINITI constructs databases on science, technology, industry and trade by collecting information from domestic and foreign sources. To enhance its service, it also provides information on technology and patent by importing the related databases from abroad. It distributes the information through its KINITI-IR, an on-line data bank and distribution network.

6) KORDIC

KORDIC is the central institution that collects information on science and technology. It constructs comprehensive databases and a general distribution system for national specific information and overseas technical information including research projects, reports, research manpower, equip- ments and instruments for science and technology. It also sets up databases for conference papers and theses on science and technology and provides digitized full-text service.

7) Science Library, KAIST

The Science Library of KAIST handles the databases on KAIST books, theses presented to KAIST, electronic journals, and the articles contained in overseas and domestic science journals. For the theses presented to KAIST, digitized full-text service is available.

B. Digital University Libraries

More than half of the university libraries are handling their work with computers and some are equipped with the computers to provide digital information service. The trend is that many university libraries are making efforts to increase their digital service capacity by upgrading their mainframe computers and by constructing more databases for digital information service. A few university libraries provide digital full-text service and VOD service through the internet.

2. Guidelines for the Development of Digital Libraries

The development of digital library in Korea is still in its incipient stage. Though several universities have started to construct the digital library system, most university libraries lag behind in constructing the system and are not ready to provide the digital information service. We suggest the following guidelines for the development of digital libraries.

First, we suggest digital libraries specialized in terms of the field of information they provides.

Second, it is desirable to construct a digital library in cooperation with other institutions that pursue the same goal.

Third, it is necessary to develop the digital library as a model service system that shows the universal effects of the information superhighway.

Fourth, it is desirable to create a synergy effect by constructing of digital libraries bring in positive effects on the other fields of the information society.

Fifth, it is recommended to carry out two separate projects in developing digital libraries, that is, 1) the project of transforming gradually the existing library into a digital library and 2) constructing a separate digital library system.

Sixth, the trend of social and technological change should be considered in the early stage of the digital library construction.

Seventh, it is necessary to examine the implementation and search model experiences of digital library construction that are carried out by other institutions.

Eighth, it is necessary to use the advanced technologies that are applied in the other domestic or overseas digital libraries.

Ninth, it is advisable that essential technology be retained for system maintenance and future expansion, though outsourcing in designing and construction of a digital library.

〈Table 2-2-8〉 Current Service Status of National Digital Library

Classification	DB Location	Size of Items	File Format
Catalog Service	Supreme Court library	3,499,159 items	MARC
	The National Library of Korea	2,492,924 items	MARC
	The National Assembly Library	329,181 items	MARC
	KINITI	41,252 items	MARC
	KORDIC	814 items	MARC
	KERIS	5,480,295 items	MARC
	Science Library, KAIST	72,849 items	MARC
	Total	11,916,474 items	
Text Service	The National Library of Korea	13,650,194 pages	Image
	The National Assembly Library	16,087,160 pages	Image, SGML
	Supreme Court library	17,156 pages	SGML
	KINITI	16,592 pages	SGML
	KORDIC	25,247 pages	SGML
	KERIS	210,940 pages	SGML
	Science Library, KAIST	52,247 pages	Image, SGML
	Total	30,059,536 pages	

Sources : Current Status of National Digital Library, May 2000

3 Cyber University

1. Introduction

The education is also in abreast with the changes in the society. The advent of digital age and the growing importance of knowledge and information bring in changes in the traditional conception of education and demands new education service. Re-education and continuing education are the cases for such new education service. However, the traditional educational system, in which education service is provided for young students in a limited space at specific time. The new education service emphasizes self-directed learning and advocates the idea that everybody learns what he wants at the place of his choice at the time convenient to him. In this regard, the new education service requires a flexible education system.

Cyber University plays an important role in satisfying the new demand for a flexible education system. For instance, Cyber University can provide various education services including re-education and continuing education by utilizing the ICT and communication network.

2. Current Status

The Ministry of Education supported operation of 15 model cyber universities from March 1998 to February 2000. A total of 71 universities (14 independently and 57 in consortium) participated in the operation of cyber universities in 1998, and 68 universities (13 independently and 55 in consortium) in 1999. The following is the list of cyber universities that are open as of May 2000 or have been open until recently:

- SNUVC (http://snuvc.snu.ac.kr)
- SCDU (http://cyber.hongik.ac.kr)
- SNOW (http://snow.sookmyung.ac.kr)
- Bool Cyber University (http://bool.tit.ac.kr)
- Yeungjin College (http://cyber.yeungjin-c .ac.kr)
- Hanbando Cyber University (managed by Soongsil University and others)
- Korea Virtual University (http://www. kyungpook.ac.kr/kvu)
- Korea Cyber University (http://chosun. com/class)
- Korea Online Virtual University (http://www. kovu.ac.kr)
- Sogang University (http://multinet.sogang. ac.kr)
- Dongguk University (http://cyber.dongguk. ac.kr)
- Chungnam University (http://cyber.chungnam. ac.kr)
- Open Cyber University (http://www.ocu.ac.kr)

With the operation of the model cyber universities, many of them offer auxiliary programs in order to improve the quality of teaching and learning in the existing courses or the programs for credit exchange between the participating universities. In some cases, programs are offered for the general public. However, in most of the cyber universities, the students currently enrolled in universities take the major part of users. The Cyber Universities in Korea is operated in two directions, that is,

undergraduate education for university students and continuing education for the general public. The number of people who enroll in cyber course ranges mostly between 10 and 50. In some cases, the enrollment is over 1,500.

3. Next Steps

With the expansion of internet service, cyber education system is actively constructed in diverse fields of the society. Cyber education system is expected to be an important re-education and continuing education system for those who have to upgrade their expertise while working in their specific jobs. It is an open and flexible education system that can provide learner-oriented education service in such cases as re-education, continuing education, education for degrees, and the internal education within a company.

The operation of cyber education depends on the use of ICT. Considering the speed of the internet development, more speedy information flow will be possible between countries, regions, and institutions. Thus cyber education system will play a significant role in realizing the globalization of education. In this regard, IEEE suggested LTSA (Learning Technology System Architecture) on the basic elements that a cyber education system should have. As the domestic educational institutions are going to establish full-scale cyber education systems in the near future, they are advised to refer to LTSA as the international standard for cyber education service as well as for the globalization of education.

4 Adapting Education to the Information Age in Universities of Education and College of Eduction

1. Current Status of Universities of Education

A. Courses Related to Computer and ICT

The courses of universities of education consist of three areas: generic course, specialized course, and enrichment course. The contents of generic course are not much different from the general course of other general universities. The subjects related to computer in the general course are 'Information Society and Computer' (3 credits) and 'Use of Software' (3 credits). Specialty course consists of the essential subjects that are necessary for carrying out the teaching duties of elementary education. The main subjects are 'Pedagogy', 'Subject Teaching', 'Practical Arts Education', 'Teaching Practice', and 'Thesis Writing'. Specialty-enhancing course is prepared in order to give the universities of education students the opportunities to learn more on the specific subjects in which they are interested. This course also enables the students to teach specific subjects as professional teachers. Thus the contents of this specialty-enhancing course include the ten subjects of elementary education, 'Computer', and 'Pedagogy'. Students take one of these subjects as his specialty.

Currently, there are two types of enrichment course in all the eleven universities of educa-

tion. Each university of education offers only one of these two course types. The first A type course has the subjects such as 'Computer Education', 'Structure of Computer', 'Programming Language', 'Structure of Data', 'Operating System', 'Computer Communication', and 'CAI'. The subjects of the second B type course are 'Elementary Computer Education', 'Authoring Tool I', 'Authoring Tool II', 'Elementary Education and Computer Communication', 'Education and Multimedia', 'Children and Programming', 'CAI', 'Data Structure and Database', 'Application of Computer to Elementary Education'. Both the type A and B course requires 21 credits for course completion.

B. Infrastructure Status

It seems that most universities of education have enough multimedia and computer labs for classroom use. On the average, there is one PC per 11students. The computer labs are open for students from 9 am to 8 or 10 pm. Thus students do not have inconvenience in the use of computers in their universities. And LAN is installed in each university of education. The computer labs provide word processing, graphic, web editor, authoring tool, and utility software for students.

C. Guidelines for Improvement

More often than not teacher's ability determines the quality of computer education in elementary schools.

The students in universities of education will teach the children after graduation and their ability will determine the quality of computer education in the future. The following is some guidelines and recommendations that should be remembered for the improvement of the education in universities of education and the enhancement of the ability of prospective teachers.

First, the required credits for the subjects related to computer in the general course should be raised from 6 to 9 credits.

Second, the subjects related to computer have to be offered as regular subjects to prospective teachers, for computer subject is going to be offered to all grades of elementary school in 2001.

Third, there should be a balanced recruitment of professors. It is necessary to recruit not only the professors teaching the practical part of computer education but also the professors teaching the elements of computer education.

Fourth, it is necessary to develop new educational contents on the education of elementary school. These new contents also should be provided not only to the prospective teachers but also to the teachers in service.

Fifth, it is necessary to enhance the computer literacy of all universities of education by developing the training programs for the professors and the administrative staffs.

2. Current Status of the Colleges of Education

A. Courses Related to Computer and ICT

The Seventh Education Curriculum, to be enforced in 2001, stipulated that every course utilize ICT for more than 10 percent in its schedule. It also stipulated that computer

course become a compulsory one from the first grade of elementary education. The information literacy certificate, which is in effect for high school students, is also planned to be applied to middle school students. In accordance with the policy of the Ministry of Education, national and private universities of education have established several departments specializing in computer and ICT. There are 20 departments in 13 national colleges of education, and 24 departments in 27 private colleges of education.

B. The Status of Infrastructure

According to the 1998 evaluation report on 40 colleges of education, 33 have multimedia classrooms, 38 operate computerized information management systems, 27 have LAN, and 25 operate web sites. All the 40 colleges have computer labs. But there are differences between the colleges in terms of the kind and capacity of computers they have. Some colleges own the computers whose capacities are far behind those of the popular computers in the society.

These facts reveal that colleges of education generally need improvement in their infrastructure for computer education as well as their information management. They are short of information and multimedia equipment in terms of both quality and quantity. Considering this situation, the Ministry of Education is planning to provide financial support for the establishment of educational material production labs in national universities of education. The educational material production labs will make the prospective teachers have the chances to use multimedia equipment and to produce new multimedia contents so that they can be the leading force in promoting the advancement of teaching environment.

C. Next Steps

We suggest the guidelines for improvement in three directions.

The first is related to the courses offered by the colleges of education. As computer related subjects are expected to increase in the Seventh Education Curriculum, teachers are required to have the abilities to teach those subjects. Thus it is advisable that the courses in the colleges of education be constructed so as to raise the abilities and expertise of the prospective teachers.

Second, there should be improvement in the infrastructure. As mentioned above, the colleges of education are short of information and multimedia equipment in terms of both quality and quantity. The computers and equipment are out of date. Some colleges do not even have enough computers for students' practice. The increase of the number of pieces of equipment and the upgrading of computer capacity are necessary.

Third, more effort should be made to enhance the abilities of prospective teachers by providing in using multimedia equipment. The plan by the Ministry of Education to provide financial support for the establishment of educational material production labs seems to be timely in this regard. Each college of education is also advised to make its own promotion plan and to enforce it in order to provide better educational services for the prospective teachers.

5 Construction of Korean Education Network

The Korean Education Network (KREN) is the non-profit information network for supporting education and research activities by connecting government organizations, educational institutions, and other institutions related to education through communication lines. The Education and Research Computer Center is housed in Seoul National University and responsible for the construction and general operation of the network as the center of this network. It also function as the regional network center for Seoul and Gyeonggi area. There are nine other regional network centers in local provinces, each of which is located at the national university of the respective province. These regional centers interconnect the institutions in each region and provide technical service for them.

In December 1999, 1,422 institutions subscri bed internet service from the education network (196 universities and Junior colleges, 1,226 elementary and secondary schools and educational administration institutions). As for on the capacity of the network, the network center is connected to US Sprint at 90Mbps speed and the network center and nine regional centers are connected at 155Mbps speed. The Education and Research Computer Center is connected to three major internet network centers (National Computerization Agency, Korea Telecom, and Dacom) for the connection to other communication networks in the country. KREN uses TCP/IP protocol and supports telnet, fttp, tftp, and e-mail service.

The huge increase of internet connection by educational institutions caused network overload and delays the connection. To improve the connection, network upgrading will serve as possible solution. As an alternative, the universities could organize a consortium and co-sponsor the network management to a high-speed commercial network service provider.

PART 3

Vision of Adapting Korean ICT Education in the Future

CHAPTER 1

Problems and Policies for Adapting Education to the Information Age

1 Problems

1. Inequity of Learning ICT

The Adapting Education to the Information Age project aims at ensuring that all students and teachers become competent in the use of ICT. The best way to achieve this goal is to systematically include instruction on these topics as a part of regular schooling. However, the topics are spread throughout the school curriculum. In elementary schools, ICT is integrated across the various subjects. In middle schools and high schools, the subject is offered as an elective. It is currently possible for students completing the regular 12-year education program to encounter very different opportunities to learn about ICT. This combined with individual differences in computer access and learning rates vary to a greater degree in their understanding and ability to use ICT.

2. Lack of Infrastructure

The project to construct multimedia laboratories started in 1997. At the end of 1999, due to cutbacks in the initial investment, it was only about 72% complete. Schools with 36 classes or less receive only one multimedia practice room. This limits the amount of time students are able to spend learning about Information Technology. For example in a school with 30 classes, scheduling each class to use the multimedia practice room for one hour per week would fully book the room. So under ideal conditions, students in small schools are able to practice their multimedia skills no more than one hour per week.

3. Insufficient Training for Teachers

Everyone needs to learn to use hardware and software in their development and growth as a part of adapting education to the information age. However because they are the leaders, first priority should be given to insuring that teachers have the required knowledge. Presently the training for teachers does not keep up with demands. In the current program, about 25% of all teachers have an opportunity for training each year. But this means that it takes 4 years for each teacher to have an opportunity for re-training. Considering the speed at which progress in technology occurs, this 4-year cycle is not sufficient to keep

teachers abreast of current change. Policies to expand the opportunities for teacher training are needed.

4. Shortage of Educational Information

Adapting education to the information age requires the development of a huge amount of educational information. Systematic quality control and limits on the amount of quality material that can be developed by the government have kept the amount of information being produced far below what is needed in the schools. Programs are in place to meet this need. They include the operation of the quality authentication system for educational content developed by nongovernmental agencies, support for school purchasing, exhibitions for educational software development, and the campaign to share educational information. However these programs are not sufficient to meet the current need.

5. Lack of Sharing Information among Educational Institutions in Local Governments

Each Office of Education in cities and provinces has only one person in charge of adapting education to the information age. With over-loaded tasks, and the complexity of each of the projects, supplementing by temporary staffs may not guarantee an effective measure. It is difficult for each local Office of Education to competently manage the large number of professors and teachers.

2 Policy Recommendation

First, government investment should be expanded and a system should be established for regular maintenance of hardware infrastructure. The national level budget should be focussed on hardware infrastructure, even if it is limited (5% of GNP is envisioned in the educational finance investment plan). A system of hardware maintenance and replacement should be established to ensure that the infrastructure is kept up to current standards.

A support system by stakeholder of education such as parents of students to provide equipment for educational information could reinforce ties between regions and schools and strengthen the ways in which parents of students can participate in education. This should be examined as an alternative policy. Standards for educational information equipment should be defined at the national level. To prolong the life cycle, a consortium with responsibility for quality control should be established to jointly manufacture and distribute educational information equipment.

Second, schools should make the information technology courses as compulsory.

Third, policy should be aligned to support and encourage information training for teachers. Current courses should be expanded where possible and on-line training system should be expanded and completed as soon as possible.

Fourth, expansion of our capability to create useful educational content should be replaced as a priority. Though the government develops

and supplies a large amount of the current educational content, more educational content that can be used directly in classroom is needed. Teachers should join the development and use the necessary educational content for their own classes with their own students. The government should create and distribute basic tools for the development of educational content and of educational multimedia to support teacher involvement in this area.

Fifth, manpower in charge of adapting education to the information age should be reinforced. The government should consider giving priority to tasks related to adapting education to the information age and unifying departments that cooperate in this initiative. It should also facilitate the exchange of views between the government and regions and encourage the sharing of methods and the results of evaluation activities.

CHAPTER 2

Future Objectives and Major Issues for Adapting Education to the Information Age

1 Background: the Knowledge & Information Society

The world economy is in the process of transforming to a knowledge and information-based economy. The major OECD countries are expanding the relative importance of the knowledge industry. In Korea it is expected that the contribution to our economy of knowledge-based industry will increase from 20.4% in 1997 to more than 27.1% in 2010. In this context, the expansion of cyberspace and the increasing ability to communicate is shrinking our planet into a single global village. By the end of April 2000, the number of domestic internet users reached 14,560,000. It has been increasing at an explosive rate for the last 6 years and it is expected that the number of world internet users will be 700 million by 2002.

Adapting education to the information age must go hand in hand with the rapid expansion of cyberspace and the explosive increase of internet users. Development of human capabilities, endowing people with the necessary moral maturity and enabling them to make effective use of ICT is an essential factor to ensure national competence in the 21st century, thereby improving our quality of life.

Current plans call for adapting education to the information age to be fully established and underway this year. It is now necessary to systematically and objectively evaluate teaching-learning methods and rigorously promote the use of ICT media and tools. There must be efforts for these to be achieved by encouraging the systematic improvement of teaching methods, the development and implementation of policies promoting optimum educational conditions, and the establishment of objective evaluation activities. This will create an effective educational environment where voluntary participation can effectively promote adapting education to the information age.

2 Objectives and Major Tasks for Adapting Education to the Information Age

The main objectives of the Adapting education to the information age project is to foster a level of skill and knowledge of

computer use in the population that is the best in the world. The concrete goals and subjects to practice are as follows.

First, the paradigm of adapting education to the information age should be promoted. This consists of more than just implementing the adapting education to the information age program to teach data processing or provide instruction about ICT. It means a complete change of purpose, content, methods of education and roles of teachers and students. A new educational system to use technology to improve the quality of public education should be designed and implemented to improve educational productivity and cultivate the manpower required in a knowledge & information society.

Secondly, a society devoted to lifelong learning through ICT should be fostered. A base of learning opportunities for occupations, leisure-time activities and intellectual development that is easily and inexpensively accessible everywhere and any time can be formulated only through information and communication technology. Adapting education to the information age and lifelong education are inseparably linked to each other. A knowledge & information society ultimately means a Learning Society or 'Edutopia' where everyone can learn what he or she wants any time and any where.

Thirdly, the infrastructure for adapting education to the information age in schools should be continuously improved. The present level of information infrastructure in domestic schools stands at 17.4 students per computer. This falls short of ratios of 5 students per computer in the United States, 6 in Singapore and 11 students per computer in Finland. Average internet network speed is 256Kbps here, compared with 45Mpbs in Singapore and 100Mbps in Finland. Improvements in the number of computers in schools and the speed of our networks are necessary.

Fourth, the school curriculum and choice of textbooks must be reflected to the new environment of ICT. Course content is revised on a regular basis and these revisions should be used to adapt the curriculum to the needs of the adapting education to the information age program. The allows the diversified integration of ICT into all subjects, and to provide the flexibility of change needed to adapt the schools to the rapid social changes introduced by technology. Using this process the number of optional technology-related courses can be systematically reduced as the use of technology is integrated into regular courses. Along with this process, the digitization of textbooks can smooth the transition to the spreading use of ICT throughout out educational system

Fifth, high quality educational material in digital form must be provided in sufficient quantity to meet the expanding needs of the educational system. Systems for developing this content should be established in cooperation with public institutions such as libraries, museums, galleries, broadcasting stations, schools, businesses, corporations, industry, educational institutions, and Offices of Education at the state, city, and local levels. Regional centers for the development of educational content should be constructed. In the meantime, participation of nongovernmental agencies is necessary for developing the large quantities of educational content needed. Incentives to encourage non-governmental organizations to provide educational materials

should continue to be provided and the systematic review process to certify the quality of educational materials continued. Criteria for excellence should be objective and widely publicized, and material judged as being excellent should be recommended to schools.

Sixth, a large database of information for academic and research along with systems for standards and distribution of information among libraries should be constructed to improve our competence in the activities of academic and research. Digitalization of text, capability to search book lists, and mutual difference services are being introduced in all university libraries. However digitalization of just 17.3% of full-text services of academic and research and 80.4% of university book lists has been done. Usage is reduced because the resources are incomplete. Purchasing of existing overseas databases for academic and research information is recommended.

A comprehensive system including standards for relative databases, digitalization of library materials, and distribution of academic information should be considered and constructed and expanded with regional and comprehensive databases. Digitalization of theses and all materials published by universities should be promoted and the plan to integrate all academic information into a single database should be continued. The KERIS should reduce costs by promoting joint purchase of overseas academic databases. At the same time, operation of the academic information system should be promoted through expanding the comprehensive listing service and the text database services.

Seventh, administrative forms, rules, programs and tasks for the educational administration of teachers, students and facilities should be reorganized to take advantage of technology and to promote transparent and productive educational administration. Partial computerization of educational administration was accomplished during the first phase of Adapting Education to the Information Age project, but it was scattered and uneven, resulting in poor connections between unit systems and information processing technology and data distribution being hampered by differences in systems and standards. In addition, as computerization was promoted according to the local needs of different administrative institutions, no centralized distribution or standards have been developed. Therefore, administrative tasks of the Office of Education in cities, provinces and other regions should be analyzed and in consultation with related institutions, standards for communication and storage of administrative data should be developed and a central database of educational administrative information established. Laws and policy should be adapted to effectively use the centralized administrative database with the goal of nationwide implementation.

Eighth, negative effects of the adapting education to the information age program should be minimized and prevented. Undesirable consequences of computerization such as computer viruses, hacking, information crime, violation of privacy, the information gap between countries and between individuals can be expected to increase. Development of individuals' abilities to use information and communication technology will help all people to cope with knowledge and information

society, to adapt, and to avoid its undesirable side effects.

CHAPTER 3

A Vision for Adapting Education to the Information Age

1 Human Resources Development

As we enter the information society, the value of information and the ability to control it becomes more important. The proliferation of information technology permeates all of human thought and action, the society, the economy, our culture, our laws and, most importantly, our education system. The education system is deemed to cultivate our citizens and prepare them to participate in our culture and society. And it is through education that we can avoid the or negative consequences of the impact of information technology on our society.

Adapting education to the information age pursues the following visions.

First, building an education and a lifelong learning society. Everyone can use all of the educational data and information that he or she wants, and can receive an education everywhere and any time using high-tech information engineering and multimedia communication. By building an open education society in which education and training in the real life situation is naturally connected and supported by education and training in cyberspace.

Second, providing the best education service. All students can be educated by the best teachers and in the best schools without regard to distance, social and economic position, or physical conditions.

Third, preparation to the knowledge & information centered country. It facilitates participation in all sorts of international projects, promotes Korea as a central country in the global Knowledge & Information Society, and acts as a bridge to close the information gap between developed and developing countries.

Fourth, implementing the educational paradigm of the information society. It replaces the system of closed education carried out in fixed time and space with an open system able to function without limitations of time and space. It replaces private and local ownership of educational resources with joint and nationwide ownership of educational information. It moves from a basis of limited local information to joint use of international information. And it changes from a cramming system of education to self-study learning and from uniform education to individualized education.

Fifth, realization of smaller and more-effective customer-centered educational administration. It provides high quality educational services through the 'Educational

Administrative Information System'. This system connects the administrative functions of all educational institutions. This will release teachers from many administrative chores and allow them to concentrate on their students and teaching. Educational administrative institutions have ready access to accurate data for education matters and management, and use this to effectively support the operation of schools.

Adapting education to the information age will affect all participants in education:

1. For Students

It will be possible for learners to freely frequent both regular and cyberspace classes, study and learn according to their own aptitudes, character, requirements and interests. They will have the capability to effectively solve problems, study subjects, and carry out projects in an environment of easy access to high quality educational information.

2. For Parents

Parents may easily access all necessary information and data concerning their children using information and communication technology. In addition, they can easily obtain all information about school subjects and may consult about various matters including the education of their children with the institutions and teachers in charge.

3. For Teachers

Teachers will spend less time on the simple delivery of information and handling of administrative chores and will focus on designing learning plans suitable for the aptitude, character, interest and requirements of individual learners, and concentrate on promoting and supporting the study of learners. In addition, they will help learners cultivate their personalities and character to prepare them as members of the new society and provide consulting and advising for students and parents.

4. For Educational Administrators

Educational administrators will find that ready access to complete and accurate data, and computer-based administrative and reporting systems will make their tasks much easier and their work more efficient and effective.

5. For General Adult Learners

General adults can easily obtain a wide range of learning data and information pertaining to their own cultures, hobbies and leisure at any time and from almost any location. They will have convenient and comfortable locations to obtain reliable information as it is needed to solve various urgent problems in their daily lives, and to exchange ideas and information with each other.

6. For Workers

Workers will be able to conveniently and economically participate in professional learning concerning their tasks from a convenient location such as their work site or home at any time. This will be especially valuable to those seeking opportunities for

reeducation or retraining and for those who would like to enter new occupations.

7. For Industry Sector

Industry will have new opportunities to establish true cooperative relationships between labor and management because they can easily identify creative laborers who have the necessary information accreditation and the ability to solve problems.

8. For People in a Remote Places of the Country

Adapting education to the information age will provide an educational environment and opportunities for those who live on islands, in fishing and agrarian villages that are equivalent to opportunities previously available only to people living in the urban areas.

9. For Government Ministries

Government agencies and public institutions provide the support for adapting education to the information age and will use the peoples' heightened information skills and capabilities to develop the country. These organizations will be more effective in establishing and implementing policies through better administrative systems and an increased awareness and support of more people for their policies.

2 Academic and Research

One of the salient changes in a knowledge-based society is the change in the form of work. Work in all industries and research is now a form of knowledge consumption and knowledge consumption is now an important form of work. In this society, creation of new knowledge, joint ownership of created knowledge and innovation of work and society through new knowledge are the critical factors that determine competence for the nation.

The most important core of a knowledge-based society is based on the knowledge cycle, and this is supported by the academic and research information service. One measure of the level of academic and research in Korea is based on the number of theses listed in the Science Citation Index (SCI). The number of all theses published in Korea listed on SCI is 7,728. This is a little less than 8,364 listed as published by Harvard University, but more than the 5,536 from Tokyo University. By this measure, the research capabilities of all Korean universities are a little lower than that of some famous overseas universities. The number of theses published per ten thousand people in Korea is 1.69, which is at the 29th position among 42 major countries. The average number of quotations from published theses is 1.7 and this ranks 61st in the world. By these measures, the level of science and research in Korea could be improved and is not sufficient to ensure our full participation in the global knowledge based society.

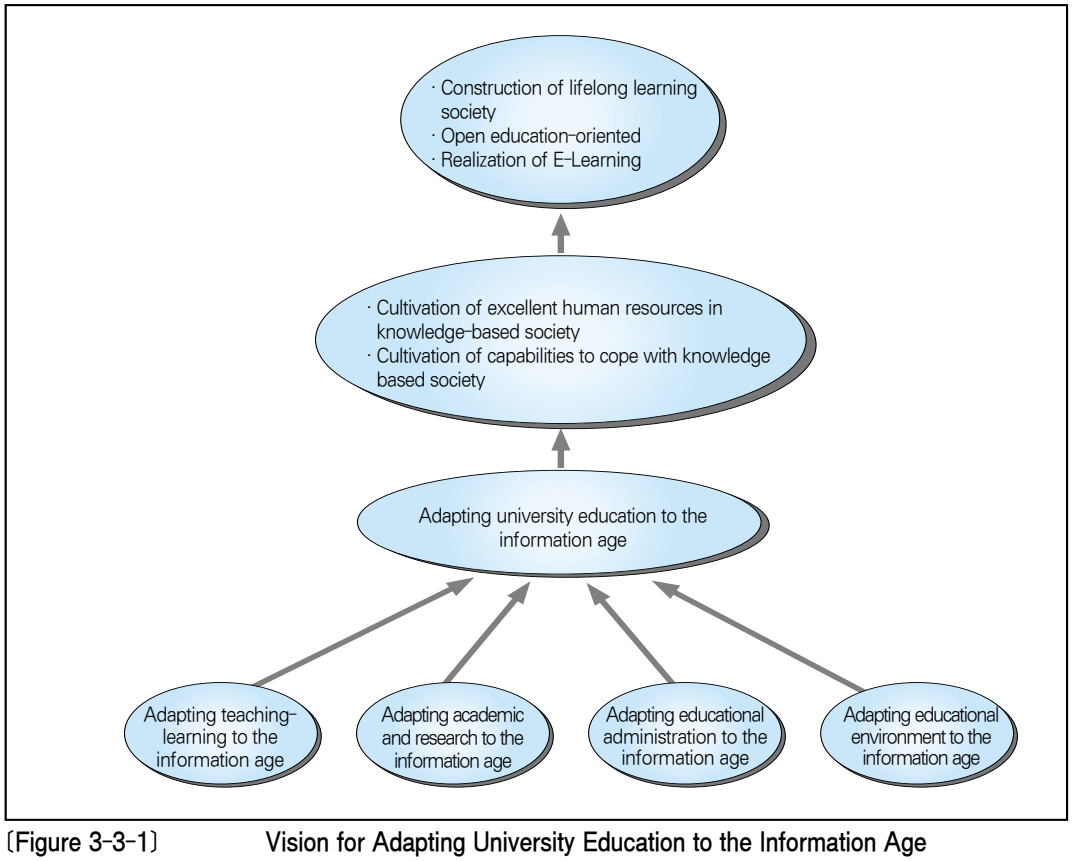
The core functions for adapting academic

and research to the information age are: providing knowledge and information resources to cultivate high-grade manpower (intellectual workers); providing knowledge & information resources for academic and research to create new knowledge; and the national management and distribution of knowledge resources. The primary objective of adapting academic and research to the information age is to improve national competence in all fields through cultivation of high-grade manpower (intellectual workers) with professional knowledge and capabilities that can make use of information.

Secondly, creation of new knowledge through adapting academic and research to the information age is related to the independent development new national academic and research resources. And third, national knowledge should be managed and distribution system should be established to enable all of our scientists and researchers to have immediate access to the global pool of academice and research information.

3 University Education

Adapting education to the information age in the university is essential to cultivating



〔Figure 3-3-1〕 Vision for Adapting University Education to the Information Age

excellent human resources in a knowledge-based information society. Adapting teaching and learning to the information age, adapting academic and research to the information age, adapting the educational environment to the information age and adapting educational administration to the information age are all necessary to realizing the adapting of university education to the information age (see Figure 3-3-1). Adapting teaching and learning to the information age can be accomplished through adapting professors and students to the information age and adapting educational methods to the developed age.

A climate that encourages cooperation and international relationships would be promoted through internet-based remote lectures home and abroad.

Adapting educational methods to the information age should aim at promoting e-Learning. That is, learner-centered two-directional and tailored learning accomplished completely through using features of computer and internet technology. Such learning should be supported by lectures using multimedia and using project learning methods. internet lectures would be open but managed, while remote video lectures are introduced. A credit exchange system with cyber universities inside and outside of the country would be established.

Construction of a digital library and development of the science and research theses database should be a first priority. In addition, with the introduction of a one stop science service based on this collection of information, research activities of professors and students would be substantially supported.

As for adapting educational administration to the information age, computerization of administrative affairs and operation of the electronic settlement system are essential in order to improve efficiency and rapid completion of tasks. Offerings of the administrative service with customers as the central figure are required, along with introducing the one-stop admi- nistrative system and the one-card system.