2006

Adapting Education to the Information Age

Foreword

We live in a global, knowledge-based society, where creativity determines the survival and prosperity of nations as well as individuals. A knowledge-based society requires us to radically reform the conventional schools and the education system that supplied the labor force of the industrial age. In response to this trend, the Korean government has continued in their educational reforms with the aim of realizing a lifelong learning society and cultivating creative talents. It is widely recognized that the adoption of ICT in education is the most important driving force and basis for enabling such educational reforms.

In order to realize educational reforms through adoption of ICT in education, the Ministry of Education & Human Resources Development has promoted various projects on a continuing and systematic basis since development of the mid-to-long-term master plan in the mid-1990s. Such as, the infrastructure for adoption of ICT in education was implemented in elementary and secondary schools by 2000 under the phase one plan. The second phase was successfully completed by 2005, resulting in activation of ICT-based education and e-Learning. Under the phase three plan, we have focused on the establishment of educational systems that meet new social paradigms created by developments in ICT.

Elementary and secondary education sectors in Korea have already had remarkable success according to comparative studies of OECD members. In future, the focus will be on e-Learning activities to bridge the educational divide between regions and social classes and the dissemination of educational welfare programs. Meanwhile, we are faced with the challenges of a low birthrate and an aging society, resulting in an environment where the middle-aged have assumed the leading roles in the national economy. In addition, owing to the radical development of knowledge and technology, we cannot maintain competitiveness without lifelong learning activities. Such environmental changes drive us to focus on lifelong learning. As a result, the government must provide the people with an environment that allows them to fulfill their educational needs. Therefore, we must continue in our effort to use ICT in response to the changes in the educational environment.

This White Paper is designed to inform people of the government's success thus far in adopting ICT in education. In addition, it is hoped that the White Paper is useful for policymakers in the drafting of regulations and legislation. Finally, I would like to thank all members of staff for their hard work in making the publication of the 2006 White Paper possible.

December 15, 2006

Kim Shin-Il

Deputy Prime Minister and

Minister of Education & Human Resources Development

Foreword

In 2006, the international community acknowledged Korea's many achievements in adopting ICT in education and our leading position in this area. With the rapidly changing ICT environment, e-Learning has become a new learning paradigm in the knowledge-based society. The Korea Education & Research Information Service, which is a national institution responsible for managing the adoption of ICT in education, has strived to realize a lifelong learning society and cultivate creative talents.

Accordingly, the 2006 White Paper introduces the three-phase master plan and policies for adoption of ICT in education that will be promoted over the next five years. In addition, it summarizes a time-series analysis of results that are expected to be achieved through execution of these policies. This time-series analysis was based on indices designed for qualitative and quantitative evaluation of the results. Furthermore, one section of the 2006 White Paper focuses on the discussion of the vision for ICT use in education and the role it will play in light of innovation in future education. The National Education Information System (NEIS) is addressed under the section covering ICT use in elementary and secondary schools, as NEIS is now considered to be fully operational. Furthermore, the 2006 White Paper focuses on policies to address the social divide and adverse effects resulting from the proliferation of ICT.

Our intention is to ensure that this series of White Papers is significant in showing analytical and statistical data on outcomes and accomplishments in the adoption of ICT in education. As an updated reference source it shows the changes in our society owing to the adoption of ICT in education. The 2006 White Paper will also serve as a useful resource for educators, school teachers, and researchers. Finally, I would like to thank the compilation committee, editors, authors, proofreaders, and all others involved for their efforts in publishing the 2006 White Paper.

December 15, 2006
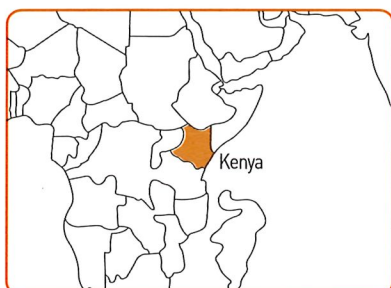
Dae-Joon Hwang, Ph.D.
President
Korea Education & Research Information Service

Cluster : Middle East

Country	Metropolitan/Provincial Office of Education	Designated University
Yemen	Ulsan	University of Ulsan
Iraq	KERIS	

Cluster : Africa

Country	Metropolitan/Provincial Office of Education	Designated University
Kenya	Gangwon	Kangwon National University

Cluster : Southwest Asia

Country	Metropolitan/Provincial Office of Education	Designated University
Bangladesh	Daegu	Kyungpook National University
Pakistan	Incheon	Inha University
Sri Lanka	Gwangju	Chonnam National University

Kazakhstan
Mongolia
Uzbekistan
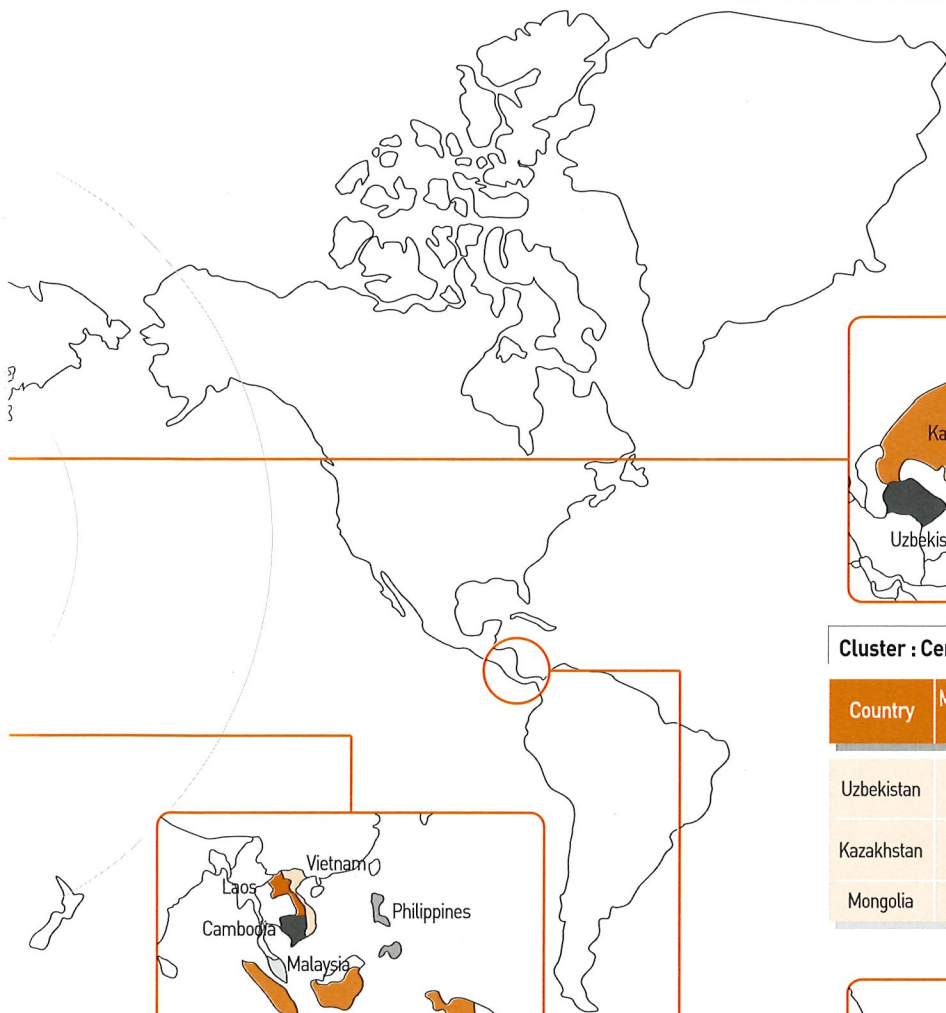
Cluster : Central Asia

Country	Metropolitan/Provincial Office of Education	Designated University
Uzbekistan	Seoul	Seoul National University
Kazakhstan	Gyeonggi	Korea National Railroad College
Mongolia	Daejeon	Jeonju University

Vietnam
Laos
Philippines
Cambodia
Malaysia
Indonesia

Dominican Republic
Guatemala

Cluster : Southeast Asia

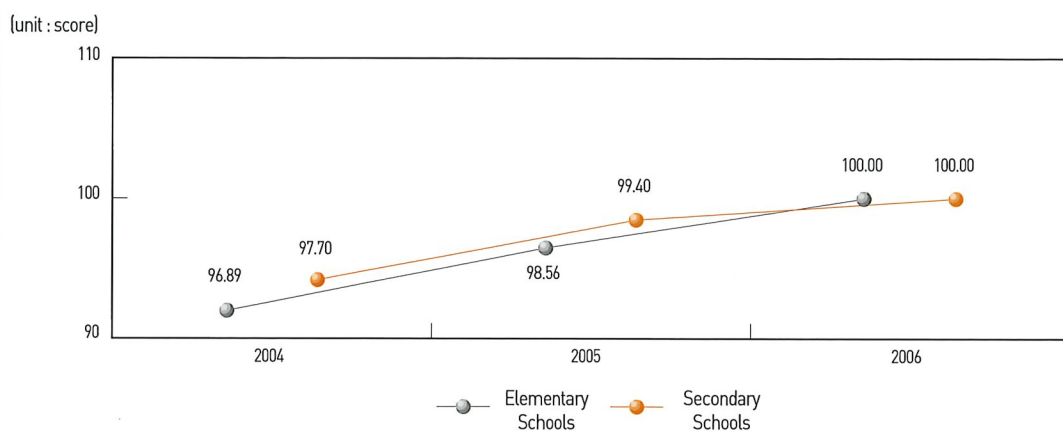| Country	Metropolitan/Provincial Office of Education	Designated University
Cambodia	Busan	Youngsan University
Indonesia	Chungbuk	Cheongju University
Laos	Chungnam	Chungnam National University
Philippines	Jeonbuk	Chonbuk National University
Malaysia	Jeonnam	Chonnam National University
Vietnam	Gyeongnam	Gyeongsang National University Youngsan University

Cluster : Central and South America

Country	Metropolitan/Provincial Office of Education	Designated University
Guatemala	Gyeongbuk	Yeungnam University
Dominican Republic	Jeju	Cheju National University

Composite Adapting ICT in Education Index, 2004～2006

(unit : score)

Elementary Schools	Secondary Schools

96.89 · 97.70 · 98.56 · 99.40 · 100.00 · 100.00

Years: 2004, 2005, 2006

Composite Adapting ICT in Education Index by Region, 2004～2006

(unit : score)

Legend: 2004, 2005, 2006

Elementary Schools

Region	2004	2005	2006
Big Cities	95.48	96.32	99.12
Small & Medium Cities	94.75	96.55	98.44
Town	98.66	98.44	101.5

Secondary Schools

Region	2004	2005	2006
Big Cities	95.85	97.62	98.47
Small & Medium Cities	96.31	98.45	98.89
Town	100.48	101.77	102.37
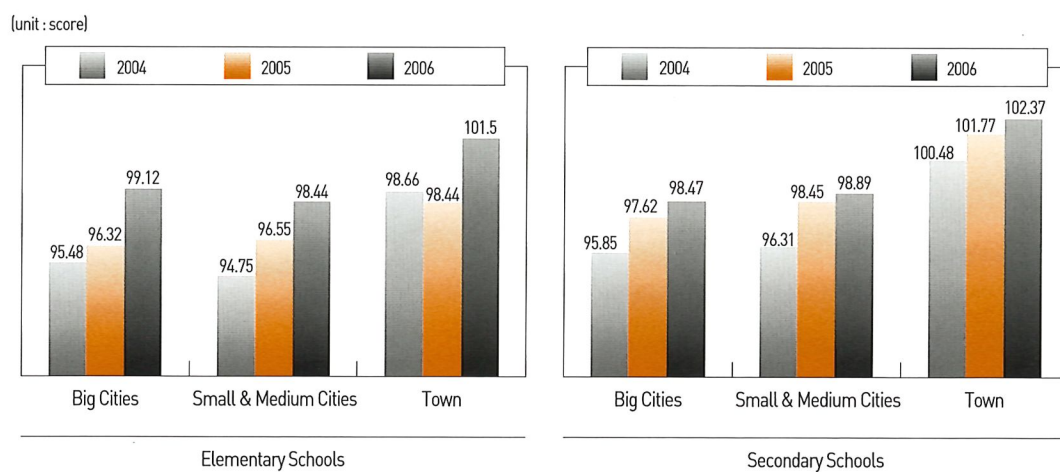
Composite Adapting ICT in Education Index by Type of School, 2004~2006

(unit : score)

Elementary Schools

	2004	2005	2006
National/Public	96.91	98.58	100.02
Private	95.99	99.76	99.32

Secondary Schools

	2004	2005	2006
National/Public	98.26	100.23	100.6
Private	96.24	97.33	98.56
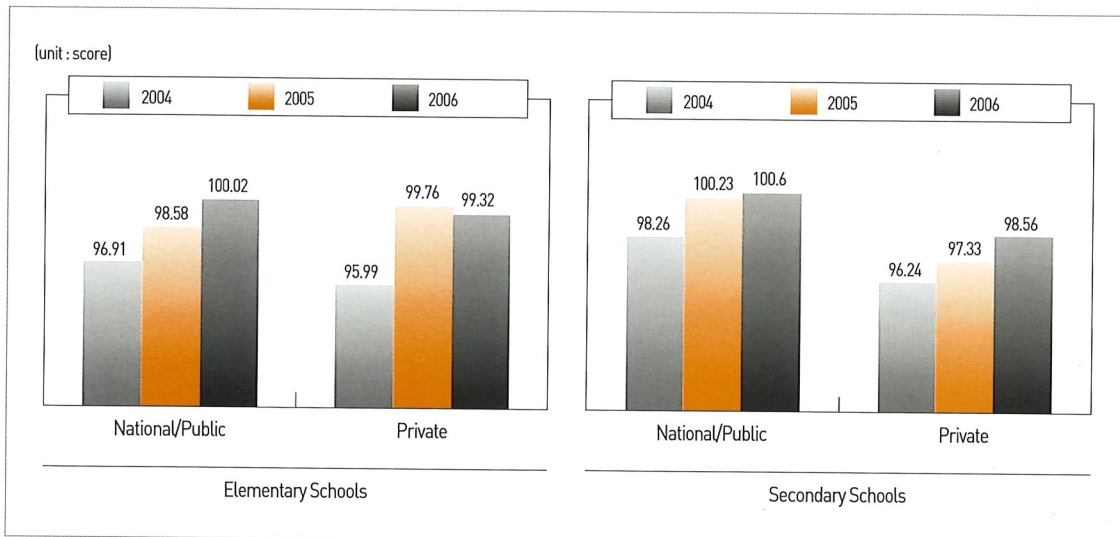
Number of Elementary Students per PC, 1991~2006
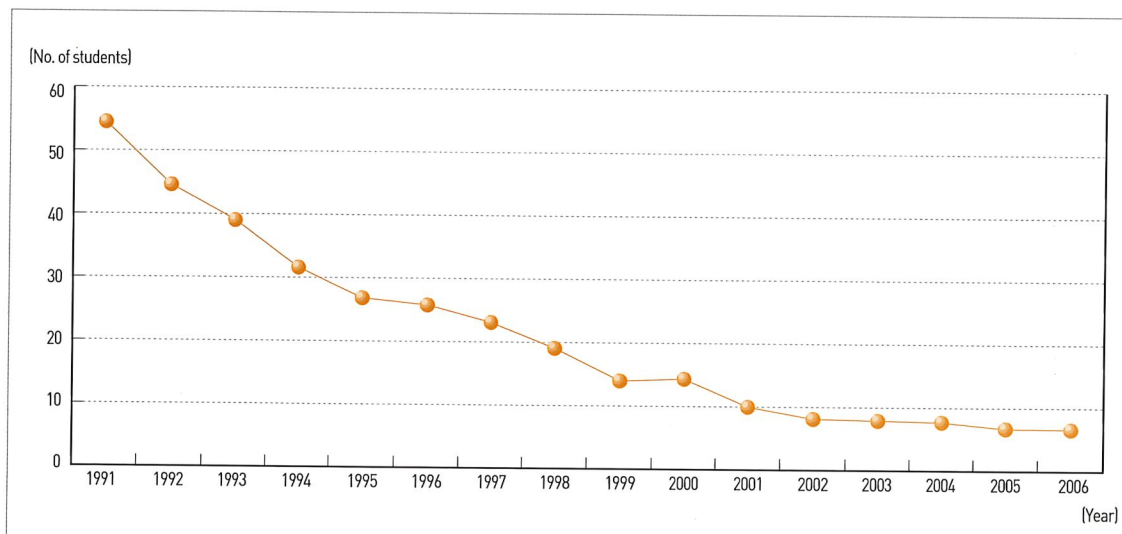
(No. of students)

Year	No. of students
1991	55
1992	44
1993	39
1994	31
1995	26
1996	25
1997	22
1998	18
1999	13
2000	13
2001	9
2002	7
2003	6
2004	6
2005	5
2006	5

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006
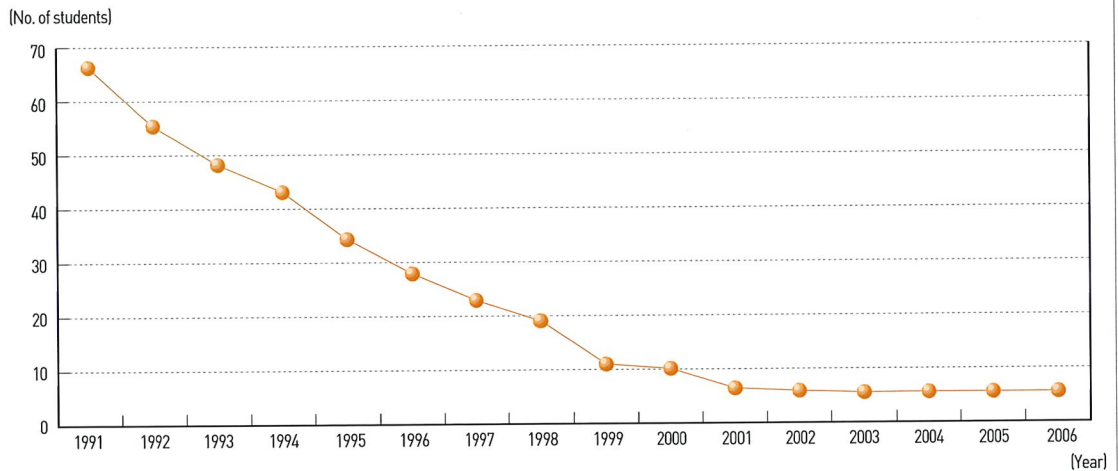
Number of Middle School Students per PC, 1991~2006
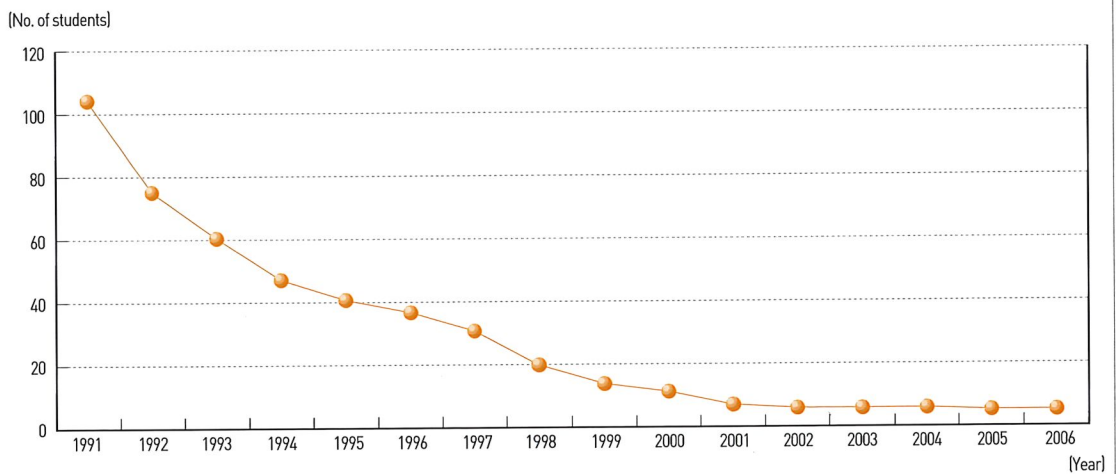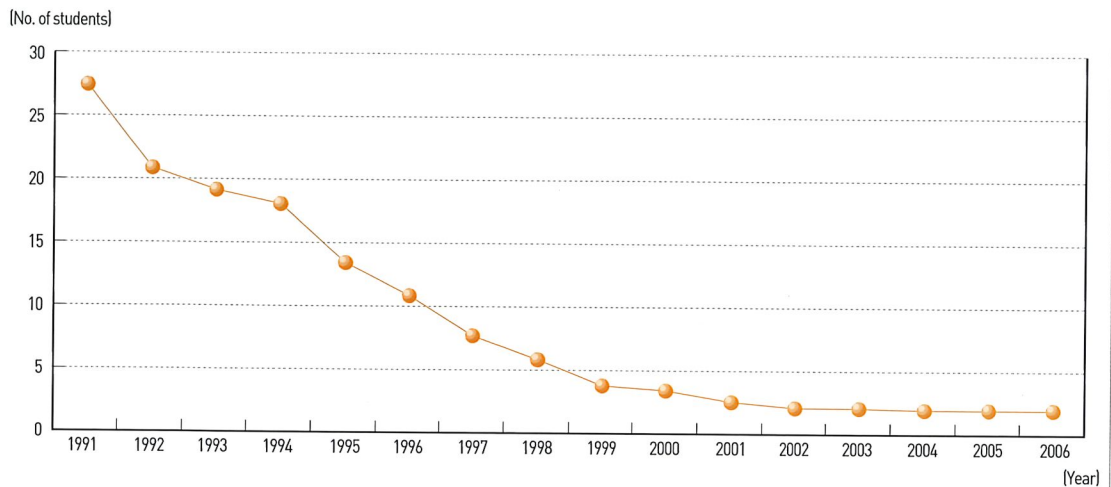
(No. of students)

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006
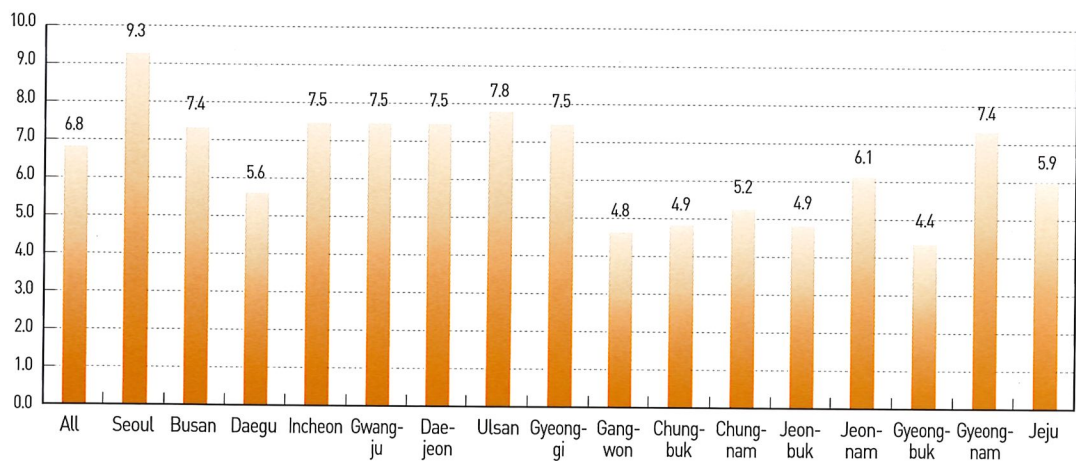
Number of High School Students per PC, 1991~2006

(No. of students)

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Technical High School Students per PC, 1991～2006

(No. of students)

```
30

25

20

15

10

 5

 0
   1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
```
(Year)

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Students per PC by Metropolitan/Provincial Offices of Education: Elementary Schools, 2006

| All	Seoul	Busan	Daegu	Incheon	Gwang-ju	Dae-jeon	Ulsan	Gyeong-gi	Gang-won	Chung-buk	Chung-nam	Jeon-buk	Jeon-nam	Gyeong-buk	Gyeong-nam	Jeju
6.8	9.3	7.4	5.6	7.5	7.5	7.5	7.8	7.5	4.8	4.9	5.2	4.9	6.1	4.4	7.4	5.9

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Students per PC by Metropolitan/Provincial Offices of Education: Middle Schools, 2006
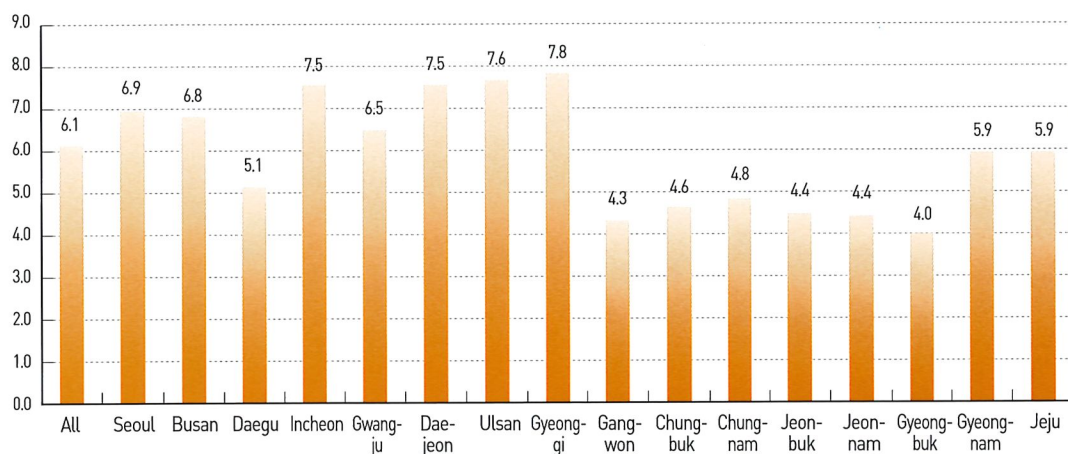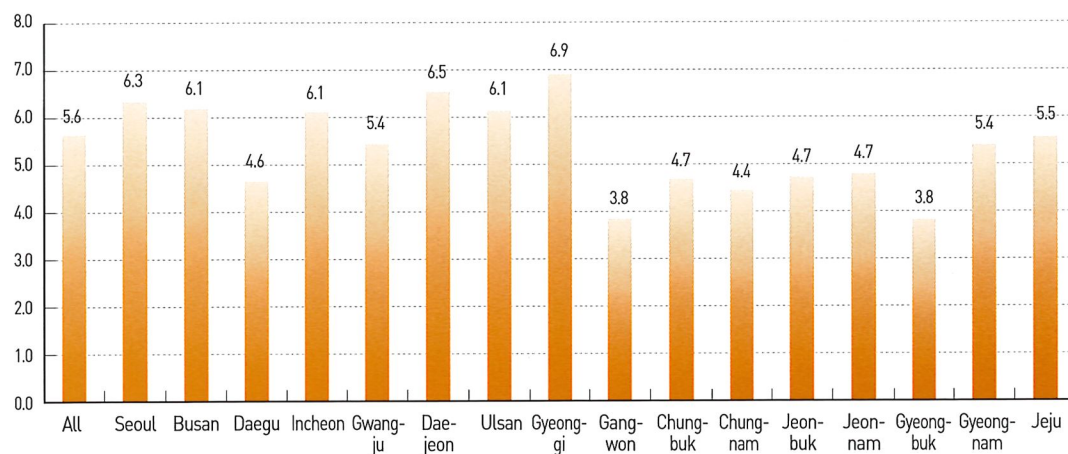

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Students per PC by Metropolitan/Provincial Offices of Education: High Schools, 2006
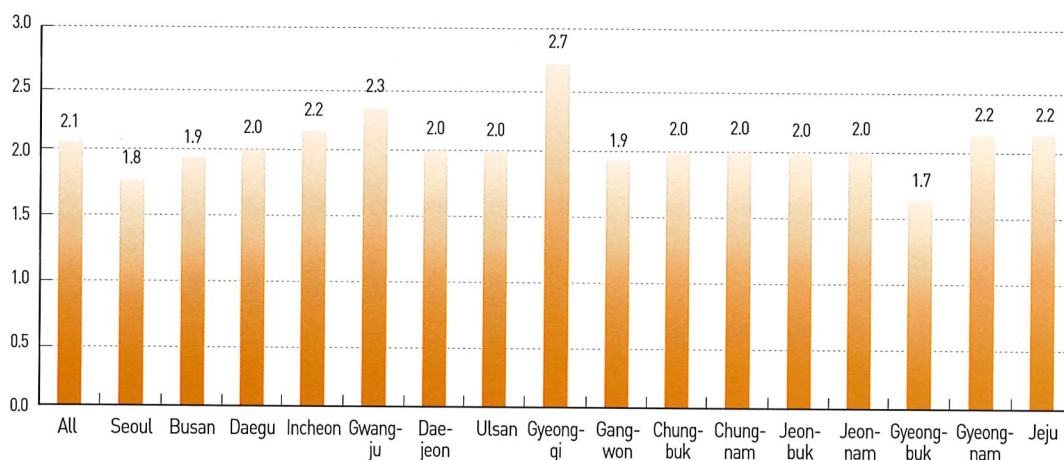

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Students per PC by Metropolitan/Provincial Offices of Education: Technical High Schools, 2006

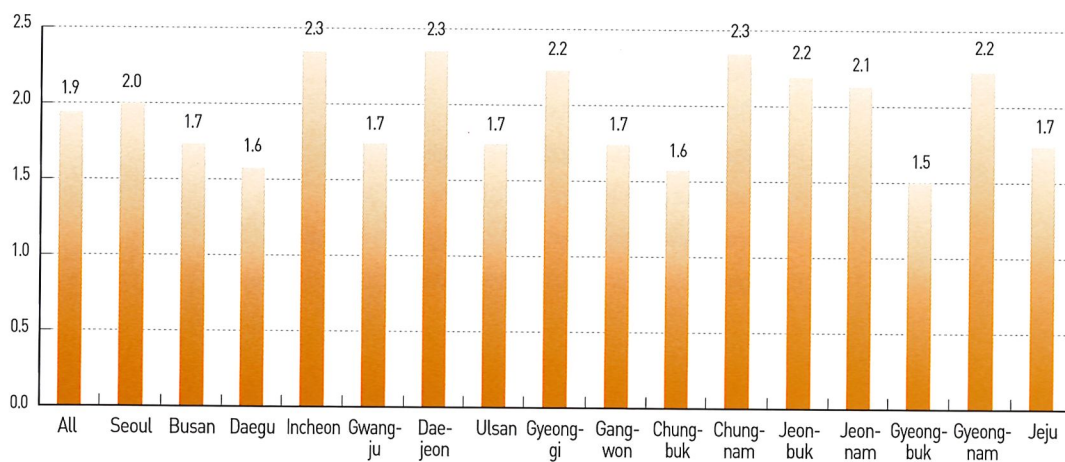| All	Seoul	Busan	Daegu	Incheon	Gwang-ju	Dae-jeon	Ulsan	Gyeong-gi	Gang-won	Chung-buk	Chung-nam	Jeon-buk	Jeon-nam	Gyeong-buk	Gyeong-nam	Jeju
2.1	1.8	1.9	2.0	2.2	2.3	2.0	2.0	2.7	1.9	2.0	2.0	2.0	2.0	1.7	2.2	2.2

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

Number of Students per PC by Metropolitan/Provincial Offices of Education: Special Schools, 2006

All	Seoul	Busan	Daegu	Incheon	Gwang-ju	Dae-jeon	Ulsan	Gyeong-gi	Gang-won	Chung-buk	Chung-nam	Jeon-buk	Jeon-nam	Gyeong-buk	Gyeong-nam	Jeju
1.9	2.0	1.7	1.6	2.3	1.7	2.3	1.7	2.2	1.7	1.6	2.3	2.2	2.1	1.5	2.2	1.7

Source : Ministry of Education & Human Resources Development, Korean Educational Development Institute, 2006

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Innovation of Future Education Through Adapting ICT in Education

The era of the information society has arrived. A new system is required to cultivate new talents suitable for the needs of this society. Since the announcement of the education reform initiatives to establish a new education system which will lead the globalization and adapting ICT in education ages, the Korean government has promoted various projects, including the development of master action plans for adapting ICT in education. Having led adapting ICT in society as a whole, as well as in the field of education, Korea is set to be a global leader in u-Learning. To this end, we have to think about the future, develop enterprising plans, and positively implement them. We must also continuously strive to find answers to the question of what the ultimate goals for adapting ICT in our education system are. In this context, the Education Reform Committee's main activities for adapting ICT in education can be summarized as follows:

First, an education reform focus on globalization and adapting of ICT in education. In order to realize the so-called "Edutopia," a lifelong learning society where anyone can get the learning they want anytime, anywhere, high-tech Information & Communication Technology (ICT) has to be closely integrated with education.

Second, the "National Multimedia Education Support Center" will be established to develop an open education system that comprises schooling, social education, vocational education and technical education. This center is intended to help learners fully develop their skills and expertise, and maximize their intellectual, creative, and problem-solving skills.

Based on the education reform plan proposed by the Education Reform Committee, the Ministry of Education & Human Resources Development also announced significant measures. Out of eight fundamental policy objectives set in terms of the above plan, adapting ICT in education is related to the objective of "Adapting ICT in Education and globalization to make cyberspace and the global village the very best place for learning." The realization of these objectives by 2006 was achieved as follows:

First, the cyber learning system connecting learner's, supporter's, counselor's and instructor's resources and information was established, and the legal, organizational, and technical foundations were developed by 2003.

Second, all elementary and secondary schools were connected through the Internet by 2002 to allow students to search for the information they need and to do their homework.

Third, classrooms equipped with multimedia tools

and equipment for production of teaching and learning materials were established at teacher' training centers by 2001, while a database system for the digitalization of resources archived at libraries was provided to national universities by 2003.

Fourth, an integrated information management system for elementary and secondary schools and an integrated information system for MOE administration was developed by 2000, while an integrated information system comprising the city and provincial offices of education was established by 2002.

The Education Reform Committee has promoted various projects with the goal of accomplishing its vision for adapting ICT in education by 2015. Therefore, last year (2006) comprised the second phase of its efforts to realize this vision. When reflecting on the accomplishments made so far, it is necessary to focus on problems rather than achievements. Most of all, it is essential to determine how the vision of achieving an "open education society" has been realized. For instance, we have to consider whether the establishment of cyber universities and development of cyber learning from home are directly related to the realization of an open education society. In addition, the programs and software products for training teachers who will be directly responsible for teaching and

learning, have not yet been fully developed. Ten years have passed since adapting ICT in education fist began and the "u-learning" age is now a reality. Such trends will continue for some time. Accordingly, some courses of action have to be re-established in order to realize true Adapting ICT in Education

Firstly, it is necessary to support the teaching and learning processes. Secondly, the active participation of learners should be encouraged. Thirdly, the needs of individuals have to be considered. And fourthly, it is desirable to realize an information society on both the micro-level and macro-level. In other words, schools must realize the same level of ICT adaption as society. To this end, it is necessary to establish "high-tech schools," which means an educational environment that actively reflects the needs and requirements of learners, as well as those of teachers. In addition, basic teaching and learning tools, such as desks, chairs, textbooks, teaching materials, writing tools, as well as devices, have to be suitable for both cooperative and individual activities. Based on such facilities and tools, software products fully satisfying the needs of individual learners need to be developed to encourage learners' active participation. However, it is expected that the development of tools and software programs will require greater effort, resources, and time.

The education reforms initiated by the Education

Reform Committee and the Ministry of Education & Human Resources Development focus on the importance of classrooms. Although this may be viewed as trivial, it is in fact, the centerpiece of the nation's education system.

Adapting Education to the Information Age

OVERVIEW

1. Analysis of Adapting ICT in Education

The Korea Education & Research Information Service conducted a time series analysis of accumulated data on adapting ICT in education, in order to investigate the present status of adapting ICT in education in schools and identify important lessons for future policy development. The number and type of schools surveyed for this time series analysis is summarized in Table 1.

⟨Table 1⟩ Number and Types of Schools Surveyed, 2004~2006

Description	2004	2005*	2006
Total	2,670	2,401	9,614
Elementary Schools	1,550	1,405	5,344
Secondary Schools**	1,120	996	4,270

* For 2005, schools located in Gyeongsangnam-do were not included.
** Vocational schools and special-purpose schools were not included in the survey of high schools. In addition, data before 2005 does not allow for differentiation of middle and high schools. So, for the purposes of this analysis, middle and high schools were categorized as secondary schools.

[Figure 1] Composite Adapting ICT in Education Index, 2004~2006

(unit : score)

Elementary Schools: 96.89, 98.56, 100.00
Secondary Schools: 97.70, 99.40, 100.00
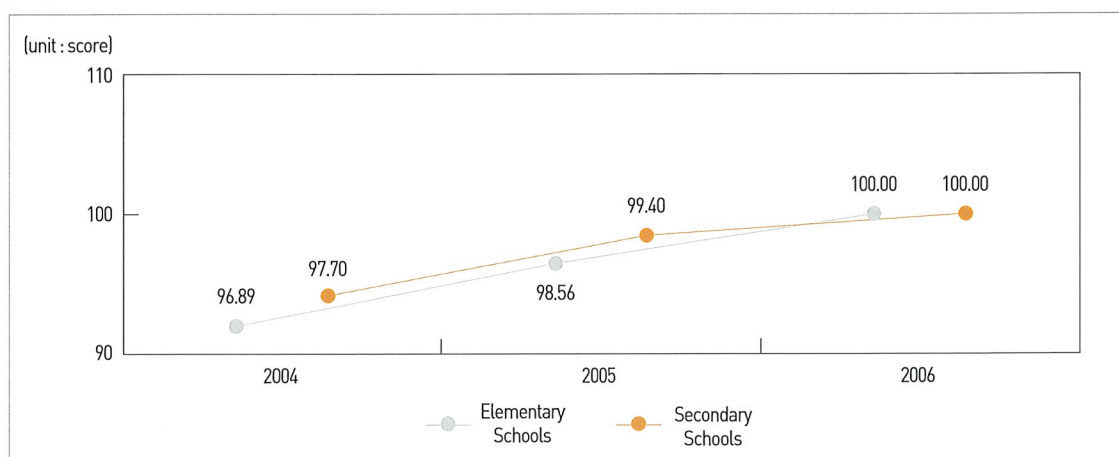
In this analysis, the adapting ICT in education score for 2006 was set at 100, in order to measure the adapting ICT in education scores against those of 2006. From this analysis, it was found that the composite adapting ICT in education score has continuously improved in all school types. It was also found that elementary schools showed a greater increase than secondary schools [Figure 2].

In addition, analyses of adapting ICT in education indices revealed that elementary schools showed higher adapting ICT in education scores than secondary schools in most aspects. Elementary schools were

especially excellent in all utilization indices [Figure 2].

For Internet access speed, one objective index showing the measurement of adapting of ICT in education level, the percentage of speeds of more than 5 Mbps has been continuously increasing. This trend is more obvious in secondary schools than elementary schools. In addition, more schools have faster Internet access speed in larger communities.

The percentage of students participating in specialized ICT programs was 26.69% for elementary schools, compared to 6.53% for secondary schools.

[Figure 2] Composite Adapting ICT in Education Index by Region, 2004~2006

(unit : score)

Elementary Schools: Big Cities 2004 95.48, 2005 96.32, 2006 99.12; Small & Medium Cities 2004 94.75, 2005 96.55, 2006 98.44; Provinces 2004 98.66, 2005 98.44, 2006 101.5

Secondary Schools: Big Cities 2004 95.85, 2005 97.62, 2006 98.47; Small & Medium Cities 2004 96.31, 2005 98.45, 2006 98.89; Provinces 2004 100.48, 2005 101.77, 2006 102.37
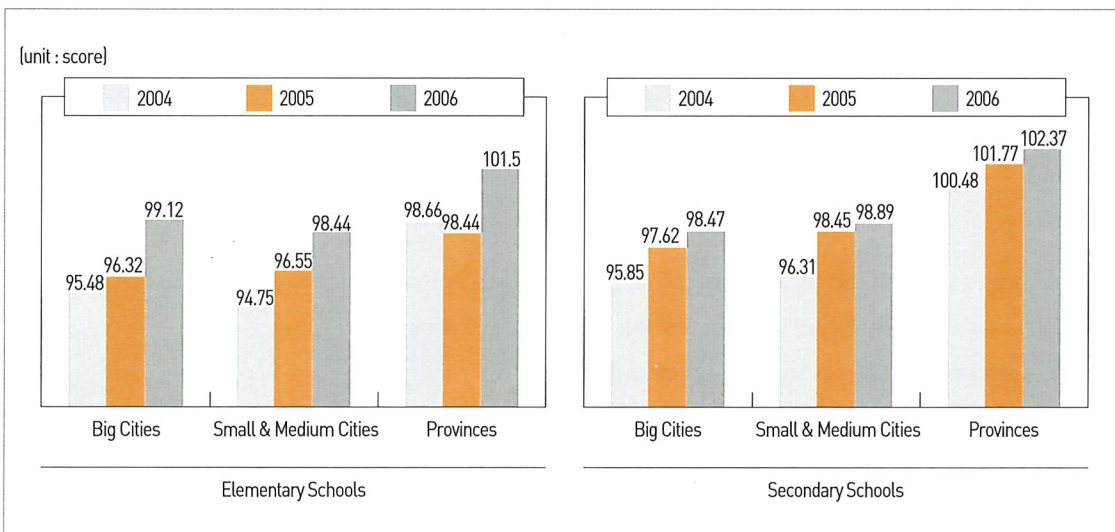
[Figure 3] Numbers of PCs per Student

(unit : PC)

0.5

0.24

0.23

0.23

0.22

0.37

0.35

0

2004　　　　　　　　　2005　　　　　　　　　2006

● Elementary Schools　　　　■ Secondary Schools
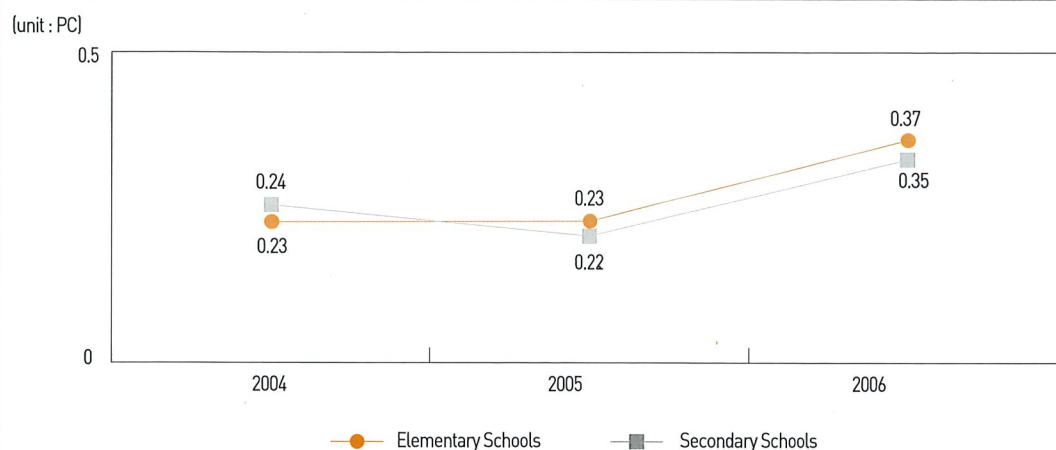
[Figure 4] Percentage of Students with ICT Certificates

(unit : %)

15.00

16.45

16.61

16.23

8.76

7.05

6.98

5.00

2004　　　　　　　　　2005　　　　　　　　　2006

● Elementary Schools　　　　● Secondary Schools
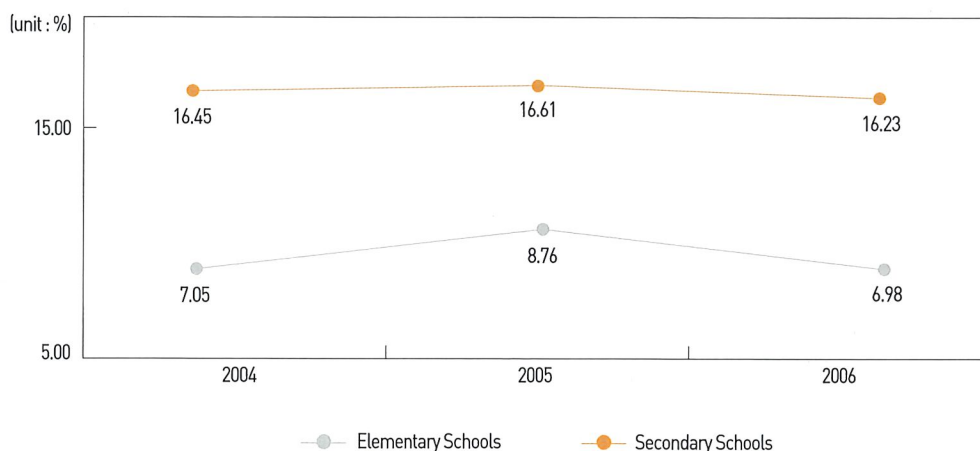
However, the percentage of students with ICT certificates was obviously higher in secondary schools [Figure 4]. This percentage was higher in big cities than small and medium cities and provinces. In addition, private secondary schools showed a higher percentage than national or public schools, while private schools showed a lower percentage in the elementary school sector [Figure 3].

Composite analysis of trends in 15 indices over the last 3 years showed that overall composite adapting ICT in education scores have been gradually increasing and

the ICT adaption level of schools has improved.

While three indices out of five in the utilization area have improved over these three years, a decrease or lack of change was shown in the indices of "the number of information exchanges per student through the school homepage (Web site)" and "the percentage of teachers who joined ICT-related clubs."

In addition, the cost of teaching and learning content and software has been reduced. The number of PCs per student was similar in elementary schools (0.37) and secondary schools (0.35) and increased in 2006, compared to those available to students in 2004 and 2005 [Figure 2]. Provinces showed the highest level, while big cities and small & medium cities showed inconsistent trends. Further, national or public schools maintained higher levels of PC availability than private schools. However, schools with more than 1,500 students showed lower figures.

For the performance sector with two indices, the index of "percentage of teachers with ICT certificates" has increased, showing an improvement in teachers' ICT skills. However, a decrease or no change was shown in the index of "percentage of students with ICT certificates."

Lessons from the three-year time series analysis of adapting ICT in education in schools can be summarized as follows:

First, the information mindset and knowledge of teachers and principals has improved, which may be the result of continuous training in ICT and efforts to improve their ICT knowledge.

Second, the adapting ICT in education level has been continuously improved in the overall input sector, with the result that the Korean adapting ICT in education level is outstanding, both on national and international levels. This accomplishment may be utilized to promote international cooperative projects for the sharing and dissemination of the Korean adapting ICT in education model.

Third, since adapting ICT in education has been promoted with a focus on the government-led development of fundamental systems, the indices in the input sector are relatively higher. However, it is now necessary to develop additional indices appropriate to represent adapting ICT in education in the utilization and performance sectors. To this end, measurement and analysis of adapting ICT in education in these sectors has to be continued.

Finally, careful examination of adapting ICT in education levels and trends by type of school must be conducted in order to develop various models suitable for the type or scale of schools and to establish appropriate support systems.

2. Master Plan Ⅲ for Adapting ICT in Education

The Ministry of Education & Human Resources Development has promoted the adapting ICT in education and development activities under the five-year mid-term plans from 1996, in order to encourage the effective utilization of ICT in education. The goal of the three-phase development plan is to promote the next generation adapting ICT in education projects on the basis of accomplishments from existing adapting ICT in education activities and to realize the u-learning society and "Creative Korea."

[Figure 5] Students' ICT Utilization

(unit : %)

Average 96.3, Australia 98.4, Austria 98.9, Belgium 96.8, Canada 97.8, Czech Republic 98.2, Denmark 98.8, Finland 99.8, Germany 97.4, Greece 96.7, Hungary 97.8, Iceland 99.2, Ireland 98.1, Italy 97.3, Japan 90.7, South Korea 99.6, Mexico 79.6, New Zealand 99.3, Poland 98.8, Portugal 98.7, Slovakia 92.6, Spain 98.5, Switzerland 98.3, Turkey 81.6, UK 99.6, USA 97.7

※ Source : OECD PISA 2003 Database

[Figure 6] Comparison of ICT Utilization and Student Achievement

ICT utilized | ICT not utilized

	Reading	Mathematics	Science	Problem-solving
ICT utilized	534	543	539	551
ICT not utilized	446	461	439	491

※ Source : OECD, 2003, PISA 2003 Database Student Compendia

[Figure 7] Comparison of ICT Utilization and Student Achievement

Realization of a u-Learning Society and a Strong and Intelligent Nation

U-Learning Environment

Reinforcement of Knowledge Creation & Learning Capacities

Global Leader of Adapting ICT in Education

Bridging the Digital Divide & Improved Security

Next-Generation Adapting ICT in Education for Educational Reform

Development of e-Teaching & Learning Reform System

- Advancing the e-teaching & learning supporting system
- Improving the expertise of e-Learning teachers
- Reforms in preparation and operation of ICT-based curriculums

Development of Lifelong e-Learning Supporting System

- Activating e-clusters of industries, universities, and institutes
- Developing an e-learning community
- Reinforcing e-learning-based education & training

Development of e-Education Security Net

- Reinforcing support to the underprivileged
- Reinforcing privacy protection and secure knowledge & information
- Encouraging a culture for creation and distribution of healthy knowledge & information

Development of Knowledge Sharing System

- Developing national knowledge & information management system
- Developing a system for sharing of research information held by university libraries
- Developing a system for sharing of overseas academic information

Promotion of e-Learning Globalization

- Developing international e-Learning partnerships
- Activating e-Learning for export of knowledge services

Development of u-Learning Infrastructure

- Developing leading models of u-Learning
- Developing u-Learning standards and infrastructure

Development of Administrative Support System for e-Learning

- Developing e-administration standards for educational organizations
- Developing statistical system for decision of education policies
- Advancement

Development of Performance & Quality Management Systems

- Developing performance management & evaluation models
- Developing and applying a quality management system

Development of Foundation for Adapting ICT in Futuristic Education

One of the major accomplishments from the first phase (1996 ~ 2000) has been the development of dedicated units responsible for the promotion of education and academic adaption of ICT. The multimedia education support center was established and the education broadcasting system was opened, creating the basis for reinforcement of ICT knowledge and capabilities. In addition, a world-leading education ICT infrastructure was developed. PCs were provided to all teachers and the Internet and teaching equipment were distributed to all schools, completing the establishment of the physical infrastructure needed for adapting ICT in education in all elementary, middle and high schools.

It has been reported that this constant investment has contributed to the accomplishment of Korea's world-leading level of ICT access [Figure 5].

The second phase (2001 ~ 2005) under the "comprehensive adapting ICT in education plan for education reforms and human resource development" also has several accomplishments. Most of all, it confirmed that infrastructure established during the first phase could contribute to the promotion of ICT utilization in teaching and learning activities and the improvement of learning benefits. According to PISA's analysis of student achievement, students with ICT capabilities showed higher scores in all aspects [Figure 6].

In addition, the possibility of reducing private education costs and ensuring the substantiality of the public education system through e-Learning were confirmed. Furthermore, a distribution system for academic information was developed to promote the offering of high-quality academic resources and information. Meanwhile, projects for bridging the digital divide were actively pursued. Under such projects, ICT training services were provided to a total of 500,000 people (students, teachers, users). From 2000 to 2005, PCs were distributed to 96,000 persons, and financial support for Internet access was provided to 380,000 people.

The goal of the three-phase plan is to realize the u-Learning society and "Creative Korea." In addition, the plan's detailed objectives include knowledge creation, reinforcement of learning capabilities, development of a ubiquitous learning environment, being the global leader in adapting ICT in education , bridging the digital divide, and reinforced security. Such objectives can be described in 17 innovation issues covering six areas.

The first objective is to provide support for development of the self-learning system − the next generation teaching and learning paradigm and in order to prepare for the knowledge information society and ubiquitous environment based on ICT. The second is to encourage all people to pursue lifelong learning through the adapting ICT in education. The third is to reinforce support to the underprivileged and ensure the security of privacy. The fourth is to develop knowledge and information sharing and a distribution network to reinforce the country's competitiveness in the global knowledge-based society. The fifth is to promote the globalization of e-Learning, meaning the active utilization of our own know-how to assist developing

countries, in order to improve the nation's international standing, contribute to bridging the digital divide, and help domestic e-Learning companies to advance into world markets. The sixth is to develop the infrastructure for u-Learning, such as basic research and development activities and continuous application of results from such activities in the formation of future learning models. As a result, leading u-Learning models will be developed and the ubiquitous "future school" projects, different from the existing adapting ICT in education, will be promoted [Figure 7].

Four issues in two areas for development of infrastructure focus on the advancement of the administrative system and the establishment of performance management, need to be addressed in order to facilitate the efficient promotion of the three-phase adapting ICT in education plan. Major activities in these two areas can be summarized as follows:

The goal of the e-education administration system is to develop a standard e-administration system for educational institutions in order to improve the services available to people. In addition, R&D activities have been conducted to develop a standardized administrative system for universities. Further, for management of outcomes and quality of adapting ICT in education efforts, the performance indices for adapting ICT in education and the performance management guidelines will be developed for objective evaluation and on-site consulting activities will be reinforced.

3. Objectives & Activities for Adapting ICT in Education

A. Objectives and Activities for Adapting ICT in Education

1. Adapting ICT in education for elementary and secondary schools

The objectives of adapting ICT in education for elementary and secondary schools can be categorized into four areas. The first is to develop high-quality content for the establishment and activation of ICT-based teaching and learning support systems for schools, to raise the level of public education. The second is to reinforce the training of teachers and encourage various competitive exhibitions. The third is to transform ICT infrastructure to make it suitable for the knowledge-based society. The fourth is to analyze outcomes from adapting ICT in education efforts and develop indices for future projects.

2. Adapting ICT in higher education and academic research

The aim of adapting ICT in higher education and academic research is to reinforce the capabilities of universities. In Korea, adapting ICT in education has been promoted since the 1980s. Continuous efforts have been made since then to utilize information infrastructure for the improvement of education. For example, one project that has been promoted is for the development of e-Learning support centers at 10 universities by 2007. The goal of university e-Learning support centers is to establish specialized and differentiated e-Learning support systems suitable for differing regional characteristics. For cultivation of teachers through e-Learning, the e-Learning center for elementary education was established at Gyeongin National University of Education in 2003 for 11 teachers' colleges and the Korea National University of Education. Furthermore, support was provided through Cyberspace to bring the adaption of ICT to university education. At present, there are 17 cyber universities in total (15 for bachelor's degrees and two for sub-bachelor's degrees). Furthermore, these are plans to change the legal basis from the Lifelong Education Act to the Higher Education Act, in order to activate cyber university education. In addition, the enhancement of university libraries will be continued through support for the adapting ICT in libraries.

The Korea Education & Research Information Service has initiated various projects, such as operation of RISS, support provided to digitalization of archived materials at university libraries, and evaluation services of adapting ICT in education operating systems. In order to generate satisfactory success, it is important for universities and other related parties to improve their understanding of such information systems. Investment by universities has to be reinforced and cooperative systems between universities need to be developed. One of the most important things, requiring enhanced cooperation between the government and universities, is to reinforce universities' capabilities to establish and operate an ICT environment. Cooperative efforts between universities and close cooperation between the government and universities may be a critical success factor in the ICT adaption of universities. Of course, it may be necessary to set up a dedicated organization responsible for developing a comprehensive support system.

3. Adapting ICT in lifelong education and policies

Lifelong education is intended to promote comprehensive national development by encouraging innovative economic activities in communities and supplying talented labor, cultivated through individual and group learning, to the national labor market. Developed countries are promoting diversified lifelong learning strategies with a focus on the formation of social capital to support the development of human resources suitable for the knowledge-based society. In addition, they are attempting to improve the skills and expertise of their human resources. Such efforts are conducted within the context of developing their lifelong learning systems to cultivate lifelong learning capabilities among their citizens. These efforts are

aimed at encouraging individuals to continuously develop the knowledge, skills, and capabilities required by the present day labor market and global society in a timely manner.

4. Education welfare and information culture

A. Education Welfare

Due to the widening economic gap, the probability of breaking through to a higher social class through

〈Table 2〉 Roles of and Responsibilities in Adapting ICT in Education

Items	Ministry of Education & Human Resources Development (MOE)	Korea Education & Research Information Service (KERIS)	Metropolitan/Provincial Offices of Education
Informatization Plan	Developing a master plan at the national level	Helping the MOE and metropolitan/provincial offices of education to develop plans, research of action plans	Developing detailed action plans for Adapting of ICT in Education according to guidelines from the MOE
Legal systems	Developing or improving legal systems and providing guidelines to educational offices and schools	Research of policies on development or improvement of legal systems	Developing and operating systems at metropolitan/provincial level, providing detailed guidelines to schools
Infrastructure	Investigating infrastructure needs providing budgetary support, providing guidelines on maintenance or operation	Forecasting infrastructure needs, analyzing technological trends, investigating model cases, researching measures for cost reduction and advancement	Investigating the need for infrastructure at metropolitan/provincial level, providing budgetary support, operating the maintenance team
Content development & operation	Establishing the content development plan, providing budgetary support, providing guidelines on development, managing operational programs	Responsible for content development at the national level, management of content quality, developing a system for sharing of content owned by offices of education or other related organizations, other research activities	Developing their own content under the MOE's plan, operating in connection with the system for sharing of content
Training of teachers	Developing a plan for teacher training, providing budgetary support, providing guidelines on training, managing operational programs	Helping development of training plans, developing training materials, operating training programs, other research activities	Developing their own training plans under the MOE's plan, operating training programs
NEIS development & operation	Developing policies, operational management, security audit, evaluation	Planning for operation of central management center, operating central management center's system and communication networks, S/W analysis, design, additional development, and maintenance	Planning for operation of regional centers, operating regional centers' systems and communication networks, S/W management and supports
Evaluation	Planning the evaluation of adaption ICT performances at metropolitan/provincial offices of education and schools and conducting evaluation	Developing methods for evaluation of metropolitan/provincial offices of education and schools, providing support for evaluation, reflecting evaluation results in development of policies	Providing materials requested by the MOE for the purpose of evaluation, developing and executing self-evaluation
Bridging the digital divide	Developing measures to bridge the digital divide of regions, schools, and parents, providing budgetary support	Researching measures to bridge the digital divide, investigating model cases, providing support for action programs	Developing their own plans and executing them in connection with the MOE's plans

education has decreased. In order to minimize the numbers of students who have limited access to education owing to their families' limited financial resources, the Ministry of Education & Human Resources Development has provided schooling expenses to children of the unemployed since 1998, and expanded to cover the children of lower-income classes in 2000. In addition, the School Lunch Act was revised in 1999 to provide lunches to students with financial support from central and provincial governments. Major education welfare projects include the focused cultivation of one high school in each rural, mountainous, or fishing village; resolution of the educational divide; reinforced cooperation with alternative education organizations; and operation of an e-Learning portal site for disabled students (EDUABLE).

B. Information Culture

The ubiquitous environment is drawing near, so the nation's educational institutions must also prepare for this transformation. Accordingly, the u-Learning pilot project to distribute one PC to one student has been promoted since 2005. In addition, universities have attempted to create "u-campuses," based on mobile devices. However, the ubiquitous environment also has the hidden problems of privacy infringement and increased exposure to hazardous information due to the massive increase in ICT devices connected to the Internet. Therefore, it is necessary to take appropriate measures against such drawbacks.

5. Roles and responsibilities in adapting ICT in education

Adapting ICT in education is the key to the knowledge-based society. In the early stages, adapting ICT in education projects were initiated by the national government. Then, in order to facilitate adapting ICT in education appropriate to the community's needs and requirements, the roles and responsibilities of the national government and other organizations were clearly defined and the necessary fundamentals, such as personnel and budgets, were prepared.

The adaption of ICT in the education system consists of administrative authorities, including the Ministry of Education & Human Resources Development and relevant authorities, metropolitan and provincial offices of education and subsidiary organizations (especially education information centers), regional offices of education, and schools, public organizations such as the Korea Education & Research Information Service, and private organizations in the adapting ICT in education industry. The Ministry of Education & Human Resources Development, which is responsible for national policies relating to adapting ICT in education, holds "Human Resources Development Meetings", through which the Ministry of Education & Human Resources Development manages and coordinates the education reforms and human resources development projects. Other relevant authorities and organizations are responsible for the development and execution of adapting ICT in education plans, mobilization and allocation of budgets and other resources, and administrativeor infinancial support. Metropolitan and

provincial offices of education take responsibility for the development and execution of detailed plans, mobilization and allocation of budgets and other resources, and education and training; while other educational organizations carry out ICT training, improvement of teaching and learning methods on the basis of ICT, and the sharing and utilization of academic information and resources. The private sector participates in ICT projects and performs research and development activities. The Policy Adviser to the Deputy Prime Minister provides policy advice on adapting ICT in education. In addition, adapting ICT in education ICT policies are coordinated through ICT adaption strategy meeting chaired by the President, the Education & Human Resources Policy Council directly responsible to the President, and adapting ICT in education Promotion Committee chaired by the Prime Minister, in order to assure compatibility with national adapting ICT in Education policies. Table 2 summarizes the roles and responsibilities of various interested parties in adapting ICT in education .

6. Adapting ICT in the education system

The Ministry of Education & Human Resources Development sets the roles of the relevant organizations for adapting ICT in education as shown in Table 3.

Sixteen metropolitan and provincial offices of education have their own units appropriate for their community characteristics to promote adapting ICT in education. In the early 1990s, adapting ICT in education was mainly treated as something merely involving administrative computerization. However, it is now something specialized and unique, which metropolitan and provincial offices of education promote, taking consideration of their own environments and circumstances. Metropolitan and provincial offices of education are responsible for the development and coordination of adapting ICT in education master plans, offering fundamental facilities and equipment required for adapting ICT in education, promoting computerization of educational administration information, operation and supervision of ICT in education courses, development of educational content and databases, training of teachers in ICT, and security management.

Organization	Roles
Ministry of Education & Human Resources Development	Developing master policies on adapting ICT in education at national level, providing administrative and monetary support, managing and coordinating educational reforms and human resources development through "the human resources development council"
Interested Agencies	Developing basic policies and implementing them, mobilizing and distributing the personnel and monetary resources, providing administrative and financial support for promotion of relevant projects
Metropolitan/Provincial offices of Education	Developing detailed policies at Metropolitan/Provincial level and implementing them, providing administrative and mone- tary support, training, etc.
Korea Education & Research Information Service	Providing support in development of policies on adapting ICT in education developing and operating the system to provide educational information, standardization of academic information, developing the sharing system, etc.

⟨Table 3⟩ Roles of Organizations for Adapting ICT in Education

Adapting Education to the Information Age

I. Adapting ICT in Elementary and Secondary Education

1. 'e-Teaching & Learning Support System' for Elementary & Secondary Education

A. Development and Operation of EDUNET, a Central Teaching and Learning Center

EDUNET connects education policies with schools and is an important axis for adapting ICT in national education. The teaching and learning center allows easy and fast access to the information users want. This system includes a central teaching and learning center and metropolitan and provincial centers.

As of August 2006, the number of EDUNET

〈Table 4〉 History of EDUNET

Dates	Description
1996. 4. 4	Adapting ICT in education working subcommittee - decided to temporarily establish the "national multimedia education support center" at the Korea Educational Development Institute - developed the plan on establishment and operation of EDUNET
1996. 9. 11	EDUNET opened
1998. 8. 10	500,000 members
1999. 10. 1	Began to provide educational information portal service, opened "01444" network for EDUNET
2000. 6. 14	2,000,000 members
2001. 5. 1	Differentiated, reinforced services (for teachers, preschoolers/parents, elementary/secondary schools, communities)
2001. 12. 1	Expanded the special education services
2002. 4. 30	5,000,000 members
2002. 5. 22	Began to provide national educational information sharing service (integrated search service covering EDUNET and 16 metropolitan & provincial offices of education)
2002. 9. 1	EDUNET integrated search, differential channel services for teachers, students, and education communities
2003. 6. 1	Revised the integrated search service
2004. 9. 15	Central teaching & learning center-EDUNET reorganized
2005. 10. 1	Began to provide targeted, differentiated services, reinforced the member management functions
2006. 9. 20	Reorganized with a focus on user-oriented services (differentiated services and functions by teachers and students)

members was 5,400,000. Infrequent or inactive users were periodically removed in order to improve the efficiency of services offered. The total number of teacher members of EDUNET is 470,000 (9%), while the percentage of student members is 41% (elementary students - 10% (520,000), middle school students - 21% (1,120,000), and high school students - 20%

(1,080,000) <Table 6>. The combined percentage of preschoolers, parents, college students, professors, and others totals 45%. Gyeonggi province shows the highest percentage of members (16%, 840,000), followed by Seoul (14%, 780,000), Busan (7%, 400,000), and Gyeongsangbuk-do (7%, 370,000) <Table 5>.

〈Table 5〉 EDUNET Members by Region

Regions (%)	Elementary Students	Middle School Students	High School Students	Teachers	Others	Total
Seoul (14%)	60,458	156,305	151,409	75,645	336,442	780,259
Busan (7%)	33,922	71,200	83,251	36,836	177,361	402,570
Daegu (5%)	31,496	60,615	56,026	27,993	104,240	280,370
Incheon (6%)	32,249	70,472	69,550	22,940	127,780	322,991
Gwangju (4%)	32,137	52,263	40,204	19,606	74,012	218,222
Daejeon (3%)	13,468	40,426	38,772	16,536	70,449	179,651
Ulsan (3%)	15,416	36,876	34,141	9,527	62,562	158,522
Gyeonggi (16%)	116,255	186,759	160,733	78,349	305,337	847,433
Gangwon (3%)	24,909	37,347	31,258	18,147	58,708	170,369
Chungcheongbuk-do (4%)	19,534	48,339	44,395	19,088	94,571	225,927
Chungcheongnam-do (6%)	34,553	63,414	60,011	21,446	150,398	329,822
Jeollabuk-do (3%)	14,507	34,252	36,106	21,334	74,376	180,575
Jeollanam-do (4%)	17,625	41,057	41,601	17,054	74,895	192,232
Gyeongsangbuk-do (7%)	32,816	75,126	76,993	25,247	157,093	367,275
Gyeongsangnam-do (6%)	30,829	77,364	73,453	30,376	133,470	345,492
Jeju (1%)	7,997	16,906	14,806	7,035	30,995	77,739
Overseas (7%)	11,616	53,402	73,623	31,226	207,254	377,121
Total	**529,787**	**1,122,123**	**1,086,332**	**478,385**	**2,239,943**	**5,456,570**

〈Table 6〉 EDUNET members, 2002~2006

Category	2002		2003		2004		2005		2006	
	Members	%	Members	%	Members	%	Members	%	Members	%
Elementary students	1,831,553	33	994,643	20	1,182,005	22	683,762	12	519,787	10
Middle school students	1,150,123	21	978,314	19	1,000,895	19	1,070,618	19	1,122,123	21
High school students	957,270	17	771,728	15	778,601	15	952,196	17	1,086,332	20
Teachers	346,309	6	290,559	6	299,011	6	385,939	7	478,385	9
Others	1,265,682	23	1,995,043	40	2,046,030	38	2,654,699	45	2,239,943	40
Total	5,550,937	100	5,030,287	100	5,306,542	100	5,747,214	100	5,456,570	100

〈Table 7〉 EDUNET daily usage, 2002 ~ 2006

Category	2002	2003	2004	2005. 7	2006. 7
Users per day (average)	145,786	123,774	129,946	234,455	387,015
Usage per user (minutes)	11	11	13	5	3
Usage per login member (minutes, average)	-	-	-	33	24

The percentage of overseas members accounts for 7% (370,000). The number of daily EDUNET users is 380,000. EDUNET was reorganized in September 2004 into the Central Teaching & Learning Center-EDUNET. Furthermore, it has provided personalized services since 2005. Reinforced cooperation with metropolitan and provincial teaching & learning centers, development of new services meeting users' needs, such as class consulting services, and reinforcement of integrated search functions resulted in a dramatic increase of users. Notably, when only logged-in users are included in the analysis, each member uses services for 24 minutes on average per login <Table 7>.

The characteristics of EDUNET can be summarized as follows: First, based on the national educational information sharing system, it provides services in close coordination with central teaching & learning centers, metropolitan and provincial teaching & learning support centers, and school teaching & learning help centers. Second, it provides integrated services with a selection of high-quality information. Third, it provides services for knowledge exchange. Fourth, it continuously analyzes or evaluates the users' behavior and use patterns on the basis of eCRM/CMS to provide services which more satisfactorily meet the user's needs.

The system for EDUNET service includes three web servers, six application and search servers (WAS, search, download), and two DB servers. Those servers are organized to provide different services, as shown in Figure 8.

EDUNET will continue to provide opportunities to create and practice living knowledge that is truly helpful to teachers and students. To this end, EDUNET has the following action plans:

First, it will expand customized services and develop services linked with central and metropolitan and provincial teaching & learning centers. Second, it will improve the search and distribution of educational information and resources and systematize their management. Third, it will provide tools for the creation and generation of knowledge to develop the foundation for knowledge exchange. Fourth, it will diversify operational strategies to expand user-customized services.

B. Development and Operation of a National System for Sharing Educational Information

The project to develop a national system for the sharing of educational information has been promoted by the Korea Education & Research Information Service and metropolitan/provincial offices of education to allow teachers and students to quickly and easily obtain high-quality educational information produced by various educational institutions and schools.
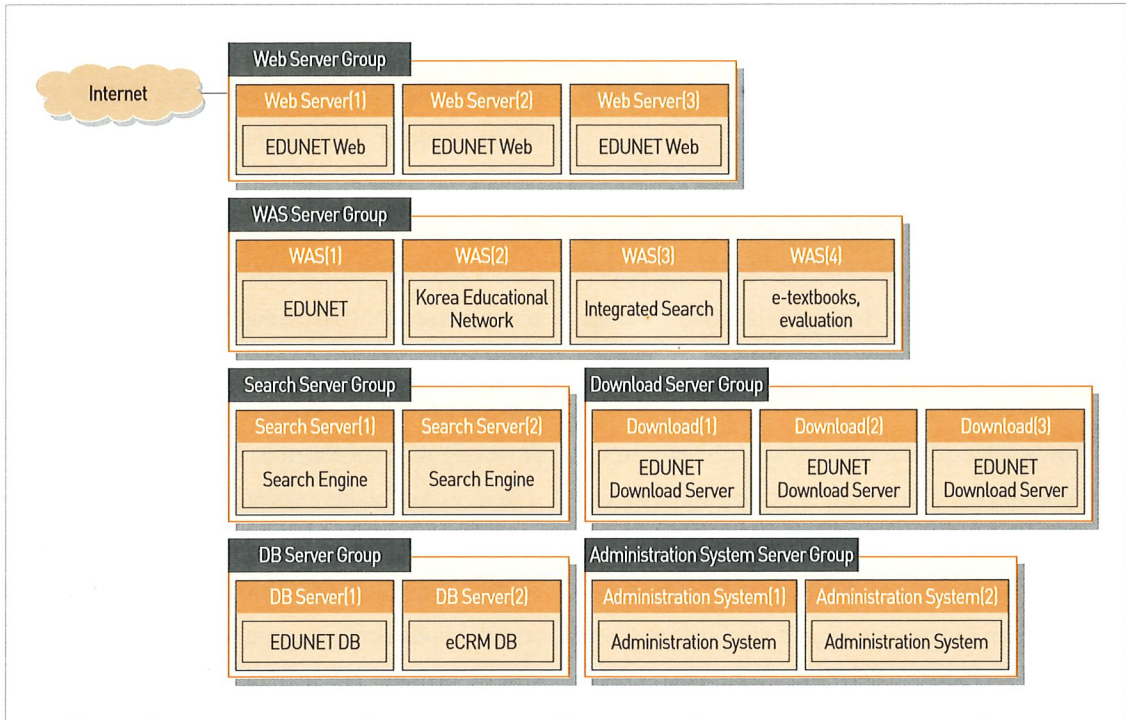
The promotion of a five-year plan for the development

of educational content since 2001 has resulted in a dramatic increase in teaching-learning materials. As a result, the need for the efficient and effective utilization of high quality content in metropolitan and provincial offices of education was highlighted. Accordingly, this project was initiated to solve the problem of duplicate efforts to develop content, distribute various content in more effective and efficient ways, and allow easy access and search. To these ends, efficient operation and manage-ment of educational meta-data is required. So, new content will be archived at the metropolitan and provincial offices of education that produced it, together with meta-data on the content, such as author, subject, theme, subject matter, and so on. In addition, the quality control committee of individual metropolitan and provincial offices of education will approve the content after examination and meta-data on those approved will also be archived at the central KEM database.

In 2006, various projects were conducted to promote and activate the sharing and distribution of educational information. As of 2006, a total of 460,000 pieces of educational information were collected and put into service. Teaching and learning materials have the largest percentage of contributions, meaning that it is mainly materials to be used in classes that have been developed. From 2006, the educational news from metropolitan and provincial offices of education or other related organizations have been collected for real-time services. In addition, cooperative relationships were formed with educational newspapers to reinforce the news service.

The integrated search service effectively the sharing

[Figure 8] EDUNET System Configuration

Web Server Group		
Web Server(1)	Web Server(2)	Web Server(3)
EDUNET Web	EDUNET Web	EDUNET Web

Internet

WAS Server Group			
WAS(1)	WAS(2)	WAS(3)	WAS(4)
EDUNET	Korea Educational Network	Integrated Search	e-textbooks, evaluation

Search Server Group		Download Server Group		
Search Server(1)	Search Server(2)	Download(1)	Download(2)	Download(3)
Search Engine	Search Engine	EDUNET Download Server	EDUNET Download Server	EDUNET Download Server

DB Server Group		Administration System Server Group	
DB Server(1)	DB Server(2)	Administration System(1)	Administration System(2)
EDUNET DB	eCRM DB	Administration System	Administration System

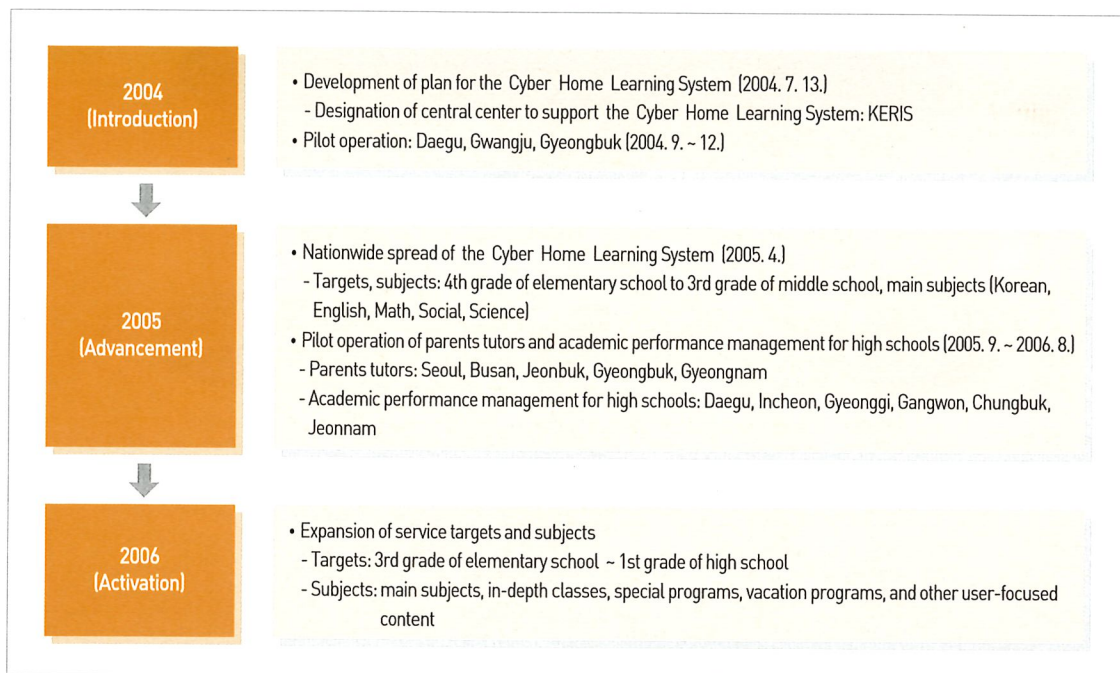of allows for enormous amounts of educational information collected by the national educational information sharing system. In 2006, EDUNET was reorganized to improve the following four services: First, to provide EDUNET with "customized" information services according to the user's profession, school, or other categories. Second, pattern analysis of key words to enable management of frequently searched key words with the "key words reservation" system. Third, to provide real-time searches of domestic or foreign educational news. Fourth, to operate a pilot service environment for "meta-data on user-friendly key words" to advance search functions.

The Korea Education & Research Information Service embedded the functions for quality control of educational information into integrated sharing tools before distribution to metropolitan and provincial offices of education. Further, it provided technical support in connection with their operation.

With the evolution of Web services, the national educational information sharing system has to analyze users' needs and improve its services from both quantitative and qualitative perspectives. It is necessary to develop service components for operational environments in order to provide an advanced sharing system. In the future, the degree to which users' various needs are satisfied will be a key factor in determining the

[Figure 9] History of the Cyber Home Learning System

2004 (Introduction)	• Development of plan for the Cyber Home Learning System (2004. 7. 13.) - Designation of central center to support the Cyber Home Learning System: KERIS • Pilot operation: Daegu, Gwangju, Gyeongbuk (2004. 9. ~ 12.)

2005 (Advancement)	• Nationwide spread of the Cyber Home Learning System (2005. 4.)
	  - Targets, subjects: 4th grade of elementary school to 3rd grade of middle school, main subjects (Korean, English, Math, Social, Science)
	• Pilot operation of parents tutors and academic performance management for high schools (2005. 9. ~ 2006. 8.)
	  - Parents tutors: Seoul, Busan, Jeonbuk, Gyeongbuk, Gyeongnam
	  - Academic performance management for high schools: Daegu, Incheon, Gyeonggi, Gangwon, Chungbuk, Jeonnam

2006 (Activation)	• Expansion of service targets and subjects
	  - Targets: 3rd grade of elementary school ~ 1st grade of high school
	  - Subjects: main subjects, in-depth classes, special programs, vacation programs, and other user-focused content

value of the Web site. Therefore, it is essential to continue to obtain high-quality educational information that users want and improve the search services, focusing on the users.
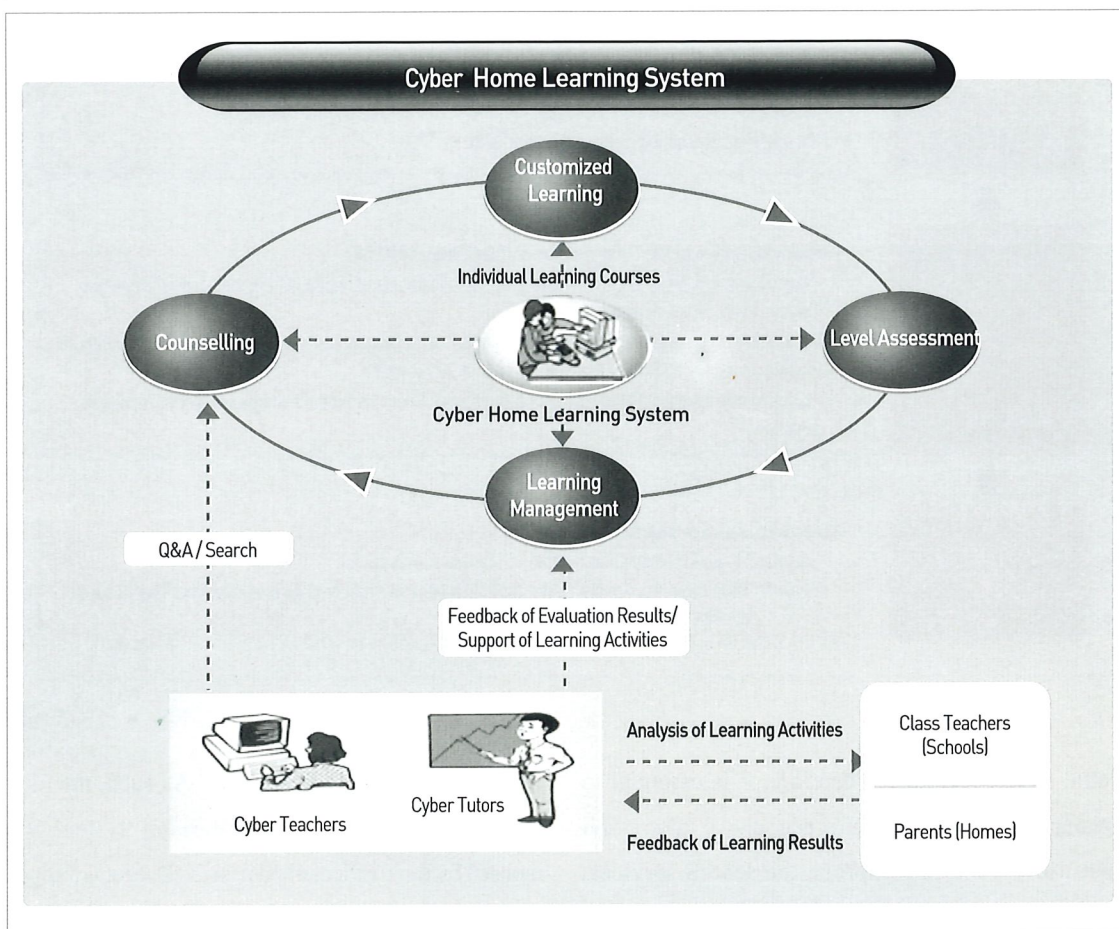
C. System to Support the Cyber Home Learning System

e-Learning is an important tool for realizing the lifelong education system in the knowledge-based society of the future. The need to move away from uniform education in schools has been increasing. Attempts to satisfy this need has led to EBS television programs for the college entrance examination on the Internet and Cyber Home Learning System, which has became the flagship of the Ministry of Education &

Human Resources Development. As such, the pilot project of the Cyber Home Learning System was initiated by three offices of education (Daegu, Gwangju, and Gyeong- sangbuk-do) in September 2004 with the three goals of "substantiation of public education," "reduction of private education costs," and "bridging the educational divide between regions and classes." Nationwide services offering Cyber Home Learning System started in April 2005.

Cyber Home Learning System is an important project for such e-Learning. It has been systematically promoted through development, distribution, advancement, and establishment after pilot operation and effectiveness analysis. Cyber Home Learning System is a service that allows users to gain access to
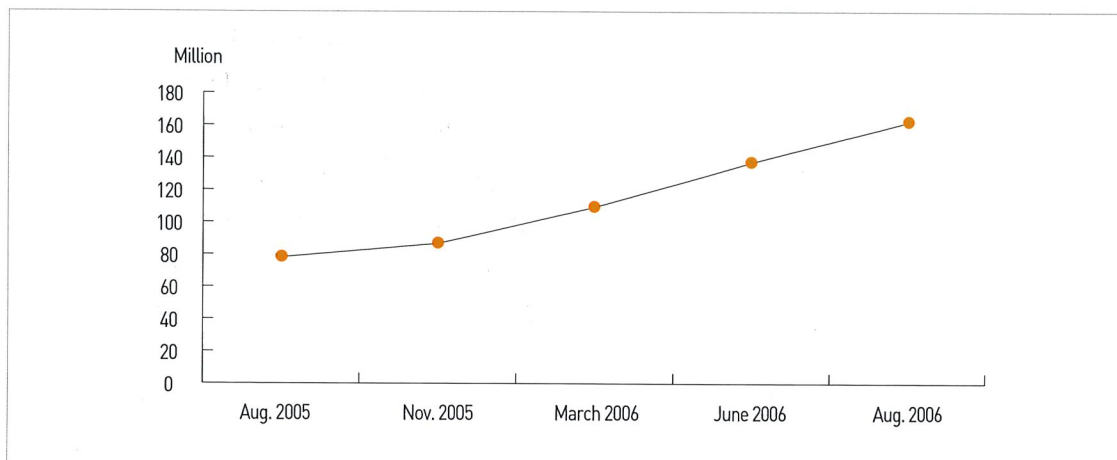
[Figure 10] Cyber Home Learning System

Cyber Home Learning System

- Customized Learning
- Individual Learning Courses
- Counselling
- Cyber Home Learning System
- Level Assessment
- Learning Management
- Q&A / Search
- Feedback of Evaluation Results/ Support of Learning Activities
- Cyber Teachers
- Cyber Tutors
- Analysis of Learning Activities
- Class Teachers (Schools)
- Feedback of Learning Results
- Parents (Homes)

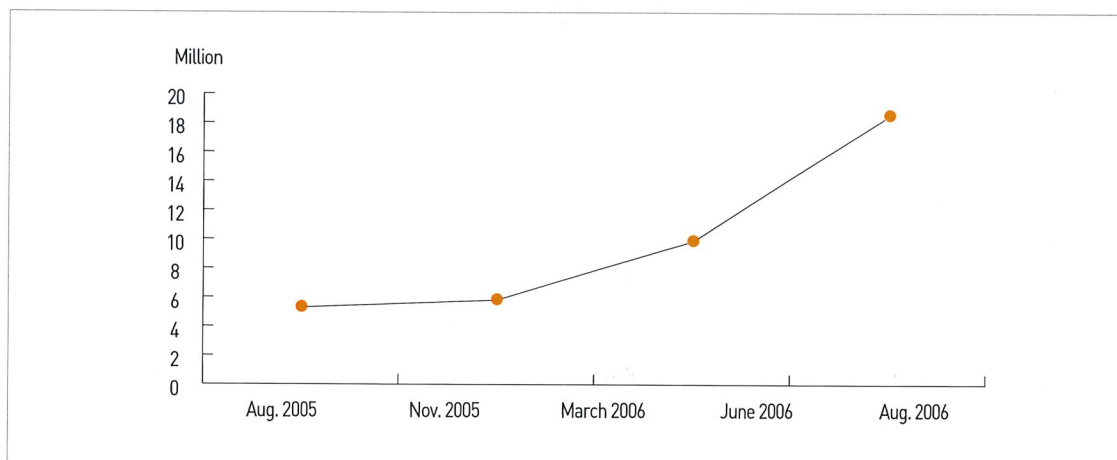appropriate cyber teaching according to their level.

In the early stages, the service was provided as a class assignment. However, in order to reduce the administrative and monetary burden of the operation of cyber teachers and to solve the problem of students' passive participation, a self-learning class style (inviting public participation in cyber classes) and the class-application style (an online/offline class operated by a real class teacher) has become the main operational mode.

As shown in Figure 10, the role of cyber class teachers, cyber counselors, and tutors (parents or college students) is to provide students wth support. Metropolitan and provincial offices of education have different recruitment, operation, and management styles considering differing regional characteristics (big cities, medium and small cities, or counties). Tutors recruited from parents or college students may be in charge of a

[Figure 11] Members Utilizing the Cyber Home Learning System

Million

	Aug. 2005	Nov. 2005	March 2006	June 2006	Aug. 2006
Value	78	85	108	136	161

[Figure 12] Cyber Home Learning System, Average Numbers of Visitors per Day

Million

	Aug. 2005	Nov. 2005	March 2006	June 2006	Aug. 2006
Value	5.3	5.8	9.8	18.3	

[Figure 13] Development of Content for the Cyber Home Learning System

Items		2004	2005	2006	2007	2008
Basic Courses	Middle	◄────►				
	Elementary (4-6)		◄────►			
	High (1)		◄────►			
Advanced/ Supplementary Courses	Middle			◄────►		
	Elementary (4-6)				◄────►	
	High (1)					◄────►

specific class in cooperation with cyber class teachers or take the responsibility for several classes. Some metropolitan and provincial offices of education give more authority to parents.

Content for the Cyber Home Learning System was developed on the basis of the principles of sharing content and avoiding duplicated development, according to the SCORM standard (Sharable Content Object Reference Model). As the utilization of Cyber Home Learning System has grown, users are demanding various levels and types of diverse content. Accordingly, the Ministry of Education & Human Resources Development devised a "plan on substantiation and advancement of e-Learning" with goals of school reform and expansion of education opportunities in July 2006 and announced three-year action plans for the development of core content.

In conclusion, the Cyber Home Learning System has to be further improved in the following three aspects. First, it must be reborn as an educatinal tool to satisfy the needs of students and bridge the regional and social divides. Second, efforts to analyze the learning habits and levels of students have to be made in oder to develop customized educational content and services, provide customized learning, and find niche makets. Third, it is necessary to develop a legal framework that acknowledges such cyber learning as an official and legitimate course.

D. EBS Internet Programs for the College Entrance Examination

EBS television programs for the college entrance examination were initiated on the Internet on April 1, 2004 by the Ministry of Education & Human Resources Development, with the goals of reducing private educational costs, overcoming distortions in education delivery, such as academic sectionalism, and reinforcing competitiveness into public education. Toward achieving these ends, EBS started to broadcast these programs that were directly linked to the college entrance examination. It is reported that these programs reduced private educational costs, bridged educational gaps by allowing the underprivileged to easily use such programs, and greatly contribute to educational welfare. Also, it has helped to spread the new concept of "e-Learning" among the greater population.

The concept of a college entrance exam preparation course as an online broadcast service was developed in January 2004. After two months of preparation and a one-month period of system development, the service commenced on April 1, 2004.

The most important challenge in the early phase was to minimize downtime arising from excessive numbers of simultaneous users and develop a service system that could reliably provide VOD streaming and download functions. To this end, a server that can accommodate 50,000 users at the same time was installed, in addition to the existing server with a capacity of 50,000 users. Furthermore, a server that could accommodate 18,000 users was employed at EDUNET in the Korea Education & Research Information Service. As a result, the system now has servers that can accommodate a total of

118,000 users at any time. After a pilot operation of three months, various follow-up projects, such as improvement of video quality, reinforcement of community and LMS services, and employment of services for the disabled (especially, the blind and deaf), were conducted. Full-scale operation was successfully launched on July 1, 2005.

For this service, the Ministry of Education & Human Resources Development, the Educational Broadcasting System, the Korea Institute of Curriculum & Evaluation, and metropolitan and provincial offices of education cooperated closely. In addition, infrastructure was implemented to accept 100,000 simultaneous users and provide 20% of educational content in downloadable format. Considering the fact that the programs were provided in video format, various functions − such as accelerated play assuring high-quality images and image bookmarks − were added to improve learning convenience and benefits. As a result, the number of users has greatly increased from 740,000 in the early stages, to 2.34 million as of August 2006 [Figure 11]. In addition, the number of daily hits by visitors has increased by 104,000 [Figure 12].

In 2006, the following new projects were initiated: reinforcement of programs on essay-type tests, training of school teachers in essays, development of item pools in preparation for school examinations, and reinforcement of interactive services focusing on individual needs.

In 2004, a task force team consisting of pro-fessionals from various disciplines, checked the infrastructure from a technical perspective, resulting in its successful operation. Since the programs are inexpensive ($40~$50/mth), the service has greatly reduced private education costs, leading to continuous expansion of the market share. In order to sustain this effect, it is necessary to develop a flexible system that can be adjusted in response to the changes of the college entrance system and to find measures that can actually contribute to overall improvement of public education.

E. Development and Distribution of Educational Content

In the 1980s, when adapting ICT in education began, the operational system was based on 8 bits, 16 bits, XT (8088), and AT (80286). Since 2000, several projects for implementation of advanced Internet enhancements and upgrading of school facilities have been success-fully completed, leading to the development of a variety of improved teaching content. Recently, the education paradigm has shifted from a teaching-oriented concept to more learning-oriented ones, such as e-Learning and u-Learning. So, it is necessary to improve the infrast-ructure and continue to develop new educational content.

We have two tasks in the development and distri-bution of educational content. The first is to provide support for teachers' research activities. To this end, there is certification of ICT competencies and support for research on ICT-based teaching techniques. These are available to encourage teachers to improve their competencies and capacities. The number of teachers

who obtained certificates of ICT competency was 248,834 out of 393,402 applicants as of 2005 (60.4%). In addition, more than 200 clubs for research of ICT-based teaching techniques were selected for provision of financial support. Their research outcomes are now available to the public.

The second is to develop multimedia materials for teaching and learning, and a curriculum and teaching materials for ICT-based teaching and learning. Multimedia materials are used as the basis for all new teaching materials. In addition, ICT-based teaching and learning materials are developed taking into consi-

〈Table 8〉 Development of Educational Content, 1980~2005

Year	Hardware	Developed by	Subjects	Characteristics
Early 1980s	8 bit, 16 bit computers Monochrome monitors	Jointly by metropolitan/provincial offices of education Korean Educational Development Institute	Mathematics, Science, etc.	Individual learning (CAI)
Early 1990s	386 computers Color monitors	Jointly by metropolitan/provincial offices of education Korean Educational Development Institute	Major subjects	Individual learning (CAI)
Mid 1990s	486 computers PC communication	Jointly/individually by metropolitan/provincial offices of education Korean Educational Development Institute	All subjects	Individual learning (CAI)
Late 1990s	586 computers Advanced teaching devices	Metropolitan/provincial offices of education	All subjects	Individual learning (CAI, WBI) Teaching
Early 2000s	PC/Internet Spread of PCs	Korea Multimedia Education Center Jointly/individually by metropolitan/provincial offices of education Korea Education & Research Information Service	All subjects	Teaching (multimedia teaching materials, ICT-based teaching & learning, teaching S/W)

※ Source : Ministry of Education & Human Resources Development, 2006

〈Table 9〉 Development of Educational Content, 2000~2005

Category	2000	2001	2002	2003	2004	2005	Total
Multimedia materials	58	44	22	8	3	4	139
ICT-based teaching & learning guidelines		107	152	93	61	-	413
ICT-based teaching materials (jointly developed by offices of education)		76	80	80	62	64	362
Total	58	227	254	181	126	227	914

※ Source : Ministry of Education & Human Resources Development, 2006

deration the needs of students.

F. Future Plans and Directions

New education paradigms based on ICT are a world-wide trend. Therefore, it is necessary to continuously publicize those services in order to increase the utilization rate. In addition, various studies have to be conducted to support them from an academic per-spective. These activities for future education will be an important basis for the ubiquitous age and u-Learning. Further, it is necessary to develop various u-Learning models and establish cooperative systems between government agencies, industry, universities, and research institutes to resolve the weaknesses of the present system.

2. Training of Teachers in ICT

A. History

With regard to training of teachers in ICT, several problems were raised, including: insufficient diffe-rentiated training programs by grade or experience level and lack of school management and leadership programs in response to social changes. As a result, new programs were introduced in 2006, such as reinfor-cement of leadership for school managers and development of training courses with a focus on teachers' competencies in order to improve the teaching and learning approaches. Also introduced were differentiated training courses and trainee-oriented programs, reforms in training content and methods for advanced training models in Korea and foreign countries, and cooperation with private training organi-zations.

Prior to 2000, ICT training programs mainly consisted of general ones for teachers and specialized ones for professors and school inspectors.

A general training course was developed covering computer literacy, including various ICT skills, such as word processing, spreadsheets, presentations and Internet skills. A total of 603,005 teachers received training courses from 1988 to 2000, indicating an average of 1.8 per teacher. More than 25% of all teachers participated in ICT training courses from 1997 to 2000. During this four-year period, an opportunity to obtain ICT training was given to all teachers more than once.

As adapting ICT in education has been highlighted and the demand for various ICT training courses has increased since 1992, metropolitan and provincial offices of education have developed special training courses for cultivation of professional personnel, such as ICT instructors, content development staff, and ICT education inspectors.

〈Table 10〉 ICT Training of Teachers, 2003~2005 (Unit : persons)

Year	Elementary school	Middle school	High school	Special school	Others	Total
2003	48,512	30,195	25,259	1,247	5,303	110,516
2004	47,698	27,655	19,758	1,017	3,927	100,055
2005	53,553	30,502	24,955	883	1,454	111,347
Total	149,763	88,352	69,972	3,147	10,684	321,918

※ Source : Ministry of Education & Human Resources Development, 2006. 3

〈Table 11〉 Designated or Authorized Distance Teaching & Training Centers, 2000 ~ 2006

Year	Metropolitan/Provincial Distant Teaching & Training Centers	Authorized Distance Teaching & Training Centers		Total
		University	Public/Private Organization	
2000	2	14	5	21
2001	12	17	10	39
2002	15	18	17	50
2003	17	17	19	53
2004	17	17	22	56
2005	17	16	23	56
2006	19	20	22	61

Note) The number of centers are indicated on a cumulative basis.

From 2001 to 2005, the training programs consisted of "official ICT training" (the office of education gave training credits on completion of the mandatory courses) and "voluntary ICT training", conducted by schools. The official ICT training resulted in more than 33% of teachers participating in annual training courses, while each school had to conduct voluntary ICT training for at least 15 hours per year.

Although the ICT training programs for teachers has achieved both minor and major outcomes, there are still some problems to be resolved in order to achieve better results. For example, it is necessary to reform the programs from new perspectives, such as integrated reorganization of knowledge, cooperation with fellow teachers, and establishing cooperative relationships with parents and communities. In addition, comprehensive management at the government level is required to encourage the voluntary participation of teachers and maximize synergies.

B. Operation of Distance Teacher Training Centers

Distance education & training utilizes cyberspace as the main learning place for teachers (including education officials) and encourages learners to do self-regulated learning through active interaction between teaching staff and trainees. As of July 2006, there were 61 centers for distance education and training <Table 11>. Training is mainly conducted via telecon- ferencing based on the Internet and multimedia. In addition, training in the classroom is also supple- mentarily conducted. The learning management function was further developed to allow competent authorities to check their progress. For objective and fair evaluation, individual centers developed strict evaluation (completion) criteria according to the guidelines set by the Ministry of Education & Human Resources Development. For example, a distance training course of more than 30 hours requires at least one class attendance.

Several metropolitan/provincial and private distance teaching training centers were newly designated or authorized this year. The Incheon metropolitan city and Jeju special self-governing province distance training centers were newly designated, meaning that all metropolitan and provincial offices of education now have disignated distance teacher training centers. Although the number of universities with distance teacher training centers has not dramaitically increased, the Seoul Art College, Youngdong University, and Gyeongsang National University were all newly authorized. Their distance teacher training centers were established with specialized goals, such as arts or counselling. Such specialized training may be the key to distance teacher training centers at the tertiary level. The Korea Invention Promotion Association's distance teacher training center was also newly authorized <Table 12>. Although the distance teacher training centers provide various training opportunities, there is still room for improvement, including develop- ment of personalized curricula, establishment of standardized content development approach and operation platforms, and establishment and operation of a national organization to support distance teacher training centers.

〈Table 12〉 Training Records at Distance Teacher Training Centers, 2001 ~ 2005

Year	Metropolitan/Provincial Centers	Authorized Centers		Total
		University	Public/Private	
2001	21,226	4,909	12,067	38,202
2002	15,110	3,119	18,987	37,216
2003	16,664	1,415	41,944	60,023
2004	20,243	878	57,446	78,567
2005	25,559	1,560	69,080	96,199
Total	98,802	11,881	199,524	310,207

Note) The number of trainees who completed the training courses at the relevant distance teacher training centers.

3. Digitalization of School Libraries

A. Operation of Digital Resource Centers

In order to cultivate independent and creative talents for the knowledge-based society, it is essential to help students to develop reading habits and foster research-oriented teaching methods. Therefore, the importance of the school library is being increasingly highlighted. However, because the importance of school libraries had not been fully recognized, they were ill-equipped and unable to successfully perform basic functions, such as lending and reading. So, PCs for library managers and users have been installed at school libraries with the goal of allowing students and teachers to access digitalized resources through the Internet. The "Digital Library System (DLS)" project was initiated to improve the efficiency, maximize the practical use through sharing of information and resources, and provide systematic support for learning.

Digital Resource Centers were developed at 114 schools in 2004, 18 national schools and 96 schools under metropolitan and provincial offices of education with six schools in each of 16 metropolitan and provincial offices of education <Table 13>. Approximately 42 million won was provided to each school. For schools under the metropolitan and provincial offices of education, the monetary support was financed by the adapting ICT in education promotion fund and the local governments (50:50). For national schools, the monetary support was provided entirely by the adapting ICT in education promotion fund. The total estimated budget was 4,906 million, 2,852 million. From the fund and 2,054 million, from local governments.

In March 2004, the "Plan for the Digitalization of School Libraries in 2004" was established. This plan included the development of Digital Resource Centers according to the model recommended by the Ministry of Education & Human Resources Development, operation of an expert support group (including college professors, librarians, and staff from the Korea Education & Research Information Service), selection of examples of best practice, and official commendations of excellent contributors.

In addition, model schools for Digital Resource Centers were selected. For schools under metropolitan and provincial offices of education, selection criterion were developed and a committee for the selection of model schools was established. However, in order to have these model schools be of help to other schools in developing digital resource centers, the following recommendations were made:

Model schools should have dedicated librarian(s) to assure substantial promotion and maintenance of Digital Resource Centers, sufficient space for resource centers (more than two classrooms) that can act as a central feature in the future, and a network speed of more than 2 Mbps using DLS.

For national schools, the model schools were

⟨Table 13⟩ Development of Digital Resource Centers in 2004

Resions	No. of Schools				
	Elementary	Middle	High	Special	Total
Seoul	2	2	2		6
Busan	2	2	2		6
Daegu	3	2	1		6
Incheon	2	2	2		6
Gwangju	3	3			6
Daejeon	2	2	2		6
Ulsan	2	3	1		6
Gyeonggi	2	2	2		6
Gangwon	3	2	1		6
Chungbuk	2	2	2		6
Chungnam	3	2	1		6
Jeonbuk	3	1	2		6
Jeonnam	4	2			6
Gyeongbuk	3	2	1		6
Gyeongnam	2	2	2		6
Jeju	3	2	1		6
National	9	5	3	1	18
Total	**50**	**38**	**25**	**1**	**114**

selected by the Ministry of Education & Human Resources Development and the Korea Education & Research Information Service. Out of 38 schools to which official letters were sent, 25 schools submitted applications. After deliberation by a committee organized by the Korea Education & Research Information Service, a total of 18 schools, including the Seoul National University Middle School, were selected for development of Digital Resource Centers.

After promotion of this project, it has become easier to share resources relating and conduct ICT activities and subject-linked learning. The school libraries fulfill the roles and functions of learning resource centers which support teaching and learning activities. Accordingly, it is necessary to expand the amount of information and resource available. The resource archive for school libraries needs to help users to improve their reading and ICT utilization competencies, and must also be useful for teaching activities.

B. Improved Utilization of Archived Information

The Digital Library System examines newly published books to select those most appropriate to elementary and secondary schools and compile bibliographies. It's important to provide information in a standardized format so as to enable sharing through DLS. In order to obtain and expand on content, it is necessary to develop teaching and learning methods that connect teaching in classrooms with libraries, indentify and share best practices for reading through DLS, provide personalized services, such as correction of book reports, and establish a community network for exchange of information among libraries.

4. Infrastructure for Adapting ICT in Education

Projects to develop the infrastructure for the adapting ICT in education were started according to the three-year plan (1997~1999), which was revised as the adaptng ICT in master education plan for elementary and secondary schools (1998~2002) in 1998 and the five-year plan for education development (1999~2003)

〈Table 14〉 **Computers in Elementary & Secondary Schools** (unit : PCs)

Category		Pentium II	Pentium III	Pentium IV	WBT & Others	Total
National	Elementary school	81	433	1,365	20	1,899
	Middle school	82	306	970	12	1,370
	High school	88	358	1,390	1	1,837
	Special school	42	266	448	1	757
	Sub-total	293	1,363	4,173	34	5,863
Public / Private	Elementary school	38,056	195,081	341,637	9,270	584,044
	Middle school	25,656	115,143	189,519	5,570	335,888
	High school	33,242	146,344	271,620	4,671	455,877
	Special school	878	4,448	6,058	46	11,430
	Sub-total	97,832	461,016	808,834	19,557	1,387,239
Total		**98,125**	**462,379**	**813,007**	**19,591**	**1,393,102**

※ Except three national technical high schools.
※ Including teachers' PCs

Source : Ministry of Education & Human Resources Development, 2005. 12.

〈Table 15〉 **The Number of Students Per PC**

(unit : PC, person)

Category		Elementary School	Middle School	High School	Special School	Total
National	No. of PCs	1,899	1,370	1,837	757	5,863
	No. of students per PC	6.0	4.7	4.6	1.6	4.2
Public / Private	No. of PCs	584,044	335,888	455,877	11,430	1,387,239
	No. of students per PC	6.9	6.0	3.8	2.0	5.6
Total	No. of PCs	585,943	337,258	457,714	12,187	1,393,102
	No. of students per PC	6.9	6.0	3.8	2.0	5.6

※ Except national technical high schools.

Source : Ministry of Education & Human Resources Development, December 2005

in 1999. Responsibilities for these projects were transferred to provincial governments in 2001 to make it possible for metropolitan and provincial offices of education to promote them. The central government's role is limited to those requiring standardization at a national level.

The goal of these projects is to continuously expand physical ICT foundations, in order to promote e-Learning and reinforce people's creative and problem-solving capabilities. At present, it is necessary to develop measures for distribution of PCs, replacement of old PCs, and maintenance of multimedia equipment and existing PCs.

In future, all elementary and secondary schools are expected to have Internet speeds of more than 2 Mbps.

With regard to distribution of PCs, the number of computers below Pentium III-level is 560,504 or 40.2% <Table 14>. For public and private schools, PC exchanges and upgrades were conducted with funding from metropolitan and provincial offices of education. However, the central government provides the necessary funding for national schools. Since there are so many old PCs, utilization of low-capacity PCs has been attempted, but produces less-satisfactory results. The copyright issue is a significant obstacle in upgrading the PCs. Moreover, the metropolitan and provincial offices of education have had difficulty in obtaining budgetary provision for exchange, maintenance, and repair of PCs, which are an important e-Learning tool. Accordingly, it is necessary to develop and maintain comprehensive and systematic measures.

As of December 2005, the number of students per PC was 5.6, which will be reduced to five per PC by 2010. The number of students per PC is currently 6.9 for elementary schools, 6.0 for middle schools, 3.8 for high schools, and 2.0 for special schools <Table 15>. When considering the fact that elementary schools are the most activated sector for ICT-based learning, but show the highest number of students per PC,

〈Table 16〉 **Advanced Teaching Equipment** (unit : PCs)

Category		TV	Projection TV	LCD Projector	Others	Total
National	Elementary school	112	415	105	253	885
	Middle school	100	190	102	71	463
	High school	141	305	104	164	714
	Special school	152	119	36	68	375
	Sub-total	505	1,029	347	556	2,437
Public / Private	Elementary school	15,642	128,401	9,153	125,426	278,622
	Middle school	6,161	57,960	7,711	32,522	104,354
	High school	6,328	49,008	11,065	28,317	94,718
	Special school	1,249	1,941	453	2,559	6,202
	Sub-total	29,380	237,310	28,382	188,824	483,896
Total		29,885	238,339	28,729	189,380	486,333

※ Except national technical high schools.

distribution of new PCs to elementary schools will be a main priority.

With the development of information and communication technology, the amount of multimedia resources has significantly increased. Therefore, it is necessary to provide an capable of Internet speed ensuring efficient ICT-based teaching and learning. The current percentage of schools with E1 (2 Mbps) is 97.1%. Table 14 shows further statistics of Internet speed.

In addition, one set of advanced teaching equipment (PC, TV, projection screen, etc) will be provided to all classes for ICT-based education. PCs for such purposes are distributed to all classes, while about 1.2 sets of projection TVs, including LCD projectors, are provided to each class as shown in Table 16.

In order to improve Internet access, it is necessary to secure financial resources and reinforce ICT staff. There is also a need to develop the level and criteria for ICT infrastructure appropriate for integration of ICTs with educational activities in schools and to secure financial resources for the efficient operation and maintenance of ICT infrastructure.

5. National Education Information System

The National Education Information System (NEIS) is a system that connects all administrative organizations, elementary and secondary schools, and special schools through the Internet and shares educational administrative information. The number of NEIS users has continuously increased and the number of visitors per day is now more than 100,000. In 2007, this system will provide data required for college entrance, leading to considerable cost reductions for parents, students, and universities.

Application software for academic affairs consists of 23,671 modules, which were developed in February 2006 and are now used by all schools <Table 17>. Further, users' comments and recommendations are consistently reflected to assure continuous improvement of the system.

From March to mid-August 2006, a total of 5,802 inquires were received, reviewed, and reflected in the improvement of functions. About 62% of those inquiries (corresponding to 3,575 inquires) related to unique characteristics of individual schools. It's thought that such a considerable amount of inquiry may be the result of almost all schools in Korea adopting the system. The inquires or errors were mainly reported by the 10% of elementary, secondary and special schools that initially introduced the system in March 2006. It should be noted that academic affairs in the first term,

including entrance to elementary and secondary schools, school affairs, curriculum, scheduling, attendance recording, change of schools, and examination results (midterm and final exami- nations), were processed successfully. Such outcomes proved that the system operates in a reliable and stable manner and resulted in a considerable reduction in teachers' workloads. Further, the development of the application software for lifelong education organi- zations that have the modified semester system (six terms in two years) was launched in July 2006 and the service will be provided from March 2007. Also, additional develop- ment of NEIS for public services and teachers with visual impairment has been promoted since October 2006.

Training programs are in place for teachers who use NEIS. In metropolitan and provincial offices of education, self-examination of NEIS utilization is conducted according to the activation plan and measures for dissemination of NEIS are being developed. Problems in connection with its operations are solved by various working groups. For example, Figure 14 shows the organization of working groups in the school administration sector.

Many significant results have been achieved by NEIS, such as decreased working hours, cost redu- ctions, and improved productivity. However, in order to

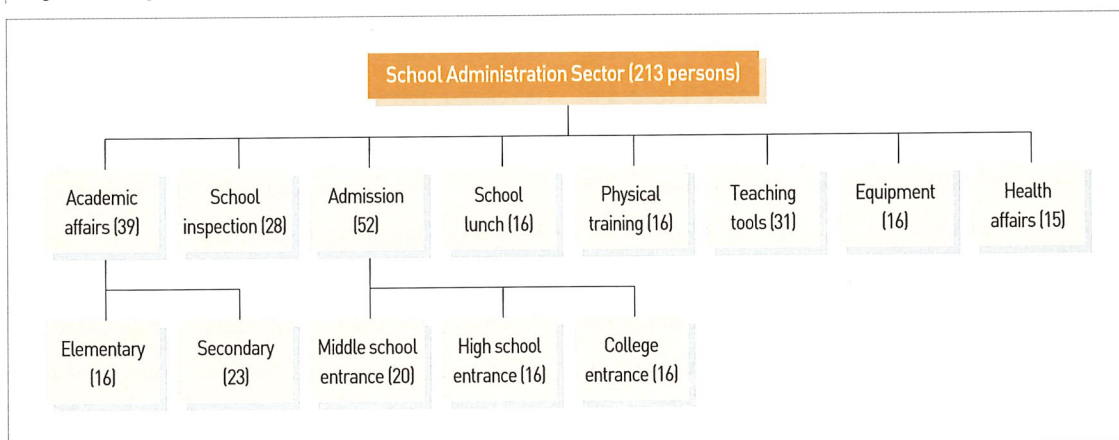realize the effective and efficient utilization of NEIS, it is necessary to improve management ICT awareness, continuously provide training programs in response to change of staff, develop diversified training and PR programs for users, and publicize successful cases relating to the use of NEIS.

〈Table 17〉 NEIS Academic Administration System Application S/W : 2006. 8

Category	Description	Modules
Elementary Schools (Academic Affairs, Admissions, Health)	Academic affairs/admissions, and healthcare for elementary schools	3,211
Elementary Schools (Academic Affairs, Admissions, Health)	Academic affairs/admissions, and healthcare for middle schools	5,012
Elementary Schools (Academic Affairs, Admissions, Health)	Academic affairs/admissions, and healthcare for high schools	5,276
Elementary Schools (Academic Affairs, Admissions, Health)	Academic affairs/admissions, and healthcare for special schools	3,799
Elementary Schools (Academic Affairs, Admissions, Health)	Academic affairs/admissions, and healthcare for generals	119
System, General	System administration, log-in, others	2,896
Others	Common modules, others	3,358
Total		23,671

※ Sources : Korea Education & Research Information Service, August 2006

[Figure 14] Organization of Working Groups in the School Administration Sector, 2006

※ Sources : Korea Education & Research Information Service, August 2006

6. Performance Management of Adapting ICT in Education

A. Evaluation of Adapting ICT in Education

Increased importance has been placed on statistical analysis for objective evaluation of the outcomes from the adapting ICT in education projects. As a result, adapting ICT in education indices have been developed from 2001 to evaluate the level of adapting ICT in education. With such indices, metropolitan and provincial offices of education, schools, and other relevant organizations can evaluate their level of adapting ICT in education. Furthermore, the indices can be used to encourage organizations to develop ICT environments and activate their utilization. Table 18 summarizes the policies, grounds, and history of research on the development of indices to evaluate adapting ICT in education.

The adapting ICT in education indices for elementary and secondary schools were developed in 2001 to encourage self-evaluation of adapting ICT in education level, activate adapting ICT in education in schools, promote diagnosis and quality management of adapting ICT in education at central or metropolitan and provincial levels, and determine the policies for adapting ICT in education in elementary and secondary schools. The development of adapting ICT in education indices were collected for written materials, expert meetings, on-site examinations of elementary and

⟨Table 18⟩ Development of Indices for Evaluation of Adapting ICT in Education

Items	Description
Policies	- Development of indices for objective evaluation of adapting ICT in education - Operation of evaluation system with focus on utilization and performance of adapting ICT in education - Trend analyses based on evaluation results and comparisons with other countries
Grounds	- "Development of indices for adapting ICT in education and evaluation", two-phase adapting ICT in education master plan (2001-2005) - "Development of a performance management system for adapting ICT in education ", three-phase education master plan (2006-2010)
History	- 2001: Development of indices for adapting ICT in education in elementary and secondary schools (two types for elementary and secondary schools respectively) - 2002: Development of indices for adapting ICT in education in colleges and universities - 2003: Development of indices for lifelong adapting ICT in education - 2004: Development of indices for adapting ICT in education in special schools (two types for special schools and special classes)
Evaluation	- 2003: 2,297 elementary and secondary schools (about 30%, random sampling) - 2004: 2,675 elementary and secondary schools (about 30%, random sampling) - 2005: 2,259 elementary and secondary schools (except those evaluated in 2003 and 2004), 115 special schools (all), 706 schools with special classes - 2006: 10,889 elementary and secondary schools (all)

secondary schools, surveys by experts, pilot tests of 400 schools, and validation of data.

In order to select indices to be used in evaluation of adapting ICT in elementary and secondary education and gather reasonable opinions from experts in the relevant fields, they were invited to evaluate existing indices. Feedback on the evaluation results was conducted according to the Delphi method. This resorted in a final selection of adapting ICT in education indices, also taking into account indices adopted by international organizations and foreign countries and results from analysis of adaption ICT in education in 2005 (non-response, correlation coefficient, etc.). Further, for optimal weighted evaluation, AHP (Analytic Hierarchy Process), a technique that statistically adjusts various experts' opinions was applied to assure the reliability of the evaluation system. Table 19 describes the adapting ICT in education indices for elementary and secondary education finally adopted through feedback of evaluation results in 2005.

Evaluation results showed that there are considerable gaps between above and below average schools. In particular, it is found that the indices relating to utilization and performance have more effect on the overall level of adapting ICT in education than the indices relating to input. Therefore, it is suggested that policies with focus on utilization and performance are required, rather than outward expansion of input area.

In connection with evaluation of adapting ICT in education level, the following recommendations can be suggested for future studies:

Firstly, it is necessary to continuously modify or improve the adapting ICT in education indices found to be redundant or ambiguous, with changes in social environments or school circumstances. The area of input is in particular need of improvement.

Secondly, the present evaluation focuses on quantitative indices, including percentages and numbers, which might be useful in the early stages. However, since the education information projects have been promoted for many years, more detailed and specific evaluation indices need to be developed. For example, the indices relating to participation of principals or teachers in ICT-related training courses should be improved to verify that they participate in programs that meet their needs and requirements.

Thirdly, present indices focus on past outcomes or performance metrics, so cannot indicate the outcomes of adapting ICT in education.

Therefore, it is necessary to develop indices that can reflect the mid- to long-term objectives of the adapting ICT in education policies and show the accomplishment of those objectives.

⟨Table 19⟩ Adapting ICT in Education Indices for Elementary and Secondary Schools in 2006

Areas	Indices
Input	1. Principals' participation in ICT training courses (hours)
	2-1. Teachers' participation in in-house ICT training courses (hours/teacher)
	2-2. Teachers' participation in outside ICT training courses (hours/teacher)
	3. Percentage of budget relating to adapting ICT in education
	4. Percentage of teachers relating to adapting ICT in education
	5. No. of PCs per student
	6. No. of PCs per teacher
	7. Percentage of PCs actually used
	8. Internet speed
	9. Cost for purchase of teaching or learning software products per student
	10. Implementation of system to block harmful information
Utilization	11. Number of teaching-learning materials posted at web site per teacher
	12. Number of utilization of teaching-learning materials posted at web site per student
	13. Number of information exchanges through the web site's BBS per student
	14. Percentage of teachers who joined the ICT - related clubs
	15. Percentage of students visited the web site in a day (mean)
	16. Time period for which a student uses the computer room
	17. Percentage of information exchanges with parents through the web site
	18. Percentage of participation in ICT programs
Output	19. Percentage of teachers with ICT certificates
	20. Percentage of participation in ICT-related events
	21. Percentage of participation in ICT-based pilot classes
	22.Percentage of students with ICT certificates
	23. Percentage of students with ICT competence certificates (secondary school)
	24. Percentage of students who participated in ICT-related events

Source : Korea Education & Research Information Service, Study on Education Informatization Level in Elementary and Secondary Schools, 2006

B. Evaluation of Policies on the Adapting of ICT in Education

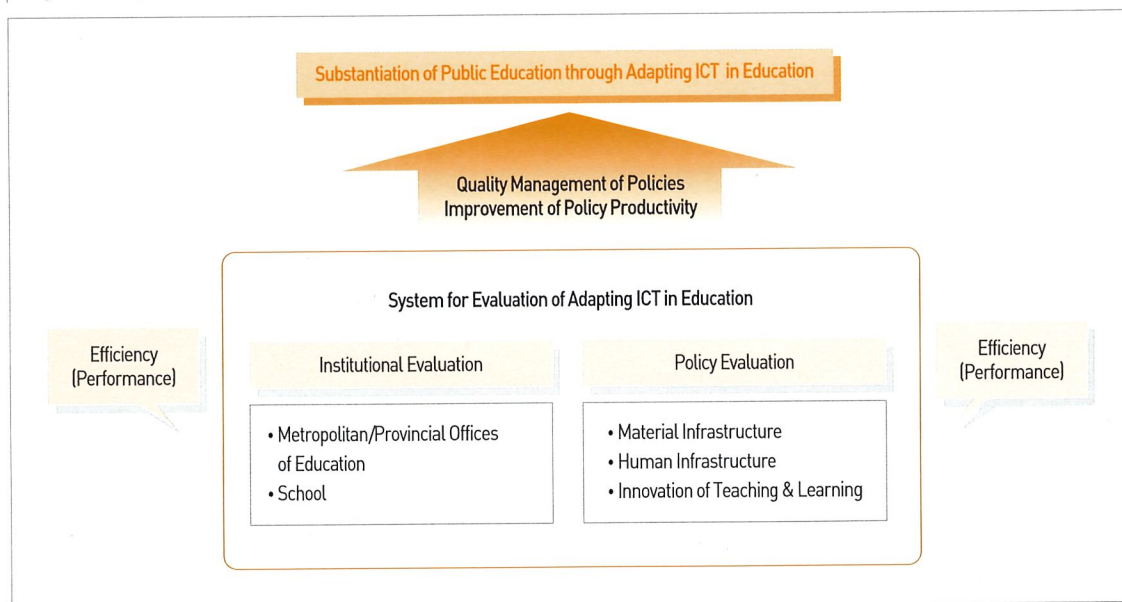As shown in Figure 16, the National Information Evaluation Committee under the Korea adapting of ICT Promotion Committee is responsible for performance management of adapting ICT in education. Individual central agencies conduct self-evaluation and the National Information Evaluation Committee verifies and examines the self-evaluation results.

〈Table 20〉 Indices for Evaluation of On-Line Service Utilization

Evaluation Areas	Indices (example)
Utilization	Scope, Frequency
Effectiveness	User's satisfaction, Meeting the intended purposes
Adequacy of System	User-friendliness, System reliability
System Operation	Adequate system management, Response to customers

[Figure 15] System for Evaluation of Adapting ICT in Education

Substantiation of Public Education through Adapting ICT in Education

Quality Management of Policies
Improvement of Policy Productivity

System for Evaluation of Adapting ICT in Education

Efficiency (Performance)

Institutional Evaluation
- Metropolitan/Provincial Offices of Education
- School

Policy Evaluation
- Material Infrastructure
- Human Infrastructure
- Innovation of Teaching & Learning

Efficiency (Performance)

In addition to the evaluation of national adapting ICT in education , there is institutional evaluation (informatization level of central agencies) and online service evaluation (major online services directly related to the people).

Education-related services were selected for this kind of evaluation in 2006. Online service evaluation focuses on service utilization, its effects, adequacy of systems, and system operation from the user's perspective. Major evaluation indices are summarized in Table 20.

As shown in Table 21, the methods and items for evaluation of adapting ICT in education have been annually improved and qualitative evaluation has been replaced by a quantitative one based on quantitative indices.

[Figure 16] System for Evaluation of National Adapting ICT in Education

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                    ┌──────────────────────────────┐
                    │ Korea Adapting ICT in Education│
                    │    Promotion Committee         │
                    │   Chairman: Prime Minister     │
                    │    Member: 24 Ministers        │
                    └──────────────────────────────┘
                                  ▲                        ┌─────────────────────────────┐
                                  │                        │ Adapting ICT in Education    │
                                  │                        │   Promotion Advisory Committee│
┌──────────────────────┐         │         ◄──────────────│  (Experts from Industry,     │
│ Ministry of          │  ┌──────────────────────────────┐│ Universities, and Research   │
│ Information &         │  │  Adapting ICT in Education    ││ Institutes)                  │
│ Communication         │─▶│   Executive Committee         │└─────────────────────────────┘
│ (Information Planning)│  │Chairman: Chief Assistant to   │
└──────────────────────┘  │   the Prime Minister          │ ┌─────────────────────────────┐
         ▲                │ Members: 25 Deputy Ministers  │ │ National Information         │
         │                └──────────────────────────────┘ │ Evaluation Committee         │
┌──────────────────────┐         ▲         ◄──────────────│  (Experts from Industry,     │
│ National             │         │                         │ Universities, and Research   │
│ Computerization       │  ┌──────────────────────────────┐│ Institutes)                  │
└──────────────────────┘  │ Adapting ICT in Education     │ └─────────────────────────────┘
         │                │   Sub-Committee Agency         │
         │                └──────────────────────────────┘
         │                          ▲
         │                ┌──────────────────────────────┐
         └───────────────▶│      Central Agencies         │
                          └──────────────────────────────┘
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In 2004, projects conducted in 2003 were evaluated by the Ministry of Education & Human Resources Development and the National Information Evaluation Committee (managed by National Information Society Agency). Seventeen small-scale projects promoted with relatively reduced budget were evaluated by the Ministry of Education & Human Resources Development, while 11 large-scale projects were evaluated by the National Information Evaluation Committee.

Since 2005, the importance and necessity of self-evaluation has been highlighted, so the Ministry of Education & Human Resources Development conducted self-evaluation of all 30 projects and the National Information Evaluation Committee performed meta-evaluation of results from these self-evaluations. Meta-evaluation focuses on completeness of self-evaluation and adequacy of evaluation results. The meta-evaluation reports were then provided to the agencies that had conducted the self-evaluations.
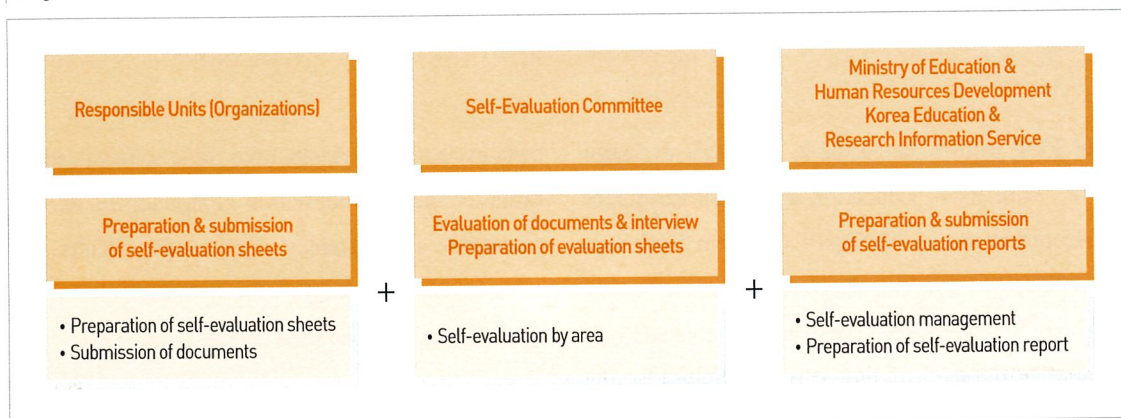
In 2006, the former qualitative evaluation was replaced by a quantitative one, resulting in weighted scores for individual indices. In the past, the evaluation results consisted of descriptions of strong points, weak points, and recommended measures under consideration of each project's characteristics. Now, the new quantitative evaluation provides a numerical expression of indices, allowing a systematic comparison of projects.

〈Table 21〉 History of Adapting ICT in Education Evaluation

Year	Subjects	Methods	Items
2004	2003 Education Adapting ICT in Education Promotion Plan 28 Projects	Self-evaluation (MOE), Evaluation by the Adapting ICT in Education Promotion Committee	Adequacy of project plan Efficiency of execution Accomplishment
2005	2004 Education Adapting ICT in Education Promotion Plan 30 Projects	Self-evaluation (MOE), Meta-evaluation by the Adapting ICT in Education Promotion Committee	Adequacy of project plan Accomplishment Utilization of evaluation results Risk management Utilization of knowledge & information
2006	2005 Education Adapting ICT in Education Promotion Plan 23 Projects	Self-evaluation (MOE), Verification by the Adapting ICT in Education Promotion Committee	Adequacy of project plan Efficiency of execution Accomplishment Utilization of evaluation results

[Figure 17] Self-evaluation of Adapting ICT in Education Projects

Responsible Units (Organizations)	Self-Evaluation Committee	Ministry of Education & Human Resources Development Korea Education & Research Information Service
Preparation & submission of self-evaluation sheets	Evaluation of documents & interview Preparation of evaluation sheets	Preparation & submission of self-evaluation reports
• Preparation of self-evaluation sheets • Submission of documents	• Self-evaluation by area	• Self-evaluation management • Preparation of self-evaluation report

Evaluation activities have been further integrated and coordinated since 2006. As a result, the Adaption of ICT Promotion Committee's responsibility for informatization evaluation was transferred to the Office for Government Policy Coordination. Accordingly, the existing adapting ICT in education evaluation and the adapting ICT in education evaluation of the Ministry of Education & Human Resources Development were integrated into the evaluation of the ICT in education sector, leading to a merging of project-based indices and agency-based indices. For example, three indices (development of ICT in education foundations, level of ICT in education & operation, and effects of ICT in education) were formerly included in the evaluation of

the Ministry of Education & Human Resources Development.

In 2006, the Ministry of Education & Human Resources Development selected the Korea Education & Research Information Service to perform the evaluation of its adapting ICT in education projects to assure an independent and professional self-evaluation. Figure 17 shows the system for self-evaluation of adapting ICT in education projects.

Since 75 performance indices focus on quantitative measurement, they are unable to sufficiently indicate the accomplishment of performance objectives. However, self-evaluation did reveal that the evaluation results from the previous year was largely reflected in most projects. Since most adapting of ICT projects of the Ministry of Education & Human Resources Development will be promoted in close cooperation with metropolitan and provincial offices of education, it is necessary to develop the performance management system to enable central government and metropolitan/provincial offices of education to respond to the evaluation results.

7. Changes in Schools Resulting from the Adapting ICT in Education

Various activities, including ICT-based teaching conventions and national educational S/W competitions, have been conducted to overcome the limitations of existing teaching in classes and encourage changes in schools on the basis of ICT infrastructure. As shown in these activities, the goal of ICT-based education is to adopt ICT-based teaching and learning in schools and accomplish the educational objectives in a more effective and efficient way. In short, realizing "better class" and "better school" environments is the ultimate goal of adapting ICT in education. In fact, the first convention for better school environments was held by the Korea Education & Research Information Service on 2003, which was sponsored by the Ministry of Education & Human Resources Development. In addition, national educational S/W competitions have been held since 1992 to encourage the development of various educational contents. Success cases of adapting ICT in education collected from the ICT-based teaching convention were published to spread and share information. In order to activate such activities and encourage changes in schools, it is necessary to publicize them, provide support, and encourage teachers' participation. In addition, measures have to be taken to activate them in close cooperation with provincial governments.

Adapting Education to the Information Age

II. Adapting ICT in Higher Education

1. Tertiary Adapting ICT in Education

A. Adapting ICT in University Education

In implememening adapting ICT in education in Korean universities, the central government has taken a leading responsibility for projects that individual universities find difficult to promote, in order to improve their competitiveness and encourage universities to voluntarily promote adapting ICT in education efforts.
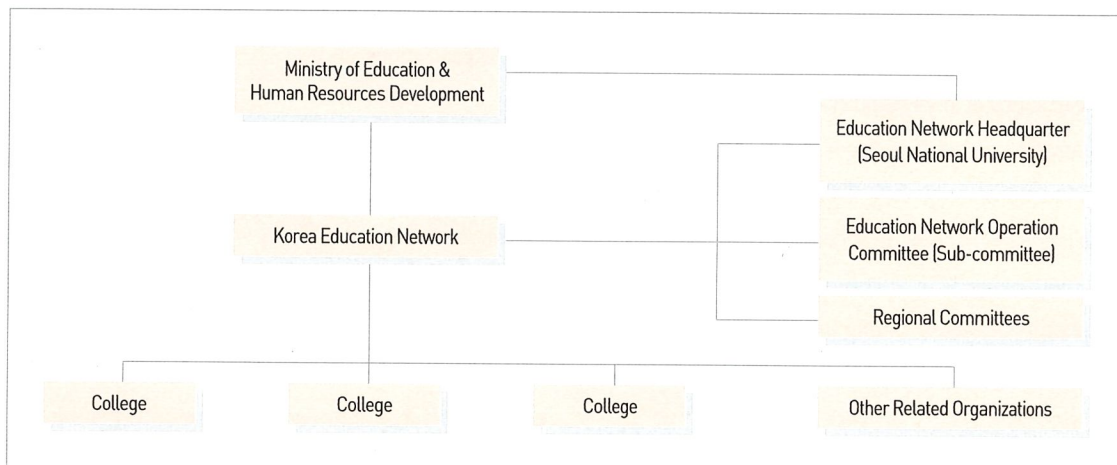
Most Korean universities established computer centers to develop the ICT infrastructure in the 1980s, which was the start of university ICT adaption. As ICT adaption spread into many social areas in 1990s, universities developed campus networks for computerization of school affairs with many successful outcomes.

The Ministry of Education & Human Resources Development has operated the "Education Network" from 1992, which is the largest non-profit network in Korea. This provides a high-quality Internet network at a reasonable cost in order to ensure the university ICT

〈Table 22〉 e-Learning Support Centers

No.	District	Coverage	Year/University
1	Seoul	Seoul	2007 (scheduled)
2	Incheon · Gyeonggi	Incheon, Gyeonggi-do	2007 (scheduled)
3	Gangwon	Gangwon-do	2005 (Kangwon National University)
4	Chungbuk	Chungcheongbuk-do	2006 (Cheongju University)
5	Daejeon · Chungnam	Daejeon, Chungcheongnam-do	2007 (scheduled)
6	Daegu · Gyeongbuk	Daegu, Gyeongsangbuk-do	2005 (Yeungnam University)
7	Busan · Ulsan · Gyeongnam	Busan, Ulsan, Gyeongsangnam-do	2004 (Gyeongsang National University)
8	Jeonbuk	Jeollabuk-do	2006 (Chonbuk National University)
9	Gwangju · Jeonnam	Gwangju, Jeollanam-do	2005 (Chonnam National University)
10	Jeju	Jeju-do	2003 (Cheju National University)

[Figure 18] Organizational Structure for Development of Educational ICT Network

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┌─────────────────────────┐
│ Ministry of Education &  │──────────────────────────────────┐
│ Human Resources         │                                   │
│ Development             │                      ┌─────────────────────────────┐
└─────────────────────────┘                      │ Education Network Headquarter│
            │                                     │ (Seoul National University)  │
            │                                     └─────────────────────────────┘
            │                                     ┌─────────────────────────────┐
┌─────────────────────────┐                      │ Education Network Operation  │
│ Korea Education Network  │──────────────────────│ Committee (Sub-committee)    │
└─────────────────────────┘                      └─────────────────────────────┘
            │                                     ┌─────────────────────────────┐
            │                                     │ Regional Committees          │
            │                                     └─────────────────────────────┘
 ┌──────┬──────────┬──────────┐
┌───────┐ ┌───────┐ ┌───────┐  ┌─────────────────────────────┐
│College│ │College│ │College│  │ Other Related Organizations │
└───────┘ └───────┘ └───────┘  └─────────────────────────────┘
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environment, bridge the digital divide among universities, and reinforce their education and research capacities.

In addition, in order to expand university informatization infrastructure, LANs (Local Area Networks) were established in 23 national universities from 1996 to 1997. In addition, support was provided to 26 universities for joint development of total information systems and implementation of LANs for provincial national universities in 1998. During the period from 1999 to 2001, support was provided to 11 teachers' colleges and 13 colleges of education to help students to improve their ICT competence. Moreover, a distance (cyber) education system was developed at three open universities, the ICT facilities were expanded at 12 colleges or universities, including nine local colleges and teachers' colleges, and support was provided to 14 national universities where the ICT level was low, to help them develop ICT education facilities during the period from 2002 to 2003. During the period from 2004 to 2005, support was given to 17 national universities, open universities, and technical colleges to help develop ICT systems, networks, e-classrooms, and ICT training centers <Table 22>.

In the second half of 2002, a plan for cultivation of talent suitable for the global and digital era, that will

lead the way in the 21st century, was developed and "e-Campus Vision 2007" was announced to accomplish these objectives. Several projects, including development of an e-Learning support center, the implementation of a next-generation university education information system (Enterprise Resource Planning, ERP), establishment of an ICT-based educational environment at teachers' colleges, expansion of ICT infrastructure at provincial national universities, and organization of a university ICT adaption committee, have been promoted since 2003 according to the plan. Such activities focused on encouragement of substantial and qualitative ICT adaption and establishment of cooperative systems among univer- sities in order to reinforce university competitiveness.

The Ministry of Education & Human Resources Development has promoted several projects for adapting ICT in university education, including the establishment and operation of e-Learning support centers, ICT of teachers' colleges and polytechnical colleges, expansion of ICT infrastructure for national universities, and operation of educational networks.

The following issues must be considered in promoting university adapting ICT in education :

First, it has to focus on substantiation and qualitative improvement. Second, voluntary specialization and differentiation must be considered. Third, the networks for cooperative development and utilization have to be reinforced. Fourth, continuous evaluation and feedback systems need to be implemented. Fifth, it is

necessary to prepare the legal or institutional systems appropriate for the knowledge and information society and develop reliable and secure environments. Finally, the efficient promotion of university ICT adaption and reform of university education services, is possible through systematic and cooperative networks between the government, universities, industries, research and other organizations.

B. Development of an Educational ICT Network

The educational ICT network was developed to provide high-quality Internet services with the goals of allowing higher educational institutions and other organizations to effectively obtain domestic or foreign educational, research, and academic information and contribute to the improvement of global competitiveness in the fields of academic research and education. Figure 18 shows the organizational structure for the development of the educational ICT network.

The central government has provided financial support to adapting ICT in education projects since 1983. The Education Network was based on its own founding network during the period from 1983 to 2000, but was transformed into a commercial network in 2001 because of the need for constant operation and technical support, and a dramatic increase in circuit price. The commercial network provides a high-quality 24-hour service.

The number of member organizations that joined the educational ICT network did not significantly increase from 2001 to 2005. However, as its operational method was changed to operate multiple contractors in 2006, the number of member organizations increased by 26% (302 to 381). The contract capacity was greatly improved, nearly doubling that of 2005. The Korea Education Network had a contract with KT from 2001 to 2002. However, the contract accepted was selected through an open competitive bidding process to assure objective and transparent selection and cost-effective and high-quality services. Dacom corporation (BORAnet) was selected in 2003, while KT (Kornet) was selected in 2004 and 2005. In 2006, member organizations were allowed to choose KT or Dacom.

In addition, a general assembly is held annually to report on the operation of the education network under contract, promote sharing of information among members, and explore measures to resolve problems with the network. Furthermore, 11 district councils were organized in 2002 under the responsibility of the selected college or university. These councils are responsible for holding training courses and seminars to promote the sharing of information among colleges and universities. Important issues discussed at these district councils were reported to headquarters in order to reflect them in operating the network. Table 24 lists the district councils.

In addition, the mean access speed increased by 360% from 2001 to August 2006. There has also been a rapid change of access speed from low-speed lines of below 10M, to high-speed lines of 45M to 155M. Moreover, the "multiple contractors" app- roach adopted on 2006 provide more reliable, cost effective, and highly efficient Internet services to member organizations.

C. Cyber Universities

A cyber university is a higher educational institution or lifelong educational facility where cyberspace based on ICT, multimedia, and software is utilized to provide educational services. Learners are able to learn and receive credit without the limitations of time and space. Graduates from cyber universities are equally ac-

〈Table 23〉 Entrance Quotas and Enrollments for Cyber Universities, 2001 ~ 2006 [2006. 04. 01]

Year	Quota	Enrolled students	Percentage (%)
2001	6,220	5,235	84.2
2002	16,700	9,920	59.4
2003	20,600	10,987	53.3
2004	22,600	10,459	46.3
2005	23,550	14,620	62.1
2006	23,550	15,878	67.4

〈Table 24〉 District Councils of Education Network, August 2006

Regions	HQ	Members	Regions	HQ	Members
District 1 (Seoul)	Sungshin Women's University	73	District 7 (Gwangju, Jeonnam)	Gwangju University	36
District 2 (Gyeonggi, Incheon)	Hangyang University	81	District 8 (Jeonbuk)	Jeonju University	22
District 3 (Gangwon)	Yonsei University (Wonju Campus)	21	District 9 (Chungbuk)	Chungju National University	18
District 4 (Chungnam, Daejeon)	Baekseok University	44	District 10 (Jeju)	Cheju National University	6
			District 11 (Gyeongnam)	Jinju National University	21
District 5 (Busan, Ulsan)	Pukyong National University	23	**Total**		**395**
District 6 (Daegu, Gyeongbuk)	Kyungpook National University	50			

∗ The number of members includes both main and branch campuses.

knowledged as those who graduated from colleges or universities.

Subsequent to the evaluation processes in 2000, cyber universities have been in operation since 2001. As of August 2006, there were 17 cyber universities in total (15 for bachelor's degrees and two for sub-bachelor's degrees). There were nine cyber universities accepted in 2000, six cyber universities in 2001, one in 2002 and again one in 2003. From 2004 to 2006, no further cyber universities were accepted due to insufficient qualifications.

The admission quota for 17 cyber universities totaled 23,550 (bachelor's degrees: 21,450; sub-bachelor's degrees: 2,100). They have 32 faculties, 122 departments, and offer 82 subjects. As of April 1, 2006, there were 60,521 students enrolled (55,591 under specified enrollment and 4,929 under extra enrollment). To date, a total of 13,034 people had received cyber university degrees (bachelor's degrees: 9,425; sub-bachelor's degrees: 3,609).

Mean tuition fees are within the range of 682,000 won to 1,364,000 won, which is one-third to half the tuition cost of non-cyber colleges or universities. In this way, various higher educational opportunities are provided at a lower cost to students.

D. Community Colleges

For community colleges, most ICT staff are working in ICT-related departments, such as computer centers. On average, each community college has 3.15 ICT staff members. In addition, most community colleges have firewalls to protect their own systems from external attacks. However, they do not have sufficient systems, such as intrusion detection, for intelligent blocking of such attacks.

For e-Learning, colleges offer a total of 613 subjects and about 70,000 students attend the e-Learning classes. The numbers of subjects and credits decreased slightly, compared to that in 2005.

2. Adapting ICT in Academic Research

A. Adapting ICT in Academic Research

Adapting ICT in academic research consists of three categories; adapting ICT in education for efficient supply of academic information, country-level adapting ICT in education, and digitalization of university libraries.

If one includes adapting ICT in academic research the strategic collection and offering of information required for teaching and learning at universities and graduate schools or for academic activities of professors and researchers, the establishment of KORSTIC (Korea Scientific Technological Information Center) in 1962 might be considered the start of adapting ICT in academic research

On the basis of the master plan for the development of a national digital library in 1997, the present national digital library system was developed, comprising the National Library of Korea, National Assembly Library, Supreme Court Library of Korea, KAIST's National Digital Science Library, Korea Institute of Science and Technology Information, Korea Education & Research Information Service, and Rural Development Administration's Korea Agricultural Science Digital Library.

Digitalization of university libraries commenced with the introduction of an IBRD loan (US$20 Million) in the early 1990's. Since then, commercial library S/W products, such as SOLARS and VINTAGE, have been used for library digitalization. In addition, the original texts were databased to develop a more advanced digital library.

Organizations relating to adapting ICT in academic research include the Ministry of Education & Human Resources Development, Korea Agency Digital Opportunity & Promotion, National Library, Korea

〈Table 25〉 Major Services of RISS, 1999 ~ 2006

			1999	2000	2001	2002	2003	2004	2005	2006. 4
No. of resources in DB	Journals		-	-	130,000	460,000	650,000	750,000	930,000	940,000
	Theses	Domestic	-	24,000	80,000	94,000	210,000	279,000	399,802	457,553
		Foreign	-	5,000	17,000	36,000	47,000	57,000	67,779	70,436
	Overseas DB License		4	5	7	11	12	12	14	-
Joint purchase of overseas DB	No. of organizations		36	93	114	132	142	147	143	-
	No. of DBs		7	52	54	63	68	76	81	-

Institute of Science and Technology Information, National Digital Library, National Assembly Library, and Korea Social Science Library.

B. Operation of RISS

The Research Information Service System (RISS) is an integrated, national academic research information service system developed in 1998, in order to share all academic information resources purchased, owned, or generated by university libraries and to improve university competitiveness. The number of registered users greatly increased from 44,000 in 1998 to 848,000 in April 2006. Its utilization rate increased more than 10-fold over five years. Original texts of domestic theses and dissertations are mainly accessed through RISS.

The total listing service is that libraries jointly prepare bibliographic data (meta-data on books) and provide their own data and information, resulting in effective and efficient sharing of bibliographic data. When this service was first introduced in 1998, a total amount of 4,500,000 bibliographic data and 18,000,000 collected data were provided. As of April 2006, the service includes 7,440,000 bibliographic data and 33,740,000 collected data <Table 26>. The number of member libraries increased substantially, from 148 in 1998 to 511 in April 2006. For quality control of the service, a project called "Development of total listing database for university libraries" was initiated in 1999 to revise seven million items of bibliographic data, leading to a removal of two million items of redundant data. In addition, the membership grading system was introduced to assure selective inclusion of high-quality data. Quality requirements were defined in 2006 to evaluate the quality of lists generated by university libraries and adjust the membership grade. For cross-reference service, the number of member libraries radically increased from 29 in 1999 to 446 in April 2006. Now, most university libraries and specialized libraries are using the total listing and cross-reference services. The number of member libraries for the cross-reference service is gradually increasing and the lending service is being activated. In addition, 135 organizations joined the overseas cross-reference service, providing new data to Korean universities. Development of the network with the Japanese NII allows 239 Korean libraries and 92 Japanese libraries to share data and information. An expanded service in collaboration with China's CALIS will be introduced in 2007.

RISS integrates and connects individual libraries and has established close ties with foreign information service organizations to provide domestic and foreign academic DBs. Universities have their own library systems and the digital system for distribution of knowledge and information provided by the Korea Education & Research Information Service (KERIS), which are connected with the KERIS' integrated system. In adddition, bibliographic data on books, data on academic journals, original texts of academic resources, and others are integrated with RISS to provide information services to all researchers in Korea.

RISS has led the way in organizing the sharing of academic information among university libraries and

offering of academic information services. When considering the physical bases for sharing of academic information owned or produced in Korea, the number of participating organizations, the number of registered users, and others, it is considered that RISS has accomplished obvious success. Now, it is time to enrich RISS from a qualitative perspective. In the future, it will be necessary to develop networks with foreign organizations in order to access and facilitate the use of foreign academic information.

⟨Table 26⟩ Database Development and Member Organizations, 1998 ~ 2006   (unit: 10,000 pieces, organizations)

Year	Bibliographic Data	Collected Data	Member Organizations
1998	450	1,800	148
1999	700	1,900	154
2000	563	2,300	204
2001	584	2,410	306
2002	600	2,600	366
2003	640	2,850	425
2004	688	3,070	460
2005	734	3,308	505
2006. 4	744	3,374	511

In 1999, about 2 mill. Items of Redundant Data were Removed.

⟨Table 27⟩ Number of Thesis and Dissertation Downloads, 2003 ~ 2005

Year	Theses	Dissertations
2003	1,089,845	1,079,649
2004	2,196,448	1,980,047
2005	3,732,420	2,695,633

Adapting Education to the Information Age

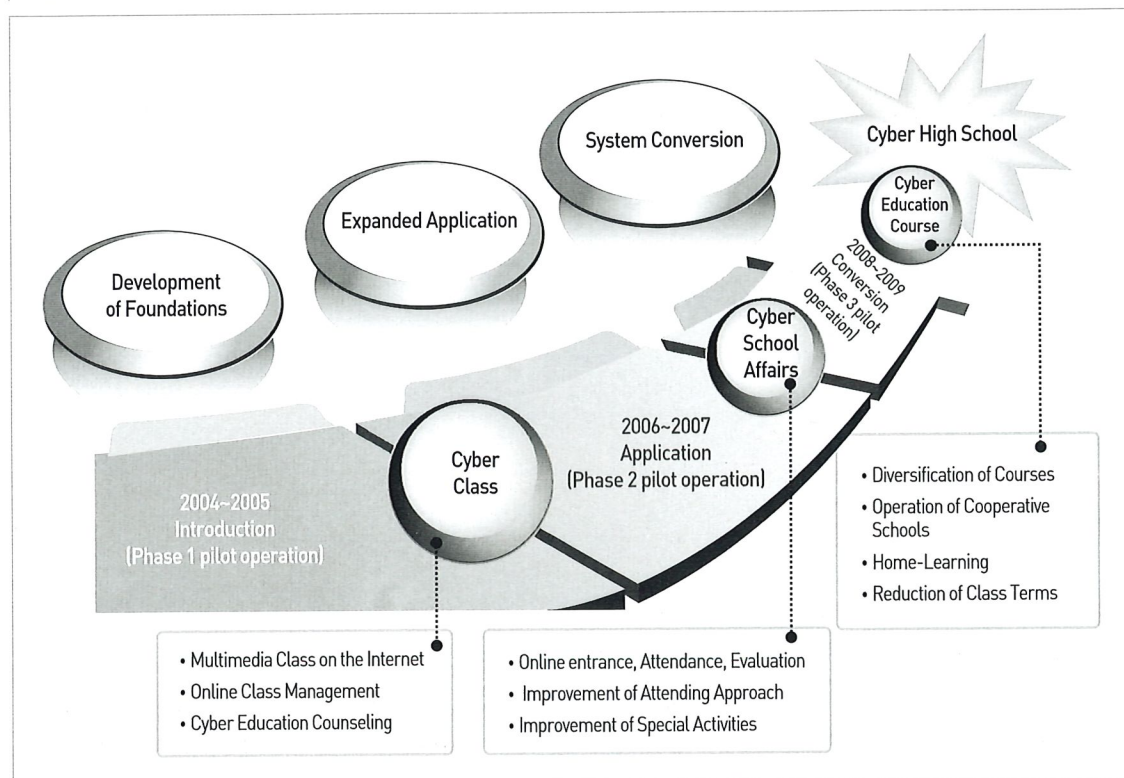# III. Adapting ICT in Lifelong Education

1. Distance Education

A. Operation of Broadcast & Correspondence High School

The Broadcast and Correspondence High School (BCHS) established "the five-year plan for cyber high schools" to overcome the limitations of the existing unilateral radio teaching and activate the bilateral Internet-based learning with a focus on moving pictures without limitations of space and time. Accordingly, the "project for development of the BCHS cyber education system" is being promoted from 2004 to 2008 with the

[Figure 19] Plan on Development of Cyber Education System for BCHS

- Development of Foundations
- Expanded Application
- System Conversion
- Cyber High School
  - Cyber Education Course
- Cyber School Affairs
- Cyber Class

2004~2005 Introduction (Phase 1 pilot operation)

2006~2007 Application (Phase 2 pilot operation)

2008~2009 Conversion (Phase 3 pilot operation)

- Multimedia Class on the Internet
- Online Class Management
- Cyber Education Counseling

- Online entrance, Attendance, Evaluation
- Improvement of Attending Approach
- Improvement of Special Activities

- Diversification of Courses
- Operation of Cooperative Schools
- Home-Learning
- Reduction of Class Terms

support of the Ministry of Education & Human Resources Development and the metropolitan and provincial offices of education.

In particulars, the improvement of the digital environment, the establishment of a cyber education system for BCHS, development of information infrastructure, and preparation of item pools have been promoted. In the future, based on the pilot project titled "operation of model schools in preparation for cyber school affairs of BCHS" to be conducted for two years from 2006, most school affairs, including general administration, such as admission, transfer, and graduation, and online evaluation and attendance management, will be managed through the Internet [Figure 19].

B. Adapting ICT in Vocational Education

Since the concept of vocational education is considered to be broad and varied, vocational education is limited to the education and training directly related to employment and self-development. Vocational education covers vocational training information services (providing information on training programs) as well as a national human resources information system (managing and publicizing overall plans on manpower supply and demand on the country level). At present, there is Careernet (www.careernet.re.kr), providing guidance and counseling on employment;

Cylearn (www. cylearn.re.kr), an integrated system providing the information on teaching and learning of vocational education; and the National Human Resources Information System (NHRD-Net:www.nhrd. net) [Figure 20]. It is necessary to link labor market information to the educational market information, connect various vocational education organizations, provide vocational education information at the regional level, and develop high-quality content for vocational education.
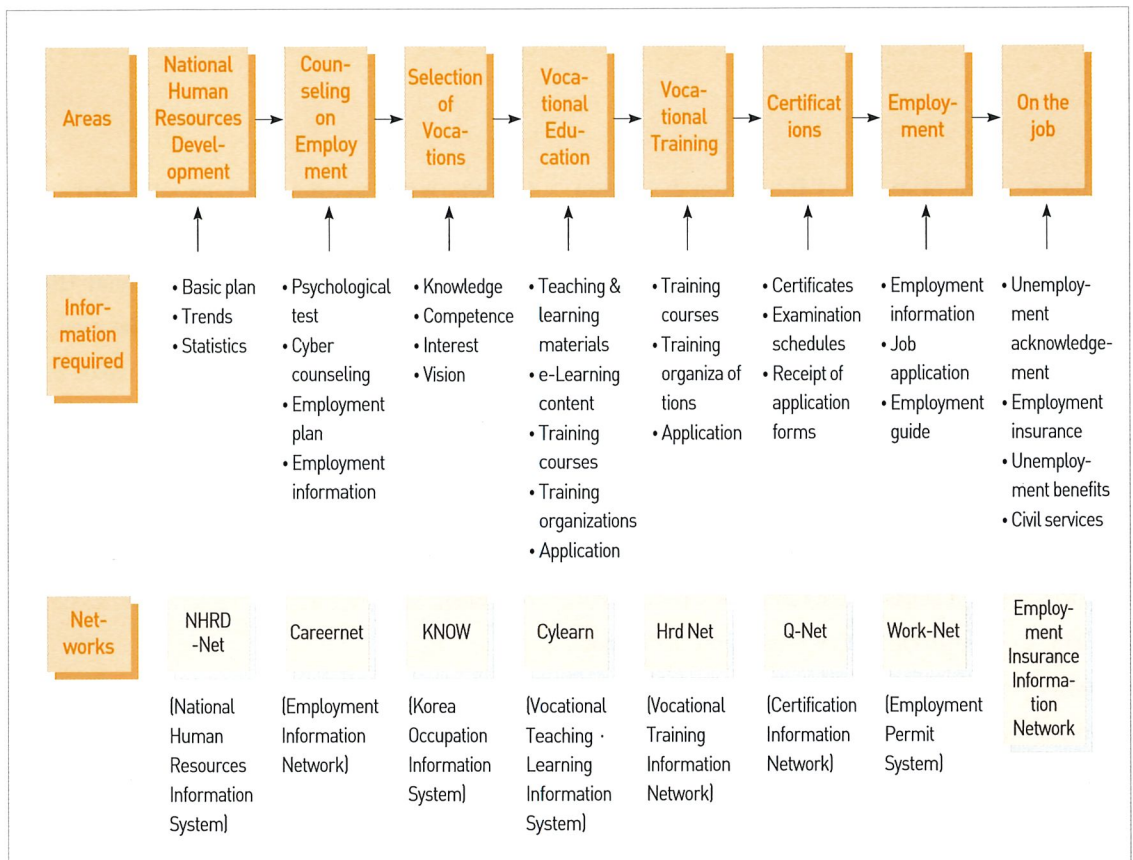
C. Operation of Korea National Open University

The Korea National Open University ("KNOU"), established in 1972, has about 200,000 enrolled students, which is the first and largest distance learning higher education institution. For the past 30 years, KNOU has provided opportunities for higher education through distance learning. KNOU has utilized various media resources for teaching, including TV, radio, teleconferencing, and cassette tapes, for effective and efficient education. In addition, it has maintained its educational fees at a relatively low level, allowing the underprivileged to have access to educational opportunities.

In particular, it has successfully introduced the so-called "tutor system," which was expanded to all

[Figure 20] Areas of Vocational Education Information Network and Relevant Networks

Areas	National Human Resources Development	Counseling on Employment	Selection of Vocations	Vocational Education	Vocational Training	Certifications	Employment	On the job
Information required	• Basic plan • Trends • Statistics	• Psychological test • Cyber counseling • Employment plan • Employment information	• Knowledge • Competence • Interest • Vision	• Teaching & learning materials • e-Learning content • Training courses • Training organizations • Application	• Training courses • Training organiza of tions • Application	• Certificates • Examination schedules • Receipt of application forms	• Employment information • Job application • Employment guide	• Unemployment acknowledgement • Employment insurance • Unemployment benefits • Civil services
Networks	NHRD-Net (National Human Resources Information System)	Careernet (Employment Information Network)	KNOW (Korea Occupation Information System)	Cylearn (Vocational Teaching · Learning Information System)	Hrd Net (Vocational Training Information Network)	Q-Net (Certification Information Network)	Work-Net (Employment Permit System)	Employment Insurance Information Network

departments. In addition, it has focused on international exchanges. Since the first establishment of a sister school relationship with an American university in 1984, it has set up such relationships or signed MOUs with 12 cyber universities by 2006 <Table 26>. In addition, KNOU has participated in the Asian Association of Open Universities (AAOU) as a member or Chair University.

⟨Table 26⟩ Sister Relationships with Overseas Cyber Universities, 2006

No.	Country	University	Date
1	The Netherlands	Dutch Open University	April 17, 1987
2	Taiwan	National Open University	December 7, 1994
3	Malaysia	Open University Malaysia	November 15, 2005
4	USA	Mississippi State University Continuing Education	April 12, 1984
5	UK	The Open University	June 11, 1996
6	Israel	The Open University	May 17, 1995
7	China	Jilim Broadcast Television College	August 26, 1996
8	China	Yanbian University	April 7, 1993
9	China	Shanghai TV University	November 7, 2003
10	Thailand	Ramkhamjaeng University	June 26, 1985
11	Thailand	Sukhothai Thammathirat Open University	April 8, 1997
12	Pakistan	Allama Iqbal Open University	October 30, 1986
	Total	**12 Universities**	

2. Operation of Information System

A. Operation of a Lifelong Education Information system

Since the enactment of the Lifelong Education Act in 1999, the Ministry of Education & Human Resources Development established a centralized Lifelong Education Bureau in cooperation with the Korean Educational Development Institute and designated 25 regional information centers and 297 lifelong learning centers in 16 metropolitan and provinces (as of April 2006) in order to promote lifelong learning. The Lifelong Education Bureau researches lifelong education policies, develops partnership with other organizations, forms lifelong learning networks, and cultivates people for activation of lifelong learning [Figure 21].

Lifelong education organizations include metropolitan or county offices, provincial libraries and museums, colleges, cultural centers, the media, non-government organizations, and private educational centers. In addition, the national project to set up lifelong learning cities resulted in 33 lifelong learning cities in 2005. The number of lifelong learning cities was increased to 57 in 2006. Lifelong education centers
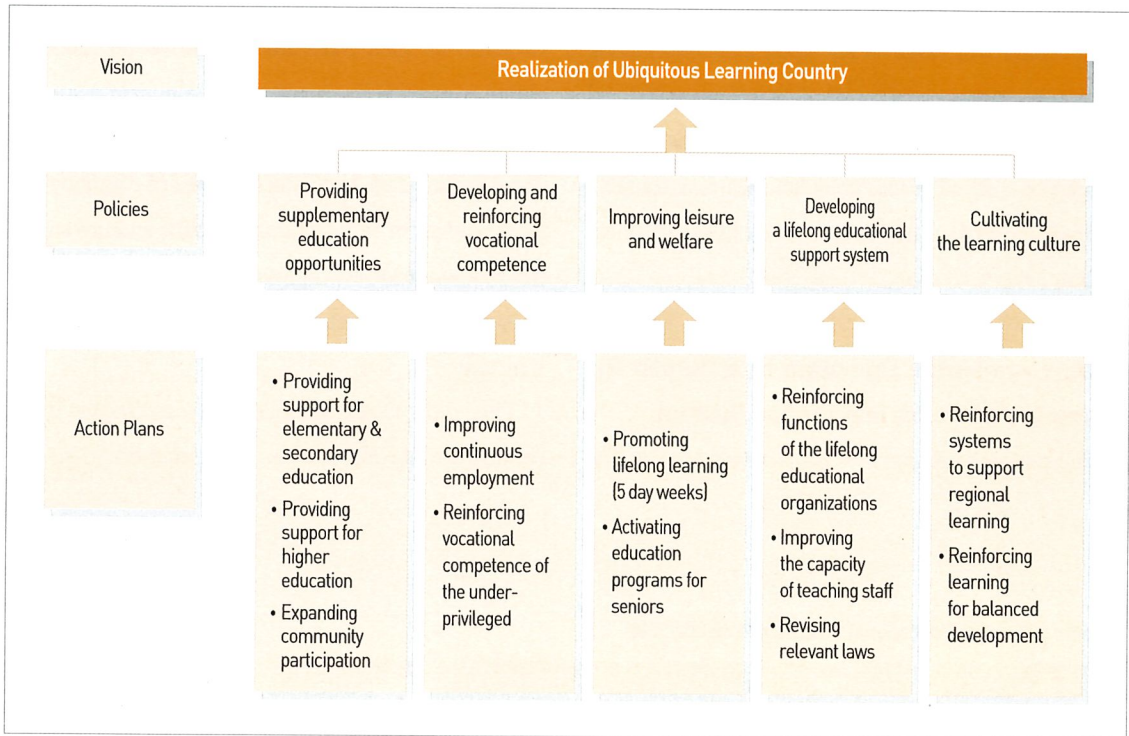
[Figure 21] National Lifelong Education System

are trying to develop lifelong learning, in cooperation with the lifelong learning city, and councils of city, and county, or district governments.

The lifelong education information network was developed to improve the quality of life, help the people to accomplish their goals, contribute to social development and country competitiveness, and realize the vision of a "ubiquitous learning country" through lifelong learning activities [Figure 22]. Major projects include the integrated literacy information system, credit bank system, lifelong education information system, learning city network, and lifelong education

statistics information system.

In the future, the lifelong education information network has to focus on its vision (realization of a ubiquitous learning country) and policies (providing supplementary education opportunities, developing and reinforcing vocational competence, expanding leisure and welfare, developing the lifelong education supporting system, and cultivating the learning culture). To accomplish these visions and policies, it is necessary to secure funding and improve relevant laws and systems. In addition, it is essential to develop a cooperative system between interested parties to collect specific data

[Figure 22] Vision, Policies, & Action Plans of Lifelong Education Network

Vision	Realization of Ubiquitous Learning Country

Policies	Providing supplementary education opportunities	Developing and reinforcing vocational competence	Improving leisure and welfare	Developing a lifelong educational support system	Cultivating the learning culture

Action Plans	• Providing support for elementary & secondary education • Providing support for higher education • Expanding community participation	• Improving continuous employment • Reinforcing vocational competence of the under-privileged	• Promoting lifelong learning (5 day weeks) • Activating education programs for seniors	• Reinforcing functions of the lifelong educational organizations • Improving the capacity of teaching staff • Revising relevant laws	• Reinforcing systems to support regional learning • Reinforcing learning for balanced development

[Figure 23] Goals and Tasks of the BCHS Support Center in 2006

Cyber High School Realizing SA

2008   Full-Scale Conversion into Cyber Education System

Successful Introduction of Cyber Education System   Increase of Beneficiaries

Development & Operation of Cyber Education System

Promotion

Basic Research & Improvement of the Relevant Laws and Systems

Substantiation of Cyber Education System

and information, activate research activities, and provide lifelong learning information to the people. Such efforts will result in an "open total information system for lifelong education" allowing integrated and systematic education in homes, society, schools, and companies and realize the "ubiquitous learning country" that will contribute to the nation's competitiveness [Figure 23].

B. Development & Operation of a Human Resources Statistics Information System

The educational statistics project was launched to support research on advanced education policies and to globalize and advance the compilation of educational statistics. Its main goals are to improve the country's global competitiveness and develop human resources policies in a scientific way, to quickly provide educational statistic data, to conduct analysis of education and labor markets in an integrated approach and investigate the root cause of unemployment, and to develop the cooperative network for exchange of educational statistics.

The main tasks in 2006 were to improve the reliability and utilization of basic education and

⟨Table 27⟩ Major Educational Statistics Projects, 2006

Category	Projects	Description
Adapting ICT in Education	Statistical research and publication of research documents	• Basic statistical investigation of schools and administrative organizations • Publication of education statistics, executive summary of education statistics, and analysis of education statistics
	Maintenance of educational statistics system and electronic equipment	• Maintenance of electronic resources required for education statistics • Support to operation of system and database according to the results of the statistical investigation • Strategic Adapting ICT projects to investigate the feasibility of linkage with NEIS
	Educational statistics upgrade	• Upgrade of web-based system for investigation of higher education organizations • Needs analysis for upgrade of annual reporting system for higher education organizations
	International education indices development	• Educational statistics projects with OECD, UNESCO, and other international organizations • Publication of translated OECD document relating to education indices (2006) • Publication of translated OECD's education policy reports • Analysis of IMD's education competitiveness indices
Human Resources Information Network	Upgrade and maintenance of national human resources statistics information system	• Statistical research of employment (graduates from higher education organizations) • Publication of annual employment statistics and employment statistics analysis • Statistical research of employment (graduates from general graduate schools)
	Statistical research and publication of research documents	• Improvement and addition of items to investigate collegian employment • Operation of automatic students sampling program for validation • Maintenance of infrastructures and systems (H/W, S/W, N/W) for statistical data on national human resources

employment data, to shift away from the offering of quantitative statistical data obtained mainly from investigational activities to analysis and forecasting services; to develop the infrastructure for forecast of manpower supply and demand, including data on shift from schools to labor market; and to reinforce the analysis of the OECD's international education indices <Table 27>.

Adapting Education to the Information Age
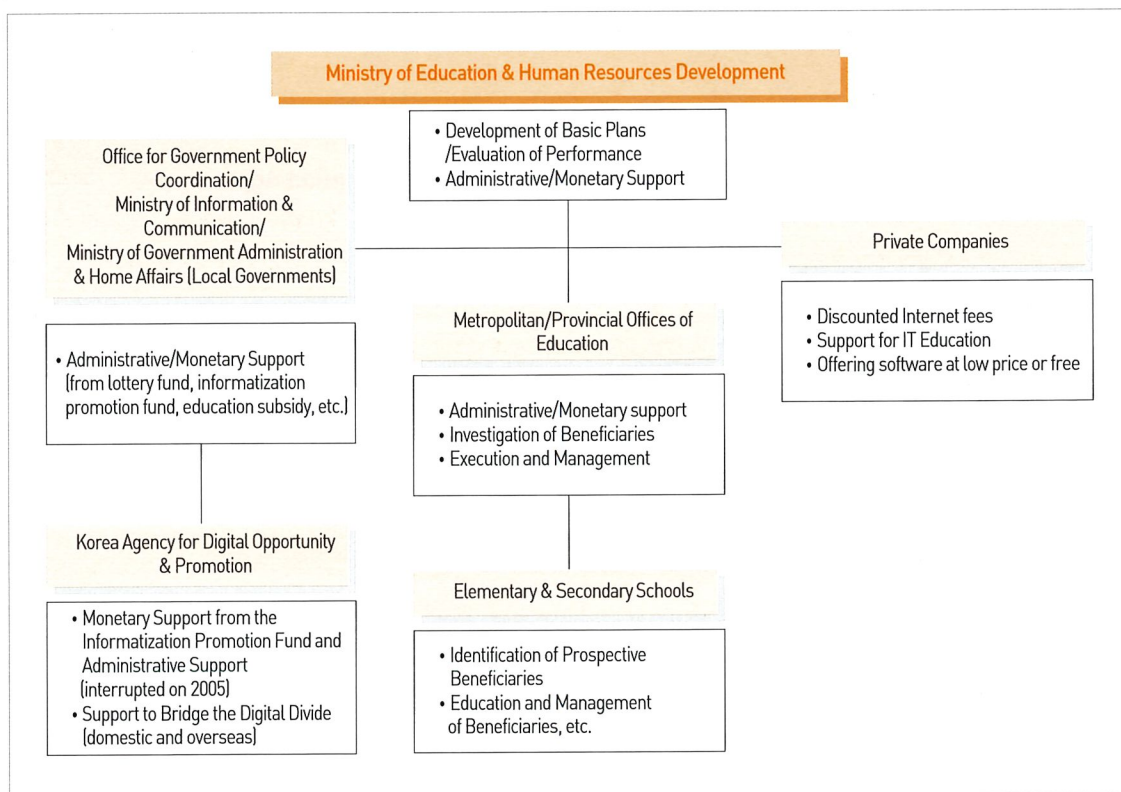
IV. Education Welfare & Information Culture

1. Education Welfare

A. Support for Children from Less-Privileged Families

In order to resolve the digital divide problem, the Korean government enacted the "Act for Bridging the Digital Divide" (Act No. 6356) on January 2001.

In addition, the Ministry of Education & Human Resources Development developed the plan on distribution of computers and offering of ICT training programs to children from lower-income families on April 2000. This project is to select 500,000 less-

[Figure 24] Adapting ICT in Education to Children from Less-Privileged Families

Ministry of Education & Human Resources Development

- Development of Basic Plans /Evaluation of Performance
- Administrative/Monetary Support

Office for Government Policy Coordination/ Ministry of Information & Communication/ Ministry of Government Administration & Home Affairs (Local Governments)

- Administrative/Monetary Support (from lottery fund, informatization promotion fund, education subsidy, etc.)

Korea Agency for Digital Opportunity & Promotion

- Monetary Support from the Informatization Promotion Fund and Administrative Support (interrupted on 2005)
- Support to Bridge the Digital Divide (domestic and overseas)

Metropolitan/Provincial Offices of Education

- Administrative/Monetary support
- Investigation of Beneficiaries
- Execution and Management

Elementary & Secondary Schools

- Identification of Prospective Beneficiaries
- Education and Management of Beneficiaries, etc.

Private Companies

- Discounted Internet fees
- Support for IT Education
- Offering software at low price or free

privileged children to provide training courses to on basic ICT and to provide PCs and Internet access cost to young people who are the sole providers for their families, students in welfare organizations, and those with good academic records <Table 28>.

The government's project to support less-privileged children in this way has delivered positive results. In view of this success, it is thought that this project should be continuously expanded. To this end, it is necessary to secure financial resources and develop effective management of beneficiaries. Based on results in 2005, some important issues can be summarized as follows;

First, it is important to develop various measures for securing financial resources and reducing budgetary expenditure through expansion of funds and subscriptions from self-governing bodies.

Second, a follow-up management and support system needs to be developed for effective utilization of the PCs provided for learning purposes.

Third, it is necessary to develop measures for reducing the administrative burdens of the city or provincial governments because of the increasing number of beneficiaries.

B. Adapting ICT in Special Education

The goal of adaption ICT in special education is to use ICT devices and programs for disabled students to take part in learning activities. It focuses on providing ICT-based support to those students, their teachers, and their parents.

This project has three goals; guaranteeing the rights of the disabled to education; developing and distributing teaching and learning materials for disabled students; and developing the educational content for cyber training programs and operation of distance learning education and training centers.

⟨Table 28⟩ Offering of PCs to Children of Lower-Income Families, 2004 ~ 2005   (unit: persons)

Items	2004	2005
Planned	20,000	20,000
Provided	20,408	20,408
Percentage	102%	102%

〈Table 29〉 **Provision of PCs for School Children, 2005** (unit: persons)

Schools	Types of Beneficiaries						
	Breadwinners for their families	Those in welfare organizations	Beneficiaries of the basic living guarantee system	Those from single parent families	Those from families with a disabled parent	Others	Total
Elementary	576	220	6,684	2,117	655	2,613	12,865
Middle	460	134	4,272	1,443	396	2,098	8,803
High	267	70	1,662	651	195	795	3,640
Others	26	136	110	20	115	27	434
Total	1,329	560	12,728	4,231	1,361	5,533	25,742
Percentage	5%	2%	49%	16%	5%	21%	100%

※ Those categorized as "sole providers for their family" or "those in welfare organizations" also fall into the category of "beneficiaries of the basic living guarantee system".

This project for ICT in special education was evaluated by an outside organization. According to this evaluation, its goals and policies are appropriate, but some activities, such as the supply of ICT devices to the disabled, overlap with those conducted by the Ministry of Information & Communication. Therefore, the evaluation report recommended that such over- lapping areas be coordinated through cooperation between those interested parties.

In the future, this project will focus on expansion of e-Learning and educational opportunities for the disabled, operation of distance learning education and training centers to improve the teaching-learning methods and the awareness of the disabled. The project will also hold ICT in special education conventions to improve the ICT competencies of disabled students and teachers, spread the benefits, and develop and supply ICT devices for the disabled to bridge the digital divide as shown in Table 30.

First of all, the number of e-Learning portal site users is expected to increase to 320,000 within a year, in order to expand e-Learning for the disabled. Support will be provided to develop teaching and learning materials for the deaf and six software products for teachers in the special education field. In addition, the operation committees of the special education portal site (www.eduable.net) will be strengthened, digital libraries will be expanded, system functions will be improved, the system for sharing of quality educational materials will be developed, and research on ICT in special education will be conducted.

Second, for operation of distance education & training centers to improve the teaching/learning methods for the disabled, five cyber training content will be developed, training will be provided to 1,200 persons in a year, and LMS functions will be improved. In particular, with regard to the operation of distant education & training centers, the development of various cyber job training content in 2006 satisfied some needs of standard teachers, special teachers and

⟨Table 30⟩ Offering of ICT Devices to the Disabled and its Utilization: 2002~2005 (unit: %)

Category	Distribution of Computers				Utilization of Computers				Utilization of the Internet			
	2002	2003	2004	2005	2002	2003	2004	2005	2002	2003	2004	2005
The non-disabled	78.5	77.9	77.8	78.9	63.0	66.7	68.8	73.3	59.4	65.5	70.2	72.8
The disabled	56.4	57.9	62.3	66.2	24.1	29.2	35.3	42.4	22.4	27.6	34.8	41.0
Gap	22.1	20.0	15.5	12.7	38.9	37.5	33.5	30.9	37.0	37.9	35.4	31.8

Source: Korea Agency for Digital Opportunity & Promotion, 2002~2004 Study on Digital Divide of the Digital Less-privileged, 2005 Study on Digital Divide of the Disabled, National Internet Development Agency of Korea, 2001~2005 Study on Informatization Level

their assistants, and parents. However, it is necessary to continue the cyber training of standard teachers to help them to better understand the needs of disabled students and the characteristics of special education and prepare the foundation for integrated education. Cyber training of special teachers is also important to improve their teaching and learning competence.

Third, national ICT in special education conventions and national e-sports festivals for disabled students will continue to be held in order to provide disabled students opportunities to improve their ICT competency. In addition, efforts to bridge the digital divide and improve the understanding of disabled students will be continued in cooperation with media and Broadcasting companies. In addition, the so-called "ICT in special education study group" will be organized to expand the scale of the national ICT in special education convention that bridges the digital divide between disabled and non-disabled students.

Fourth, more than three cooperative projects with interested organizations will be initiated in order to establish and expand the cooperative system among relevant organizations and promote efficient and substantial projects.

Problems raised in the course of projects in 2006 include the insufficient education service for the seriously disabled students, lack of channels to provide information on special education, distribution of supportive communication devices developed under the ICT in education projects, and lack of professional staff required to operate the expanded systems. To solve these problems, efforts will be made to promote "the Cyber Home Learning System" for constant offering and utilization of educational content for disabled students, develop the community for special education teachers, improve the systems to encourage the utilization of supportive communication devices, and increase the professional staff required for efficient and stable system operation.

C. ICT Education for the Disabled

The government has conducted ICT training activities for the disabled from 1999. In order to improve the ICT competency of the disabled. Disabled students and citizens need to be encouraged to adapt to the knowledge and information society, and their participation in social and economic activities should be promoted.

The ICT training for the disabled is conducted in various ways, such as collective training at designated ICT training locations, one-on-one training by visits to the seriously disabled, and specialized programs for the disabled with ICT competency to cultivate ICT professionals.

The number of trainees participating in the ICT education for the disabled was only 3,099 in 1999. However, the number had significantly increased to 65,046 by 2004. As of July 2006, a total of 297,000 disabled people took part in the ICT training courses.

The Ministry of Information & Communication will henceforth provide the ICT training courses to 400,000 persons for the next five years to bridge the digital divide. In addition, in order to improve efficiency and encourage more disabled persons to participate in social activities, training through visits and in-depth ICT training will be expanded.

In order to accomplish the above plan, the following measures will be taken:

First, customized education programs will be developed, taking into consideration the type of disability to satisfy the various needs of the disabled.

Second, training through visits to the seriously disabled will be continuously expanded, instructors suitable for customized training will be cultivated, and various continuing education and training will be provided to the instructors. In addition, the so-called "information desk" which provides various services, such as repair and installation of computers, ICT devices, and software products, for the seriously disabled will be activated and total services comprising telephone counseling, visiting services, and education support will be provided.

Third, specialized in-depth ICT training programs for the deaf − such as cultivation of programmers, mobile experts, and web experts will be developed to help the disabled graduating from higher education to get jobs or start their own companies.

Fourth, special education organizations will be periodically evaluated to recommend measures for their development. Periodic fact-finding surveys, satisfaction surveys, research on teaching approaches according to the type of handicaps through the working committee of the adapting ICT in education for the disabled, and others will continue.

2. Information Culture

A. Privacy Protection

Since more intelligent and automated hacking and virus spreading has become a major concern due to their potentially devastating consequences, it is necessary to reinforce the protection of private information. Although it is very important for educational institutions to protect privacy data, they do not have an integrated system for security and privacy protection. Therefore, it is time to develop a protective system against various threatening factors. The number of incidents and accidents affecting educational institutions has been greatly increasing, with the highest frequency among all public organizations.

Opinion surveys, researches and discussions have been held among interested agencies to seek ways to better protect private information held by educational (administrative) organizations. In addition, major tasks for protection of information include the establishment of a dedicated data protection unit, reinforcement of the security infrastructure, improvement of legal and institutional systems, and the promotion of sound cyber culture.

B. Security of Educational Cyberspace

With the spread of the Internet, cyberspace is becoming like a second living space. However, several unexpected problems have also arisen and it is thus necessary to develop measures to prevent and resolve such problems. These problems are causing considerable damage to individuals as well as communities and are serious obstacles to the spread of a sound information culture. In order to resolve such problems, several government agencies, including the Ministry of Information & Communication, Ministry of Education & Human Resources Development, and Ministry of Culture & Tourism, have promoted various projects focusing on the development of security policies.

Major problems include Internet addiction, cyber crime, and spam mail <Table 32>. Government agencies have taken various actions, such as educational activities for the prevention of Internet addiction, preparation of flash animation products for educational purposes, and development of a spam blocking system, to accomplish security in educational cyber space.

〈Table 31〉 Utilization of the Internet by Age, 2005

Age Groups	6 - 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
Utilization rate	97.8%	97.9%	91.0%	68.7%	35.7%	11.9%

Sources : National Internet Development Agency, December 2005

⟨Table 32⟩ **Degree of Internet Addiction**   (unit: %)

Category	Cases	High-risk group	Potentially at-risk group	General group
Elementary students	633	1.9	12.2	85.9
Middle school students	432	2.1	12.5	85.4
High school students	462	3.9	13.6	82.5
Total	1,527	2.6	12.7	84.7

Source : National Internet Development Agency, December 2005

C. Laws and Institutional Systems Relating to Adapting ICT in Education

The adapting ICT in Education Act was enacted to establish a legal basis for adapting ICT in education to ultimately realize or accomplish educational of philosophy, values, and objectives. In other words, the Adapting ICT in Education Act is an essential foundation for adapting ICT in education to provide equal opportunities for education, high-quality education services, and bridge the educational divide.

Although various information systems have been newly introduced, satisfactory legal systems are not fully developed for their effective management. This has lead to duplicated investment and insufficient linkages between systems. As a result, the Act on Efficient Introduction & Operation of Information Systems at Public Organizations (No. 7816) was enacted on December 30, 2005 and came into effect in July 2006. Its role is to facilitate the efficient configuration and utilization of the ICT architecture, establish the system for supervision of the ICT infrastructure, and provide the basis for efficient introduction and operation of information systems at public organizations. In addition,

in order to protect youth from harmful materials, the Act on Promotion of ICT Network Utilization & Protection of Information (Article 44-3) states that ICT service providers have to voluntarily delete any materials that are posted on any web site without measures to limit youth access and which might be in appropriate for children. Further, the acts of illegally collecting and using personal data, such as resident registration numbers (Article 49-2 of the Act on Promotion of ICT Network Utilization & Protection of Information), hiding the sender's identity while sending advertising information (spam) through e-mail or mobile phone, and providing advertising information for illegal purposes (such as spam mail) (Article 50-8 of the ICT Network Act) are prohibited in accordance with said Act.

⟨Table 33⟩ Educational Content for Prevention of ICT's Adverse Effects

	2003		2004		2005
1	Production & distribution of viruses	1	Cyber sexual violence	1	Ethics: cellular phones
2	Theft of game items	2	Copyright infringement	2	Financial deception on the Internet
3	Distribution of obscene material	3	Fraudulent transaction using cellular phones	3	Excessive investment in cyber money
4	Fraudulent sale of game items	4	Spam messages: cellular phones	4	Creation & distribution of bizarre photos
5	Distribution of illegal copies	5	Internet addiction	5	Cyber kangaroo court
6	Privacy	6	Distribution of false information	6	Chatting addiction
7	Spam	7	Privacy	7	Obscenities addiction
8	Slander	8	Language ethics	8	Online game addiction
9	Linguistic violence			9	Community addiction
10	Fraudulent transactions on the Internet			10	Online shopping addiction

Source: Korea Agency for Digital Opportunity & Promotion

2006

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V. Future Education & e-Learning

1. Management of e-Learning Quality

A. Quality Assurance of e-Learning

As e-Learning becomes a new educational paradigm in the knowledge-based society, most countries are actively adopting e-Learning programs.

In addition, with the rapid spread of e-Learning, the demand for quality management of e-Learning is also increasing. For e-Learning in the public education

[Figure 25] e-Learning Quality Management System (proposed)

sector, if the Ministry of Education & Human Resources Development takes the responsibility for quality management, the efficiency, effectiveness, and quality level of e-Learning will be guaranteed. The needs and backgrounds for quality assurance of e-Learning can be summarized as follows:

First, it is necessary to develop policies on quality management of e-Learning at the national level in order to assure continuous improvement of e-Learning. The quality aspect of e-Learning may be treated with less regard, which can become an obstacle to the greater development of e-Learning.

[Figure 26] Roadmap for Quality Management of e-Learning

Integrated Quality Management
[Phased integration]

Expansion Phase (from 2008)

* Targets: K-12, Higher Education, Lifelong Education
* Operation: National e-Learning Quality Management System

Establishment Phase (2007)

* Targets: K-12, Higher Education
* Operation: Development and Pilot Operation

Introduction Phase (2007)

Second, it is necessary to use e-Learning as a core driving force to reinforce the country's competitiveness. Several international organizations, such as UNESCO and OECD, recommend adoption of guidelines on quality management of higher education in order to assure quality management with international transparency beyond national borders.

Third, it is necessary to reinforce the quality management system to assure the people's right to learn and give people more confidence in e-Learning. To protect learners from poor e-Learning services, it is essential to improve its effectiveness and reliability through quality management.

B. e-Learning Standardization

Standardization of e-Learning systems will facilitate the sharing and distribution of educational resources. In addition, standardization may result in the investment of more efforts and resources in improvement of learning effectiveness and development of higher-quality contents. Moreover, it may improve the reusability and interoperability of educational content and systems.

The need for e-Learning standardization is closely related to changes in off-line education and the shift to cyber education. For example, in order to develop a system that is able to provide an optimized and personalized learning experience to the learners taking into consideration their personal characteristics and levels, standardized technology is an essential factor. Such systems can be realized through interaction of various systems for learning, educational content, and data on learners' profiles and levels.

It is expected that the concept of ubiquitous education will be actively introduced to the learning field. In the ubiquitous learning environment, people will use various ICT resources and tools to obtain, utilize, and create data and information through the self-learning process. Such changes in learning activities are closely related to technological developments. In this regard, various research activities relating to futuristic contents or next-generation learning models will resolve the present educational problems through adoption of ICT.

Therefore, appropriate understanding of e-Learning standardization and development of original technology will improve the country's competitiveness, especially educational competitiveness. Indeed, most developed countries known to lead the ICT in education trend, such as the USA, Europe, and Japan, have concentrated on R&D of original e-Learning technology with the goal of accomplishing e-Learning standardization within three to five years.

In conclusion, there is no option but to develop and implement e-Learning standardization technology. It is especially important for all government agencies to consistently develop and implement e-Learning standardization policies. In addition, resources should be concentrated on the strategic development of e-Learning standardization technology.

2. Globalization of e-Learning

A. International e-Learning Partnerships

The success of Korea's various adapting ICT in education and e-Learning projects has attracted the global community's attention. Furthermore, globalization of e-Learning has been increasingly attempted at the national level. In order to satisfy the expectations of the global community and reinforce Korea's position as a leading e-Learning country, the Ministry of Education & Human Resources Development has actively promoted projects for globalization of e-Learning since 2005, in cooperation with the Korea Education & Research Information Service, metropolitan and provincial offices of education, and other related organizations <Table 34>. For globalization of e-Learning, the e-Learning International Cooperation Center was established in October 2005, with its office at the Korea Education & Research Information Service. In February 2006, the e-Learning Globalization Strategy was determined.

The vision of the e-Learning Globalization Strategy is for Korea to become a global e-Learning partner through the reinforcement of e-Learning capacity, resolution of the digital divide, and international cooperative research on e-Learning.

At present, various adapting ICT in education projects are being promoted with APEC, ASEM, OECD, UNESCO, and World Bank. In particular, Korea is taking a leading role in projects initiated by APEC and will continue to lead international projects for adapting ICT in education.

B. Support for Adapting ICT in Education Projects in Developing Countries

As more countries hope to benchmark Korea's success adapting ICT in education, projects to support adapting ICT in education efforts in developing countries have been initiated as a part of the e-Learning Globalization Policy in order to improve the brand value of Korea and develop an international e-Learning consulting system.

These projects initiated in 2005 are said to be successfully introducing Korean e-Learning to developing countries and creating favorable opportunities for Korea. To date, it is estimated that the various types of support measures, such as the supply of refurbisbed PCs and training of teachers. Particularly, the supply of refurbisbed PCs has obvious advantages in light of the reuse of resources and creation of jobs (for about 100 persons) to repair used PCs. In addition, it has helped developing countries to use them for training in computers and ICT.

C. Support of Adapting ICT in Education for Overseas Koreans

KOSNET (Korean Language Study on the Internet, http://www.kosnet.go.kr) is an online Korean language program for overseas Koreans and foreigners, which is

〈Table 34〉 MOUs between the Ministry of Education & Human Resources Development or the Korea Education & Research Information Service and Foreign Organizations

Category	Foreign Organization	Date	Description
Ministry of Education & Human Resources Development	Microsoft	2006. 5. 25	- Cooperation in holding Imagine Cup 2007 - Supporting u-Learning projects
Korea Education & Research Information Service	China Academic Library & Information System	2005. 11. 23	- Sharing of academic information and connection of systems
	Education.au, Australia	2005. 11. 23	- Cooperative research of e-Learning and joint holding of international events
	Learning Innovation Center, Stanford University, USA	2005. 12. 6	- Cooperative research of e-Learning and joint holding of international events
	USSL (U.S. Satellite Laboratory), NASA, USA	2006. 3. 9	- Sharing of e-learning content (science, mathematics) - Sharing of learning materials and curriculum
	ADL Co-Lab, USA	2006. 3. 10	- Cooperative research and development on SCORM standardization - Cooperative relationship as a member of Academic ADL Co-Lab

operated by the National Institute for International Education Development. KOSNET, the first attempt to teach Korean on the Internet, had 7,100 registered users and more than 420,000 visits as of 2001. As such, it's a pioneer in the field of online Korean language study.

Unlike other Web sites for studying Korean, KOSNET has some differentiated features as follows;

First, KOSNET has an independent, mid-range server, providing an excellent environment for users in terms of speed and rich content.

Second, it employs various multimedia technologies for the development of learning materials.

Third, KOSNET is available on four levels according to the learner's age.

Fourth, its textbooks are based on modern, colloquial Korean.

Fifth, the most important feature of KOSNET is its various service languages.

In addition, KOSNET has a varied and unique Q&A function that, though limited, allows for interactive learning activities between learners and administrators.

In addition to KOSNET, there are several Web sites providing services for studying Korean as follows;

a. Korean Studies at Sogang (http://korean. sogang. ac.kr)

"Korean Studies at Sogang" is a Web site for studying Korean operated by Sogang University's Multinet (http://multinet.sogang.ac.kr) and provides

various learning content to help understand Korean and the Korean culture. It provides services for studying Hangeul, the Korean alphabet, for beginners and various step-by-step learning materials. Important words and phrases, and text are displayed in both Korean and English. Furthermore, it has an audio function to help users learn correct pronunciation.

b. Korean Tutor

(http://www.koreantutor. com)

"Korean Tutor" is a web site operated by Seoul National University's Korean Language Education Research Institute to help foreign students to study Korean and provides services in English, Japanese, and Chinese. It provides services for studying the Korean alphabet, basic sentence patterns, and advanced courses (grades 1 to 4). It has a dual membership system, free and paying. Paying members can use various learning materials, including the Korean competence examination, language tour, Korean songs, and folktales.

c. Sun Moon University's Korean Language Ins-
titute (http://www.sunmoon.ac.kr /~koredu)

This Web site uses the Cyber classroom for studying basic Korean and includes writing practice, vocabulary, pronunciation table, and pictures & vocabulary.

d. Korean through English
(http://www.mct. go.kr/hangeul)

This is a web site operated by the Ministry of Culture & Tourism (http://www.mct.go.kr/) and provides services for reading practice and basic conversation texts. Unfortunately, this web site consists mainly of text and does not include any multimedia functions.

e. Talking to Koreans
(http://www.arts.mon ash.edu.au/korean)

"Talking to Koreans" is a web site for studying Korean to provide the independent learning and cooperation environments for students and instructors in close cooperation with the Korean program of Australia's Monash University (http://www.mon ash.edu.au). It has lots of learning materials and resources, including information on courses and useful links.

3. Ubiquitous Learning Society

"Ubiquitous" is a word of Latin origin, meaning "being or seeming to be everywhere at the same time." Currently, "ubiquitous" is widely used as a contracted expression for "ubiquitous computing." Now, ubiquitous technology is becoming a core technology in Korea. As a result, nine u-Learning pilot schools were designated on the basis of wireless Internet, tablet PCs, and PDAs to investigate the potential use and effectiveness of ubiquitous technology in the educational field. U-Learning will enable personalized and customized learning according to the learner's interests, preferences, learning style, and context. In addition, learning activities in different places and at different times can be automatically stored and managed, allowing for integrated and seamless learning. Moreover, easy and fast exchange of information between personal devices will improve the cooperation and interaction among learners, which will realize a truly user-friendly education environment.

Global trends in research on ubiquitous learning are not very different from the abovementioned developments in Korea features. However, overseas countries are focusing more on PDAs. So, they use the term "handheld" instead of "u-Learning." Sometimes, terms like "mobile learning" or "wireless learning" are used. Although some argue that a PDA's monitor is too small to display full texts, there is no need to show the entire contents on the monitor.

The goal of u-Learning is to apply this technology to all courses of study. However, it is mainly used for science education at present. For u-Learning, it is especially important to promote training of teachers because u-Learning will change the future paradigms of teaching and learning.

When considering several case studies, u-Learning in Korea is characterized by its mobility, access, and speed. The features of mobile devices expand the learning places beyond conventional schools and enable learning models characterized by prompt interaction and feedback. It is thus necessary to develop the teaching and learning models, high quality content, and supportive systems for u-Learning.

⟨Table 35⟩ Pilot u-Learning Schools Designated by the Ministry of Education & Human Resources Development and their Main Tasks in 2006

No	City or Province	School	Task	Remark
1	Seoul	Sinhak Elementary School	Investigative application of ubiquitous computing technology to elementary schools	6th, Tablet PC
2	Seoul	Gyeongbok High School	Alternative learning system - three-phase u-learning system	3rd, PDA
3	Busan	Namsan High School	Self-leading learning activity with mobile devices (UMPC)	1st, UMPC
4	Daegu	Daegu Electronic Technical High School	Creating a new exciting school with ubiquitous technology	2nd, UMPC
5	Incheon	Buwon Middle School	Joyful u-school project	2nd, Tablet PC
6	Gwangju	Jeonnam Girls' Commercial High School	Personalized, customized learning with UMPC	2nd, UMPC
7	Daejeon	Dunsan Girls' High School	Development of teaching and learning models with ubiquitous technology	1st, UMPC
8	Chungcheongbuk-do	Heungdeok High School	Investigation of u-learning model with UMPC	1st, UMPC
9	Ulsan	Nongso High School	Development of customized teaching-learning models with U-SRM	1st, UMPC0

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