

A Study on the Current Status and Improvement Plans of ICT Education for Elementary and Secondary Schools in Korea

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Abstract

The purpose of this paper is to present the current status and development plans of ICT education in Korea. So far Korean government has emphasized ICT education since 2000. In this paper, first of all, the basic concepts and areas of ICT education are introduced. Then, current status of ICT education is discussed in terms of ICT literacy and application education. Also, the current status of ICT education for 5 IT advanced countries are introduced. After the current status analysis, various development plans are presented. Those plans include provision of mandatory independent ICT courses, reformation of laws and regulations, development of index on ICT use in education, enforcement of coding education, development of ICT literacy and application index, development of smart education index, development and distribution of e-books, etc.

Keywords : ICT Education, ICT Literacy Education, ICT Application Education, Smart Education

1. Introduction

In current knowledge and information society, the understanding and application of ICT is very important factor to enhance personal, social, and national competitiveness. For personal aspect, ICT literacy and application are essential for one's daily life. For social aspect, ICT becomes very popular communication tool for discussing social issues. On the other hand, ICT industry becomes more important than any other industry in most developed countries.

In knowledge and information society, educational system should be reformed to help every citizen have good level of ICT literacy and application. In Korea, ICT education in elementary and secondary schools is recommended according to “Adapting ICT into Education Master Plan and the Promotion Plan for using ICT in Schools” initiated by MOE & HRD(Ministry of Education and Human Resources Development) in 2000. MEST (Ministry of Education, Science and Technology), has taken over the roles of MOE & HRD since 2007. In

Received (March 08, 2015), Review Request(March 09, 2015), Review Result(March 25, 2015)

Accepted(April 17, 2015), Published(June 30, 2015)

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2013, MOE(Ministry of Education) has taken over roles of MEST. Four goals to be achieved by introducing ICT in education are as follows[1]. First, we encourage ICT application by fostering ICT application capability of teachers and providing education contents to all courses using PCs distributed to all classes and Internet. Second, we need to construct teaching-learning support system for all courses and raise quality of teaching-learning by building distance education support system for remote villages schools and optional courses. Third, we need to support supplementary study and independent study at home by providing autonomous study support system and supplementary class support system for slow learners. Fourth, we need to foster activation of ICT use by establishing policies by specialists on education and by providing systematic teaching-learning methods of ICT education.

This paper is organized as follows. In Chapter 2, the overview of ICT education is introduced. Especially, concept of and necessity of ICT education and three areas of ICT education will be presented. In Chapter 3, the current status of ICT education in Korea is discussed. In Chapter 4, the current status of 5 IT advanced countries are introduced. In Chapter 5, various development plans of ICT education are presented. Finally, we give conclusions and further research issues in Chapter 6.

2. ICT Education Overview

2.1 Concept of ICT Education

ICT education implies education based on computer and communication tools for current knowledge and information society[2]. ICT education can be classified into two categories: ICT literacy education and ICT application education. ICT literacy education means education about computer and information communication. On the other hand, ICT application education is education about applying ICT to problem-solving in daily life as well as courses in various subjects such as math, science, and foreign languages.

The objectives of ICT education are to provide capability for collecting and analyzing information necessary to each individual, and let everyone use this capability to have active and creative life. In order to achieve these objectives, ICT education should be activated in schools.

The necessities of ICT application education are as follows[3]. First, ICT application education provides flexible and various study activities than existing in-class education. Second, ICT application education encourages initiative in study, creativeness and problem-solving capability for students. Third, ICT application education can lead student into active participation in their study through motivation-support.

2.2 Areas of ICT Education

Three areas of ICT education are knowledge, application, ethics, respectively[4].

Area 'knowledge' means overall knowledge about ICT literacy. The literacy usually includes the basic theories on ICT and computer science courses, such as computer architecture, operating system, software engineering, data bases, computer network, and information system, etc.

Area 'application' means how to use ICT in daily life as well as study activity. Typical ability includes how to manipulate application software such as word processor, spreadsheet software, and presentation software, and various authoring tools. Also, programming work is included in the area. In programming work, students are supposed to choose a programming language, and write a program and debug a program if necessary.

Area 'ethics' means information and communication ethics. The information and communication ethics usually includes wide subjects such as personal information security, copyright protection, diagnosis and treatment of internet addiction, cyber crime, and, netiquette etc.

3. The Current Status of ICT Education

3.1 ICT Education Training Guidelines

In 2000, MOE & HRD has announced ICT training guidelines as in table 1[5].

[Table 1] ICT Education Guidelines

School	Training guidelines
Elementary school	<ul style="list-style-type: none">- Be familiar with computer application environments- Foster basic literacy for ICT and apply it to study activities
Middle school	<ul style="list-style-type: none">- Based on contents learned from elementary schools, apply ICT to study activities and problem solving in real life- Foster information communication ethics
High school	<ul style="list-style-type: none">- Apply ICT to the whole life actively

Realizing that it is very important to foster students to have independent thinking and creativeness in the 21st century, in the year of 2000, MOE & HRD has proposed a "Guideline for Adapting ICT into Elementary and Secondary School Education". The guideline emphasizes the followings. First, fostering ICT skills for information processing, second, selecting contents for guiding students to learn knowledge, skills and information communication ethics in balanced manner, third, emphasizing practical ICT use to link different courses with problem-solving ability, fourth, customizing ICT in education with requirements in local communities, educational environments in schools, and student's individual abilities, etc.

3.2 ICT Literacy Education

Current status of ICT literacy education in elementary and secondary schools are as follows.

Elementary school

ICT literacy education in elementary schools has been adopted in 2001 for 1st and 2nd grade, in 2002 for 3rd and 4th grade, in 2003 for all grades, respectively. ICT literacy education was implemented in 12 hours in “Practical Arts” class that is mandatory. Also, the ICT literacy education is performed in, as optional class, “Free Activity Class” for 1st to 4th grade, in “Special Activity Class” or “Free Activity Class” for 5th and 6th grade students, respectively. As a result, the ICT literacy education took at least 34 hours per year.

In 2007 and 2009, there were some changes in ICT education curriculum. According to minor reformation, in 2007, ICT education became one of the elective courses during “Free Activity Class”. In 2009, ICT education can be selected as one of the elective courses in “Creative Experience Activity” class.

Middle school

In middle schools, ICT literacy education, in association with Information Literacy Test, has been started before 7th National Education Curriculum that was initiated in 2000. The ICT literacy education has been implemented in optional “Computer” class. Also, ICT literacy education can be implemented in mandatory “Manual Training” class or “Home Management” class. In this “Manual Training” or “Home Management” class, at least 30 hours were guaranteed for ICT literacy education. At the discretion of principal, the principal was allowed to have special class such as “Free Activity Class” or “Special Activity Class” for ICT literacy education. In 2007 and 2009 education curriculum reform, “Information” subject was created and became one of the elective courses.

High Schools

In high schools, optional “Free Activity” class or “Information-based Society and Computer” class is adopted. For vocational high schools or science high schools, ICT-related special class can be created at the discretion of school principal. If students do not take ICT-related classes, special class such as “Free Activity Class” or “Special Activity Class” can be used to teach ICT literacy education, depending on school principal’s discretion.

3.3 ICT Application Education

According to MOE & HRD plan published in 2000, years of applying ICT application education for elementary school, middle school and high school are summarized in table 2.

[Table 2] Years of applying ICT application education for schools

Year	Elementary school	Middle school	High school
2001	1 st to 2 nd grade	7 th grade	-

2002	1 st to 4 th grade	7 th to 8 th grade	10 th grade
2003	All schools	All schools	10 th to 11 th grade
2004	All students	All students	All students

According to recommendation of MOE & HRD, each course is recommended to include study activities more than 10% ICT activity. That is, each course is required to include ICT - related activities depending on course characteristics and contents of ICT literacy education for students.

4. The Current Status of ICT Education in Advanced Countries

In this chapter, the current status of ICT education in 5 IT advanced countries is introduced. The followings are summarization of ICT education in those countries[6][7].

4.1. United States of America

In USA, ICT education has been considered as basic literacy education that is a part of so called 3R(Reading, wRiting, and aRithmetic) education. Although there is no national curriculum for ICT education, most states have their own curriculum for ICT education. ICT education has been taught as core part in science and technology subject in elementary and secondary schools.

In USA, two are two academic societies that propose the representative ICT education curriculum. They are ISTA(International Society for Teacher Education) and ACM(Association for Computing Machinery), respectively. ISTE(<http://isfte.org>) provides ICT curriculum[8]. The curriculum is proposed for teachers and students. The curriculum aims at balance of knowledge, application, and ethics. On the other hand, ACM provides ICT education curriculum that emphasizes computer science knowledge so that the core computer theory subjects and programming are emphasized[9].

In USA, for elementary schools, the focus of ICT education is on enhancement of the basic information searching ability. In middle schools, new computer technology issues and software application are focused. Finally, for high schools, ICT education curriculum is provided as optional courses for students' interest. Also, there are ICT courses that are related with students' interest and future.

4.2. United Kingdom

In United Kingdom, IT course is included in one of the 11 mandatory courses in national curriculum reform(IT course has been renamed as ICT later). The educational object of ICT education is as follows. First,

it is to improve problem-solving ability using ICT tools and information itself. Second, it is to increase study ability under various situations in daily life. Third, it is to increase understanding of necessity of IT technology in daily life so that students can enhance their ability to use information and ICT tools for problem-solving.

In United Kingdom, prior to the extensive ICT education, national infrastructure has been supported. That is, NGFL(National Grid for Learning) has been constructed from 1997 to 2002. Based on the infrastructure, various software and databases are developed for intensive ICT education. Also, based on the infrastructure, ICT education has been included in national education curriculum.

4.3. Japan

Japan traditionally emphasized technology-related courses in elementary and secondary school. ICT education has been started with 1969 national education reformation. Computer-related courses were emphasized and included in 1998 national curriculum.

In elementary school, various courses such as "Integrated Learning" include computer-related activities. In middle schools, "Information and Computer" subject is obligatorily included in "Technology and Home Economics" In high schools, "Information" course was newly founded and became the mandatory course.

4.4. Singapore

ICT education has been started with 1980 middle school curriculum in Singapore. In 1981, computer science course was included in high school curriculum. In 1985, computer application education has been taught in mathematics courses in elementary schools. In 1994, computer application is taught as a regular course.

The ICT education policy of Singapore has been proceeded as "Master Plan". The First Master Plan(1997-2002) is to provide the basic infrastructure and let teachers prepare ICT education in their classes. The Second Master Plan(2003-2007) is to continue strategy and projects from the First Master Plan, and enhance technology application in education.

The objectives of the Second Master Plans are as follows. First, students can effectively use ICT for their active study. Second, connection of curriculum, teaching-learning, and assessment is tightened. Third, teachers can effectively use ICT for their academic expertise and personal growth. Fourth, schools can have ICT application ability for the development of schools.

4.5. India

Although India is still underdeveloped country, India has recognized importance of IT industry, and supported

fostering of IT human resources. India has established so called STP(Software Technology Parks) policy since 1991. The government-oriented IT upbringing policy has turned national curriculum into IT-oriented education curriculum. In India, algorithm and applied mathematics were included in ICT education curriculum. The main characteristic of Indian ICT education is that programming education is performed first and ICT application education is done later.

In elementary schools, LOGO programming language as well as the basic computer theory is included and taught. In middle schools, application software usage and high-level programming language such as C++ are taught. In high schools, students can select and take the higher-level ICT courses.

5. Development Plans of ICT Education in Korea

In this chapter, some guidelines are proposed to develop ICT education in Korea as follows.

Provision of Mandatory Independent ICT Courses

As discussed in Chapter 4, all of 5 IT advanced countries provide ICT courses in education curriculum as either mandatory courses or mandatory study subjects in mandatory courses. More countries like China and Estonia are making ICT courses mandatory .

The following table 3 shows the summarization of the current status for various IT advanced countries[10].

[Table 3] Summarization of ICT Education for IT Advanced Countries

Country	ICT Education Status
United Kingdom	-Mandatory for elementary and secondary schools
Japan	-Mandatory for middle schools -Make a choice between the two optional courses for high schools
China	-Mandatory for high schools -Optional for 3rd grade in elementary schools to middle schools
Israel	-Mandatory for middle schools -Optional for high schools
India	-Mandatory for elementary and secondary schools

Currently, in Korea, for national educational curriculum, there is no mandatory courses in elementary and secondary schools. In order to expand the base for fostering IT human resources, mandatory courses must be provided for elementary and secondary school students.

Reformation of Laws and Regulations

Currently ICT education in Korea is encouraged and protected by various laws and regulations. Especially,

according to Article 23 of the Basic Law of Education, government and local autonomous bodies need to support educational information projects and support ICT application in education. Also, various policies related to ICT use in education will be established and executed by the governments year by year. Our laws can be classified into two categories, ones for promoting ICT use in education and the others for preventing negative effects stemming from ICT use in education[11].

As of 2015, the names of laws related to the use of ICT in education are as follows. Education Basic Law, National Informatization Law, Lifelong Learning Act, and Higher Education Law, etc. Those laws are established to foster ICT education in the following areas: general education, elementary and secondary education, adult education, lifelong education, educational administration, and information ethics, etc.

Development of Index on ICT Use in Education

According to MOE & HRD's "Adapting ICT into Education Master Plan", ICT index in education for elementary and secondary schools was published in 2001. Index for elementary and secondary schools, higher education, and lifelong education has been completed in 2005. Table 4 shows index for using ICT in elementary and secondary education[12]. The index is now outdated so that it must be updated to reflect the current status in schools.

[Table 4] Index for Using ICT in Elementary and Secondary education

Major area	Sub-category
Deployment	Support, Hardware/Software
Application	Teachers, Students, Internet
Outcomes	Teachers, Students

Enforcement of Coding Education

In addition to provision of mandatory independent ICT courses in national curriculum, coding education must be strengthened. Recently various countries such as United States and United Kingdom enforce coding education in regular curriculum. Over the simple use of application software, more and more people are making their own software by their own coding skills.

Coding education has been for only computer science major students or special interest groups. However, coding education becomes popular with advanced user friendly programming languages as educational programming language. With wide distribution of educational programming languages and 4th generation programming languages, it is easier for the ordinary people to write a code and make their own software.

Development of ICT Literacy and Application Index

In order to check if students and teachers are qualified for their roles, various ICT standards are necessary.

Since ICT technologies are changing quickly, those standards need to be updated regularly. Also, as ICT education is divided into two categories, ICT literacy education and ICT application education, we need two types of standards.

So far, in Korea, two standards have been developed for ICT application[13]. They are called ISSS(ICT Skill Standard for Student) and ISST(ICT Skill Standard for Teacher). Two standards have 4 categories: collecting information, analyzing and interpreting information, sharing and delivering information, and security issues and information ethics, respectively. These two standards were published in 2002 so that they need to be updated.

Development of Smart Education Index

With recent advances in wireless internet technologies, smart education becomes a new paradigm in education. With wide distribution of smart devices and smart application software, smart education becomes more popular and more activated.

With the extensive enforcement of smart education, various indexes must be developed such as smart literacy index for students and teachers, smart contents index, etc. Recently, in [14], quality standards of educational smart contents are developed. In their work, quality indexes of smart contents for teachers and students are developed. As in ICT literacy and application index, the extensive smart education indexes must be developed.

Development and Distribution of e-books

According to [15], MEST will let schools use only e-books by year of 2015. So far many types of e-books such as CD and web contents have been used in classes. However, those e-books are supplementary materials for the existing paper-based textbooks. However, it is expected that demand of e-books is increasing gradually. Before the entire enforcement to use e-books, various laws and regulations need to be updated as well.

6. Conclusions and Further Works

In this paper, the current status of ICT education in Korea is discussed. Our concern is mainly on elementary and secondary schools. For this purpose, the concept and necessity of ICT education and three areas of ICT education are discussed. The current status of ICT education in 5 IT advanced countries are also introduced. Also, development plans for promoting ICT education are introduced. Those guidelines include provision of mandatory independent ICT courses, reformation of laws and regulations, development of index on ICT use in education, enforcement of coding education, development of ICT literacy and application index, development of smart education index, development and distribution of e-book, respectively.

ICT education in Korea has been started since year of 2000. So far, government has an initiative for overall ICT education policies and guidelines. Also, policies such as laws and regulations, supporting programs for

students and teachers, supporting standardization of educational information, providing online comprehensive educational information system service and certification of ICT skills, etc are seemed to be established and improved gradually.

Further works of this study are as follows. First, the extensive survey works will be done for teachers and students in order to check their ICT literacy and application ability. The results will be very helpful to establish ICT education policies. Second, other than students and teachers, more extensive groups such as the disabled and the old will be considered to investigate the current status of ICT education.

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