ICT-Based Education for School Learners in Korea: Policy Development for ICT-Based Education

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〈Abstract〉

Information and Communication Technology (ICT) is an important education media, which is frequently used by children for learning and communication purposes. Thus, children are becoming more comfortable with ICT than ever before. However, there are still some concerns as to whether the ICT-based education really enhances the quality of student learning or if it only makes superficial changes in the ways of student learning. The primary purpose of this study is to identify the specific ways in applying ICT for student learning and to suggest new directions of ICT use for future education in which teaching and learning technologies essentially facilitate students' self-directed learning.

Keywords: educational policy, ICT-based education, educational technology.

1. Introduction

There have always been generation gaps and difficulties in understanding when it comes to talking with teenagers. To make matters worse, there seems to be something more than just generation gaps and misunderstandings when trying to talk with students living in the 21st century. These days, students grow up being surrounded by multimedia and digital devices, and thus, they are very comfortable with the cutting edge technology and with even using small screen devices. Information and Communication Technology (ICT) is not beyond reach when it comes to educational purposes in some societies; it is already an important educational media with which children are getting comfortable and are frequently using for learning and communication purposes. If parents and teachers are not able to cope with the educational needs from their children in transforming education, it is impossible to provide them with equitable and effective learning opportunities in the new millennium era. There are many terms to call students living in the 21st century, such as Homo Zappiens (Veen, 2003), Net Generation (Oblinger & Oblinger, 2005), Screenagers (Schcerer, 2011), and New Millennium Learners (Pedro, 2006).

The New Millennium Learners (NML) read through a screen instead of paper, write by using keyboards or keypads instead of a pen or pencil, and can tap into immeasurable amount of information on the Internet without having to go to the library. They freely use multimedia for multi-tasking, instantaneous communication, and information management in nearly all aspects

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of daily life. Therefore, along with generation gaps and misunderstandings, we have to keep in mind that the means of communication itself has undergone radical changes when we think about appropriate ways of teaching the NMLs.

There are many countries including South Korea where high-technology and multimedia play an essential role in managing the system of the society and education. In most homes and schools, high-speed Internet connection is available, and most people, including children, use cellular phones to access a variety of information and broadly share such information with others. Taking advantage of the groundwork of nationwide information technology, digital textbook, personal digital media, Internet Protocol TV (IPTV), and etc. has been explored for possible use in education during the last half decade.

Many specialists in education and technology have been trying to find effective and efficient teaching methods and techniques for NMLs. Research projects that utilize such multimedia tools have concentrated on investigating the appropriate functions of learning devices, developing applicable teaching methods, improving students' academic performances by learning devices, enhancing students' motivation and attitude, and suggesting solutions to problems that may arise when using these tools in the classroom. However, despite these efforts to improve educational environments through adapting Information and Communication Technology (ICT), there are still some concerns as to whether the ICT-based education really enhances the quality of student learning or makes superficial changes in the ways of student learning. The primary purpose of this study is to identify the specific ways in applying ICT for student learning, to find out possible side effects in ICT-based learning environments, and to suggest new directions of ICT use for future education in which teaching and learning technologies essentially lead to qualitative changes in student learning.

2. National policy for ICT-based education

The educational vision that the Korean government draws in this new millennium year is to educate students to be competent with core academic skills and to be proficient in future digital technology. In order to realize this vision in the near future, the Korean government strategically plans to initiate some changes to the educational system. For example, they are trying to establish a national ICT master plan, operate a student performance assessment system nationwide, and facilitate the decentralized/localized governance in education (Ministry of Education, Science, and Technology, 2010). In this educational reform, constructing ICT infrastructure into the educational system is a precondition for the success of the reform because the primary assumption in future education is that the ICT infrastructure effectively improves students' performance within the learning environments.

In order to establish the ICT-based educational system on a nationwide level, several

Table 1. National Master Plan : ICT in Education (Ministry of Education, 2014)

Classification	Areas	Main Outcomes	Characteristics
Education Converging with Technology (2010~2014)	. Foster the Innovative& Digitally Gifted . Reinforce Advanced R&D Capabilities . Informatization of Communication& Convergence . Establish Information Infrastructure of Education Science &Technologies	. Smart Education Introduced& Applied . Future Education Research & Trial Operation . EduFine & EDS Services . Informatization of Preschool Education	. Readjusting & re-evaluating Master Plans'Time &Scope upon integration of MOE . Instituted Comprehensive Master Plan in Education &Science Sectors
	(Smart Education Strategic Subjects) . Digital Textbooks Developed . Strengthen Online Class Performance & Evaluation . Create Accessible & Free Education Content Environment . Enhance Teachers' Smart Education Competencies . Developed Cloud Education Service System	. Digital Textbook Infrastructure Management &Pilot Development . Online Classes Activated . Resolving Copyright Issues with Educational Content . Enhance Teachers' Competencies . Establish Cloud-based Education Service	. Domain Enlarged: Education Systems Transformation . Limited to Primary & Secondary Education

Source: MOE & KERIS (2024). 2014 White Paper on ICT in Education Korea.

governmental institutes involve and cooperate with each other. First, the President's Council on Information Strategies coordinates the national ICT plan and plays role as the control tower for projects under the educational reform. Second, the Ministry of Education (MOE) promotes educational reforms at the national scheme. The primary role of the MOE is to manage projects throughout the entire processes of planning, implementation, and evaluation. Third, the local offices of education play a significant role as well. They carry out plans for elementary and secondary schools at the regional scheme. Their practical role in the project is to apply various information and communication technology for teaching-learning environments in schools, administer the evaluation for ICT-based student learning, and provide schools and students with feedback for more improvement in academic achievement. Further, the Korea Education and Research Information Services (KERIS), as the national research institute pursuing education that is oriented in knowledge, information, and technology foundation, provides MOE with professional and technical supports in the implementation of ICT for elementary and secondary schools as well as for government-funded institutes (MOE, 2010).
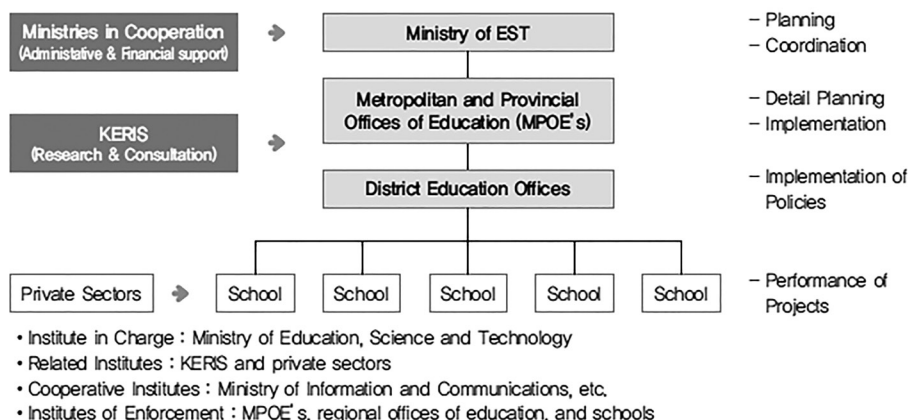
Figure. Implementation, Organization, and Responsibilities of Infrastructures for ICT in Elementary and
Secondary Education
Source: MOE & KERIS, 2010.

In order to enhance the educational environment at school sites based on ICT, the Korean government drives several strategies which are major assignments that should be accompanied in the process of policy implementation. The strategies are as follows: constructing ICT infrastructure in education; training teachers to know how to use ICT for teaching in the classroom; establishing a quality control system and the standardization of the ICT-based education such as e-Learning; and planning R&D for future education. To be sure, all of these strategies should place top priority in improving teaching-learning environments at school sites. The followings describe how ICT-based education in Korea has been applied in the teaching-learning environment at schools in terms of 1) interacting through personal learning devices, 2) communication through social media, and 3) engaging students with audiovisual contents.

2.1 Interacting through personal learning devices

In 2005, the development of digital textbooks was instigated with the funding from the South Korean government. By 2009, digital textbooks for 10 subjects were developed including Korean, English, Social Studies, Mathematics, Science, and Music for 5th grade students; and Korean, Mathematics, Social Studies, and Science for 6th grade students. The implementation began with 5 experimental schools in 2006, and by 2010, digital textbooks were put into service in 112 schools (Korea Educational Research Information Service, 2010). Digital textbooks use the same content as the printed textbooks along with multimedia contents such as video clips, animation, virtual reality, access to search engines, and a variety of interactive tools (Lee, 2008). The hardware used for a digital textbook is the tablet PC which is networked to the teacher's computer and the electronic blackboard. Students can use an electronic pen in order to take notes or highlight contents in the textbooks, and save them for later viewing.

Table 2. Digital Textbook Development Status: 2013-2014 (as of October 2014)

Classification	Subject	Grades	Year Developed	No. of Books	Developers, Publishers &Appraisal Authorities
National Textbook	Social Science	Grades 3~4	2013 (Completed)	4	- Compiled by: Chinju National University of Education State-Published Book Compilation Committee - Developed by: WEDU Communications - Reviewed by: National Social Science Digital Textbook Compilation Committee
		Grade 5	2014 (In development)	4	
	Natural Science	Grades 3~4	2013 (Completed)	4	- Compiled by: Korea Foundation for the Advancement of Science & Creativity State-Published Book Compilation Committee - Developed by: DaouinCube, Sangrok Media - Reviewed by:National Science Digital Textbook Compilation Committee
		Grade 5	2014 (In development)	4	
Qualification	Social Science①	Grade 7 (Middle School)	2013 (Completed)	5	- Published by: Doosan Dong-A, Mirae-n, Chunjae education, Visang education, &Jihak textbooks - Reviewed by: Korea Institute of Curriculum & Evaluation
Approved	Natural Science①	Grade 7 (Middle School)	2013 (Completed)	8	- Published by: Kyohak Books, Doosan Dong-A, Mirae-n, Visang education, Sinsago Books, Jihak textbooks, Chunkae books, &Chunjae textbooks - Reviewed by: Seoul Metropolitan Office of Education

Source: MOE & KERIS (2024). 2014 White Paper on ICT in Education Korea

The digital textbook not only expands the possibilities for learning, but it makes what was impossible with the printed textbook to become possible. For example, video clips of interviews with authors can show students what the authors had in mind when writing in a more personal manner than when it is only written on paper. Augmented reality technology or animation of volcano eruption can visually assist science lessons. In foreign language classes, authentic audio and video files can provide much needed ample exposure to the target languages.

An appropriate use of multimedia can make classrooms come alive, but then again, that does not mean that it always increases students' comprehension and cognitive ability. Multimedia alone cannot substitute the role of teachers, replace the humanness of classroom interaction, nor take the place of firsthand experience (Lee, 2006). Therefore, appropriate and high quality interaction patterns, students-content, student-student as well as student-teacher interaction need to be ensured and enforced through suitable application of multimedia tools. For example, interactive composing tools can be used in music classes where students can compose musical pieces and play them using a variety of musical instruments. Also, in math classes, students can solve problems on their respective tablet PCs. Teachers can click on students' computers from the teacher's computer to take a look at how they are doing. The teacher can also display a specific student's tablet PC screen on the electronic blackboard for the entire class to observe. The individual student can then compare the process of solving mathematical problems with their peers. By sharing their thought processes and knowledge with each other, students can rise above passive reception of knowledge and actively engage in learning.

There is an assortment of Personal Learning Devices (PLDs) available for classrooms such as the tablet PC, personal digital assistant, portable media player, and cellular phone to name a few. In employing PLDs in the classroom, the interaction patterns between students or between students and teachers need to be diverse regardless of the type of PLDs and functions. When the teachers successfully make the most of PLDs while providing maximized interaction, it may be possible to bring forth positive changes to the students' performance and the quality of education in schools.

2.2. Communication through social media

Like other developed countries, the majority of students in Korea carry cellular phones with them wherever they go (Leem, 2009). Cellular phones are primarily used for communication purposes, but some students use them for more than just communication. The advancement and evolution of cellular phone technology has allowed users to listen to mp3 files stored in their phones in order to listen to songs, study foreign languages, or record voices. Recently, the release of smart phones allows users to take pictures as well as record videos, surf the Internet, and watch Internet lectures through digital multimedia broadcasting services. Moreover, smart phones allowed numerous academic applications for students to use. Students can search for the nearest library and the availability of books. Visually impaired students can download applications that read books aloud to them. To the NMLs, a cellular phone is no longer a phone. Rather, it is a personal computer that they use to send messages, to surf the web, and even to study as a PLD (Rosen, 2011).

Even though there is a flood of applications and functions that are made available via cell phones, the most popular and the most frequently used function is needless to say, Short Message Service (SMS). It is common to see students sending messages in school, in restaurants, on the street, and sometimes, even in classes. The one way to overcome the communication gap is actively engaging in communication through the methods that the target group uses. If students use SMS to carry on interaction, it means that it is worth considering SMS as a potential tool of student-teacher interaction. In fact, incidents of Korean public school teachers successfully building relationships and taking communication to a meaningful level with teenagers by using SMS have been reported (Lee, 2007). The interactions reported were meaningful in that it was more than a mere increase in frequency, but the content of communication was genuine. More specifically, students felt more personal to the teachers who were willing to communicate in the way that they do and were willing to open up to the teachers who seemed to understand them.

According to Brown (2007), affective domains regarding knowledge and skill acquisition, such as students' attitude, beliefs, and underlying emotions, affect learning, significantly. Also, intimacy to teachers engender students' affinity-seeking behaviors in a variety of context, and positively affects students' performance in the respective academic subjects, and ultimately,

school life in general (Mottet, Richmond, & McCroskey, 2006). If a teacher can successfully communicate to the students using SMS or instant messengers (IM) in order to reinforce genuine student-teacher interaction, it may lower students' affective filter and promote an enhanced learning environment.

If the SMS component of cellular phones can be used as a tool for individual counseling, social media such as IMs, Tweeter, and blogs can be used as group counseling or group communication tool for the entire class as well. PLDs provide group and individual communication tools such as e-mail, message, and chat; even so, considering the efficiency, instantaneous application, and students' familiarity, cellular phones and social media seem to be more effective for communication purposes.

2.3 Engaging students with Audiovisual Contents

In order to get in touch with NMLs, more and more teachers are turning to video files, TV programs, and DVDs in the classrooms. To assist these teachers and to enhance the quality of education through ample provision of academic programs and resources, the government began installing IPTVs in all South Korean public elementary and junior high schools since the fall of 2010. However, the teacher perspectives on IPTV have not been positive so far. Some teachers have complained that the remote control operated IPTV is complicated, and some wanted a control panel to be linked to the teacher's computers (Leem, 2011). The fundamental issue with IPTV that the majority of the teachers addressed, surprisingly, was not on the technical unfamiliarity, but on the educational value of using audiovisual contents for a prolonged time in class (Lim, Kim, Han, & Ko, 2009). It is difficult to find time to have students-teacher interaction outside of the classroom, and many teachers are unwilling to sacrifice in-class students-teacher interaction time by showing long audiovisual contents in class.

It seems that the most preferred web contents of Korean elementary school teachers are textbooks related to a 3~5 minute video clip from the major Korean broadcasting companies and foreign news programs. The short video clips related to the contents found in the national curriculum are edited and provided to teachers as educational resources. The teachers found them useful for focusing students' attention on the content, activating schema, and bringing together the lesson for follow-up activities (Jyun & Hong, 2010; Lee, 2006). NMLs are immersed in technology. However, educators should use technology within the appropriate amount of time. For instance, watching video, or any other medium, for too long may impede their attention, even when it is solely used for instructional purpose (Han, Ryu, & Kim, 2003). When DVDs or TV programs are used in reality, teachers do not have enough time to check the students' comprehension, not to mention discussion or interaction. Audiovisual contents can be very useful in class, however, too much of the contents does more harm than none.

3. Possible side effects on ICT-based education

The digital textbook used in the teaching-learning environments displays the contents through LCD monitors and projectors that are based on wireless Internet, similar to PLDs. Although this type of learning content delivery has multiple strengths on NMLs' learning in terms of effective presentation adapted for various students' characteristics and learning conditions, it could not be a cure-all and certainly has its downsides. Some concerns raised and experienced regarding ICT-based education are directly associated with students' physical, mental, and social aspects in their development. First, the increased use of PLDs in schools has caused health problems among the students. Forty elementary school students who have used a digital textbook for more than one year were asked if they have experienced discomfort while using the digital textbook. Some of them have complained of eye strain, stiff neck, shoulder pain, fatigue, dizziness, drowsiness, and lethargy when using digital textbooks (SeoMoon et al., 2009). In addition, the exposure to electromagnetic wave may connect to some health problems from which students frequently suffer during their learning. In order to prevent these types of health risks, students should be advised to keep a distance of at least 50cm from the screen (SeoMoon et al., 2009).

Second, Internet abuse and Internet games may cause mental problems in the students. In particular, students are easily exposed to the Internet, Internet-game addiction, and cyberspace crimes, which are the so called dysfunction of the information society. The national policy has driven campaigns to protect students from Internet addiction disorders and cyber crimes. In addition to developing and implementing Internet software that prevent illegal and injurious contents, educating students with ICT ethic should regularly be conducted at schools and at homes as well. For this preventive education, teachers should be able to teach students to protect themselves from the harmful contents of cyberspace. With this reason, in-service training opportunity should be provided for teachers in order to enhance their teaching ability regarding ICT ethic and proper use of the Internet.

Third, privacy protection is another important issue in the ICT-based education. In the networking environment, private information leakage via websites, shared folders in peer-to-peer (P2P) network, auxiliary storage management (hard discs, USB drives, etc.) could be vulnerable from cyber attacks and criminal use in cyberspace. Private information of students includes test scores, school life records, student ID number and password, parents' information, and etc. MOE established the Education Cyber Security Center (ECSC) and has operated some programs to protect student information in the school administrative system and prevent possible cyberattacks to the educational institutes (MOE, 2010). In addition to managing a stable privacy protection system in the ICT-based educational environment, the legal system regarding the protection of students' privacy in cyberspace should be elaborated in order to consolidate ICT-based education in schools.

Arguably, developing new technologies and electronic devices, for instance e-ink and smart pens that electronically save handwritten notes, is good news in reducing the possible side effects of ICT-based education. However, the introduction of such technologies could not be a complete way to solve the problems, rather, various approaches such as education of ICT ethic and in-service training for teachers should be taken into account in order to alleviate the possible problems and concerns in the ICT educational environment.

4. New directions for ICT use in education

Since the primary goal of ICT use in education is to enhance teaching and learning practices in educational environments, the focus of the ICT-based education for NMLs should not center only on the convenient use of educational technology but also on the effectiveness of education. In this respect, ICT-based education for future education should pursue some directions for its sustainable development such as facilitating individualized learning including tacit learning for creative and critical thinking, enlarging ICT use for lifelong education outside of schools, and managing diverse and flexible curriculums in schools.

First, in future education, student learning will be self-directed. In self-directed learning, educational contents have to be provided to students in an individualized manner and by matching the learning abilities and characteristics of students. Based on their learning interests and motivation levels, students respond differently to educational contents and teaching methods. Thus, the primary principle of ICT-based education is that students can select learning levels and contents according to their learning conditions such as achievement levels, characteristics, and interests. In this way of learning, ICT is just a delivery tool of learning contents. Even in ICT-based education, learning – as a cognitive process of changing, adapting, and developing – should be accomplished by students themselves.

Second, in order to facilitate individualized learning across grades and/or school levels, educational curriculums in schools should be diverse and flexible. As mentioned above, ICT-based education provides students with personalized learning opportunities that are customized to students' learning progress and characteristics. It means that some students, for instance, may learn different levels of learning contents than other students in the same mathematics class, or some students may learn the same content with different teaching-learning methods because of their different progress and characteristics in learning. A standardized curriculum that still exists in the school system cannot properly respond to the various students' needs in the future educational environment. Rather, diverse and flexible curriculums should be developed and equipped in the educational environment in order to successfully implant ICT-based learning in students.

Third, tacit knowledge as well as explicit knowledge should be embedded in the ICT-based education. In the previous learning environment, students are accustomed with traditional

learning methods in which the primary way of learning is to have interactions with teachers and other students, face-to-face communication, and various learning activities in a real place at the same time. By this kind of learning method, students can acquire tacit knowledge that they have to possess in order to improve their social skills, critical, and creative thinking abilities. In ICT-based education, however, students are exposed in personalized learning environments in which interactions and communication with teachers and other students are frequently limited. Even in the ICT-based education environment, improving students' social and critical thinking skills should be the primary goal of learning. To embed tacit learning in ICT-based education, teaching-learning methods and educational curriculums should be developed in order to customize the way of learning to multi-directional communication, group activities/projects, interaction with others, such that students have an opportunity to provoke their way of thinking and social skills.

Last but not least, the role of schools in the future ICT-based educational environment is different from that of the contemporary school environment in terms of the target group and place of learning. Students, as life-long learners, will have more learning opportunities from community-based educational institutes than schools. The school at that time will be one of the community institutes that provide many types of learners – including not only elementary and secondary students but also adult learners – with various learning contents and opportunities. ICT-based educational environment should not be limited to school education, yet, teaching and learning activities should be open and acceptable to be held at homes, business sectors, community libraries, civic centers, and etc. ICT-based education should reduce the learning gaps between regions and between individuals and also curtail the society of lifelong education.

5. Conclusion

What we know for sure about NMLs is that we don't know enough about them. The things we know are limited to the external descriptions such as they use the Internet and cellular phones at all times, they prefer audiovisual presentation over textual, they put an emphasis on emotion and sensation, and they are used to a quick access to information online. But as we've already seen, NMLs do not stare at screen just for the sake of doing so. They seek genuine interaction through SMS, look for group identity through Bulletin Board System (BBS), and consider audiovisual content as ineffective if it is too long. Teaching NMLs is perhaps an area that is best addressed by NMLs—what they think, how they feel, what they want — are questions that they alone can give answers to.

As Prensky (2001) claimed, we are digital immigrants, whereas the NMLs are digital natives, and the bizarre circumstance of immigrants trying to teach the natives is what is going on in schools. That of course, does not mean that the immigrants should give up and leave the natives own their own. What needs to be kept in mind is that the NMLs are students. They

have lots to learn, and so far, they lack experience and knowledge and thus, need teachers to guide them. This is the reason why a meaningful interaction between students and teachers is needed, and further, teachers need to learn the language of NMLs to communicate with them. Some teachers use SMS to build student-teacher relationship and win the student's trust, and others use blogs and Twitters to reach out to their students. When experienced and qualified educators are clearly informed of needs, preference, and learning styles of this distinct and unique generation, appropriate and effective teaching methods that is suitable for the NMLs may be developed and made available for improving the quality of the classrooms.

ICT is an infrastructure that facilitates educational changes for future education. However, the lack of empirical data that verify the positive impact of ICT use on student learning improvement exists. This means that we have to prepare a strategic approach and load the map for future education. The implementation of ICT in the learning environment of the society could not be accomplished without the holistic supports from the educational system such as appropriate curriculum development, teacher preparation/training, and community cooperation outside of schools. Finally, this systematic approach has to assist students' self-directed learning in the ICT-based education.

Acknowledgement

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