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Comparative Analysis of ICT Integration Initiatives in Korean, German and American Educations*

The purpose of this article is to compare three ICT initiatives for education reforms by three countries representing different continents with different cultural backgrounds: the Republic of Korea, the Federal Republic of Germany and the United States of America. Through comparison, some convergences and divergences were found as anticipated. Convergences were found especially in terms of intervention of central government and the spectrum of core policies. Divergences were found especially in implementation approaches and processes of policy decision-making regarding ICT integration into education. Comparing divergences among the three countries reveals common tasks for which they may cooperate on in order to resolve mutual problems. Through the observation of school sites of each country, as well as related literatures, one can see that ICT integration is still far from being satisfactory. Thus, it is implied that, in addition to individual country's efforts such as increasing teacher training, diverse international cooperation focused on common problems must be devised among the three countries.

Introduction

Use of information and communication technology (ICT) as an instructional tool has brought about an alternative form of education and will provide a revolutionary educational environment worldwide. Educational reforms in a knowledge-based society, thus, need to be directed in terms of a nation's survival, rather than for mere reform initiatives. Further, given that the educational paradigm in today's information era is totally different from anything seen before, any educational implementation not commensurate to the conditions as prescribed by the educational paradigm is likely to render human resources improper and unfit to an information-reliant society, which, in turn, should lead to the lowering of national competitiveness. Many countries all over the world have been, in this vein, implementing drastic educational reforms targeting twenty-first century compatibility since the 1970s (Cookson, Jr. et al, 1992; Finn, Jr., & Rebarber, 1992). The main theme of their recent efforts naturally revolves around effective use of information and communication technology in education, of course.

The purpose of this article is to compare three ICT initiatives for education reforms by three countries representing different continents with different cultural backgrounds. The Republic of Korea, representing Asia, has recently sprinted to the national task of «Educational Informatization» and achieved remarkable outcomes (Korea Ministry of Education, 1998 & 1999; Korea Education & Research Information Service, 2000 & 2001). The Federal Republic of Germany, which has taken up the largest proportions of IT spending in Europe as of late (IDC, 2001), has also initiated a national project «Schulen ans Netz e. V.,» equipping schools with hardware and implementing various projects together. The United States of America, representing North America, has lead worldwide in education reform, especially with national educational technology plans from the previous Clinton administration («The Technology Literacy Challenge») and the present Bush administration («No Child Left Behind Act»).

By comparing these countries, educational technology reforms and how they are initiated, as well as the problems and implications in the processes can be revealed. Convergences and divergences emerging in the comparative analysis help to unveil potential strengths and weaknesses of the countries, therefore providing helpful feedback to one another. This study attempts to focus on ICT integration in comparing educational technology reforms because ICT use is an issue that is at the core of recent education reforms in many countries worldwide.

The materials used in this study mainly consist of various literatures at the federal and state government level dealing with such things as educational guidelines, white papers and web site contents. It is because, with the fact

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that educational policies and practices vary by school district particularly in Germany and the USA, overall state can be easily identified from literatures at the level. In comparison, the researcher of the study did not indulge in specific statistics considering difference of scale of individual countries. Rather, the researcher made site visits to ordinary schools of each country in order to not be mislead by overall statistic figures and to get more practical on-site data. The study is also limited to general secondary education, which is publicly funded to promote equivalence, consistency and easiness in the comparison.

ICT integration Initiatives in Korean Education

Initial efforts to integrate ICT into education in the Republic of Korea is said to have begun in 1987 when the «Computer Education Strengthening Plan» was published by the Ministry of Education (Korea Ministry of Education, 1998). Although introduction of computers into school curriculum started in the 1970s as a part of technology curriculum, the plan, which actually resulted from the «Master Plan for Education Reform» in 1987, was a springboard for formalizing school with utilization of computers. Entering the 1990s, the concept of computer education initiated a new phase, where it was subsumed and continued under the so-called «Educational Informatization». The «5.31 Education Reform» proposed by the Presidential Commission on Education Reform in 1995, in particular, took the lead in emphasizing this new educational catchphrase, insofar as to imply a total change in contents, methods, and objectives for the educational system, rather than mere introduction of information technology in education.

The Ministry of Information and Communication, on the other hand, was newly organized in 1994 in order to implement informatization more effectively at the national level. This, in turn, initiated establishment of the Informatization Promoting Committee under the leadership of the prime minister in April 1996. The Committee prepared for the «Master Plan for Informatization Promoting» and proposed 10 major tasks, of which includes «Educational Informatization».

The Ministry of Education, abreast of the Committee's plan, also established «The Implementation Plan for Promoting Educational Informatization» in July 1996. The plan, proposing seven major tasks as below, basically intended to foster an environment of educational informatization in hopes to reform school education (Korea Ministry of Education, 1998).

- Building infrastructure for open-ended education
- Development and dissemination of multimedia software for instruction/ learning
- Diffusion of distance education
- Advancing Information infrastructure for Science and Research
- Database building for academic information
- Digital library building
- Development of networked co-research and -experimentation system

Regarding the above tasks, one can see that the first four are particularly related to building educational informatization infrastructure for brains-nurturing in an information-reliant society, while the last three adhere to fostering an environment of information service for science and research.

The Implementation Plan in 1996 was revised into and publicized as «The Mater Plan for Educational Informatization at Elementary and Secondary Schools» as the current Kim Dae-jung administration entered into new service in 1998. The plan emphasized six major tasks in achieving educational informatization effectively (Korea Ministry of Education, 1998). They are as follows:

- Building infrastructure for educational informatization
- Development and dissemination of educational information and contents
- Strengthening ICT education
- Supporting informatization of educational administration
- Advancement of information infrastructure for science and research
- Network system construction for academic information

It appears that the tasks above are similar to the ones seen in the 1996 plan except that the task of «Strengthening ICT education» was newly added. This addition implied that the ultimate goal of the plan was to enhance teachers' and students' ability to utilize information technologies. Additionally, this was confirmed by the government whitebook. The 1998 plan thereafter has been implemented such that implementation plans are refined every year.

Directly related to the subject of this study, ICT integration initiatives in secondary education in the Republic of Korea center around four specific tasks: Building information infrastructure, strengthening ICT education, teacher training for ICT use, and development and dissemination of educational digital contents (Korea Education & Research Information

Service, 2001). These tasks were originally planned to be completed in 2002, but hastened to be finished two years earlier, as the president emphasized so in the State of the Union Address in 2000.[1] The reason for the hastening was, among other things, due to the urgent notion that educational reform through ICT integration could not be slowed by procrastination and to the fact that the Seventh National Curriculum was to start in 2000.

Among the four tasks, «Building information infrastructure» was specified into distribution of computers for student and teacher use, installation of multimedia equipments, and construction of computer networks enabling Internet use at schools. With completion of the plan at the end of 2000, at least one computer lab was built in every elementary and secondary school and every classroom had a computer with Internet access and multimedia equipment. Together with these, the government completed agreements for free or very low-priced Internet access at schools with relevant institutions in July 2000.

The task of «Strengthening ICT education» included two aspects of computer education: information literacy education about ICT skill itself and utilization of ICT within curriculum. Information literacy education had been provided as an elective and as an extra-curricular activity in the regular curriculum. However, it became compulsory starting from the first grade of elementary school that more than 10% of classroom instruction/learning make use of ICT in every subject from the year 2001 onward. Also, in order to facilitate this climate, an information literacy certification system began to be introduced to all secondary education levels to help evaluate and identify students' information literacy skills. This, in turn, may be used as a condition for college entrance.

The task of «Teacher training for ICT use» has been driven in four specific tasks: ICT training for in-service teachers, encouraging study-groups for ICT integration into subjects, activation of contests for teachers' ICT use, and introduction of an ICT skill certification system. With regard to the ICT training for in-service teachers, in particular, approximately 25% of all teachers had participated in various forms of training as of 2000. Further, from 2001, the plan was extended to 33% of all teachers every year. Special training for informatization agents was also conducted for a total of 10,000 teachers, one from each elementary and secondary school.

Finally, the task of «Development and dissemination of educational digital content» has been proceeding in a systematic manner in public and private sectors. First of all, the Korea Education & Research Information Service (KERIS), which was reorganized by the merger of two related institutions in 1999 as a subsidiary of the Ministry of Education, has been taking the lead in developing multi-media educational content and disseminating them through a national education information server, EDUNET. The education server, which originally started its service in 1996 as a part of the «Education Reform» in 1995, has been of much use to students and teachers nationwide at all levels of education, as well as to persons involved in education one way or another. The Ministry of Education, along with each provincial Office of Education, also promotes development of educational contents and software through public software contests and supports each school's purchasing expenses for educational software, in order to promote development by the private sector. Other strategies to promote development and dissemination of educational contents include hosting educational software exhibitions, establishment of the Authorized Software Distribution Committee, and issuing KERIS certificates for qualified educational software, followed by public announcements.

The progress of educational informatization in Korean secondary schools thus far, especially in terms of infrastructure building, are summarized in Table 1.

Table 1 Progress of Information Infrastructure Building

	Targets (%)	Progress by year				Cumulatives Up to 2000 (%)
		1997	1998	1999	2000	
Distribution of computers for student use	572,288 (100.0)	326,274	61,000	76,104	131,990	595,368 (105.64)
Distribution of computers for teacher use	333,197 (100.0)	105,335	71,652	56,330	107,537	340,854 (102.30)
Installation of multimedia equipments	214,083 (100.0)	59,958	25,752	24,416	112,020	222,146 (103.77)
Construction of computer networks	10,003 (100.0)	346	1,267	2,689	5,762	10,064 (100.61)

Overall, ICT integration efforts in Korean education (which got started from computer education in the late 1980s and has been thought of as a

[1] They systematized the educational informatization plan by two phases recently with the ambitious goal of making the country using computers best in the world by the year 2002, and completed the initial phase at the end of 2000 and have currently entered the second phase of the educational informatization.

movement of educational informatization beginning in the mid-1990s) appear to be making great strides in a relatively short period of recent time. They have invested a significant portion of the national budget on educational informatization in spite of economic difficulties and have launched an all-out approach on every aspect of the plan so that substantial outcomes are now conspicuous. For instance, nationwide, every school has at least one computer lab; moreover, every classroom has Internet access with multimedia presentation facilities as of April 2001. This situation was confirmed by site visits by the researcher.*

In spite of these remarkable outcomes, however, some problems were raised, especially from on-site teachers. The most important one among them was that the degree to which information technologies were utilized at schools was much lower than expected (Cho, 2000; Korea Education & Research Information Service, 2001). This is primarily because the national initiative of educational informatization was hurried without prior scrutiny into its effectiveness in school practices. For instance, teachers' clerical works along with subject teaching are so much that it results in having insufficient time to study for integration of information technologies into their subject matter. Also, the chronic competitive nature of schooling in preparation for college entrance makes the situation worse, such that teachers consider the use of information technologies as making no difference and even time-consuming. In-service training is, of course, being emphasized in this regard, but it is likely to be of no use mainly because the contents of most training programs are far from being practical.

Based on these findings, however, they are struggling to find out the best ways to integrate information technologies into everyday teaching and learning. Thus, it can be said that real ICT integration practices in the Republic of Korea are being conducted from the second phase of the educational informatization project, which started in 2001(Korea Education & Research Information Service, 2001).

* The site visits were made to two schools on February 22-23, 2001, where one teacher of each school was interviewed and other teachers, 14 & 12, respectively, surveyed by a simple questionaire. The schools were located in the suburbs of a metropolitan city(Seoul) and were very ordinary secondary schools in terms of ICT-related infrastructure as well as general things. Here, the average percents of teachers' instruction and students' homework using ICT were rather moderate (11.43% & 23.54% at one school and 25.83% & 33.75% at the other school).

ICT Integration Initiatives in German Education

Discussions about ICT integration in the Federal Republic of Germany have been conducted in the framework of media education. Media education, evolved since the start of film in the early twentieth century, has purported to raise consciousness on various media – particularly against its potentially harmful influence on young people. Media education, of course, did not exist in the school curriculum, but was carried out, until the 1990s, within various subjects like German Language, and Arts and Politics where it mainly dealt with media messages through text analysis (Oechtering, 1998). This might mean that media education did not gain a footing in everyday school life at that time and, at best, led a niche existence in study groups and projects.

With rapid development of microelectronics in the 1980s, media education began to embrace the theme of information technology education (Informationstechnische Grundbildung: ITG). In December 1984, the Federal Government-Länder Commission for Educational Planning and the Promotion of Research (Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung; BLK) adopted a framework for «Information Technology Education in Schools and Training», declaring the main tasks of information technology education as follows (Bildung und Wissenschaft, 2000/3):

- Working through and classifying the experiences that pupils have of information and communications technology in their environment
- Recognizing basic structures of information and communications technologies
- Practicing simple applications of information and communications technologies
- Assessing the opportunities and risks of information and communications technologies
- Acquiring criteria for independent assessment, decisions and action in all situations where information and communications technologies play an important role
- Establishing a rational relationship to information and communications technologies

The BLK in 1987 also published the «Overall Concept for Information Technology Education» (Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung, 1987). According to this, the main tasks of the

information technology education are as follows:

- Examination and categorization of individual experiences with information technology
- Teaching basic structure and terminology in the field of information technology
- Introduction into handling of computers and their peripherals
- Teaching knowledge about possible application and control of information technology
- Introduction into algorithmic representations of problem solving
- Insight into the development of electronic data processing
- Creating awareness for social and economic effects of the diffusion of microelectronics
- Presenting chances and risks of information technology building up a rational attitude towards the technology
- Introduction into problems of privacy and data protection

On the basis of these targets, the 1987 framework aimed at integrating ITG into existing school subjects in order to give every student access to new technology and media. This meant that basic information technology education acquired a different degree of binding nature in comparison with media education. However, it did not extend beyond mere teaching principles (Bildung und Wissenschaft, 2000/3). As a result, a binding introduction of basic information technology education came about in secondary stage I, and the subject informatics for extended study of this area was recommended in higher grades in most federal Länder.*

The ITG statements in 1984 and 1987, however, were still within the concept of media education although they insisted on using the term ITG. According to the 1987 paper, it states that dealing with the computer and other information and communications technology pose demands to existing media education and computer-related media education convey an adequate and responsible attitude. It seems that, considering the time, information and communications technologies were not part of the media in the true sense. Moreover, there were considerable difficulties found with the implementation of the BLK policies. There were still many obstacles for ITG to overcome in order to become a natural part of schooling, such as

* The subject informatics, of course, started from the 1970's and had been implemented broadly in the secondary level II education during the early 1980s (Schulz-Zander & Fankhänel, 1997).

lack of hardware and software, insufficient teacher training, lack of interest of subject teachers as well as principals, etc. (Hauf-Tulodziecki, 1996; Schulz-Zander & Fankhänel, 1997; Wilkens, 2000).

In this vein, a series of media education guidelines on the federal level have been proposed since 1995. With regard to the 1995 BLK framework, the Federal Länder were called upon to establish effective and workable media education. The framework was the first systematic attempt to define a role for the new electronic media in schools. Further, the Conference of Education Ministers (KMK), with reference to the BLK orientation framework, published «A Declaration on Media Education at Schools» (also in 1995), emphasizing the need for intensified media education (Schulz-Zander & Fankhänel, 1997). In another resolution made at the Conference of Education Ministers in 1997, the importance of media education and an integrative approach was again stressed on the subject of «New Media and Telecommunications in Education». The subsequent declarations made at the Conference of Education Ministers were an important turning point in the discussion about schools and media, particularly concerning the call for an integrative concept. This integrative concept should mean that information technology education and media education, once treated as two different things, are now integrated due to the development of computer networks and multimedia applications. On the other hand, it should also refer to the integration of media education in curriculum subjects (Bildung und Wissenschaft, 2000/3).

These BLK and KMK guidelines, in turn, were reflected in the follow-up guidelines of individual states by way of media education framework for all grade and informatics guidelines for higher grades. However, this dialectical effort to integrate the aspects of ITG and media education into the German education system still seems to need more systematization. It is because no agreed upon contents with respect to new media can be stated, especially for lower secondary education, for example. Further, the elements of Internet knowledge and skills that should be part of general education, in particular, are not clearly elaborated. Naturally, a thorough analysis of the different areas of media education in comparison to older media and resulting adequate curriculum development are missing (Langner, 2001).

Substantial progress in ICT integration into German education can be said to have started in 1996 when a national model project, «Schulen ans Netz e. V.» – a joint initiative between the Federal German Ministry of

Education and Research (BMBF) and Deutsche Telekom AG – was proposed for educational reform. Specific objectives for the education system were identified at the start as follows*:

- Use of interactive technology that is already used at home and in leisure and will be an essential tool at work
- Development of skills in dealing with media and computers (media skills)
- Communication and cooperation with other schoolchildren and schools all over the world
- Creative preparation of new teaching and learning material suitable for the media,
- Use of databases and libraries
- Exchange of teaching concepts and material, especially to relieve teaching staff
- Changing the role of the teaching staff

The «Schulen ans Netz» started with equipping schools with hardware, in turn, deploying various projects with it as seen in Table 2. With regard to the hardware equipments, the project set itself the initial aim of connecting 10,000 schools to the Internet within 3 years. German schools at that time allowed only around two percent of pupils to work permanently on computers (Bildung und Wissenschaft, 2000/3).

Table 2 «Schulen ans Netz» and related projects

Projects	Website	Description
Schulen ans Netz	www.san-ev.de	The so-called starter or pilot project schools are funded to be equipped with ISDN board, software plus a charges credit.
Lehrer-Online	www.lehrer-online.de	Teachers-online: a topical online sevice for all those teaching for course preparation and techching.
LeaNet	www.leanet.de	Leherinnen-Angebot im Nets: service for women teachers in the net and offers a ladies only discussion, learning, working platform.
LizzyNet	www.lizzynet.de	Schülerinnen im Netz: an online project which addresses girls and young women exclusively
Other projects	uin@schule	The network created between and competition addressed at teachers and learners at universities and schools.
	Netd@ys Europe	An international competition of European countries of which the Schulen ans Netz is the co-ordinator.

* Available on-line: http://www.san-ev.de/presse

The objective for the year 1996 was accomplished by March 1999, and was expanded by additional funding to the degree that all of the 44,000 German schools should be online by the end of 2001.

Parallel with information infrastructure building, the «Schulen ans Netz» initiative also propelled various projects such as media skills promotion for teachers and students, InfoSchul, Netd@ys, Nature Detectives, Lehrer-Online, LeaNet, LizzyNet, etc. Further, it brought about a nationwide educational server like Deutscher Bildungs Server (DBS) as a national web portal (www.bildungsserver.de), by which, the 16 Federal States, as well as private, non-profit-making organizations, have installed a server (Hedtke et al., 1998). Recently, the initiative has gone on to include primary schools via launching the Internet competition (EnterPreis), as well as citizen's projects, which go beyond school boundary due to additional fund raising.

Media skills promotion among the various projects of the «Schulen ans Netz» was especially an effort to conform with the basic tenet, which called for the embodiment of new media and the use of the Internet into everyday teaching. Thus, teacher training was such a major task in the promotion that the Ministry of Education endorsed the ICARUS project to develop a model for ICT education in teacher training at the university level (Schulz-Zander & Fankhänel, 1997).

In spite of diverse efforts, however, the «Schulen ans Netz» did not seem to bring about desirable teacher training and effective use of technology in the end (Langner, 2001, OECD, 2001a). Moreover, German schools are said to be lagging behind other industrialized countries even in terms of Internet equipment (Bildung und Wissenschaft, 2000/3). This ICT integration situation in German schools was confirmed through a site visit by the researcher*. For instance, the school visited had two computer labs only where Internet access was possible and the average percents of teachers' instruction and students' homework using ICT were rather low(2.92% & 5.12%, respectively). Also, the number of students per computer was still 25 (Bundesministerium für Bildung und Forschung, 2001).

Not everyone, however, sees the fact that German schools are lagging behind other countries as a negative. For example, the news magazine Der Spiegel(1999/42), with the lead story «Kinder im Netz», raised the

* The visit was made twice on May 9 and 14, 2001. There, two teachers were directly interviewed and other 13 teachers, surveyed by a simple questionaire. The school visited was located in a medium city of NRW and was a very ordinary secondary school (Gymnasium) in terms of ICT-related infrastructure as well as general things.

question: «Do computers and the Internet expand or block the grasp of reality?». Die Zeit(2000/14), in an editorial contribution entitled «Verheissung Internet,» argued that discussions about Internet and computer equipments directed attention away from the real problems and educational tasks of schools. Essentially, it seems that German society still takes a prudent attitude within media education tradition while plunging into a competitive world in terms of ICT integration at the national level. In other words, the fundamental, critical attitude of the media seems to prevent technological development from being equated with progress and help traditional, cultural techniques to remain in sight, in spite of all the fuss revolving around the Internet.

ICT Integration Initiatives in American Education

Starting from a federal call for reform of American education in the early 1980s (for example, «A Nation at Risk» report in 1983), the United States of America began to initiate a series of educational reform measures in order to get ready for an information-reliant society. For example, in order to improve instruction in mathematics, science, foreign languages, adult literacy, and other subjects, especially to traditionally under-served students, the Star Schools Program was legislated and launched in 1988. Capitalizing on new interactive communication technologies including satellite delivery systems, open broadcasts, cable, and the Internet, the program was implemented to reform education on a large scale by basically delivering distance education courses and services in the United States and around the world.*

Entering the 1990s, the former Bush administration announced another reform initiative called «AMERICA 2000» in 1991. For this, the nation's 50 governors were invited to attend an education summit to discuss the nature of current educational problems. As a result, they, in cooperation with the White House and the education community, established six national education goals, which were aimed for achievement by the year 2000. President Clinton, elected in 1992, wished to introduce massive educational reform measures of his own as well. In order to distinguish its efforts from «AMERICA 2000», the new administration offered a set of initiatives called «GOALS 2000: AMERICA 2000» in 1994.**

* Avaiable on-line: http://www.ed.gov/prog_info/StarSchools

** Available on line: http://www.ed.gov/pubs/Prog95

Parallel with these educational reform efforts, the matter of national competitiveness was proposed in a new perspective, especially as both the capabilities of technology and number of its users grew in the early 1990s. That is, the «National Information Infrastructure Act» was introduced in the Senate as part of the proposed «National Competitiveness Act» of 1993. The new vision here advocated for a seamless mesh of high performance computing and communications resources that would reach every U.S. community and enhance the life of each and every citizen (Executive Office of the President, 1993).

Discussions on ICT integration into education in the U.S.A. can be said to have been embossed in these educational reform efforts, as well as the national competitiveness movement. More precisely speaking, the topic began to be directly dealt with in the «Improving America's Schools Act». This Act, passed by the Congress in 1994, reauthorized the «Elementary and Secondary Education Act» of 1965, but with some significant changes. Among them was a measure supporting a comprehensive system for the acquisition and use by elementary and secondary schools of technology and technology-enhanced curricula, instruction, and administrative support resources/services to improve the delivery of educational services. However, the act was not entirely for ICT integration itself, but as a general education reform measure, included technology as a part of education.

More important impetus for ICT integration, therefore, was given 2 years later when the Clinton administration announced the «Technology Literacy Challenge» on February 15, 1996, envisioning a 21st century where all students benefit from the use of educational technology. At the heart of this challenge were four concrete goals that helped to define the task at hand*:

All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.

All teachers and students will have modern multimedia computers in their classrooms.

Every classroom will be connected to the information superhighway.

Effective software and on-line learning resources will be an integral part of every school's curriculum.

As can be seen here, every effort eventually seemed to converge on one aim, which was integrating technology into the classroom and, in turn, improving teaching and increasing student learning**. In support of the

* Available on line: http:// www.air.org/forum/goals.htm

** Given the substantial progress in achieving these goals and on the continued changes

«Technology Literacy Challenge», the Secretary of Education also released the nation's first national educational technology plan in June of 1996: «Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge» (U.S. Department of Education, 2000a). While acknowledging the federal government's leadership role, the purpose of this report was to present a framework in which states and local communities could use to develop local plans of action that would support the use of technology in achieving high standards of teaching and learning in all classrooms for all students. To help further the comprehensive policies outlined in the national plan, the administration supported various programs to reach these goals and has invested more than 8 billion dollars in educational technology from 1995 – 2000. These programs, their time schedule, and annual budgets total by year are in Table 3.

Table 3 Supporting Educational Technology Programs

	1995	1996	1997	1998	1999	2000
Technology Innovation Challenge Grants (TIGG)	→	→	→	→	→	→
Technology Literacy Challenge Fund (TLCF)			→	→	→	→
Preparing Tomorrow's Teachers to Use Technology (PT3)					→	→
Community Technology Centers (CTC) Program					→	→
Learning Anytime Anywhere Partnerships (LAAP)					→	→
Assistive Technology	→	→	→	→	→	→
Migrant Education			→	→	→	→
E-Rate				→	→	→
Annual Totals ($)	46,510,790	72,857,131	293,353,072	2,226,134,709	2,642,316,363	2,749,140,411

*Source: U.S. Department of Education (2000a).

in the capabilities and affordability of technology, the initial goals were revised into five new goals in the fall of 1999. The essence of them, however, was not changed and they accordingly converged on the same aim.

On the other hand, each of the fifty states has also established and implemented a set of policies related to educational technology according to respective statewide technology implementation plans, as each state is basically responsible for its own education system. These plans addressed teacher training, staff development, and financing for technology. In addition, the national educational technology plan is being continued by the current Bush administration under the «No Child Left Behind Act».

As a result of the «Technology Literacy Challenge» and its sequel initiatives thus far, a great deal of progress has occurred toward achieving desired goals. A poignant illustration of this can be seen in The Office of Educational Technology of the U.S. Department of Education's report regarding America's progress overall toward the four major goals, Figure 1:

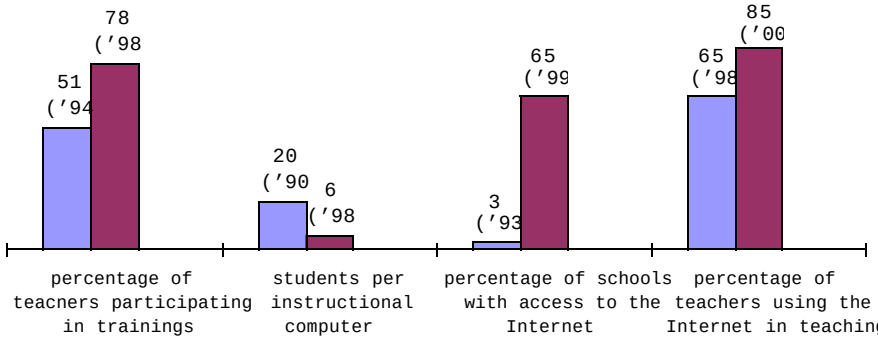

Figure 1 Progress toward the goals of the Technology Literacy Challenge

*Note: graphed according to the data reported in U.S. Department of Education (2000a)

Overall, it seems that, even though education is a responsibility left to each state and even every district, ICT integration into education in the U.S.A. has been implemented successfully through the White House, the National Science Foundation, the National Science and Technology Council, and the Department of Education. In other words, it has been systemically driven according to federal education technology policies, as related institutions revolving around the Department of Education harmonize with each other. Some recent studies have demonstrated that school improvement programs employing technology for teaching and learning yield a host of positive results for students and teachers (Idaho Council for Technology in Learning, 1999; Mann et al., 1999; Silverstein, Frechtling, and Miyaoka,

2000; The Milken Exchange on Education and Technology, 2000; Xin, 1999).

There has been cynical observation regarding the outcomes of ICT integration efforts, of course. For instance, Venezky (1998) pointed out that the integration of technology into the curriculum was still in its infant stages, hardware targets were still in gross student per machine ratios rather than in terms of desired access or functionality. The U.S. Department of Education (2000b), having undertaken a strategic review and revision of the 1996 national educational technology plan, also confessed recently that, despite taking great strides, there is still more the nation needs to do to improve access and connectivity. For instance, the ratio of students per instructional computer was 16 to 1 for the poorest schools in the United States, while the nation's richest schools averaged 7 students per computer as of 1999. Also, even in schools with sufficient access to modern computers, Internet and digital content, teachers still face challenges using technology in an effective manner. This situation in American schools was confirmed by site visits by the researcher*.

Given that many schools and classrooms have only recently gained access to technology for teaching and learning, the overall ICT integration efforts in American education so far suggest that the future for American education could be bright. This view is plausible especially considering the fact that various efforts such as facilitation of teacher networking as a way of ICT-relatet professional development (OECD, 2001b) and academic development of ICT integration models (Johnson & Liu, 2000) are now being made.

Implications of ICT Integration Initiatives of the Three Countries

With the advent of an information-reliant society and growing use of Internet, the three countries compared in this article set out to plunge into substantive implementation of ICT use in education as an education reform starting in the mid-1990s. Although each country has provided their students with computer education previously, it was not focused on pure ICT integration into education; but rather, for computer skill development in preparation for post-industrial society. Thus, the countries established and introduced full-scale initiatives in a variety of ways to utilize information communications technology in terms of education innovation. On one hand, the coincidental efforts of ICT integration into education certainly broke out due to the sense of urgency each country had; but on the one hand, it is said to have resulted from a phenomenon of educational globalization.

In the wake of ICT policy implementation in the three countries, there are some convergences seen. First of all, the federal ministries in these countries have taken the lead in preparing for the framework of ICT integration. Although educational policy implementations in Germany and the U.S.A. are basically decentralized, the Federal Ministry of Education takes the lead in preparing for national framework of ICT-related policies. This is also same with the Federal Ministry of Education of the Republic of Korea, but stronger leadership is being effectively exerted with regard to educational policies in general, as well as ICT integration into education. What is important here is that the top-down approach rather than bottom-up approach in ICT integration policy is conspicuous in these countries. It seems that, being a major impetus for education reform, ICT-related policy is being taken into account as a main task at the national level in these countries.

It is also found that the spectrum of core policies of ICT implementation in the three countries has been aligned in similar fashion. That is, it tends to proceed from the infrastructure building through use of digital contents and resources, student/teacher use of technology, and teacher training. Each country, on the contrary, shows dissimilar priority regarding core procedures in accomplishing ICT integration into education. Due to its prudent approach to media, for instance, German policy still favors the initial procedures in the spectrum: infrastructure building and use of digital contents and resources. The U.S.A. is, in contrast, beginning to focus on the latter part of the spectrum: teacher training, and recently, performance enhancement of students and teachers (McNabb, Hawkes, & Rouk, 1999; Sherry et al., 2001). On the other hand, the Republic of Korea takes on a relatively all-out approach regarding every aspect of the spectrum. It is largely because the organization of the educational administration is

* The visits were made to two schools on October 18 and December 14, 2001, where one teacher and the principal of each school were interviewed and other teachers, 16 & 23, respectively, surveyed by a simple questionaire. The schools were located in the suburbs of a big city of Massachusettes and Pennsylvania and were ordinary secondary schools in terms of ICT-related infrastructure as well as general things. There, the average percents of teachers' instruction and students' homework using ICT were rather low to medium (1.94% & 5.31% at one school and 9.30% & 9.13% at the other school).

centralized, such that every policy is delivered effectively and efficiently. What is implied here is that the core policies of the three countries could, among other things, have something to do with information technology development phases worldwide, and also means there is similarity of perspectives on ICT implementation, regardless of cultural distance.

There are some divergences found in terms of ICT initiatives among these countries. The first divergence is that each country is characterized by uniqueness in its ICT-related policy implementation approaches. As mentioned earlier, the German approach is described as prudent and cautious whereas the American approach, especially recently, is outcomes-oriented. The Korean approach can be characterized as «sprintable,» meaning commanding an all-out approach in a short period of time.

The other divergence is found in terms of the three main types of policy decision-making. With regard to degree of centralized decision-making, ICT integration policies in Germany and U.S.A. are basically decentralized, while the ones in the Republic of Korea are centralized. In other words, German education takes a completely decentralized stance for the whole implementation period. In contrast, the Republic of Korea does vice versa. In American education, central government plays an active role in the initial stage, but, as the implementation of ICT integration progresses, some balance seems to be kept between centralized policies and grass-roots decisions.

The second issue of policy decision-making concerns initial introduction of hardware and infrastructure into schools. German education relatively tends to start with pilot experiments in selected schools and/or proceeds by successive approach. This is in stark contrast to Korean education where initial introduction is done largely by an «at once» approach. Compared to the other two countries, American education seems to have proceeded by combining both approaches. The pilot approach can help to avoid costly mistakes by allowing for formative evaluation, but it might not be able to provide sufficient grounds for which ICT integration can be encouraged on a large scale. The «at once» approach is more equitable and able to satisfy political pressures more readily. However, some combination of the two approaches is desirable in a sense, with pilot schools being under special study and serving as bridgeheads for large-scale implementation.

The third issue of policy decision-making concerns the way that ICT is integrated into school curriculum, either by an integrated approach or a self-contained approach. The integrated approach takes into account information and communications technology as an integral part of general school curriculum, while the self-contained approach stresses teaching of new information technology as separate subject matter. American education tends to focus on the integrated approach more, while German education is still slightly skewed toward the self-contained approach even though there is a strong tendency to dialectically relate these aspects of the instrumental and the medial character of information technology to each other within the framework of media education (Wilkens, 2000). In the Republic of Korea, the integrated approach and the self-contained approach are emphasized equally in the course of ICT policy implementation. It is generally acknowledged that the self-contained approach is the most feasible at the initial phase and requires less human and material resources. The German approach is not the case here, of course, and is supposed to be due to special, cultural background, which includes the role of media as propaganda for governments in the past (Langner, 2001).

Conclusions

Through comparison of recent ICT initiatives of Korean, German and American educations, some convergences and divergences were found as anticipated. Convergences were found in terms of intervention of central government and the spectrum of core policies. Divergences were found in implementation approaches and processes of policy decision regarding ICT integration into education.

Considering viability of comparative studies like this article, divergences in characteristic approaches of each country would have particular significance here. This is due to the potential weaknesses of one country being spotlighted, thereby providing helpful feedback to the other countries. For instance, probable procrastination in German ICT initiatives, which can be caused by an excessively prudent approach, can be prevented when referring to outcomes of American initiatives and «sprintable» Korean efforts. On the other hand, the speedy outcomes-oriented and goals-driven approach of American and Korean ICT initiatives needs to be controlled by prudence and critical attitude against possible side effects. The German perspective of media education of incorporating diverse media (including computers, in particular) is a very conceivable point for American and, especially, Korean practices of ICT integration into education, where every effort tends to be focused solely on computers and Internet.

Comparing divergences among the three countries also reveals common tasks for which they may cooperate on in order to resolve mutual problems. Looking at school sites of each country as well as related literatures, one can see that ICT integration into schooling is still far from being satisfactory. Thus, it is implied that, in addition to individual country's efforts such as increasing teacher training, diverse international cooperation for common problems needs to be devised among the three countries.

One thing that must be finally indicated with regard to any other follow-up studies of this sort is that more in-depth analysis is needed in comparing ICT initiatives of different countries. As indicated, this study mainly dealt with literatures at the federal and/or state level. Looking at details of ICT implementation including school districts and local practices as much as possible, however, would provide more meaningful results and implications that would not be identified otherwise.

References

Bildung und Wissenschaft (2000/3). Bonn, Germany: Inter Nations e. V.

Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung. (1987). *Gesamtkonzept für die informationstechnische Bildung. Materialien zur Bildungsplanung Heft 16*. Bonn, Germany: Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung.

Bundesministerium für Bildung und Forschung. (2001). *IT-Ausstattung der allgemein bildenden und berufsbildenden Schulen in Deutschland*. Bonn, Germany: Bundesministerium für Bildung und Forschung.

Cho, M. H. (2000). Educational policy on information and communication technology: Achievement and direction for change. *Cheongju Teachers College Journal*, 37, 359–386.

Cookson, Jr. P. W., Sadovnik, A. R., & Semel, S. F. (Eds.) (1992). *International handbook of educational reform*. New York: Greenwood.

Der Spiegel (1999/42). Hamburg, Germany: SPIEGEL-Verlags Rudolf Augstein GmbH & Co.

Die Zeit (2000/14). Hamburg, Germany: Zeitverlag Gerd Bucerius GmbH & Co.

Executive Office of the President. (1993). THE NATIONAL INFORMATION INFRASTRUCTURE: AGENDA FOR ACTION. Washington, DC: The White House. (Available by FTP at ftp.ntia.doc.gov, file niiagenda.asc; by gopher at gopher.nist.gov.)

Finn, Jr. C. E., & Rebarber, T. (Eds.) (1992). *Education reform in the 90's*. New York: Macmillan.

Hauf-Tulodziecki, Annemarie. (1996). Warum es nicht reicht, nur Computer in die Schulen zu stellen-Erfahrungen mit der Einführung der informationstechnischen Grundbildung. (Available on-line: http://region.hagen.de/FORUM/ITG.Top.html)

Hedtke, R., Kahlert, J., & Schwier, V. (2001). Service industry for teachers? Using the Internet to plan lessons. *European Journal of Education*, 36(2), 189–193.

Idaho Council for Technology in Learning (1999). *The Idaho Technology Initiative: An Accountability Report to the Idaho Legislature on the Effects of Monies Spent throughthe Idaho Council for Technology in Learning*. Idaho: The State Division of Vocational Education, The State Department of Education, Bureau of Technology Services.

IDC (2001). *IDC 2001 Worldwide blackbook*. Boston, MA: IDC.

Johnson, D. L., & Liu, Leping (2000). Frist steps toward a statistically generated information technology integration model. *Computers in the Schools*, 16(2), 3–12.

Korea Ministry of Education. (1998). *Information and communications technology in education*. Seoul, Korea: The Ministry of Education.

Korea Ministry of Education. (1999). *Information and communications technology in education*. Seoul, Korea: The Ministry of Education.

Korea Education & Research Information Service. (2000). *Information and communications technology in education*. Seoul, Korea: The Education & Research Information Service, The Ministry of Education.

Korea Education & Research Information Service. (2001). *Information and communications technology in education*. Seoul, Korea: The Education & Research Information Service, The Ministry of Education & Human Resources Development.

Langner, Irene. (2001). The status of Internet education in Japanese and German guidelines on ICT and media education. MedienPädagogik, 2001(2). (Available on-line: http://www.medienpaed.com)

Mann, D., Shakeshaft, C., Becker, J., and Kottkamp, R. (1999). *West Virginia Story: Achievement and Gains from a Statewide Comprehensive Instructional Technology Program*. Santa Monica, Calif.: The Milken Family Foundation.

McNabb, M., Hawkes, M., & Rouk, Ü. (1999). Critical issues in evaluating the effectiveness of technology. National Conference on Educational Technology. Washington, D.C., July 12, 1999.

OECD (2001a). *Education at a glance: OECD indicators.* Paris, France: OECD.

OECD (2001b). *Learning to change: ICT in schools*. Paris, France: OECD.

Oechtering, V. (Ed.)(1998). *Computernetze-Frauenplätze: Frauen in der Informationsgesellschaft*. Opladen, Germany: Lesde & Budrich.

Schulz-Zander, Renate, & Fankhänel, Kristine. (1997). Learning networks in German schools and teacher education. *European Journal of Teacher Education*, 20(1), 61–70.

Sherry, L., Billig, S., Jesse, D., & Watson-Acosta, D. (2001). Assessing the impact of instructional technology on student achievement. *T.H.E. Journal, 2001(Feb.). (Available on-line: http://www.thejournal.com/magazine/vault/A3297.cfm)*

Silverstein, G., Frechtling, J., and Miyaoka, A. (2000). *Evaluation of the Use of Technology in Illinois Public Schools: Final Report*. Prepared for Research Division, Illinois State Board of Education. Rockville, Md.: Westat.

The Milken Exchange on Education and Technology (2000). *Miami Dade County Public Schools Assessment Study:1999-2000.* Santa Monica, Calif.: The Milken Family Foundation.

Tulodziecki, G. (1996). Contributions of media use and media literacy education to school innovation. *Educational Media International*, 33(1), 23–38.

U.S. Department of Education (2000a). *Progress report on educational: State-by-state profiles*. Washington, D.C.: Office of Educational Technology, U.S. Department of Education.

U.S. Department of Education (2000b). *e-Learning: Putting a world-class education at the fingertips of all children*. Washington, D.C.: Office of Educational Technology, U.S. Department of Education.

Venezky, R. L.(1998). The United States of America. In Myung-suk Pang(Ed.), *Information & Communications Technology in Education: A policy analysis casebook*. Seoul, Korea: Korea Multimedia Education Center.

Wilkens, U. (2000). *Das allmähliche Verschwinden der informations-technishen Grundbildung*. Aachen, Germany: Shaker.

Xin, J. (1999). «Computer-Assisted Cooperative Learning in Integrated Classrooms for Students with and without Disabilities». *Information Technology in Childhood Education*, 61–78.