An Exposition of the Crucial Issues in China’s Educational Informatization

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Educational informatization, an indigenous term widely used in several Asian countries including China, is about the systematic and comprehensive use of modern information technology (IT, e.g., computers, multimedia, the Internet, telecommunication, and satellite) in China’s K–12 and higher education. This article systematically examines the educational informatization of China in the past several years, by addressing developments in the wide area network (WAN) education network, distributed resource network, automatic system for assessing student IT skills, technical standards for educational informatization, technologies supporting interactive classroom, use of online games in K–12 schools, development of mobile learning or education, and modern distance education in rural and underdeveloped areas of China. Progress in these areas reflects the accomplishment and challenges of China’s educational informatization.

Ever since China’s establishment of the Tenth Five-Year Guidelines for Developing Educational Informatization and the launching of Networking All Schools project in 2000, the waves of educational informatization have swept over the major areas of China. Educational institutions have made substantial progress in funds allocation, construction scale, software and hardware platforms, and the implementation of IT in teaching and learning. From 2000 to 2004, in particular, a handful of inspiring models for implementing educational informatization have emerged; they are examined below in further detail.

An Upsurge in WAN Education

WAN is a computer network that spans a relatively large geographical area. Typically, a WAN consists of more than two local area networks (LANs). These are often connected through public networks, such as the fiber system, leased data lines, or satellites. The Internet, for example, is the largest WAN in existence. From 2002 to 2004, China constructed branches of WAN educational network (WEN) throughout metropolitan areas such as Beijing, Shanghai, Shenzhen, Foshan, Dongguan, and Guangzhou. The construction of WEN has been a catalyst for fully developing regional educational
informatization, including IT integration in curriculum and the development of e-learning.

Building on broadband, WEN connects the intranets of China’s Department of Education with the networks of many K–12 and higher educational campuses. Aiming to modernize education and educational administration, WEN also provides various educational software and resources, which form a comprehensive digital service environment for regional educational institutions. Therefore, WEN is considered the best media with which to fully facilitate regional educational reform in both technology and pedagogy.

The network structure of WEN includes five parts: (a) educational digital resource providers (satellite, university, or corporate digital resource training centers), (b) network center, (c) public digital networks, (d) school and university campus networks, and (e) connections to homes (see Figure 1). Among the five parts, campus networks are the basic nodes of WEN, and network center is the core element. Campus networks use public broadband data communication networks to access the education information network and the Internet. WEN also has two peripheral parts: (a) home networking, which is an extension to WEN and the foundation of continuing and lifelong education; and (b) the social resource service organizations, which use the Internet and satellite radios to periodically update education resources and other corresponding services for the education information network center. Figure 1 illustrates the WEN of FoShan, a city in Southern China (Cen & Yu, 2003).

The application system of WEN adopts the application services provider (ASP) architecture, a centrally operated service, system rather than an individual system installed on individual campuses. Thus WEN is able to provide personalized, customized teaching and management services for all local schools and universities in a particular city. WEN has the following advantages:

- Its centralized service supports the entire education system and associated institutions.

The WEN-based information management system used in education, for instance, includes the server, database storage system, and information management system. Local bureaus of education play the role of vendors, who provide one-to-many Web-based service to K–1 schools and other educational institutions. These bureaus also provide other services to these educational clients, such as management and service related to online education, including upgrading, maintaining, and updating hardware and software. As a result, educational clients do not have to purchase management software and servers. Nor do they have to build individual and inconsistent computer information systems. They do retain the option of designing their own Web interface and management systems rather than using the default systems offered by the bureaus, and thus have the ability to manage their own information. Figure 2 displays a WEN used for educational management and information services.
The WEN-based information management system for education costs much less than the total costs that would be incurred if each individual institution built its own system. WEN also lowers the risks of service outage and the need for maintenance. In addition, from the perspective of information management, centralized WEN service can help avoid the formation of isolated “information islands,” which are often caused by incompatible systems and inconsistent data format.

We believe that WEN construction needs to make teaching, course, and educational management its core elements. The core educational information center would provide network administration, information management, digital instruction, resource sharing, IT education training, and distance education services. The regional educational information center will enable the deployment of education management databases for every regional school district and university. It will also enable the deployment of instructional support platforms (ISPs) based on a campus network, so as to promote network-based teaching and learning, which can better foster student creativity and self-regulation in learning than is possible in lecture-based classroom learning. In addition, WEN also needs to include instructional resources and resource management systems for all subject areas of K–12 education to meet the particular needs of individual schools. Accordingly, WEN builders need to provide training to the large number of school teachers and administrators to facilitate their adoption of network technology in teaching and learning.

The Emergence of the Distributed Resource Network

Education resources constitute one of the key factors that must be well managed in educational informatization. In the past several years, it has been common practice to provide an entire region (city or school districts) with a high-volume, high-quality WEN-based service system, so as to synergize the distributed education resources in that region. The system built by the Audio-Visual Education Center of Guangdong Province is exemplary in integrating educational resources into its WEN system (Yu, 2002). This system uses distributed resource storage, a centralized resource directory, a high-speed data resource cache, and a dynamic collection of resources (see Figure 2).

In distributed resource storage, resources are accessed and shared among campus networks, and the metadata information of all resources is periodically autosubmitted to the directory center. Thus, the centralized resource directory provides users with an up-to-date resource directory covering all of the education resources in a particular province. It maintains a resource

Figure 2  A WEN (Wan-based Educational Network) used for educational management and information services.
directory in the resource center to achieve synchronous update management of resource directories among different sites in local areas, and it also provides a powerful retrieval system that can offer quick indexing of resources on different sites.

In addition, the exchange of data in a distributed resource network encourages different product vendors to import data from their management systems into a central system. The central system then systematizes valuable instructional resources and management methods for wider and more convenient user access. For instance, teachers in Shenzhen City can use resources from nearby cities by accessing the central resource center in Guangzhou, although they use a different database system.

Also, the high-speed data resource cache mechanism stores parts of resources locally from superior resource sites, and then adjusts the stored data according to resource access hits, so as to encourage more user access. Finally, the resources-searching agent enables dynamic tracking and automatic collection of copious education resources on the distributed resource network as well as metadata on the Internet.

Using the above technologies and systems, the AV Education Center of Guangdong Province built an index server for education resources of the province. This index server collects the metadata information of distributed education resources from all school districts and higher educational institutions. Thus, when a regional resource database is updated, the index directory hosted in the provincial resource center will be synchronously updated. The regional resource bank and the index directory center are thus seamlessly connected through an education resource network covering the entire province, which will eventually help accomplish distributed storage, management, and value-added supply of shared resources throughout the province. This index server method not only ensures that schools have easy access to education resources, but also helps reduce access traffic and the failed access associated with the traditional centralized models.

The Capacity of the Automatic Assessment System

The development of IT courses in elementary and middle schools coincides with an urgent need to properly assess the IT skills of students. Because IT skills are often reflected in practice, the exclusive use of written exams in many of the subject areas is not sufficient to assess the hands-on capabilities of students in using computers. Therefore, test questions in IT courses often include two item types: (a) the objective items examining students’ basic knowledge and techniques, which can be easily evaluated by computers; and (b) the practice items addressing students’ hands-on skills with operating systems and major applications such as Word, Excel, Powerpoint, and FrontPage. Therefore, teachers must keep scores of both the objective answers and students’ operational skills.

However, assessing students’ hands-on abilities with computers is still challenging because evaluators must be present during student use of the applications being tested. In addition, observations of multiple evaluators sometimes can be biased and unfair: Different evaluators might apply different standards to student performance. To solve this dilemma, the automatic assessment system (AAS) was created and widely adopted to assess student grasp of IT skills. The AAS can reduce the time needed for exam administration, improve the accuracy of evaluation, and meet the needs of schools and all levels of IT assessment organizations. The use of AAS in many regions, for example, Tianjin, Pingxiang (Jiangxi Province), ShenZhen, Futian, and Foshan (GuangDong Province), has been successful.

Network-based AAS can accept different types of autosubmitted papers and evaluate them all at once. The system is able to trace operational items so that students can easily know what they missed and can review accordingly after the test. It integrates several subsystems, such as proposition, testing, and grade analysis, into a single larger system, thus speeding up the evaluation process for teachers. For safety and other purposes, the system can also recover from a power failure, and thus has strong fault tolerance. The testing management system includes
student enrollment, paper submission and evaluation, publications of student grades, and printing. Figure 3 illustrates the structure of the AAS.

The Standardization of Educational Informatization

In China, the technical standards for educational informatization are not yet fully established. Because of this, various education resources cannot be shared effectively among different schools, institutions, and organizations. This lack of sharing results in repetitive low-level development efforts, and creates barriers for China’s educational practitioners and technologists to communicate with international e-learning systems. These problems become more salient with the rapid development of online learning and e-learning.

Responding to this urgent need, China’s Ministry of Education (MOE) founded the Chinese e-Learning Technology Standardization Committee (CELTSC) and organized experts from eight key national universities to perform the corresponding work of standardizing educational informatization. This committee is also a member of the ISO Standards Workgroup for Information Technology for Learning, Education, and Training (ISO JTC1/SC36) and the Learning Technology Standards Committee (LTSC) of the Institute of Electrical and Electronics Engineers (IEEE). This committee aims to study, establish, and popularize the technical standards for educational informatization and e-learning in particular.

Regarding the rapid development of distance education and educational technologies in China, establishing a set of standards will help promote the development of e-learning in China, to help achieve resource sharing, system interoperability, and the quality of services (QoS) of distance education. Because these standards are to be established especially for China, they are expected to be well received throughout the educational institutions of the nation.
Although still being finalized, the current established e-learning standards include 27 subdivisions (Zhu, 2003), which can be further divided into general standards, teaching resource standards, learning standards, the teaching environment standards, and the education QOS standards. In addition, the committee also launched four research projects to track the impact of these standards on education. The current standards are still being piloted, and the associated research can help fine-tune them to be nationally applicable. Research on every subdivision is expected to report on the following aspects:

- The specification text section, which describes the objectives, category, glossary, system elements, the metadata definition, and the data exchange format of the standard.
- The practice guide, which includes a thorough explanation of the specification and some application examples.
- The test specification, which describes the testing programs and methods for standardized e-learning products.

After more than a year's effort, the CELTSC committee proposed a relatively integral e-education architecture composed of several standards and specifications, such as distance education resource construction specification, and educational management information standards and specifications, which now regulate the Chinese e-learning industry.

The distance education resource construction specification can be used to guide the development, application, and management of educational resources. The educational management information standards address the daily management of educational institutions and K-12 schools.

Pedagogical Reform: Promotion for Interactive Learning

The keystone of educational informatization is the integration of IT into classroom instruction. The traditional educational methods in China often feature instructor-centered lecturing or presentations, in which students are passive audience members who take notes and try to pass exams (He, 2004). Lower level integration supports teacher presentation of course content, for example by constructing multimedia facilities such as classroom projection systems to assist teaching and learning. By contrast, higher level integration improves and enhances the student-student and student-teacher interaction of classroom instruction through course design and IT facilities. The integration of IT in the classroom therefore creates opportunities for more frequent student-teacher interaction. The increasing popularity of highly interactive instructional systems became a significant portion of e-learning promotion in 2004.

Multimedia classrooms, instant messaging

Figure 4  Representative interactive multimedia classrooms.
feedback system (such as QQ), and campus network-based instructional systems are all examples of innovative instructional systems. A multimedia classroom is equipped with a computer network that consists of many interconnected computers with AV transmission and interactive software systems, or a set of specialized AV hardware controllers. The multimedia features include live broadcasting of teacher presentations, teachers' central control of students' screens, relaying of team teaching from a distance, electronic forum, network interphone, network theatre, remote command, system lockdown, remote restart, mouse and keyboard lockdown, electronic voting, remote tutoring, electronic ferula, and instant messaging. Multimedia classrooms, similar to Western smart classrooms, have been popular in many schools and universities until now because they provide for more interaction and an ideal environment for technology use in regular classrooms. On the other hand, the high cost of multimedia classrooms is a disadvantage. Figure 4 shows the structure of typical multimedia classrooms and the ways in which students use the media.

Among all the multimedia features, especially noteworthy is the instant information feedback system (see Figure 5), a software-hardware teaching tool with interactive feedback controllers and recording of class statistics. This system enables teachers to obtain student feedback live in class through group infrared technologies and multimedia instructional technologies. Students use a controller and a receiver to connect to computers at the teacher's station, thus allowing them to easily attend quizzes and other games; in turn, the system provides the teacher with information about each student's progress. The system is easy to use, convenient, and inexpensive. It can increase the degree of classroom interaction and help create a sense of learning community. The system can also automatically grade test papers, store students' learning records, analyze students' answers to teachers' in-class questions, provide teachers and parents with learning schedules, and monitor the learning status of students.

This instant information feedback system uses freshly collected classroom data to provide instant and precise feedback on the teaching process. It creates an easy way of interacting with the teacher and therefore is considered a breakthrough in China's educational technologies. This system changes the traditional unidirectional mode of class instruction and promotes student-centered learning. With the aid of the classroom feedback controller, this system makes regular equipment, such as class computers and projectors, more useful in teaching and learning. This system is currently used in class-
room evaluation, controlling of PowerPoint documents, voting, scoring, group competition, and student research.

In many K–12 schools, students can use a small and inexpensive wireless device to respond to polls, surveys, questionnaires, and questions from the instructor. Answers and results can be projected onto a big screen for the teacher to analyze, enabling the teacher to adjust teaching right on the spot.

Multimedia classrooms are facilitating China’s pedagogical transformation from the traditional teacher-centered instruction to student-centered learning. In the new learning environment, instructors learn to reposition themselves as facilitator, or coach. Their teaching philosophy is gradually changing from knowledge transmission to knowledge construction.

According to several existing studies (Yu, 2002; He & Yu, 2005), multimedia classrooms enhance both the process and outcomes of learning.

The campus-network-based instructional system is a supporting tool operated by individual higher educational institutions. This system includes many components: online special remediation, a questioning-answering center, a discussion group, courseware management, instructional management, lesson preparing, schoolwork review, online expert consultation, and instructional evaluation. The system is also conducive to the building of virtual and interactive learning communities. In addition, it can separate general interactive functions to help teachers stay focused on writing the course content, which will greatly reduce their workload. Moreover, this system can provide many self-directed learning strategies, thus stimulating students’ learning interests and promoting student-centered learning.

The Emergence of Online Educational Games

Educational games have been popular in Western education but have only recently entered China’s educational realm. Online educational games are recreational but clearly focus on teaching and learning. Similar to other online games, educational games can be competitive and entertaining. They provide learners with virtually challenging scenarios and can add an element of fun to learning. Many games require students to use their active and inert knowledge to solve problems and to complete the challenging tasks. Students learn from establishing expectations, solving problems, and competing intensely. In addition, online games can be easily accessed anytime and anywhere the Internet is available.

At present, two types of online games are in use in China: (a) human-computer games and (b) interpersonal online games. The former consist of two subtypes: (a) the network version of face-to-face educational games and (b) the client-server network game. The gaming rules and interaction manner of the former are oriented toward human-computer, and thus the design and many features differ from its face-to-face version. In the client-server network game provided by the server, players interact with the server-side games through networks. A handful of Web sites built upon human-computer interaction (such as Shenda Co., gamequarium.com, learningplanet.com, and Games2Train.com) include a wide range of applications such as online learning, arithmetic, virtual lab, online map, thinking training, medical diagnosis, and personalized problem-solving training. Figure 6 displays an online game, Learning from Lei Feng, which has been used in moral education in many schools.

The gaming rules and interactions of interpersonal online games are between players; computer networks that host the games help facilitate this type of interaction. Similar to the human-computer games, interpersonal games allow players to seamlessly integrate online learning with the playing process. Not only does this facilitate human-computer interaction, it can also help attain interpersonal competition, interaction, cooperation, and extensive simulated teaching through interpersonal communication and real-life problem solving. Therefore, this type of game promotes problem-based learning, role playing, cooperative learning, task-driven learning, and inquiry learning. This kind of game has great potential for broad application and has drawn a great deal of attention.
from the educational and training communities, such as SchMOOze University (http://schmooze.hunter.cuny.edu/).

Figure 7 shows a representative interpersonal educational game, Learning English in CollegeTown (telnet://galaxy.bvu.edu:7777/). Once users log on to CollegeTown, they can access different topic areas, such as seminar room, newbie...
hall, or south quad, and then can interact with others in English, thereby improving their English skills.

Online educational games incorporate knowledge, fun competition, cooperation, and virtual reality into learning, making them suitable for cultivating problem-solving and cooperative skills for K–12 students. These games can also stimulate students’ learning interests and maintain their learning motivation. Without doubt, educational games will lead the trend of e-learning and mobile learning in China’s near future.

Systematic instructional design (ID) principles can guide the design and development of these games. The current game design process used in China is similar to the Western ADDIE (analysis, design, development, implementation, and evaluation) model, and it has a strong focus on the analysis of learning goals, students, and teaching strategies. The design is often task based, and thus technology is positioned as a tool to help learners accomplish these tasks.

The Growing Application of Mobile Devices

Mobile learning, defined as learning with mobile devices such as Palms, PocketPCs, wireless cameras, Web tablets, cell phones, and any other handheld devices (Harris, 2001; Kossen, 2001; Quinn, 2000), has drawn a great deal of attention in the United States and Europe. Several exemplary projects in the West are worth mentioning. In higher education, the ActiveCampus Project of the University of California at San Diego aims to increase communication and collaboration among its large “nomadic” undergraduate student population through the use of PDAs and an extensible suite of mobile services such as instant messaging, ActiveClass, and ActiveResearch, so as to build and sustain learning communities (Ratto et al., 2003). The Mobile Inquiry Technology conducted at the Stanford Research Institute provides science and math inquiry for K–12 students through portable accessible computing. The Institute currently is piloting the project with teachers from four Massachusetts public school districts who are leaders in math, science, and technology (Shih, personal Web site, 2004).

Mobile computational devices currently used in China include mobile phones, pagers, Palms, PocketPCs, wireless cameras, and small notebooks. Along with the development of data communication technologies and the broad application of mobile terminal units in China, mobile devices were first used in disciplines such as finance, telecommunications, mass media, business, transportation, and health care. The unprecedented success of cell phone text messaging inspired the telecommunications industry to develop additional multimedia applications. With their sophisticated features and powerful affordance for communication and collaboration, mobile devices finally entered the field of education in the past two years and thereby launched China’s new era of mobile learning or education (m-education) (Cui et al., 2004). Although the use of mobile devices in education is still in its infancy, there have been several exemplary cases of successful use in K–12 schools and higher educational institutions.

Aiming to integrate mobile communication and network technologies with education, mobile learning is more advantageous than online learning in China for its mobility, universality, personalization, and efficiency. Until recently, China’s mobile phone users largely outnumbered wired PC users. Even mobile users who are not familiar with computers can easily access the network through cell phones. This easy accessibility has greatly encouraged personalized, anytime-anywhere, and lifelong learning. Technologically, 2.5G and general packet radio service enable users to be “always connected and online,” which facilitates learners’ information acquisition and processing and thus better supports their learning.

Recently, the educational technology communities in China have initiated research about the principles and practices of mobile learning. The MOE established a mobile education program that supports mobile learning, teaching, and support services for education. “M-Education is the education activity that can take place anytime, anywhere with the help of a mobile computer device. The device must be capable of presenting educational content and providing
wireless two-way communication between teacher(s) and student(s)” (Cui et al., 2004, p. 1).

However, the current use of mobile devices is still limited to student-teacher and student-student communications. For instance, several experimental K–12 schools use mobile devices for students and teachers to exchange short text messaging: mobile e-mails, text messaging, activity notices, and grade queries. Several leading institutions of higher education have attempted to create mobile virtual classrooms. The E-learning Lab of Shanghai Jiaotong University (SJTU), for instance, has successfully delivered its undergraduate-level courses through mobile devices such as cell phones and PDAs (e.g., PocketPC 2003, see Figure 8).

The E-Learning Lab plans to pilot implementing mobile learning activities with its several large-size classes, which can benefit from mobile interaction and communication. Each student will receive a PocketPC or a powerful cell phone and will be able to communicate more easily with instructors and classmates.

This easy communication will help students get the instructor’s attention and have their questions answered promptly. The final goal is to build mobile virtual classrooms (MVclassrooms), where classroom and online students can share presentation tools, interact among themselves, and engage in dialogue with the instructors. Courses that are delivered in MVclassrooms will have to be redesigned with more student-centered learning activities, and include multiple assessment methods such as team projects, discussions, participation, and tests. Currently, college-level courses in China predominantly feature teacher lecturing, students silently taking notes, and then a final fate-determining test. It is our hope that mobile learning can bring bottom-up pedagogical changes to higher education in China by placing students at the center of instruction and by encouraging more interaction and collaborative learning.

The Distance Education Department of Peking University has also built a mobile virtual...
class (MVclass) to facilitate resource sharing and communications among campus students, distance students, and instructors. Their piloting implementation reveals that MVclass could improve the efficiency of teaching (Cui et al., 2004).

With the rapid technological development, mobile learning in China will have enormous opportunities in the near future. The traditional teacher-centered curriculum, however, is urgently in need of redesign to make the best of the advantages of mobile devices. For instance, several of the distance education departments of institutions of higher education are actively seeking ways to adapt their current curriculum for successful delivery to mobile devices. Thus, we hope that the development of mobile learning can also bring pedagogical changes to higher education. More research needs to be conducted to explore the impact of mobile learning on student learning motives, their course performance, and their mastering of IT skills, as well as the effect of mobile learning on student satisfaction, sense of community, and learning outcomes.

Bridging the Digital Divide: Modern Distance Education in Rural Areas

The “Digital Divide” frequently discussed in the Western world exists in China as well. In China, it specifically refers to the large gap between those who have easy access and those have little or no access to information. The development of IT has widened this information gap, which in turn widens the income gap between the rich and the poor. The digital divide affects economic, political, and social progress in China, and it has increasingly become an outstanding problem of China’s information age. Economist Hu AnGang (2002) stated that China currently faces three big digital divides: (a) between China and the world, (b) between the different regions of China, and (c) between urban cities and rural areas of China.

Compared to the developed nations of the world, China is lagging behind in digitizing information, managing information, and applying digital information in life and work. Within China, the midwestern regions are falling behind the eastern and southern regions in this digital evolution. Finally, the rural countryside, where people can barely acquire their basic daily needs, lags well behind urban centers in digital development.

One critical strategy to help bridge these divides is the development of education. Inadequate educational development in the midwestern regions, and in the rural areas in particular, has had a negative impact on economic development. A negative loop is formed between low productivity, low demands for modern technology, lack of high-quality human resources, low emphasis on improving human quality, and limited material resources. All of these enlarge the digital divide and hamper investment in education; the lack of educational investment in turn helps to perpetuate the other deficiencies.

China faces a major challenge in breaking this vicious circle and jump-starting the development of education, thus fundamentally reducing the gap in educational resources, beliefs, methods, and systems. Bridging these gaps will improve the economic interaction among the local areas of these provinces, and will increase use of IT and education for IT. Toward this goal, since 2002, China’s Department of Education has invested about 10 billion Yuan in its Rural Area Modern Distance Education Project, which aims to improve K–12 education and vocation education in rural regions.

In 2002, the Li Jiacheng educational foundation also launched two large-scope projects in Gui Zhou province and the capital of Tibet, La Sa: (a) the West K–9 Schools Distance Education Project, and (b) the West K–9 Schools Teacher Development for Distance Education. By 2003, both projects had accomplished much. They established 10,000 centers that could receive satellite-based educational programs. They also built media centers for 5,000 elementary schools, where teachers and students can use CD-ROM in teaching and learning. Sets of up-to-date CD-ROM courseware were provided to these schools as well.

In 2002, with the approval of the government, another 3.64 million Yuan was allocated to build more modern distance-education-demonstration projects. These projects involve about 29,229
elementary schools and 2,350 middle schools in the western regions. They are currently building about 5,016 satellite-receiving centers, and also are constructing computer classrooms for about 200 schools in the five northwestern provinces. Similar projects were launched in 2003. Their goal is to bring educational technology and resources to 110,000 rural elementary schools, which serve about 5.1 million students. They will also launch programs to train teachers in teaching methods, computer literacy, and the best applications of computer technologies in teaching and learning.

Overall, three models are used in the rural modern distance education development: (a) Constructing media centers including TV, CD-ROM and DVD players where CD-Rom and DVD-based courseware are used in teaching and tutoring; (b) building “smart classrooms” that are equipped with satellite-receiving facilities, broadband Internet, TV, DVD players, and sets of CD or DVD courseware; and (c) building computer-equipped classrooms, which also have satellite-receiving facilities, access to the Internet, and multimedia facilities. Thus, all three models will help create technology-based learning environments for large numbers of students in these areas.

Rural modern distance education projects can significantly contribute to educational development in the western areas of China. Distance education centers built by these projects can be expanded to more areas, so as to further spread advanced science and technology. These centers can also facilitate resource-sharing between the more developed cities in the eastern, southern, and central regions and the rural towns and villages of the western regions. All these endeavors will lead to the balanced development of education and the gradual bridging of the digital divide.

However, the initial efforts of these projects are all heavily focused on technology facilities and hardware. Teacher training is still given low priority. There are short-term workshops on how to use the equipment, but no prolonged efforts in helping teachers redesign their curriculum and create hands-on activities to improving learning outcomes. Therefore, rural areas still face many pedagogical challenges. First, many schools have teachers who never receive formal college or teacher education. Second, beyond that basic educational preparation, teachers in rural China must know how to use computer technologies and improve their digital literacy skills. They then face the bigger challenge of reforming their curriculum and creating new and innovative teaching activities that can make the best use of the available computer technologies and smart classrooms. Thus, teachers will need systematic training to release their control of the classroom and learn how to encourage student initiative and active participation in the learning process. Finally, the sudden introduction of technology into rural schools underscores the need for systematic and large-scale research to address what changes, pedagogical or otherwise, have taken place in technologically integrated classroom practices.

Conclusion

In this article, we have addressed several crucial issues of educational Informatization in China. All these help to predict future trends and to identify the improvements needed in this challenging task.

Primarily, China’s educational technology has been overly focused on technology. Although technology has advanced a great deal in China, the application of technology in education awaits further development. Therefore, educational technology here needs to switch from being hardware-centered to being implementation-centered or teaching-centered. Fortunately, the changes have begun in some developed areas such as Shanghai, Guangzhou, and Shenzhen, where educators have realized the importance of software training and implementation help.

Second, there are urgent needs for teacher training, especially when Chinese educators are gradually adopting the constructivist way of teaching and learning. They begin to focus the technological and pedagogical needs on the students instead of themselves. Therefore, the next phrase of informatization should emphasize student learning needs from all aspects: software, hardware, and educational resources. This
change forms a clear contrast with the current education management systems and databases that mainly support teachers and instructors.

Third, with the gradual development of educational informatization in big cities, it is critical to maintain a long-lasting and balanced development in all regions of China, including small cities and the remote countryside. Researchers and practitioners should address how to maintain the positive impact of informatization on education, and how to help each region keep up with each other’s progress in this mission. We anticipate the extensive use of many advanced technologies or technological solutions such as digital video broadcasts, social software, real time audiovideo interactive conference systems, virtual reality learning environments, intelligent instruction support systems, and development evaluation systems.

Finally, the standards for educational informatization, including online learning, e-learning, and mobile learning, will be continuously refined and further implemented.

The principle challenges facing China in the development of its educational technologies include putting its rapidly developing technologies to better use, closing the gaps between regions and between urban and rural areas, and connecting its educational systems, standards, and development to the rest of the world. These issues are begging for creative ideas from researchers and practitioners in education and educational technology.

Educational informatization can help China transform from a primarily knowledge-based to a more skills-based educational system. Using educational technology effectively can help facilitate the integration of the two systems, so as to form a unique Chinese pedagogy, one that builds a systematic knowledge base, but also cultivates students’ critical thinking skills and helps them build character.

References


Distance Education in Malawi

By Ross A. Perkins, Simeon M. Gwayi, Paxton A. Zozie, and Barbara B. Lockee

 Whereas Africa is a continent of widely diverse peoples, languages, religions, and beliefs, many of its countries share some unfortunate commonalities. Of the 50 countries listed by the United Nations as “least developed nations,” 34 (68%) are found in Africa or just off
one of its coasts (UN Office of the High Representative for the Least Developed Countries, 2005). The blame, in part, has been placed on the lack of ability in those countries to provide basic schooling to their citizens. Education has been and continues to be linked with economic prosperity (Carnoy & Samoff, 1990; DeYoung & McKenzie, 1989; Fägerlind & Saha, 1989; Michele, 1987), and therefore, innovative approaches to education are important issues to decision makers. Encouraged by the scalable initiatives they see around the world, and because this can help overcome barriers related to lack of human capacity and other infrastructure concerns, leaders in low-income societies have turned their attention to distance education (Aabenhus & Kenworthy, 1996; Brown & Brown, 1994; Chung, 1992; Demiray, 1995; Eastmond, 2000; Hawkridge, 1991; Ferraton, 2000; Shrestha, 1997; Sibanda & Northcott, 1989). As Tam (1999) wrote, “distance education has become . . . the anthem of comprehensive national development” (p. 24). In the low-income nations of Africa and elsewhere, distance education is viewed as a low-cost alternative that can expand traditional, formal education; it is not solely a supplement to an existing education system (Jenkins, 1989; Rumble, 1989).

That distance education works in the global context is largely because it operates on an economy of scale (McIsaac & Gunawardena, 1996; Tam, 1999). Enrollment in distance education programs around the world, especially in Asia, dwarfs the enrollment of any university (private or public, virtual or traditional) in North America. India alone has more than 50 distance education providers (Eastmond, 2000).

Enrollment numbers ranging from hundreds of thousands to more than 10 million, from places such as India, China, Turkey, and South Africa (Demiray, 1995; Indira Gandhi National Open University, 2005; Lee, 2004; University of South Africa, 2005) show the incredible demand that exists for education and training. Similar institutions in developing African countries would probably not have to contend with such high enrollments because the overall population is lower (Jenkins, 1989). Nevertheless there is a real need for programs that are large enough to meet a high demand: The population keeps growing and traditional institutions (at any level) cannot accommodate everyone. For example, to fulfill their promise of free basic education for all children in Malawi, the government of Malawi literally opened the gates in 1994 and the school population increased from 1.9 million to 3.2 million by 1998 (Ministry of Education Sports and Culture [MOESC] and United Nations Children’s Fund, 1998). On some accounts their attempts are laudable, but now, as students are ready to move from primary school into high school, they face a transition rate of less than 10% (MOESC, 1998). Where will the ones who are not accepted into secondary schools receive an education after the eighth grade? In Malawi, as well as in many other countries around the world, leadership in the Ministries of Education faces tough choices to provide quality education—as inexpensively as possible—to hundreds of thousands of eager learners (Perraton, 2000).

Although there are many compelling distance programs being developed and maintained in Africa (see Working Group on Distance Education and Open Learning, 2002), an interesting account comes from the small, landlocked country of Malawi. Given its lack of resources—both technological and human—efforts there to establish distance education are fraught with difficulty. Many of these issues are enlightening to those interested in instructional technology, because they clearly illustrate the influence of context in design and delivery of courses. In this article, we first examine the history of distance education in Malawi and then, based on first-hand reports, outline the difficulties that it still faces in trying to implement non-traditional, distance-based schooling.

The History of Malawian Distance Education

The use of distance education is not new to Africa (Jenkins, 1989; Kinyanjui, 1994; Sibanda & Northcott, 1989), nor is it new to Malawi. A number of distance education institutions and organizations sprang up across the continent during the 1960s and 1970s, including the
Malawi College of Distance Education (MODE). Established in the mid-1960s and once considered a successful program (Brown & Brown, 1994), it is now defunct, although there is some speculation by educators from Malawi that it will be revived in the near future. In 1993, just before the Ministry of Education converted the MODE’s distance education centers to community day secondary schools (Canadian Higher Education Group (CHEG), 2004), MODE reported an enrollment of 35,000 students. The courses offered led to either a Primary School Leaving Certificate (Grade 8 exam), a Junior Certificate (Grade 10 exam), or the Malawi School Certificate of Education (Grade 12 exam). The material for the courses was developed by course writers and tutors. Teachers (who were not qualified to teach secondary courses and were not trained in distance education methods) led face-to-face instruction at distance education centers around the country. Radio broadcasts supplemented course material. Currently, Malawians do have access to other distance education opportunities, to obtain certifications offered by companies such as Microsoft and Cisco, not school certificates.

Two separate distance education programs funded by foreign governments, both of which focus on teacher training, have been implemented in Malawi since the mid-1990s. One of the initiatives, funded by the United Kingdom’s Department for International Development, is the Malawi Integrated In-Service Teacher Education Program (MIITEP). The second initiative, known as SSTEP (Secondary Schools Teacher Education Program), is funded by the Canadian International Development Agency, and is coordinated by two Canadian universities, a private Canadian corporation, and Domasi College, located in Zomba, Malawi. Like the MIITEP program (Kunje, 2002; Kunje & Chirembo, 2000; Stuart & Kunje, 2000), SSTEP relies on a combination of residential training, supervised teaching, and distance instruction via correspondence (print-based) methods (CHEG, 2004).

Both the MIITEP and SSTEP programs are funded, designed, and administered by agencies outside Malawi. This does not make them any less relevant; many course writers and in-country administrators are Malawian. Both programs have seen success despite challenges. The combination of MIITEP and SSTEP programs have allowed for the basic educational training of thousands of teachers in Malawi. A problem inherent in an outside system, though, is one of sustainability. Does Malawi have its own human capacity to build, design, and administer a native distance education program without the continued assistance of outside agencies?

An approach recently taken by the United States Agency for International Development (USAID) was to fund proposals specifically related to building human capacity that would help meet challenges to the long-term success of various programs. To examine distance education efforts in Malawi in more detail, one USAID project and the results of a pilot test of a distance-based program are described below.

An Instructional Technology Distance Program in Malawi

Starting in fall 2001, USAID funded a five-year partnership between Virginia Tech (Blacksburg, Virginia) and Mzuzu University (Mzuzu, Malawi) that centers on the preparation of an instructional technology faculty cadre who design and administer an instructional technology program. Going by the acronym UPIC-ICT (University Partnerships for Institutional Capacity—Information Communication & Educational Technology), the ultimate goal of the project is to advance the skills of Malawi’s primary and secondary educators.

In early 2002, five lecturers from Mzuzu University enrolled at Virginia Tech in the Instructional Technology master’s degree program. After completing one semester of classes, the Mzuzu participants returned to Malawi to carry out a national needs assessment (see Zozie et al., 2004). The needs assessment plan was designed by the Malawian students in conjunction with professors at Virginia Tech. Initially, the project leadership planned to transition Virginia Tech’s online Instructional Technology Master’s Program (ITMA) for electronic delivery within Malawi by Mzuzu University. However, the needs assessment indicated that although Malawi’s universities and teacher training col-
Leges had computer and network access, such resources were limited, and in many cases not available, to practicing educators. The Web-based program would have to be revised for delivery via print through the nation’s postal system. Additionally, needs assessment data suggested that curriculum needs varied widely, but there was interest among teachers for a postbaccalaureate program. The Mzuzu and Virginia Tech teams agreed that five ITMA courses would be redesigned to create the curriculum for the honors degree, as well as to meet the contextual needs of the learning environment. The five courses to comprise the program would be (a) Introduction to Instructional Technology, (b) Instructional Design, (c) Instructional Media, (d) Advanced Educational Psychology, and (e) Educational Research.

While participating in courses in Blacksburg, the Mzuzu faculty worked with Virginia Tech instructional technology faculty and students in a clinical experience to revise the ITMA course materials for use in Malawi (see Perkins, 2003). Because Virginia Tech’s Department of Teaching and Learning had another educational reform project that involved a group of six doctoral students from Malawi, the instructional technology project was able to leverage that group’s expertise as formative evaluators for the revised courses. Their feedback proved to be invaluable. Their recommendations focused not simply on content clarification, but also on cultural issues that needed to be addressed, such as further modification of examples so as to be relevant to Malawian students. Additionally, the shift to a print-based delivery system created the need for an implementation system that was not asynchronous, as the online ITMA program is. The adapted system would need to be more strictly regulated in terms of assignment submissions and deadlines in general to reduce the logistical overhead normally mitigated by Web-based database systems.

After the Mzuzu faculty members completed their master’s degrees, they returned to Malawi to begin preparations for the start-up of the honors program. Later, because of discussions at Mzuzu with administrators, the title and nature of the program changed, becoming a postgraduate diploma. Virginia Tech instructional technology faculty traveled to Malawi in January 2004 to assist with a final evaluation of the courses so that a regional pilot test could be conducted. Return trips in July 2004 and October 2004 allowed the teams to communicate their progress and findings during the pilot testing phase.

Results from the Pilot Test

From March 2004 to September 2004, the Mzuzu team ran a pilot test of the postgraduate diploma courses with a limited number of students. Each of the five courses had approximately five students enrolled. Many students were situated near the university, though some lived a far away as 80 K. After the students completed all course requirements, the Mzuzu team conducted interviews and gathered other data and feedback to examine what worked and what needed improvement. In their final report, the team members described many challenges that affected the pilot project. The challenges varied from logistical aspects to communication barriers. For example, the team had to use a single vehicle at Mzuzu for transportation to and from the schools where their students were employed. Although the vehicle was purchased through USAID specifically for project purposes, it was unavailable on occasion. When this happened, providing feedback to students was not possible. An unreliable postal system caused communication delays, and uneven distribution of communications networks meant that phone support was not always feasible. Furthermore, although it was possible for students living in the Mzuzu area to travel to the university campus to meet with instructors, it was not possible for students outside town to do so, because time constraints and safety of travel were chief concerns.

Another challenge to course delivery affected the actual team doing the work. Unlike other correspondence courses that might hire tutors, the ICET team was grading work and traveling to schools to provide feedback in addition to their regular duties. The project began with the Virginia Tech team working on the assumption that Mzuzu would allow these lecturers released time. Given Mzuzu’s staff shortage (meaning
they had no one available to cover the courses or duties left vacant by ICET team members, this idea was unrealistic. Unfortunately, because of USAID regulations, remuneration for extra time spent ("topping off") was not possible. This remains a serious challenge.

Certain administrative and policy challenges affect formation of a distance learning program as well. For example, it is still unclear in which faculty (department) the distance education program belongs. In order to extend the program beyond its current postgraduate diploma status, capacity at Mzuzu must be upgraded with people who hold a doctorate in instructional design.

Students who enrolled in the pilot project remain uncertain about costs and fees. A delay in establishing a fee structure has resulted in uncertainty, and students do not know when the program would begin or how much it would cost them when it finally does. Finally, larger policy decisions (such as upgrading teachers), which are made by the Ministry of Education, are slow in coming. The ICET team recommended that Mzuzu University needs to assure that there is good communication between the Ministry and university officials.

Implications for Course Design and Delivery

Taking evaluation data from all courses offered during the pilot project, it is evident that some redesign is still necessary. Just as the conversion of print-based courses for Internet delivery requires adaptation, so too does the adaptation of Web-based materials for print-based delivery. Any revisions must include cultural adaptations. But as observed in an initial case study (Perkins, 2003), changes to the ITMA courses offered by Mzuzu are required because of logistical and infrastructure considerations.

Student feedback for all courses showed that supplementary, instructor-created text should be used, in part, to explain textbook-based examples that are exclusive to a United States or North American perspective. Since the original extra-course materials (the Web-based versions) were created by and for U.S. citizens, such explanatory materials were not included. The question about student fees and course-related expenses also touches on textbooks. The current texts were paid for by grant monies through Virginia Tech. Some of the texts are very expensive, even by U.S. standards. An additional consideration then becomes whether the Mzuzu ICET team will continue to use texts, some of which are now going out of circulation as newer editions become available, or if they will place all course material in instructor-created workbooks. Should instructors have to subsume current text material into other documents, the development time, and resulting delay in programmatic offering, will be extensive.

Another instructional design issue that is affected by logistics points to assessment of student work. Courses in the online and face-to-face master's degree in instructional technology at Virginia Tech rely on student-created projects for the bulk of assessment. Given fast networks and readily accessible technology, as well as a corps of highly educated and trained graduate assistants and faculty, regular feedback on such projects happens on a daily basis. When the entire system slows down as a result of print-based media and reliance on surface transportation, the feedback necessary for such projects starts to suffer. For example, students in courses such as the Educational Research module and Principles of Instructional Design module benefited from quick feedback. The inability to support students in a way that helps them gain success and learn the materials can be quite frustrating. Therefore, the actual instructional design decisions with regard to assessment need to account for differences in feedback. It is likely that the courses offered by Mzuzu will leave project-based work and revert to more testing. A possible alternative solution would be to hire tutors or establish tutorial centers.

The Future of Distance Education in Malawi

Given Malawi’s widespread lack of communication infrastructure and end-user access to computers, the plan to implement Web-based learning is not feasible on a national level at the current time. Distance programs that have been
successful, at least in terms of enrollment numbers, continue to rely on correspondence methods and models. These programs have made and continue to make an important and significant contribution to one of Malawi’s greatest needs—the training of qualified teachers. Because of their reliance on print-based technologies and traditional, human-intensive approaches to teacher training, the existing programs still face the challenges of scalability and cost-efficiency.

One suggestion might be to pilot Web-based learning where it is possible, such as on university campuses, rather than trying to initiate a national program. Such a test would not only allow university administrators to experience the process of developing or adapting content for the Web, it would also allow them to evaluate mechanisms for assessment, feedback, and student support. To further evaluate limits of the innovation, another suggestion for those charged with teacher training would be to look at alternative models of candidate evaluation. The current system requires supervised teaching practice. Such a system depends on supervisors, which is again confronted by limits to current human capacity. Thus, many people who need teacher training are prevented from attaining it. With literally hundreds of schools across Malawi filled with nonqualified teachers, non-scalable programs are not tenable.

Conclusion

Any discussion of technology as a “tool-only” definition is incomplete. Instructional technology also refers to a systematic means of solving problems (Reiser, 1987). In the case of Malawi and so many other low-income societies where tools are difficult to purchase and maintain, one resource that is not in short supply is the number of able and willing people who could themselves provide solutions to the country’s many challenges. The important role of the instructional designer should not be ignored. Mzuzu University has the benefit of having five trained instructional technologists among its faculty. Increasing the number of designers with experience in distance teaching and learning would benefit Malawi. The insight provided by people who have taken instructional design, educational psychology, and related courses, would undoubtedly open minds to new possibilities. Not only could they guide instructional development for Web-based learning, they could design and offer training on new technologies as they become available. Although consultants from outside Malawi can offer excellent advice based on their education and experience, such input is necessarily limited by the lack of a true understanding of contextual issues. The advantage indigenous designers have, of course, is first-hand knowledge of their own context, which plays a very important role in shaping instructional decisions (Arias & Clark, 2004; Perkins, 2003; Tessmer & Richey, 1997). Indigenous instructional designers should be called on first to offer guidance as leaders in ministries and at international funding agencies seeking reasonable solutions to the challenges to access and growth that lie before them.

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Construction of E-learning Environments in Korea

By Chul-jo Kim and Rowena Santiago

South Korea is striving to be at the cutting edge in the competitive global educational movement, through the build up of information infrastructure in many sectors of its society, and through the construction of e-learning environments where the appropriate information infrastructure will support teaching and learning. The ultimate goal of this mission is to foster creative human resources in a knowledge-based society. In this article, we describe the current e-learning environments in K–12 and higher education that exist in Korea, and the results of its efforts to adapt its educational systems to a knowledge-based society.

Many countries in the world are making efforts to adapt their educational systems to information or knowledge-based society. Adaptation is the key to maintaining a competitive edge in a global community. South Korea is one of those countries that strives to be at the cutting edge in this competitive educational movement, first, through the build up of its information infrastructure in many sectors of its society, and then, through the construction of e-learning environments where the appropriate information infrastructure will support teaching and learning. The ultimate goal of such a mission is to foster creative human resources in a knowledge-based society. As a result of these efforts, e-learning has become popular in many sectors of Korean society, and it is one of the fastest growing areas in the country’s business market.

Within the context of Korean education, e-learning is operationally defined as a network of academic content and a series of processes by which to carry out the interaction between the students and information, and thus, promote learning. Supported by a national education policy, the Korean government has provided very strong leadership toward the advancement of information infrastructure and curriculum development, so that its citizens can benefit more from and make better use of the e-learning environments that are being established.

In this article, we review the overall trends among e-learning systems in Korea, and specifically describe e-learning at different levels of its educational system: elementary, secondary, and higher education. We also review various policies and practices that are being put in place in Korea for e-learning and related fields.

Information infrastructure for a knowledge-based society

Given its strong policy and constant support for information technology, Korea has achieved a competitive edge globally and has attained a well-developed information infrastructure, which puts the country at the forefront of online education or e-learning.

As of 2002, more than 11 million households (more than 70% of all households) had installed high-speed Internet network connections. According to Organization for Economic Co-operation and Development (OECD) statistics, Korea is ranked as the first among the most Internet-wired countries in the world and it is also ranked first in subscription rates for high-speed Internet service (OECD, 2003). Internet broadband coverage is above 98% in small and medium cities and rural areas. The Ministry of Information and Communication has a master plan to equip the country with broadband convergence networks that can provide connection speeds of 50–100 Mbps, which is one of the fastest in the world and a very significant increase from the current transmission speed of 1.5–2 Mbps. It is expected that with this highly improved overall information infrastructure and the strong state-level support for e-learning-related policies, Korea is working toward its aim to be an advanced nation in e-learning.
The growth in e-learning environments

High-speed Internet capability is crucial for constructing the nation’s e-learning environments, as proven recently by the introduction of a great number of educational programs that utilize the Internet and the increase in the number of online sites that provide information and lectures for educational purposes. Currently, there are more than 500 e-learning companies in Korea that provide various educational programs. Most of these e-learning industries are heavily focused on private educational institutions that are oriented toward college preparatory exams and the study of foreign languages (mostly English). According to Ministry of Commerce, Industry and Energy (MOCIE) statistics, the e-learning market in Korea is growing annually by 33% (2003a). Figure 1 summarizes the increase in e-learning market sizes in Korea from 1999 to 2003.

In addition to cutting-edge information infrastructure, the other factor that contributes to the growth of e-learning as one of the most profitable businesses in Korea and to the booming e-learning market is the zeal of Korean parents for their children’s education. Under the influence of Confucianism, Koreans have a long history of emphasizing education in their way of life. Koreans still view a good education as the most effective means of gaining socioeconomic success. Within this social context, the growth in spending rate for private tutoring in the past year was 15%, a rate that is much higher than the increase in the nation’s gross domestic product. According to the Bank of Korea (2003), the amount of money spent on private tutoring for Korean children is now twice the amount recorded five years ago. Thus, the education market has become a major profitable industry in Korea, where enthusiastic parents allocate money in the belief that they are investing in their children’s success. This exceptional zeal for education will be a great catalyst in Korea’s efforts to become an advanced nation in a global, knowledge-based information society.

Recently, the Korean Minister of Education announced that the ministry will promote e-learning in an effort to strengthen the nation’s public education system, as opposed to costly private tutoring favored by wealthy parents. The role of the Education Broadcasting Station (EBS), which runs educational TV programs and online-based educational programs throughout the nation, has started to include webcast free tutorials to help students prepare for college entrance examinations. In the future, e-learning
in the public education sector may play an even more influential and crucial role than it does now. This recent initiative may make the Korean public become more familiar with and more accepting of e-learning.

Korea’s vision for integrating information communication technology (ICT) in education

The goal to be a leading nation in e-learning through the construction of advanced physical infrastructure for information technology and the adaptation of its educational system to the information age is part of Korea’s vision for integrating ICT in education. This vision, which is represented in Figure 2, has three major phases. The first phase establishes a comprehensive technology-based support system for ICT. This will then serve as the foundation for the second phase, the adaptation of ICT into the Korean educational system. This should lead to the third and final phase, which envisions a citizenry, workplace, and culture that will create one of the leading knowledge-based nations in the world.

ICT\(^1\) in Elementary and Secondary Schools

National policies and initiatives to integrate ICT in Korean education

Leadership at the national level initiated the introduction of ICT in Korean education. Korea’s initial efforts for adapting education to the information age started in 1987 with the “State Plan to Strengthen Computer Education” (MOE, 1998). This was followed in the early 1990s by another document titled, “Outline of Regulations on the Promotion of Information Communication Technology,” which became a national-level policy in Korea. In 1996, the “Implementation Plan for Adapting Education to the Information Age” was carried out under the leadership of the Prime Minister. The first stage of this implementation plan was the construction of the infrastructure for ICT throughout the nation, and this was completed in 2000. This project was targeted for elementary, middle, and high school classrooms in Korea. The immediate goal was to provide computers and Internet access to school classrooms throughout the nation. The following goals were realized by this project:

- By the end of 2000, local area networks (LAN) and Internet connections had been installed in 10,064 schools throughout the nation.
- A total of 431,981 computers had been installed in school labs.
- Multimedia equipment, such as projection TV, multimedia PC, VCR, visual presenter, overhead projector and screen, printers and computer tables that had been allocated for each school classroom throughout the nation, had been distributed and installed.

The achievement of these goals signified the successful implementation of the nation’s “classroom advancement” initiative (MOE & HRD, 2001). The government’s strong and consistent support for ICT helped make Korea the first nation in the world to establish a school network that linked its more than 10,000 elementary and secondary schools together through the Internet.

The Ministry of Education is now pursuing the second phase of its comprehensive plan for promoting ICT in education. This plan is scheduled to be completed in 2005. The goal of the second phase is to create an environment that would provide one computer per five students in every school, install computer labs for dedicated classes in specific subjects, and reduce class size. This phase of the national plan also aims to increase Internet connection speeds at elementary and secondary schools to over 2Mbps, which will provide the necessary information technology infrastructure that will maximize the integration of ICT in Korea’s 7th National Curriculum (MOR & HRD, 2003b).

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\(^1\) ICT use in education is focused on school context where the teaching and learning process occurs. The assumption is made that online resources and connectivity are available and accessible.
Integrating ICT in the curriculum through teacher training

To carry out ICT utilization in school education, the 7th National Curriculum requires that 10% or more of classroom activities in every subject must utilize computers in the teaching-learning process. To achieve the integration of ICT in classroom activities, teacher training has become a top priority. Every year, about 25% of all teachers in Korea participate in in-service training. As of 2003, the percentage of teachers who have received the training has reached more than one third of the total teacher population every year.
(MOE & HRD, 2003b). Special training has also been provided to 1,000 teachers, who will take their places as professional information technology teachers (a position that is similar to instructional technology coordinators in public schools in the United States), with one teacher assigned to each elementary or secondary school in the nation. Since 2000, Korea’s teacher training programs have included distance learning courses in their curriculum to help teachers overcome time constraints and travel problems.

EDUNET: e-learning resources for K–12

In April 1996, the Korean Ministry of Education and Human Resource Development established a public organization called KERIS (Korean Educational Research Information Service). KERIS has a four-fold mission: (a) to provide educational services based on cutting-edge technology, (b) to foster highly trained human resources that will help carry out educational reform, (c) to manage a school information management system that ensures efficiency and transparency in educational administration, and (d) to provide education that is available to everyone, anytime, anywhere. Among the various e-learning public and private agencies that exist in Korea, KERIS is the most influential and best known.

KERIS provides educational services through an online community known as EDUNET. EDUNET allows the sharing of education-related information between teachers, students and parents. Students and adults can access high quality education information at any time and from any location using a PC with an Internet connection. In 2002, EDUNET service was rearranged into four different channels: (a) integrated search, (b) teacher, (c) student, and (d) educational community.

The integrated search channel enables comprehensive searching of educational resources through the redesign and integration of various databases.

The teacher channel provides various teaching materials that are organized by subject, class, grade, chapter, and unit. It provides teaching materials that are sufficient for a semester’s use. Teachers select and use these materials based on their instructional goals. They can obtain access to highly appropriate teaching materials instantaneously. Further, the teacher channel is also designed to provide teachers with educational multimedia materials such as images, sounds, animation, and Internet reference sites for various subject areas and grade levels.

The student channel provides diverse subject matter content and services to support student learning. It also provides customized services for individualized learning. Students can interact with cyber teachers through a question and answer service and receive feedback within 24 hours.

The educational community channel is a new learning place where students, teachers, and parents from different regions or countries can participate and share their ideas using innovative teaching and learning models such as project-based learning, cooperative learning, interactive discussion, and scientific experiment-based learning (MOE & HRD 2003a). Those who participate in this channel can actively engage in various learning activities and can improve their expertise in a particular field of knowledge through the innovative learning methods.

As of 2003, EDUNET had more than 5 million registered users. It is open to everyone, and requires a simple, straightforward registration process to open a user account. As a comprehensive education service and network system, EDUNET is expected to serve the various educational needs and interests of K–12 students, parents, educators, and other members of the educational community.

Introducing E-Learning in Higher Education

E-Campus Vision 2007

In December 2002, Korean universities began the implementation of “e-Campus Vision 2007 (2003–2007)” as part of the nation’s higher education informatization movement. The goals of e-Campus Vision 2007 include:

- Create a knowledge-based community that encourages innovative thinkers.
Implement reforms in administrative services.

Revise various laws that regulate universities in order to raise Korean universities to the level of world-class institutions through a strong ICT infrastructure.

This is a long-term plan to improve education and to modernize research facilities in the country’s universities. The plan has five main initiatives: (a) creation of college e-learning support centers, (b) expansion of academic research information sharing through KERIS, (c) implementation of the next-generation of university administrative information system called Enterprise Resource Planning (ERP) which will be deployed across colleges, (d) enhancement of the current system for introducing ICT into colleges, and (e) creation of healthy cyber culture (MOE & HRD 2003a). Figure 3 summarizes the major phases of the e-Campus Vision 2007 plan.

Cyber universities

Cyber universities in Korea officially opened in March 2001 after a series of experimental implementation projects during the period from 1998 to 2000. Introducing cyber universities in Korea was an effort to overcome the limitations of traditional higher educational institutions. This movement was made possible through government support and promotion of cyber education under Korea’s Lifelong Education Act.

Cyber universities offer educational programs through distance learning over the Internet, thus enabling learners some relief from time constraints and geographical limitations that occur when attending a traditional university.

On March 5, 2001, the opening of Korea’s first nine cyber universities, with 39 departments and 5,235 students, marked the beginning of cyber education in the nation. Six other cyber universities joined in March 2002. According to statistics from the Ministry of Education, as of 2003, Korea has 16 cyber universities that have been accredited, with courses offered in more than 90 departments and an enrollment of approximately 23,850 students (MOE & HRD, 2003b). Most of the freshmen in these cyber universities are between 20 and 30 years of age, and more than 80% of the total freshman population is older than the average freshman in traditional higher institutions (MOE & HRD, 2003a). More than 75% of cyber university students are employed while pursuing their degrees. Many of these students are seeking education through cyber universities for retraining purposes. Classes offered mainly at cyber universities are either discipline-specific courses on computers, information technology, and management, or certificate-related courses for majoring in languages (e.g., Japanese, English, Chinese), real estate, tourism or social welfare. Thus cyber universities can be seen to differ from traditional universities in terms of course offerings. In addition, cyber universities can be more sensitive and responsive to the demands and immediate needs of society and the job market, with their emphasis on specific disciplines and certificates.

Appendix A lists 16 Korean cyber universities, their enrollment quotas, and their course offerings.

Conclusion

Compared to traditional education, e-learning has the potential for cost effectiveness, interactivity, and convenience. These benefits have contributed to the recent rapid-growth trends for e-learning in Korea. So far, there are no indications that e-learning will completely replace traditional education. That is, these two forms of education have mutually beneficial and complementary roles, and the sound combination of both online and classroom instructions could bring about the best results in all levels of education. Based on Korea’s remarkable efforts and achievements in constructing e-learning infrastructure and in adapting ICT into all levels of education during the last decade, Korea is well on its way to fulfilling its vision to be a world-leading e-learning country by 2010. However, in spite of the successes of this ambitious national plan to date, there are still some major tasks to be resolved. Developing and securing good quality content for e-learning is of utmost importance. Utilizing this quality content in educational materials and finding support for materials development is likewise crucial. Finally, the training and nurturing of e-learning
experts such as curriculum specialists and learning design specialists for all phases of e-learning are also essential for the promotion of e-learning in Korea.

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Rowena Santiago is the director of the Teaching Resource Center and professor of Instructional Technology at California State University San Bernardino.

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Appendix A  List of cyber universities in Korea.

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<thead>
<tr>
<th>Cyber University</th>
<th>Freshman Quota</th>
<th>Major Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wonkwang Digital University (2001)</td>
<td>700</td>
<td>Digital Administration, Game Planning, Game Software, Game Graphic (5 Depts.)</td>
</tr>
<tr>
<td><a href="http://www.wdu.ac.kr">http://www.wdu.ac.kr</a></td>
<td></td>
<td></td>
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<tr>
<td>Open Cyber University (2000)</td>
<td>1,400</td>
<td>ICT, Engineering, Business Administration, Contents Construction &amp; Design, Social Science, Foreign Language for Business (5 Depts.)</td>
</tr>
<tr>
<td><a href="http://www.ocu.ac.kr">http://www.ocu.ac.kr</a></td>
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<td>Hansung Digital University (2001)</td>
<td>750</td>
<td>Culture &amp; Arts, Tourism, Multimedia, Visual Literary Art, Digital Administration, Digital Movie, Life-Long Education (13 Depts.)</td>
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<td>Korea Cyber University (2000)</td>
<td>1,650</td>
<td>Literature Writing, Real Estate, Chinese, Social-Welfare, Practical English, Digital Media Design (8 Depts.)</td>
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<td>800</td>
<td>Internet, E-Biz, Special Education, Social Welfare, Real Estate, Judicial Affairs Administration (5 Depts.)</td>
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