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Information and Communication Technology in China: Connecting 200 Million Children for Better Education

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ABSTRACT

This article provides an overview of the recent development of information and communication technology (ICT) utilized in Chinese elementary and secondary education. Specifically, the article discusses the positive impact ICT has on Chinese education, as well as the existing problems in the application of ICT. The potential for further developing education with ICT in schools is considered. In addition, challenges are discussed, and recommendations are made with regard to providing better education with ICT. The target audience of this article is policy makers, educators, ICT professionals and researchers.

Keywords: *Chinese Education, Impact, Information-and-Communications-Technology*

INTRODUCTION

If Confucius (551 – 479 BC) is considered the beginning of Chinese education, it has a history of 2,500 years. In Han Dynasty (206 BC – 220 AD) the first civil service examination program was instituted to find common people to fill public positions based on knowledge and ability, not genealogy. This national examination system was used with little variation for nearly 2,000 years through different dynasties, until it was abolished in the last feudal dynasty in 1905. In 1949, the People's Republic of China was established, starting a new page in the development of Chinese education. In 1978 the Chinese government implemented the policy of reforming and opening up and Chinese education began to develop in a speed that had never been seen before.

As the most populous developing country in the world, China has the highest demand for developing its human capital. While Chinese education has a long history, the gap between education in China and education in developed countries is obvious. In 2005 the Chinese combined gross enrolment ratio of primary, secondary and tertiary schools was 69, compared with the American ratio of 93, the Japanese ratio of 86, and the Canadian ratio of 99 (United Nations, 2007). With regard to secondary education, in 2005 the Chinese gross enrolment ratio of upper secondary education was 50, compared with

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the American ratio of 88, the Japanese ratio of 102 and the Canadian ratio of 134 (UNESCO Institute for Statistics, 2007).

In China, grade 1 to grade 6 is elementary education and grade 7 to grade 9 is junior secondary education. Elementary and junior secondary education is compulsory and is referred to as basic education. Formal education from grade 10 to grade 12 is senior secondary education, and it is not compulsory, but most youth graduate from secondary school, or receive some senior secondary education (Ministry of Education, April 2008).

The Chinese economy has changed from a planned economy to mainly a market economy, and all kinds of market-related skills have to be imparted to students in schools, yet the education system is still quite isolated from the market. For three decades (1949 – 1979) almost all Chinese schools were funded and administered by governments at various levels. Today there are international schools operated by Chinese in partnership with foreigners, private schools owned and operated by individuals or organizations, and cooperative schools operated by individuals or organizations in partnership with governments. These schools are different from public schools, which are the vast majority of Chinese schools. Public schools are funded and administered completely by governments.

ICT IN ELEMENTARY AND SECONDARY EDUCATION

The significant social development in China requires that elementary and secondary education be available for all children. It also requires that education be effective and efficient. In making elementary and secondary education available for all and in making it more effective and efficient, ICT can play a greater role. The rapid ICT progress may help the Chinese education system deal with the challenges brought about by the increasing demands to make education available for all and to further improve the education system.

Although China has a vast population, it still lacks sufficient human talent. One of the country's main strategies is to develop such talent by turning its large population into an advantage, changing its economic growth model from a resource-intensive one to a knowledge-intensive one. To develop human talent and build a knowledge-intensive economy, China needs to expand preschool education, improve elementary education and universalize secondary education. In addition, some Chinese learning facilities and teaching methods are out of date (Li, 2007). In renovating learning facilities and updating teaching methods, contemporary ICT will be helpful. The Chinese government is developing satellite and broadband-based distance learning to increase education availability, improve learning effectiveness, reduce operational costs, and provide equitable learning resources for all students.

In 1997, the Ministry of Education started a project of experimental schools for the development of educational technology. Over the years these experimental schools have made progress in building an ICT environment and in promoting the application of ICT in teaching and learning. These schools have made strong efforts to create and improve systems that apply ICT to teaching and provide ICT education to all their students.

With regard to ICT application in schools, eastern regions, particularly urban centers, have an advantage over the central and western regions, since economically eastern regions are more developed, and household income is usually higher in urban centers. In 2003 the Ministry of Education decided to provide distance education facilities to all schools in the rural areas of central and western regions to help make educational ICT available for all rural children. By the end of 2007, 270,000 elementary and junior secondary schools in central and western regions had been equipped with facilities that used contemporary ICT, which allowed them to receive teaching and learning resources through satellite technology provided by China Education Television (CETV). These schools built computer classrooms and most

of them were connected to the Internet for the first time (Ministry of Education, October 27, 2008). Over 100 million rural children in central and western regions benefited from this project (*China Education Info*, 2008).

Currently, making ICT and its education available in all schools is still the focus of the Ministry of Education. At the end of 2006, across the country in rural areas, on average there was one computer for every 39 elementary students and one computer for every 19 secondary students (*China Education Info*, December 2007). Since then more computers have been put in schools and most schools are connected to the Internet, but there are still schools, mainly those in remote western rural areas, without a computer (Ministry of Education, February 25, 2008).

As Chinese are more involved in international education exchanges and Chinese educators are increasingly aware of practices in other countries, it has been pointed out that the Chinese elementary and secondary education system has its shortcomings. In addition to outdated learning facilities and teaching methods (Li, 2007), there are other problems. One problem is that the Chinese elementary and secondary education system puts too much emphasis on the provincial and national unification in curriculum administration, when compared with curriculum administration in other countries.

To deal with problems in Chinese education, to catch up with developed countries, and to make education more effective, efficient and engaging, as described by Spector and Merill (2008), ICT application should play a greater role. In reforming the Chinese curriculum, education ICT can be a catalyst. With the rapid advancement of educational ICT, the application of multi-media computers, the Internet and satellite technology is increasing in classrooms, which is conducive to a comprehensive curriculum reform.

The author believes in the following areas ICT application facilitates and supports a curriculum reform:

1. Combining ICT application with curriculum materials allows teachers to work more effectively toward their teaching goals (Song, Yang, & Wang, 2008).
2. Using ICT allows teachers to differentiate their instruction. Students will receive more appropriate teaching, which in turn will improve their learning outcomes (Song, Yang, & Wang, 2008).
3. With ICT, a new curriculum will pay more attention to resources outside school that are not available in the traditional curriculum. There are multi-media software and textbooks, Internet education programs, and satellite programs, where teachers and students can obtain rich information (EL-Halawany & Huwail, 2008).
4. ICT will transform the role of teachers, help them update their knowledge more quickly, and change the relationship between teachers and students (Kok, 2008).

Today Chinese are more aware of international competition, which ultimately is competition of people, especially well-educated and creative people. The most important task facing Chinese educators is to foster critical and creative thinking in their students. It has been a government policy to foster critical thinking among students (Wen, 2008). ICT facilitates the development of a learning environment where students can acquire their information acuteness, which is a necessary quality of innovative people with critical thinking ability in the increasingly globalized knowledge economy. ICT breaks the constraints of environment, time and space. This advantage helps to develop students' ability in obtaining and using information by themselves. With hyper-text and hyper-media, ICT facilitates the understanding and retention of knowledge, assisting students' self-exploration and self-discovery from an early age.

Chinese educators are learning from advanced international experiences to contribute to the Chinese economy further integrating into the world economy, which entails extensive international information exchange. As ICT

plays an important role in this information exchange, its application in education is also increasing in Chinese classrooms. Developing the most advanced education ICT is one thing that must be accomplished to narrow the gap between Chinese education and education in developed countries. It is also necessary to make ICT education available in all schools to let every student develop the ability of obtaining and using information available nationally and internationally through ICT.

The development of Chinese elementary and secondary education is inequitable. There is a gap between eastern and western regions, as well as between urban and rural areas. Education attainment is significantly higher in eastern regions than in western regions (Zhou, Jiezhen, 2007). The difference between schools in cities and those in rural areas is apparent, with rural schools at a disadvantage (Li, X., 2008). The rapid development and increasing utilization of ICT in education is contributing to the emergence of new forms of teaching and learning. Distance education with ICT can be open to anybody anywhere who has access to the Internet and a satellite receiver. In addition, with contemporary ICT students may have more influence in determining what to learn, how to learn and when to learn. Teachers and students in less developed areas can share the same learning resources as students in more developed areas at no, or little, extra cost.

With unbalanced regional income, inadequate education funding, and a huge task of developing human capital, ICT should play a greater role in making the provision of education, particularly secondary education, more equitable. On September 3, 2007 at 10 a.m. over 100 million elementary and secondary students participated in a virtual class through the Rural Elementary and Secondary Distance Education Platform, the Chinese Education Television Station and the Internet (Wu & Song, 2007). This is the first time in Chinese education that so many students took part in activities in one class.

ICT provides an important condition for student-centered learning. Through educational networks, students can individually obtain information on the most recent scientific developments from prestigious institutions around the world that provide an open access to their information. Students can also learn about the most current international affairs from a variety of sources. Without the constraints of nation, status, time, space, and institution, information can be obtained with ICT by anyone who has access to the Internet and satellite technology.

There are 410,755 elementary and secondary schools in China with over 200 million students, making it the largest education system in the world (Ministry of Education, April 2008). The Internet and distance education networks have reached all eastern and some central and western schools, establishing a platform where learning resources can be shared. But there are still schools to be connected. Many schools have been trying to integrate ICT into their teaching and learning, others have just started, but still there are others that have never applied ICT in teaching (Song, Yang, & Wang, 2008).

While many schools have started ICT application and established a campus network, teachers and administrators face a variety of problems (Song & Wang, 2008). There is a general lack of comprehensive understanding of school networks. In building networks, planning and guidance is inadequate. More attention is paid to hardware, not to software and to training on how to use these networks. Some networks are not well-maintained and not used effectively. Sometimes there is even a lack of funding for the proper functioning of the school network. Quality is not satisfactory and services after sales are inadequate. It is estimated that most school networks are not functioning effectively in providing a better learning environment. Most schools with a campus network are still exploring how to use their network. The positive impact from ICT on student learning outcomes is far from what is expected (Li, X., 2008).

The Ministry of Education has been using ICT in training elementary and secondary principals, which in itself increases administrators' awareness of ICT application in schools

(Zhao, 2007). Teachers are also using ICT in their professional development (Li & Zhang, 2008). The general trend is that ICT application in schools is increasing across the country (Ministry of Education, October 16, 2008). As ICT application in education increases, the demand for educational hardware and software is the biggest in the world. Chinese entrepreneurs need to develop relevant and affordable education ICT products for schools and help the growth of ICT application in education.

Since investments in education contribute to individual and social welfare, there has been a global trend of increased investments in education (Dahlman, Zeng, & Wang, 2007). Chinese have a long history of acquiring education for social and individual improvement. Today Chinese are increasingly aware of the importance of education in developing economy and making social progress. Since the opening up of the country in 1978, Chinese education has made significant advancements. Still, the gap in education between China and the Organization of Economic Cooperation and Development (OECD) countries is obvious, and many Chinese are aware of this gap (Li, 2007).

To narrow the gap and eventually to catch up with developed countries, the Chinese government has increased investments in education in recent years. However, it is beyond the government's ability to provide all the funding necessary so that Chinese education can quickly reach the level of developed countries. The Chinese government has stated that developing education is one of its priorities. Specifically, with regard to educational ICT, the Ministry of Education has planned to make all elementary and secondary schools have access to the Internet by 2010. The Ministry of Education has also been providing ICT training to teachers. Up to the end of 2007, over 300,000 secondary teachers had received ICT training. The Ministry of Education has been cooperating with Intel and Microsoft in ICT training, with Intel providing assistance to teachers and Microsoft providing assistance to technicians working in schools. The Ministry of Education's goal is to connect every school and every classroom with ICT (Ministry of Education, February 25, 2008). It is hoped that ICT application in teaching and learning will facilitate the updating of the Chinese education system (Ministry of Education, May 18, 2007, February 25, 2008).

In November 2006, the Ministry of Science and Technology and the Ministry of Education launched the Public Service Demonstration Project for Digital Education. They hoped to advance key technologies to establish a new model of services and promote equity and accessibility (Yan, 2007). By the end of 2007, a rural distance education network had been established, extending ICT application across the country (Guo, 2007). Recently, in its *2009 basic education curriculum standard experimental textbook list,* the Ministry of Education (October 16, 2008) stipulates that "Information Technology" is one of the subjects that must be taught in senior secondary schools.

Today elementary education is universally available for all Chinese children. Secondary education, particularly senior secondary education, is not available for some youth in remote sparsely populated western areas (Ministry of Education, April 2008). The next important step is to make senior secondary education available for all youth. In 2007 the Chinese senior secondary education gross enrolment rate was 66 percent, with an increase of 6 percent from the previous year (Ministry of Education, April 2008). With China's huge education needs and geographic dispersion, ICT application has great potential. It can provide opportunities to different youth at various levels in different places. It should play a unique and increasingly important role in connecting the Chinese school-age population of over 200 million for better education.

CHALLENGES AND RECOMMENDATIONS

ICT application in Chinese schools is a relatively recent phenomenon in need of continuous improvement. While ICT application in schools is developing rapidly in the country, it is far

from meeting most people's expectations (Li, X., 2008; Wang & Huang, 2008; Xie & Yang, 2008). Some of the problems associated with ICT application in schools are discussed in the following paragraphs.

Although some Chinese teachers have been learning from their international colleagues (*Distance Education in China*, 2008), it seems that they may need to do more in this area to utilize successful experiences from other countries, given that most Chinese teachers are not familiar with ICT application (Ministry of Education, February 25, 2008).

Domestic experiences have not received sufficient study. There is a lack of high quality research to inform practice (Li, X., 2008). Educational ICT application models are few. Most school networks are used for promoting these schools to the general public. Administrators use their school networks for management, and teachers use them mainly for content presentation and explanation. Most teachers do not pay enough attention to the learning environment and to the interaction between them and their students, or the interaction among their students. A large part of network content is a direct video broadcasting of teachers' instruction, with little or no interaction between teachers and students, or among students, although those whose teaching practices are broadcast are excellent teachers. Students use their school networks mainly to do exercises and take quizzes. There are not enough network activities that encourage students to conduct more self-exploration and self-study. In addition, school network learning resources are not updated frequently enough (Wang & Huang, 2008).

The development of school ICT application is quite uneven. In addition to the differences among regions, among provinces, and between urban centers and rural areas, there is a digital divide even among areas within the same province and among schools in the same area, with economically less developed areas and schools with less financial resources at a disadvantage (Li, X., 2008).

Nationally developed and distributed educational resources with ICT application are not always applicable across the country, since China has a large area, a diverse population of over 50 ethnic groups, and significant differences among regions in economic development (Xie & Yang, 2008). Educational resources with ICT application developed in Beijing may not be applicable in Gansu Province and other autonomous regions in the west, where in addition to the main Chinese ethnic group of Han, there are Hui, Tibetans, and other minority groups with languages and customs different from Han.

Although network technology is generally shared and the opportunity for cooperation is there, teachers use it at their discretion. A broad national distance education platform, where teachers can exchange teaching resources freely, has not been established. Some schools repeat what others have already done, which is a waste of financial and human resources (Huang, 2008).

While most school principals are interested in increasing ICT application in teaching, few of them have done anything specific to promote it. There are not enough teachers who specialize in ICT application and ICT education (Ministry of Education, February 25, 2008). Some teachers are not even interested in using ICT in their teaching. Not enough training has been provided to teachers. In addition, the training provided is often not very effective. Many schools do not offer an ICT course at all (Li, X., 2008).

The average Chinese education attainment of 8.5 years (Zhou, Ji, 2007) is significantly lower than the 12 years of OECD countries. The needs for education spending are estimated at 6-9 percent of national GDP, but the actual expenditures are about 5 percent (Dahlman, Zeng, & Wang, 2007), significantly lower than the OECD average of 6.2 percent (OECD, 2007), although the demand for education in the country continues to grow.

To create a better environment for the development of ICT application in Chinese schools, several recommendations are made here. Teachers should learn not only from colleagues in developed countries, but also from colleagues in other developing countries. In

India and Namibia, educators use open schooling with ICT to complement the formal system (Rumble & Koul, 2007). Their experiences are particularly applicable in China, since making secondary education available for all youth is one of the goals of Chinese education and the current government is not able to provide the financial resources necessary through the traditional format to universalize secondary education. In Turkey, teachers have been using ICT to increase the interaction between them and their students and the interaction among students (Kok, 2008).

Given the current financial situation, it is difficult for the traditional means of education to provide secondary students in western regions the learning resources comparable to those in eastern regions. ICT application should play a greater role in making similar education resources available for all youth across the country.

ICT training needs to be provided to all teachers and administrators, and this training needs to be made more effective. In providing ICT training, ICT itself needs to be applied more extensively (Yu, 2008; Yuan, Diao, & Wang, 2008). School administrators need to be more proactive in promoting ICT application. Governments need to provide assistance to regions and areas where household incomes are significantly lower than the national and provincial average to make learning conditions more equitable (Li, X., 2008). In this respect, Chinese can learn from Americans who have an education rate policy as part of the Telecommunications Act of 1996 to promote digital equity (Park, Sinha, & Chong, 2007).

ICT education resources need to be developed not only nationally, but also locally, taking into consideration a region's economic development, ethnic composition, cultural customs and linguistic diversity (Li, J., 2008; Xie & Yang, 2008). In developing educational ICT resources, teachers and students should play a more active role, which will make the developed products more applicable and increase students' motivation for learning. Only when educational resources are appropriate for local students in terms of their life background and particular way of thinking, will they be effective.

Instead of only "demonstrating and explaining", education ICT resources should stress "learning" and increase students' participation and interaction. When teachers use ICT in their teaching, they need to consider the advantages provided by ICT to promote interaction, in addition to using ICT as a convenient method of transmitting content. They need to use ICT as a way of reforming traditional teaching methods. Teachers can use ICT to provide more activities that encourage students to conduct exploratory study. They can also provide extracurricular activities that attract students, since many secondary students are very interested in using the Internet and learning the most recent ICT (Wang & Huang, 2008).

The Ministry of Education needs to expedite the establishment of a national elementary and secondary ICT teaching and learning resource platform, where teachers and students can freely share educational materials. Teachers need to co-operate with each other more in creating teaching resources with ICT application, improving the effectiveness of their teaching (Huang, 2008). In addition, more ICT application may improve the effectiveness of teachers' own professional development (Gong, 2008). To realize the great potential of ICT, the government needs to play the important role of a diffuser, promoter and regulator (Abbasi, Niaraki, & Dehkordi, 2008) and seriously consider the concept and practice of "open schooling" (Commonwealth of Learning, n.d.).

Some scholars argue that further opening up the Chinese education system will allow Chinese educators to benefit from other countries' resources and expertise (Dahlman, Zeng, & Wang, 2007; Yan, 2007). Allowing non-government funding to participate in education will gradually alleviate the problem, to a certain extent, of inadequate funding. They also argue that the Chinese government should allow market forces to play a greater role in determining educational policies. Actually, the Eleventh Education Development Five-Year-Plan Outline does indicate that the Chinese

education system will be more open to the world and to other sectors in society (Ministry of Education, May 18, 2007). Further opening up the Chinese education system is beneficial to its development.

One of the main problems in China is the shortage of investment in education. The government cannot bear a sudden significant funding increase in education; the inadequacy of financial resources has constrained the improvement in education. It is necessary to establish appropriate mechanisms to finance education by governments as well as by individuals and organizations (Li, 2007).

Finally, to promote more ICT application in schools, to develop it more effectively and efficiently, and to provide equitable opportunities to all youth everywhere in the country, governments at various levels need to invest more in secondary education, making it available for all youth in the age group. There has been a strong global trend for increased investments for school-age population in formal education, but China still spends only about 14% of average per capita GDP on secondary education, lower than the median of almost 20 percent for upper-middle-income countries (Dahlman, Zeng, & Wang, 2007). It is a positive thing that the revised national *Compulsory Education Act*, part six, section 42, stipulates that the increase in allocation for education from the national State Council, provincial and local governments be higher than the increase in their revenues and that average per student expenditure increase gradually (The Central People's Government of China, 2006). The Chinese government may consider specifically increasing financial allocation significantly for senior secondary education, which is actually demanded by many People's Congress representatives, so that secondary schools are in a better position to provide education to every school age youth, increase ICT application in teaching, and improve students' learning outcomes.

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