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Comparative Studies of Chinese-Japanese ICT Based Educational Environment

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Abstract

It is an information society in 21st Century. More and more countries in the world have been devoted to promoting the application of information technology in education. Through the comparison of three areas such as school infrastructures construction, curriculum settings of information technology computer science, and training ICT for the teachers, this paper has described the state of ICT based educational environment in both China and Japan. It gives a simple analysis of Chinese achievement and existing problems in the field and summed up Japanese useful experiences in this regard, aiming to provide a reference for the rapid ICT based educational environment construction of China

Keywords: ICT based Educational Environment, Information Education, Information Technology Education

Introductions

It is an information-based society in 21st Century. With computer technology, microelectronic and communication technology developing by leaps and bounds, the society becomes more and more informationized and the living and work environment of people have changed greatly. The information technology has brought up rapid and deep impact upon human life as well as human understands about the world. From the end of 20^{th} Century, the developed countries and some developing countries in the world have been devoted to promoting the application of information technology in education. The ICT based educational environment requests to utilize comprehensively the computer, multimedia and the network communication as the foundation present information technology in the education process. To promote educational reform, adapt to the new request which is arriving at the informationization society which proposed, deepen the educational reform and implement education for all-around development, it has the significant significance. Japan, one of our friendly neighbor countries, has a lot of common characteristics in terms of national conditions as our country. Besides, it has acted as a leading role in ICT based educational environment among Asian countries. Therefore, this article introduces as simply look into the development of Chinese-Japanese ICT based educational

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environment in three aspects: school infrastructure construction, information technology education curriculum settings, and teacher' training & further studies, exploring out gaps in between and useful experience of the other country to accelerate the rapid development of our ICT based educational environment.

I. Comparison of Chinese-Japanese School infrastructure Construction

Japanese government is fully aware of the important role of infrastructure construction in the whole set of ICT based educationl environment system thus formulated specific objectives and implementation plans for development of information education in many times, which leads to the fast development of computer infrastructure construction and internet connection among its primary and secondary schools. The National IT Strategy Headquarter put forward that, as of the "e-Japan" strategy in Jan 2001, the specific goal of ICT based educational environment is that at least one computer for every 5.4 students should be achieved in the primary and secondary schools and the broadband network connection rate and LAN connection rate of general classrooms in all schools should reach 100% by 2005. In the "New IT Strategy" that was proposed by Japanese government in Jan 2006, the new goal is that one computer for every teacher should be achieved and as well as continuing to complete the broadband network connections, the school realizes the optic fiber network diligently. A recent survey conducted by Japan's Ministry of Education indicated that the average number of students sharing one computer for educational purpose in primary and secondary schools (Table1), "Student-to-computer rate" is 7.0 by March of 2008, the computer equipped rate for teacher is 57.8% and the LAN connection rate of general classrooms is 62.5%. The broadband network connection rate is 99.9% and the optic fiber network connection rate is 60.1%. Although this is few far from the designed goals, the development has been quite amazing.

China also paid much attention to the infrastructure construction of ICT based educational environment. The Ministry of Education proposed, "Notify on Popularization of Information Technology in Primary and Secondary Schools" issued on 14 November 2000, to launch "Campus to Campus" project and achieve that about 90% of independent schools in the country could be access to internet in the coming 5 to 10 years. But, because the regional economy, the education level of development and the ICT based educational environment construction's investment and so on many aspects are not balanced, our country primary and secondary schools ICT based educational

Table 1 The investigation about Japanese ICT based education condition in 2007

Japan	the student-to-computer rate	the computer equipped rate for teacher	the LAN connection rate of general classrooms	the broadband network connection rate	the optic fiber network connection rate
Total	7.0	57.8%	62.5%	99.9%	60.1%

Note: Each data is from the results of an investigation about the actual condition of the school edition informationization by the Ministry of Education, Japan. (The Heisei 19 fiscal year) environment presents imbalanced situation on the area development. In many well-developed regions, especially big littoral cities in the eastern part, the specialized education network construction has taken a rudimental shape. The broadband network connection rate is 77.8% in the country primary and secondary schools. In order to change this kind of present actuality, another project "Modern Distance Education for Primary and Secondary Schools in Rural Area" has been launched in 2003. From 2003 to 2007, wherein there has built a total of 110,000 teaching CD-ROM player points, more than 384,000 Satellite teaching receiver and 37,500 computer classrooms. As of the end of 2006, the primary and secondary schools in rural area of China have had 3,056,000 sets of computers, which more than double the number of 1,460,000 sets in 2002. The popular degree of the primary and secondary schools in rural area of China has been promoted largely. Generally speaking, successful as it is, there are still a considerable gap in between, compared with developed countries. Moreover, a significant difference has also been varying from urban to rural areas, and between regions.

Ⅱ. Comparison of Information Technology Education Curriculum Settings

Internationally, there are basically two methods for implementation of information technology education curriculum in primary and secondary schools, that is, delivering information technology subject (hereinafter, "curriculum settings" in short) and integrating information technology into teaching of other subjects (hereinafter"integration"in short). Presently in Japan, there is no stand-alone "curriculum settings" in primary schools; In junior secondary schools, a module of "Information and computer" is put into the subject of "Technology and Homemaking" with an emphasis on "integration"; while a stand-alone subject of "information" is delivered with stress on "integration".

The argumentation and reform on information technology education in primary and secondary schools has been undergoing all the time. In July 1998, a report of Japanese Educational Courses Auditing Conference put forward the issues in relation to systematic information technology. In December 2005, Japan Association for Development of Information Education (JADIE) Discipline Council and JSISE Information Council brought about a report "Advice on promoting information Education in Primary and Secondary Schools" which stated that status quo of information education in Japan is far from optimistic. In primary and junior secondary schools, there is no systematic teaching due to there is no stand-alone information subject; the credits for the subject of information in the senior secondary schools only takes a portion of 2% of the total credits, which turns out to be few, compared with other subjects. As of this, this report proposed to add the new subject of "Information" into the senior grades of primary schools to cultivate the student's ability of information application, esp. information ethics; it also proposed to add new subject of "information" into Junior Secondary school curriculum so as to systematically cultivate the ability of information application based on technology competence. Besides, this report also suggested trimming and substantiating the teaching materials for the subject of "Information" in the senior secondary school and increasing the credits.

The Ministry of Education of China, in the "Notice on Popularization of Information Technology Education among Primary and Secondary Education" released on 14 November 2000, has put forward to have information technology as a compulsory subject in the primary and secondary schools and speed up the integration process of information technology and other subjects in the following 5 to 10 years. According to the statistics, there has been up to a portion of 92.15% among 14907 senior secondary schools in nationwide listing information technology as the compulsory subject while a commencing rate of 65.32% among 66600 junior secondary schools mainly locating in medium-class and big cities, as well as 10.33% among 491300 independent primary schools mainly locating in medium-class and big cities.

In 2003, the Ministry of Education published "Technology Curriculum Standards for General Senior Secondary School", a benchmark for the starting of primary and secondary school information technology curriculum setting in China. With the delivery of information technology subject popularizing from primary to senior secondary schools gradually, "Primary and Secondary Schools Information Technology Guideline" formulated in a prerequisite of students as Beginners no longer took effect, therefore, it is highly demanding for a new setting to thread through primary school-junior secondary school-senior secondary school education on the basis of "Technology Curriculum Standards for General Senior Secondary School". Of which the key lies in how to set goals and consistent teaching content for students of different levels and develop diversified information technology courses to cater for different needs of students.

At the same time, we have come to know most schools' information technology infrastructure is used mainly to support information technology courses and is not yet used to support teaching of various subjects, particularly there lacks of innovative informationized teaching practice. Besides, traditional module mode, assessment system and in-classroom instruction structure brought about many practical problems to effective integration of technology with modules. It should be acknowledged that "integrated model" will be an irreversible development trend of information technology education in the future. Schools should, based on the existing level of information technology, encourage teachers for other subjects to integrate information technology with their own teaching process, have the two complement each other and accomplish the task of information technology education.

As an example in general high schools of Japan and China, on the information technology courses in teaching aim, teaching contents, teaching time and course-selection mode, there is for a simple comparison. We could see from the table2: in Japan, the teaching aim is detailed and included of the flexibility to use acquired the knowledge and skills which are related of information and information technology; developing a scientific way of thinking, the correct understanding of information technology on society and actively involved in the building of information-based society. The teaching contents have three courses and every course is different aspect and divided. As a student, you must choose one course as the required course from information A, B, C. Of course it's OK that you choose all. Each course corresponds to 2 credits. There is a credit that having 35 credit hours and per credit hour equals 50 minutes.

In China (Table3), the teaching aim is that can improve students' information literacy, which is represented as knowledge and skills, processes and methods, attitudes and values. These three sides of objectives mutually penetrated and linked organically. This course is composed of six modules and the module of Basis of Information Technology is required course, otherwise the five modules are as the elective courses. Each student must choose one elective module at least to continue to study after learning the required module and he should graduate from the general high school.

Through the comparison of information technology education curriculum settings, we can see: The teaching aim of Japan is more specific and detailed than China's. In the teaching contents, Japan would pay more attention to the attitude, manner and approach which collect and send information, while China would pay more attention to technical learning about information technology. The range of optional information technology course modules in China are widely than in Japan, and composed of one required module and five elective modules while in Japan there are only elective modules. In respect of a single module for teaching time, Japan is longer, but the overall information technology courses of teaching time, the general high school of China is more.

Table 2 The contents on guidelines for IT curriculum teaching, Japan

<table>
<tr><td></td><td colspan="3">JAPAN</td></tr>
<tr><td>Teaching Aim</td><td colspan="3">1. Flexibility to use acquired the knowledge and skills which are related of information and information technology.
2. Developing a scientific way of thinking, the correct understanding of information technology on society.
3. Actively involved in the building of information-based society.</td></tr>
<tr><td>Teaching</td><td>Information A</td><td>Information B</td><td>Information C</td></tr>
<tr><td rowspan="2">Contents</td><td rowspan="2">*Learning the basic knowledge and skills of information collection, processing and sending.

*Bringing up the manner that is using information for a subject.</td><td>*Learning a scientific way of thinking and method of solving problem effectively by computers</td><td>*Feeding ability to utilize computers in expression and communication effectively.
*1
*Raising a desirable manner on participating in information-intensive society.*2</td></tr>
<tr><td>[subclass]
*Understanding the expression and structure of processing on the storing of information by computer.

*Understanding the role and influence of the information technology to support information-intensive society.</td><td>[subclass]
*1 Understanding the digitization of the information and the characteristic of the information and communication network.

*2 Understanding the influence that the development of the information gives to the society.</td></tr>
<tr><td>Teaching time</td><td colspan="3">Each course of information A, B, C corresponds to 2 credits. There is a credit that having 35 credit hours and per credit hour equals 50 minutes.</td></tr>
<tr><td>Course-Selection Mode</td><td colspan="3">One course must be compulsory from information A; B; C and it is ok that all of them are learning. Course-choosing hasn't be ordered, is freely.</td></tr>
</table>

Table 3 The contents on guidelines for IT curriculum teaching, China

<table>
<tr><td></td><td colspan="5">CHINA</td></tr>
<tr><td>Teaching Aim</td><td colspan="5">This course aims to improve students' information literacy, which is represented as knowledge and skills, processes and methods, attitudes and values. These three sides of objectives mutually penetrated and linked organically.</td></tr>
<tr><td rowspan="4">Teaching Contents</td><td colspan="5">Compulsory: Basis of Information Technology</td></tr>
<tr><td colspan="5">1. To master fundamental technique of information accessing, processing, managing, expressing and communicating.
2. To solve practical problems during every day life and learning.
3. To understand how information technology affects social development and foster positive value.</td></tr>
<tr><td>Optional Module 1 : Algorithms and Programming</td><td>Optional Module 2 : Application of Multimedia Technology</td><td>Optional Module 3 : Application of Network Technology</td><td>Optional Module 4 : Data Management Techniques</td><td>Optional Module 5 : Basis of Artificial Intelligence</td></tr>
<tr><td>*elementary processes when computers solve problems
*basis of programming language
*enumeration of simple algorithms and problem solving</td><td>*multimedia technology and social life
*multimedia information gathering and processing
*multimedia information expressing and communicating</td><td>*application of Internet
*Basis of network technology
*website design and evaluation</td><td>*basic knowledge on data management
*database creating, applying and maintaining
*database application system</td><td>*knowledge and its representation in AI.
*AIlanguage and problem solving</td></tr>
<tr><td>Teaching Time</td><td colspan="5">This course is composed of six modules, each modules corresponds to 2 credits.Criterion of 22 credits: there is a credit hour in each week during 20 to 21-weeks-long semester and one credit hour equals 40 to 45 minutes.</td></tr>
<tr><td>Course-selection Mode</td><td colspan="5">The module Basis of Information Technology is compulsory, while other five modules are optional. Four credits are prerequisite to graduate from high school, which is composed of two compulsory and two selective.</td></tr>
</table>

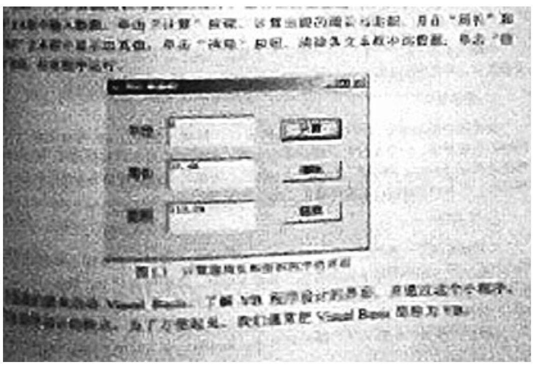

Fig.1 Chinese IT textbook

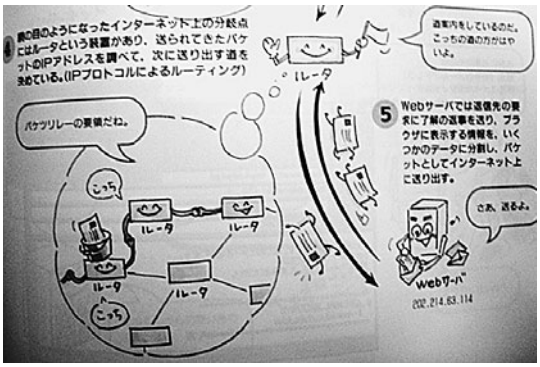

Fig.2 Japanese IT textbook

Ⅲ. Comparison of Training for relevant teachers between China and Japan

To guarantee a high-level online-learning operation in primary and secondary schools, Japan put the very emphasis on the bettering of the teachers' quality, focusing on two parts, i.e. training and continuing education of in-service teacher and improvement of information technology level of normal education. There are five ways for the in-service teachers of primary and secondary schools to undertake continuing-education about information education, including national and educational training activities organized by the Education Committee and the country, continuing-education conducted by the school and continuing education organized by Universities or Research groups or enterprises, etc.

In accordance with the requirement of national strategy and principles, and ICT based educational environment, teachers of primary and secondary schools has been designed to undertake continuing education since 2000. Varieties of trainings conducted by schools are mainly in the form of on-campus training. It is a regular training method for Japanese teachers to use the experience of a selected unit to promote studies in the entire area. Presently, the training for in-service teachers has featured systematically in three levels, i.e. national, prefectural and at school level. Based on the above achievement, as of March 2008, Japan's primary and secondary school teachers that have the capability of teaching-materials research and instruction by the computer have accounted for 71.4% while those that can take advantage of computer in instruction accounted for 55.2%. And only in 2007, about 19.7% of primary and secondary school teachers has undertaken continuing education.

China has also exerted great focus on information technology training for teachers. During 1999-2003, "Primary and Secondary school teachers Continuing Education Project" enforced by the Ministry of Education has stated the training for information technology as one of the essentials of teacher training. By the end of 2003, approximately 90% of the teachers have, through a variety of channels, undertaken one-round training on basic computer knowledge and basic operation skills to varying degrees. Most of the teachers have preliminarily mastered basic knowledge and operational skills of information technology. In the end of 2004, the Ministry of Education issued Educational Technology Competency Standards (Trial) for Primary and Secondary School Teachers, which provided a scientific reference for carrying-out of teacher training.

In April 2005, the Ministry of Education officially launched the implementation of "National Educational Technology Capacity-Building Program for Primary and Secondary School Teachers", aiming to help all the primary and secondary school teachers in nationwide complete no less than 50 hours of education and technical training from 2005 to 2007. As per a related survey released in Sept. 2004, China's primary and secondary schools has highlighted the importance of information technology training, that is, approximately 95% of the schools hold regularly or irregularly training courses in this regard; about 94% of the schools require the management personnel participate in the training. Nevertheless, the training for teachers for subjects is yet to be attended to, approximate 51% of schools provide information technology training opportunities to these teachers while nearly half of the schools provide them with little or no training opportunities. Therefore, it shows that schools provide less training opportunities for teachers than that for management personnel.

Additionally, in terms of training methods, conventional training methods with fixed and large-capacity content take up a large proportion. As a result, learners have difficulty in digesting and absorbing what they got in such a short period of time. Besides, since most of training are impractical and not given according to the learner' s aptitude, they turn out to be ineffective. To avoid this, it is recommended to take advantage of the local city and county continuing education schools for teachers as the main sites for teachers' modern information and education technology training. Moreover, the campus-based training is subject to be further strengthened. In the training process for teachers, we should pay attention to getting computer-aided teaching, instead of the computer, as the focus, and information technology thread through all the courses in the purpose of improving the education quality of various disciplines.

IV. Discussion about Future ICT based educational environment of China

China' s ICT based educational environment has made tremendous progress in the past, but on the whole, it has been still at the preliminary stage for further development. The topic how to ensure the sustainable development of ICT based educational environment arises to be the major task for leaders of all levels and all the staff in educational industry. ICT based educational environment is a complex cultural and education development process, which can only be accomplished upon long-term coordination and supportive endeavor of the government, educational institutions, educators and the society. In this regard, the approach of Japan, the neighbor country of similar cultural background as our country, is undoubtedly of worthy reference for us.

i) Government should vigorously promote sustainable and balanced development of ICT based educational environment.

In the perspective of infrastructure construction, Japanese government has always attached great importance to the role of administrative guidance, and has provided positive policy support and adjustment along with vigorous financial investment. Japan has exerted computer outfit investment for education industry, about 201 billion Yen in 2003 and 205 billion Yen in 2004 respectively, keeping a huge growth annually. In Dec. 2005, against unsatisfactory implementation conditions of strategy indicators, the Ministry of Education of Japan additionally issued Promotion Plan for ICT based educational environment-Strategic Goal-oriented to further drive on ICT based educational environment development in primary and secondary schools to ensure the realization of goals. In the perspective of financial Input, even though the overall budget of the Ministry of Education has been reduced by 10% in 2006 than in 2005, the budget for fundamental informationization has remained the same as that of the previous year while the input for informationization of school education area higher than that of the previous year. This kind of continuous governmental investment with certainal scale and intensity maintained is the critical driving force for the sustainable development of ICT based educational environment in Japan.

At the same time, policy and investment democracy is much notable, and so it is the same with close attention to the disadvantage group (Table 4). Take "Student-to-Computer" rate for example, as of March 2008, there are an average rate of 7.0 students per set with a rate of 8.4 students per set

Table 4　The number of students sharing one computer for educational purpose

The kind of school	Primary School	Junior Secondary School	Senior Secondary School	Special Education Institution	Total
2006	8.9	6.7	5.5	3.1	7.3
2007	8.4	6.5	5.2	3.1	7.0

Note: The date is from the results of an investigation about the actual condition of the school edition informationization by the Ministry of Education, Japan.（The Heisei 19 fiscal year）

in the primary schools, 6.5 for junior secondary schools, 5.2 for senior secondary schools and 3.1 for special education institutions（schools for the blind, schools for the deaf and mute and conservation schools inclusive）. Compared with the rate of 2006（by March 2007）, i.e. an average of ate of 7.3 students per set with a rate of 8.9 students per set in the primary schools, 6.7 for junior secondary schools, 5.5 for senior secondary schools and 3.1 for special education institutions, there has been a slight increase in the proportion of primary school, junior secondary school and senior secondary school education while same level being held in special education institutions. In Japan, a special eye has always been kept on the informationization development for special education in the ICT based educational environment development outline, so it is supported at tentatively in terms of policy and financial investment. Therefore, special ICT based educational environment construction development has prevailed over that of other types of education in Japan.

At present, China's ICT based educational environment development has been very uneven. As of the survey in September 2004, there is still a great gap in the rate of "Student-to-Computer" between cities, towns and rural areas, that is, up to 80% of schools in the city region have a "Student-to-Computer" rate over 20:1, while 54% in town region and only 37% in rural area, much lower than the average rate of the surveyed schools. Moreover, about 40% of the schools in the rural area have no computer. Similarly, there are also certain gaps between the eastern, central and western regions, that is, about 74% of schools in the eastern region have a "Student-to-Computer" rate over 20:1, while 61% in the central region and 41% in the rural area, about 40% of the schools in the western region have no computer. The country must adopt powerful and impelling co-ordination of plans and initiatives to take more care of the development of central and western regions via policies and funds investment. Ways to help the poor in poverty-stricken areas should be transformed into major intellectual support, with a focus on support of ICT based educational environment and the quality of teachers with modernized educational means, so as to popularize our ICT based educational environment throughout urban and rural areas, enable all the poor and disabled students to have the opportunity to access to advanced education technology and achieve the truly democratization of education.

ii）Research institutes and researchers play a guiding role in ICT based educational environment.

Japanese ICT based educational environment development does not only rely on the planning and implementation by educational administrative departments, but also base on research work. National

Education Information Center, Japan Educational Technology Promotion Association, Computer Education and Development Center, ICT based educational environment Promotion Council and Japan Information Technology Development Studies Society, etc. guarantee the ICT based educational environment undergoes in a scientific and orderly way. Researchers, esp. those in Universities have revealed certain advantage in academic studies, policies advice, practice guidance and outcome promotion of the ICT based educational environment. Take information and technology education for example, related research institutes and researches has exerted an important role in education courses auditing report in Mar. 1999, "New Primary school and Secondary School Studies Guidance Essentials" in Dec. of the same year and also in the New Senior Secondary School Guidance Essentials issued in Mar. 1999 and New Information Education Guidance issued after that for they have participated actively in curriculum settings and construction, studies and promotion of outcome, reflecting their prudence and pragmatic and scientific attitude and style.

In China, ICT based educational environment researches remain a serious "in name only" problem. The 10th Five-Year Plan Project of national education scientific studies for the first time sets up a disciplinary group for Education information and technology, and approves in 1st round assessment hundreds of research topics in related to education technology and ICT based educational environment including two national key projects. National and provincial modern Education technology experimental schools also participated in the research. However, except for a few schools that have made teaching and research accomplishment under the guidance of professional supervisors, most of the schools get vain in searches outcome. Furthermore, many research projects are not in purpose of resolving the existing problem in practice but only facially "on airs", merely intended for glaring reputation of the topics, which is absolutely subject to a correction. Hereby, Educational authorities at all levels should adopt various measures to strictly control over "establishment of research project"and "assessment and approval" in order to have more outstanding research results serve for the process of ICT based educational environment.

iii) Social forces actively participate in the process of ICT based educational environment and play a solid role of protection.

ICT based educational environment popularization and promotion should not be not merely from strength of institutions and government, but also from mobilization of all the communities for common interest and participation. In Japan, the positive direction of ICT based educational environment policies will inevitably bring about the rapid expansion of the market. It is a common practice for ICT based educational environment in Japan that business promotes ICT based educational environment while education rewards the business acceleration. Almost every strategic enforcement will be supported by business, the latter provides more abundant economic and technology resources and consolidated safeguard for the promotion of the former.

For example, in August 2005, Japan's Ministry of Education authorized NTT (Nippon Telephone and Telecommunications Company) to hold an activity entitled "IT in schools 2005", which targets at high school students and tries to stimulate and cultivates in them the innovation and imagination ability, aiming at cultivation of future high-tech talents for IT sector. In April 2006, Japan Computer education development center launched an activity "Business helping information teaching practice

2006" to recall the most advanced information technology-related businesses or groups to dispatch lecturers to teach in primary and secondary schools in the purpose of supply them with the latest and most advanced educational content or activities.

In regulation with our government's guidance and encouragement, there are many world-renowned enterprises coming to participate in the construction of educational informationization, and bring up some influential project, for instance, "Hand-in-hand Education Support" project in 2003 by the joint effort of the Ministry of Education and Microsoft (China), "Innovative Approaches to Education" launched in 2004 by Ministry of Education in joint of IBM, "Apple Tomorrow Classroom Project", "Intel Future Education Projects" and so on. Although their products and services have speeded up the pace of China toward integration of information technology and curriculum, as well as that of the professional development of teachers, it can be seen that the passion, scale and influence of well-known domestic enterprises in participation of ICT based educational environment is far from satisfactory.

From now on, our government should be active to encourage all sectors of the society to participate in educational informationization construction process in an appropriate manner, for instance, establishment of school-oriented favorable service system, donation of the demanded equipment and educational and teaching resources to primary and secondary schools, esp. schools in remote and impoverished areas. All the enterprises should take their own role as one part in strategy participation, product customization and service support. Museums, art galleries, universities and research institutions should also speed up electronic information publishing process, open Student Services page, and develop incentive policies to encourage private enterprises and organizations to develop computer teaching software, provide financial support to those projects of good quality and in line with the teaching requirements, and reward the distinguished student-oriented software works, along with granting of recognition for those in contribution to the computer teaching software development.

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