

The Vision for ICT in Education

– Toward the Creation of a Learning System and Schools
Suitable for the 21st Century –

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Ministry of Education, Culture, Sports, Science and Technology

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Introduction

The significance of the ICT in education¹ was pointed out as early as in the first report of the National Council on Educational Reform (June 1985).² In the Council's second report (April 1986), basic qualities that enable individuals to select and utilize information and information media independently were positioned as the learning basis, together with reading, writing, and arithmetic.³ The report of the Central Council for Education published in January 2008 also cited, as matters requiring cross-curricular improvements from the viewpoint of coping with social change, the necessity to arrange conditions concerning the ICT environment,⁴ as well as the importance of information education.

Furthermore, in response to the enforcement of the Basic Act on the Formation of an Advanced Information and Telecommunications Network Society (January 2001), various National Strategies concerning ICT, such as the "e-Japan Strategy," "New IT Reform Strategy," and "e-Japan Strategy 2015," have been established in the field of education and others.

However, the ICT utilization in education in Japan has not been successfully advancing compared with other industrialized countries, having failed to achieve the government targets contained in those various National Strategies established so far.⁵

Furthermore, in recent years, it has often been pointed out that Japan has been losing its international competitiveness.⁶ Cultivation of human resources is indispensable for resource-poor Japan. However, various problems have become revealed regarding the academic abilities of children, who will lead Japan in the future. These include the fact that the number of children with lower achievement levels is larger in Japan than in the high-ranking countries in the OECD's 2009 PISA, and that Japanese children are good at finding and extracting the necessary information from reading materials, but poor at understanding the correlations among elements of such information, making their own interpretations, and connecting the obtained information with their own knowledge and experience.⁷ Under such circumstances, it is highly

¹ This Vision deals with the informatization of education, mainly targeting school education at elementary, lower secondary, and upper secondary schools, etc. (together with the linkage with local communities, families, and institutions of higher education). The informatization of education consists of three elements, i.e. information education, utilization of ICT in course instruction, and introduction of school administrative works. See Chapter 1, Section 2 for details.

² The report contains suggestions, such as that it will become more and more important for people to acquire the ability to make full use of information based on their independent selection, so as to have the informatization of society fully work to enhance people's living standards.

³ Following the publication of the second report, and based on the report of the Curriculum Council of December 1987, the Courses of Study published in 1989 introduced the new elective subject "basic information" into technology and home economics classes at lower secondary schools. Furthermore, based on the report of the Curriculum Council of July 1998, the Courses of Study published in the same year designated the subject "information and computer" in technology and home economics classes at lower secondary schools as a compulsory subject, and also established a new compulsory subject "information" for general education courses at upper secondary schools.

⁴ ICT is the abbreviation of Information and Communication Technology, meaning technology related to information and communication, such as computers and the Internet.

⁵ For example, schools in the U.S. are equipped with computers at a rate of one per 3.8 students (in the autumn of 2005), and in the UK at a rate of one per 3.6 students (at lower secondary schools in June 2009). On the other hand, in Japan, the rate is one per 6.4 students (in March 2010; "IT New Reform Strategy," which was established in 2006, set the goal to be achieved as one computer per 3.6 students.)

⁶ According to the International Institute for Management Development (IMD), Japan's international competitiveness, which was ranked at the top in 1990, declined to the 27th place in 2010 (Industrial Structure Vision 2010 by the Ministry of Economy, Trade and Industry)

⁷ The OECD's 2009 Programme for International Student Assessment (PISA) (see Footnote 15 for details)

necessary to cultivate fundamental abilities in Japanese children that will help them survive in the world of the 21st century. The utilization of ICT in education will enable us to work toward the creation of a learning system and schools that are suitable for the 21st century, and that will foster children with the necessary abilities.

Based on such recognition, the Ministry of Education, Culture, Sports, Science and Technology (hereinafter MEXT) established the “Conference on the Use of ICT in Primary and Secondary Education⁸” (hereinafter “Conference”) in April 2010 and has held 12 meetings. MEXT also established three working groups under this Conference — “Working Group on Support for Teachers,” “Working Group on Information Literacy,” and “Working Group on Digital Textbooks and Teaching Materials, and Information Terminals” — and has held a total of 14 sessions to exchange opinions with academic experts, school officials, heads of local governments, local education administration officials, and private business operators and organizations. Also, on the website, “Jukugi Kakeai (Mutual Deliberation Forum),⁹” which aims to realize policy formation based on deliberation, opinions have been sought widely from people of various positions engaged in education, on such themes as “What is the ideal form of schools and learning for the 21st century that makes the most of ICT” (May 2010) and “Establishing visions for ICT in education” (February 2011).

In the “New Strategy in Information and Communications Technology¹⁰” determined at the government’s Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (hereinafter referred to as the “IT Strategic Headquarters”) on May 11, 2010, the creation of an environment that may realize school education suitable for the 21st century was cited as the priority in the field of education, with the aim of fully utilizing ICT so as to (i) make classes more interactive and easy-to-understand, through teaching and learning among students themselves, (ii) reduce burdens of teachers and other school staff, and (iii) enhance children’s information literacy. On June 22, 2010, the IT Strategic Headquarters decided upon the roadmap for this strategy, showing concrete measures to be taken at respective ministries and agencies for the short-term period (2010 and 2011), the mid-term period (2012 and 2013), and the long term period (2014).

The “New Growth Strategy” approved at the Cabinet meeting on June 18, 2010 says that “Information and communications technology will be used to improve the quality of medical, education, and other services, such as by facilitating collaborative education, in which children teach and learn from each other. Japan will also promote further utilization of optical cable and other types of broadband services in order to provide greater convenience for all citizens.

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Under the Great East Japan Earthquake in March 2011, it is required to properly collect, judge,

revealed following problems: (i) The number of children with lower achievement levels is larger in Japan than in the high-ranking countries; (ii) Japanese children are good at finding and extracting the necessary information from reading materials but poor at understanding the correlations among elements of such information, making their own interpretations, and connecting obtained information with their own knowledge and experience; (iii) Japanese children’s mathematical literacy is above the OECD average but far below the levels of the high-ranking countries.

⁸ “Conference on Informatization in Primary and Secondary Education” (http://www.mext.go.jp/a_menu/shotou/zyouhou/1292783.htm)

⁹ “Jukugi Kakeai (Mutual Deliberation Forum)” (<http://jukugi.mext.go.jp/>)

¹⁰ The “New Strategy in Information and Communications Technology” (determined at the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society on May 11, 2010) (<http://www.kantei.go.jp/jp/singi/it2/>) In accordance with the expression used in said strategy, we also use the term “ICT” in this Vision.

transmit, and convey information. In light of the fact that many schools have been functioning as evacuation centers, we also need to realize the safe and secure schools in preparation for future emergencies. Even from this point of view, the ICT utilization in education has become more and more important.

Based on these moves of the government as a whole, and past discussions at the Conference, MEXT has compiled this “The Vision for ICT in Education” as its comprehensive policy on the utilization of ICT in education towards FY2020.

Chapter 1 Creation of a Learning System and Schools Suitable for the 21st Century

1. Abilities required for children who will lead the 21st century

- The 21st century is said to be the age of a knowledge-based society,¹¹ where new knowledge, information, and technology will dramatically grow in importance as the basis for activities in politics, economy, culture, and all other fields of society. In a knowledge-based society, where competition and technological innovation constantly take place, people are required to have the ability to create new sense and value based on their broad knowledge and flexible thinking. Furthermore, the globalization of social structures accelerates international competition for new ideas and knowledge, as well as for qualified human resources, and also increases the necessity to seek coexistence and international cooperation among different cultures and civilization.
- Placing importance on this point, “New Courses of Study”¹² states that it has become more and more important to cultivate a well-balanced “strength to lead a life” in children, who will lead a rapidly changing future society, by simultaneously fostering solid academic abilities, spiritual wealth, and a sound body. The guidelines also point out that in order to foster children’s solid academic abilities, it is necessary to have them acquire basic and fundamental knowledge and skills, and develop enough ability to think, to make decisions, and to express themselves for solving the problems based thereon, and cultivate an attitude of proactive learning.
- In order to cultivate the ability to think, to make decisions, and to express themselves,¹³ which is one of the weaknesses of Japanese children, it is necessary to have them acquire basic and fundamental knowledge and skills in each subject, and at the same time, to provide them with more opportunities for language activities to utilize their acquired knowledge and skills, through such activities as observation and experiments, the preparation of reports, and dissertations.
- To cultivate information literacy¹⁴ is to cultivate people’s ability to independently collect, judge, process, arrange, create, and express necessary information, and to transmit and convey it. This may also help children steadily build basic and fundamental knowledge and skills, and will be the basis of the language activities that utilize their acquired knowledge and skills, thereby contributing to their “ strength to lead a life.”

¹¹ The report of the Central Council for Education dated January 17, 2008 (“Improvements to the Courses of Study for Elementary, Lower Secondary, and Upper Secondary Schools”) and the report of the Central Council for Education dated January 28, 2005 (“Vision for the Future of Higher Education in Japan”)

¹² The Courses of Study for elementary and lower secondary schools were revised in 2008, and those for upper secondary schools and schools for special needs education in 2009.

¹³ See Chapter 3, “The Present State of Children and Current Issues” in the report of the Central Council for Education dated January 17, 2008 (“Improvements to the Courses of Study for Elementary, Lower Secondary, and Upper Secondary Schools”)

¹⁴ Regarding information literacy, three points of view (practical capability to utilize information, scientific understanding of information, and attitude to willingly participate in the information society) are important. See Chapter 2 for details.

- Such awareness is shared internationally. During the period between 1997 and 2003, the Organisation for Economic Co-operation and Development (OECD) worked, together with experts in cognitive science and assessment, and people involved in education from various countries, to define key competencies, i.e., abilities necessary for children who will lead the age of the knowledge-based society in the future, and started to conduct a survey on part of these competencies through its international PISA test.¹⁵ The OECD maintains that key competencies consist of three categories: “competency to use socio-cultural and technological tools interactively,” “competency to form relationships and interact in various groups,” and “competency to act autonomously.”¹⁶ Competency to use socio-cultural and technological tools interactively includes the ability to utilize knowledge and information and the ability to utilize technology.¹⁷
- In order to cultivate these abilities which are necessary to the children who will lead the 21st century, the most important thing is to respect each child’s diversity and provide education suited to the individual, letting them capitalize on their strengths and fulfill their potential. At the same time, it is also crucial to provide education that enables children with different backgrounds and various abilities to create new value in collaboration through good communication.

¹⁵ The Programme for International Student Assessment (PISA) survey that OECD commenced in 2000. PISA aims to assess to what extent 15-year olds, who are in the last stage of compulsory education, can utilize their acquired knowledge and skills in solving problems they face in various scenes in real life. In 2009, the survey was conducted with regard to reading literacy, mathematical literacy, and scientific literacy.

(Definitions)

- Reading literacy: The capacity to understand, use, and reflect on written texts, in order to achieve one’s goals; to develop one’s knowledge and potential; and to participate in society in an effective manner
- Mathematical literacy: The capacity to identify and understand the role that mathematics plays in the world; to make well-founded judgments; and to use and engage with mathematics in one’s present and future personal life, vocational life, and social life with friends, families, and relatives, and in ways that meet the needs of one’s life as a constructive, concerned and reflective citizen
- Scientific literacy: (i) Scientific knowledge for identifying scientific questions, acquiring new knowledge, explaining scientific events, and drawing evidence-based conclusions on science-related problems, and the capacity to utilize such scientific knowledge; (ii) Understanding characteristic aspects of science as one form of human knowledge and questioning; (iii) Recognizing how science and technology form people’s material, intellectual, and cultural environment; and (iv) Willingly getting involved in science-related problems as reflective citizens with the scientific frame of mind

¹⁶(<http://www.deseco.admin.ch/bfs/deseco/en/index/02.parsys.43469.downloadList.2296.DownloadFile.tmp/2005.dskcexecutivesummary.en.pdf>)

¹⁷ The European Commission cites the following eight capacities as the key competencies for lifelong learning: (i) Communication in the mother tongue; (ii) Communication in foreign languages; (iii) Mathematical competence and basic competences in science and technology; (iv) Digital competence; (v) Learning to learn; (vi) Social and civic competences; (vii) Sense of initiative and entrepreneurship; and (viii) Cultural awareness and expression.

Furthermore, the project “Assessment & Teaching of 21st Century Skills (ATC21S),” which has been conducted with the participation of researchers from Australia, Finland, Portugal, Singapore, the United Kingdom, and the United States, suggests that ten skills, such as creativity, innovation capability, critical thinking, problem-solving, communication skills, collaboration skills (teamwork skills), information literacy, and ICT literacy, are significant 21st century skills critical to individual economic success and important to effective functioning at the personal and societal levels. (<http://atc21s.org>)

2. Roles of the ICT in education

- In order to provide education to cultivate abilities required for children who will lead the 21st century, as described in the previous section, it is important to take full advantage of the features of ICT, i.e., being free from time and spatial restrictions, having interactivity, and enabling easy customization.¹⁸ At schools, which are the major place for children's learning and daily life, the ICT utilization in education should be promoted, with teachers fulfilling their duties and utilizing ICT in a manner that makes the most of its features. Such efforts will promote individualized learning responding to each child's abilities and personality, and collaborative learning where children can teach and learn among themselves, along with conventional mass learning by class guidance all at once.
- More specifically, the ICT utilization in education aims to enhance quality of education from the following three aspects:
 - (i) Information education¹⁹ (cultivating children's information literacy)
 - (ii) Utilization of ICT in course instruction (realizing easy-to-understand classes that deepen children's understanding through the effective use of ICT)
 - (iii) Introduction of ICT for school administrative works (enabling teachers to provide more detailed guidance through information sharing by utilizing ICT and reducing their burden of school administrative works)
- In a society where utilizing ICT is considered to be extremely common, it is the obligation of school education to train and send students into society with a minimum level of information literacy necessary. This is also essential from the viewpoint of maintaining and strengthening Japan's international competitiveness and making contributions to the international community, while continuing to ensure a rich life for Japanese people as one of the front-runners leading the whole world.
- In course instruction, teachers can utilize ICT to emphasize certain images, or choose video and audio materials so that they can give easy-to-understand explanations and raise children's interest in learning.²⁰ Children, for their part, can acquire fixed knowledge and skills through repetitive learning. Furthermore, ICT enables interactive class activities, where children collect, select, and accumulate pieces of information to compile them into documents and charts for presentation; teachers and children exchange information; or children teach and learn among themselves. In such a process, ICT also makes it possible for teachers to ascertain and analyze each child's learning history. All these are considered to encourage children to understand material contents more deeply and express themselves more positively.
- For children who require special needs education, such as those enrolled in schools for

¹⁸ Customization means to arrange existing items into what users want.

¹⁹ Information education is education to cultivate information literacy.

²⁰ The results of the project commissioned by MEXT, "Study Contributing to the Promotion of the Informatization of Education" (March 2007; National Institute of Multimedia Education) show some cases where higher learning effects are observed when utilizing ICT in course instruction.

special needs education or in special classes at elementary and lower secondary schools, as well as those with developmental disabilities in ordinary classes, ICT works especially effectively, when used in accordance with each child's disabilities and characteristics, enhancing their achievements in each subject and activities to promote independence. In particular, ICT can be used as a good communication tool for collecting, editing, expressing, and transmitting information.

- However, just as teaching by using blackboards in class has been proven effective, new teaching methods should be developed and improved by effectively utilizing ICT, with such conventional methods as their base, so as to create a learning system and schools suitable for the 21st century. ICT is very important but nothing more than a tool. When utilizing it, full consideration should be given to school types, children's growth stages, subjects, concrete purposes, and situations, so that the utilization surely contributes to the enhancement of children's learning.
- As measures against negative aspects of the ICT use, education in "information morals" needs to be provided for children to build their basic ideas and attitude concerning how to behave properly in the information society.²¹ In addition to this, measures to raise awareness of teachers and guardians on information morals, as well as countermeasures against harmful environments need to be taken concurrently.
- In the meantime, efforts to increase children's real experiences and face-to-face communications²² will further gain in importance at schools.²³ It is important to promote the ICT utilization in education, while paying attention to the limits of ICT as well as the potential of it.
- Regarding the introduction of ICT for school administrative works, some schools introduce a system to input and share information on children's good points among all school teachers and reflect such information in teaching activities.²⁴ There are also survey results showing that the introduction of a school administrative support system has increased hours for teachers to directly teach children by 30 minutes or more per day.²⁵ This indicates that the introduction of ICT for school administrative works surely contributes to enhancing the quality of education for children and reducing burdens for teachers.
- The utilization of ICT also makes it possible for children to receive learning support back at

²¹ MEXT prepared a model curriculum for information moral guidance (FY2006) and created a portal site for information moral guidance (FY2007).

²² One example is to have children transmit what they learn through outdoor observation activities by utilizing ICT. Combining real experiences with ICT in this manner may create new learning possibilities.

²³ Bearing this in mind, MEXT has held meetings of the Communication Education Promotion Conference since May 2010 and has conducted surveys and reviews concerning concrete measures to foster children's communication skills and dissemination thereof.

²⁴ Such activities as "finding good points" are being adopted in Komaki City in Aichi

²⁵ Since FY 2007, the Kumamoto Prefectural Board of Education has been developing and introducing groupware for the sharing of information on children and electronic approval of duties, a school administrative support system for the computerization of score evaluations and teaching records, and a document secure system for the management of personal data and various documents preserved at schools.

home or in local communities, when they review what they learnt at school. This will further increase learning opportunities for children.²⁶

²⁶ Under the Program for Promoting Leading Informatization of Education commissioned by MEXT, the Chitose Institute of Science and Technology has taken the initiative in supporting home study through e-learning, in collaboration with schools, the administration, and families.

Chapter 2 Cultivation of Information Literacy

(Smooth and steady implementation of the New Courses of Study)

- For information education, i.e., to cultivate children's information literacy, the following three points of view are important: (i) practical capability to utilize information (the ability to independently collect, judge, process, arrange, create, and express necessary information, and to transmit and convey it in accordance with the circumstances of the recipients, which also includes the ability to properly utilize information sources depending on problems and purposes); (ii) scientific understanding of information (understanding of the characteristics of information sources that will be the basis of the utilization and understanding of basic theory and methods to properly handle information and assess and improve one's own ways of utilization); and (iii) an attitude of willing participation in the information society (attitude to understand roles and influences of information and information technology in social life, consider the necessity of information morals and one's own responsibilities for information, and willingly participate in the creation of a desirable information society). Efforts should be made to have children acquire these three in a balanced manner, by connecting them mutually.
- The cultivation of children's information literacy is adopted as a compulsory subject in Technology and Home Economics (Technology) in lower secondary schools and "Information" for general education courses in upper secondary schools. However, information literacy can be grown through utilizing ICT in other subjects as well.²⁷ First of all, the New Courses of Study, which requires further enhancement of information education in each subject,²⁸ need to be implemented smoothly and steadily.²⁹ In that process, the view on information literacy expected to be acquired at each school stage and case examples of teaching as indicated in the MEXT's "Guideline on ICT in Education"³⁰ should be disseminated widely in an easy-to-understand manner, while collecting and introducing best practices at schools as much as possible.
- It has also been pointed out that more deliberate and effective means to cultivate children's information literacy should be indicated and disseminated widely in detail, specifically showing what to be taught in what manner. For this purpose, more efforts should be made

²⁷ The New Courses of Study requires that language activities should be increased in all subjects. For example, teachers are to consider effective methods of course instruction, combining activities such as presentation, recording, summarization, and reporting with the fostering of information literacy.

²⁸ The New Courses of Study states that at the elementary school stage, children should "learn basic operation and information morals" concerning information sources, such as computers and IT networks, and that "learning activities should be enhanced so as to enable them to utilize information sources properly." At the lower secondary school stage, students should "acquire information morals" and "learning activities should be enhanced so as to enable them to utilize information sources properly, independently, and positively." Furthermore, at the upper secondary school stage, students should "acquire information morals" and "learning activities should be enhanced so as to enable them to utilize information sources properly, practically, and independently."

²⁹ Some point out that often people limit the scope of informatization in schools to just having teachers and children utilize ICT in learning. However, in reality, the concept is much broader.

³⁰ The guideline was prepared by MEXT in October 2010 as a reference for teachers, schools, and boards of education that shows concrete examples, for the purpose of contributing to the smooth and steady informatization of education under the New Courses of Study.
(http://www.mext.go.jp/a_menu/shotou/zyouhou/1259413.htm)

to develop teaching materials for teachers that extract and explain case examples concerning scenes, procedures, and points suitable to cultivate children's information literacy out from various course units of each subject, as well as learning materials for children that compile basic and fundamental knowledge and skills for properly utilizing information.

- In recent years, more and more children come to use the Internet through highly functional mobile phones, causing new problems concerning defamation and bullying on the Internet, as well as crimes and illegal and/or harmful information on the Internet. In a society where informatization is rapidly proceeding, ensuring information security has become increasingly important. In light of these facts, schools are to be required to work hard on information moral education in collaboration with families, local communities, and related organizations, while fully understanding both the light and dark sides of informatization.³¹
- Upon the occurrence of the Great East Japan Earthquake, remarks arousing people's anxiety were transmitted on the Internet, along with useful information for people's safety and security. Recently, there was also an incident of illegal acts committed by a university entrance examinee using a mobile phone. Therefore, it is becoming increasingly important to foster children's basic ideas and attitudes toward utilizing information by teaching them basic rules and manners for communication in the information society, as well as safe and proper means to utilize ICT in daily course instruction, and in particular, in moral classes.

(For establishing future curricula)

- From the viewpoint of providing information education to children who will lead the 21st century, systematically in a more effective manner, throughout their school stages from elementary to lower and upper secondary schools, empirical research is required to search for desirable curricula for fostering information literacy, by utilizing such systems as the experimental school system, while taking international trends into account. In particular, for ensuring children's effective utilization of ICT in learning, enough blocks of time should be secured in the curriculum to allow children to learn basic ICT operations and have basic learning experiences.³² The preparation of basic learning materials, such as a digital "Information Utilization Notebook (provisional title)" may also be one of the options.

³¹ The term "information morals" may seem to refer to some mental attitude that does not require acquisition of knowledge. However, as the core of the mental attitude to participate in the information society, it is important to have children acquire necessary knowledge on the features of the media and the ideal image of the information society, and enable them to make judgments based on such knowledge. For example, guidance on information morals can be provided not only in morals classes, but also in such course units as "Comparison of Information Obtained from Newspapers and the Internet, etc." in Japanese classes, "Study on the Information Industry" in social studies classes, "Study on the Relationship between the Use of Computers and Other Information Equipment and People's Health" in health and physical education classes (health education), "Study on Intellectual Property Rights" in music classes and fine art classes, and "Study on Selection and Purchase of Goods and Services Necessary for Daily Life" in technology and home economics classes (home economics). Furthermore, children may also be able to experience and learn rules on the network and safe utilization naturally through routinely utilizing ICT in such classes.

³² At the Conference meeting, some suggested the possibility of creating new subjects for elementary and lower secondary schools in which children try to enhance their information literacy and learn in groups by utilizing ICT.

- Another option is to grant preferential treatment to schools where good ICT environment and teaching system are in-place, i.e. those equipped with one information terminal per one child and with enough ICT advisors, and which are willing to conduct curricula studies. By granting an exception to such schools regarding the required curricula, we may be able to verify information literacy to be required in the future and concrete teaching contents and methods necessary for that purpose.
- For reviewing future curricula, a forum could also be established to broadly exchange information and opinions among MEXT, universities, boards of education, and school teachers and staff.
- Further studies should be conducted on information literacy-related curricula, teaching methods, and assessment in foreign countries pioneering in this field, as well as the results thereof. Discussions on how to carry out proper field surveys on information literacy need to be reflected when establishing concrete measures to cultivate Japanese children's information literacy. Based on studies and survey results, the idea of information literacy itself needs to be reviewed as necessary, in response to a rapid progress in the informatization of the society and accompanying changes in learning environments.³³

(For developing human resources related to advanced IT in the future)

- In order to develop human resources related to advanced IT who will lead the ICT industry in the future, a good social environment needs to be arranged by holding workshops, etc., targeting children in elementary, lower secondary, and upper secondary schools, so that they can participate in the production of digital content, programming, and the like in club activities and local activities, in addition to receiving class lessons at schools.³⁴

³³ The results of the above-mentioned efforts concerning desirable curricula in the future shall be reflected upon in discussions at the Central Council for Education on this theme.

³⁴ The “New Strategy in Information and Communications Technology” (see Footnote 10) states that measures to develop human resources related to advanced IT should be taken together with measures for children at the elementary and lower secondary school stages.

Chapter 3 Utilization of ICT in Learning

- At schools, textbooks and other various types of materials used in classes play extremely significant roles in children's learning. Therefore, textbooks, materials, and information terminals, which are important tools for school education, need to be developed in a manner that would help fostering abilities required for 21st century children, as explained in Chapter 1. The utilization of ICT will promote individualized learning responding to each child's abilities and personality, and collaborative learning where children can teach and learn among themselves, in addition to conventional mass learning by class guidance all at once, and thereby helping children acquire basic and fundamental knowledge and skills, develop enough ability to think, to make decisions, and to express themselves, and develop an attitude of proactive learning.

- The following are examples of concrete measures:

(i) For mass learning in class:

Teachers can enlarge and highlight important parts and use video, etc. that will attract children's interest

(ii) For individualized learning:

Children can use digital content, etc. to investigate their questions in detail, learn at their own pace, and choose assignments in accordance with their own understanding and problems

(iii) For collaborative learning:

Children use information terminals and data terminal equipment in classroom lessons to share and discuss mutual ideas, exchange opinions, and make presentations. They can also join exchange lessons with other schools inside and outside Japan and enhance each other through the use of such equipment.

The utilization of ICT will thus contribute to realizing goals in each subject and children's better understanding of subject contents.

From the viewpoints of the "acquisition of basic and fundamental abilities and skills," "development of enough ability to think, to make decisions, and to express themselves," and "fostering an attitude of proactive learning," which are stipulated as the three elements of academic abilities as prescribed in Article 30, paragraph (2) of the School Education Act, Table 1 shows concrete examples of class activities (Chart 2 illustrates a learning environment suitable for the 21st century and images of learning based thereon).

1. Digital textbooks and other materials³⁵

(Digital textbooks)

- So-called digital textbooks are "teaching materials for digital equipment and information terminals that contain the contents of existing textbooks and have basic functions, such as editing, transferring, adding, and deleting content, in addition to software to browse such content." They are roughly divided into digital textbooks mainly for teachers, which are

³⁵ The "New Strategy in Information and Communications Technology" (see Footnote 10) and the "Intellectual Property Promotion Plan 2010" (determined by the Intellectual Property Strategy Headquarters on May 21, 2010) use the term "digital textbooks." Therefore, we also use the term in this Vision.

used by teachers in teaching children by displaying its contents on an interactive white board, etc. (hereinafter referred to as “digital textbooks for teachers”), and digital textbooks mainly for children, which are used by children for individual learning with their own information terminal (hereinafter referred to as “digital textbooks for learners”).³⁶ At present, all of the digital textbooks published by textbook publishers are for teachers. They are based on ordinary paper textbooks but are categorized as “other teaching materials” under laws and regulations.

(Digital textbooks for teachers)

- Digital textbooks for teachers contain the contents of existing textbooks and have functions contributing to deepening classes in an easier-to-understand manner (such as through enlarging certain parts, selecting narration of certain sentences, or choosing appropriate video). Many textbook publishers have been developing these digital textbooks, in line with the spread of interactive white boards for displaying them³⁷ and in accordance with the revision of the Courses of Study. Furthermore, measures need to be considered to promote the development of such teaching materials and to assist school establishers in purchasing necessary equipment. Furthermore, the use of digital textbooks may be expanded to allow users to browse other website on the Internet and also realize interactive class activities between teachers and children.

(Digital textbooks for learners)

- As explained in Chapter 1, in order to facilitate learning suitable to each child’s abilities and personality, as well as collaborative learning where children can teach and learn among themselves, digital textbooks for learners should be developed in a manner that can flexibly meet individual learning needs and enable the ascertaining and sharing of children’s learning histories.³⁸³⁹
- Digital textbooks for learners should not only contain the contents of paper textbooks as they are, but also have functions of audio playback, video, and enlargement just as present digital textbooks for teachers do. In addition, they are to help children use the Internet, enable interactive class activities between teachers and children or among children, contribute to the sharing of written data through a network, support teachers to ascertain children’s learning histories, and assist children’s self-learning at home and in local communities, depending on their individual levels of understanding.

³⁶ See Chart 3 for expected functions of digital textbooks for learners, digital textbooks for teachers, information terminals for learners, and information terminals for teachers. However, those are only examples. Some functions expected from digital textbooks include those that can be provided partially by information terminals, and some functions expected from information terminals include those that can be provided partially by digital textbooks. Respective functions expected from digital textbooks are basically expected from other digital materials, as well.

³⁷ According to the 2009 “Survey Results Regarding the Informatization of Education,” as of the end of March 2010, the number of interactive white boards equipped in public schools under the FY2009 first supplementary budget was around 56,000 (interactive white boards are equipped at nearly 60% of the total), having increased from around 16,000 in the previous fiscal year.

³⁸ These learning histories record individual children’s learning process and achievements.

³⁹ In South Korea, empirical research concerning digital textbooks for learners has been conducted since 2007, targeting model schools.

- For developing digital textbooks for learners and information terminals, which are detailed in the next section, it is important to deepen discussions, while taking into account the trends in the computerization of other books in general, and focusing on (i) educational effects and teaching methods for each school type (elementary, lower secondary, upper secondary schools, and schools for special needs education), children's growth stages, and subjects; (ii) selection and extraction of necessary functions; (iii) specifications to realize such functions; (iv) development of model contents; (v) methods to provide and deliver contents; (vi) influences on children's health; (vii) specifications and utilization methods conscious of such influences; and (viii) response to unique conditions and characteristics of children with disabilities. For this purpose, empirical research should be carried out sufficiently by utilizing model regions and model schools.
- Based on the results of such empirical research, it is also necessary to review ideal forms of paper textbooks, their relations to and distinction from digital textbooks for learners and other digital materials, and overall textbook-related systems, including the textbook authorization system and the system to provide textbooks free-of-charge, as well as problems concerning copyrights.
- Presuming that each child comes to own one information terminal and a set of digital textbooks for learners to study, research should be conducted for establishing guidelines concerning points to be noted when children and teachers utilize information terminals, broadly based on knowledge of related parties of experimental schools and experts in the fields of education, cognitive science, psychology, medicine, and information engineering.⁴⁰

(Other digital study materials)

- In order to provide high-quality education by utilizing various types of digital material, content quality needs to be ensured. Therefore, it is important for the government and others to develop and provide model digital materials⁴¹ and to arrange a favorable environment where teachers and wide-ranging private bodies can exercise their originality, and thus it is required to encourage and honor their development of high-quality contents. For promoting the production and utilization of digital materials, copyright clearance should also be further facilitated.
- Furthermore, in order to accumulate and share high-quality digital materials in a database,⁴² efforts should be made both at the local level (local education centers should actively collect and provide such materials) and at the national level (high-quality materials

⁴⁰ When conducting such research, the "Guideline for Occupational Health Management while Operating Visual Display Terminals (VDT) (2002)" may be referenced. The guideline was compiled by the Ministry of Health, Labour and Welfare for persons engaged in duties utilizing ICT in private companies, etc.

⁴¹ For example, the Japan Science and Technology Agency (JST) operates a system to provide digital materials for scientific technology and science education ("Rika Network (Science Network)"), contributing to the provision of high-quality digital contents.

⁴² Nearly 90% of schools "wish to have more educational software that teachers and children can handle more easily" (the project commissioned by MEXT in FY2006, "Study on Advanced Cases of Utilizing ICT Environments Depending on Region/School Features" (March 2007)).

developed locally should be accumulated and shared nationwide). This may help teachers prepare for class lessons more efficiently and facilitate the cultivation of children's information literacy.

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About teaching practice, including teaching plans and materials, the websites and the database of the National Institute for Educational Policy Research, should disseminate best practices at pilot schools. At the same time, research should be conducted on the effective distribution of information, for providing communication methods to exchange and share information about the activities by schools, boards of education, and education centers nationwide and about excellent digital content that they make and possess.⁴³

Furthermore, it is also important to distribute the education information database of the National Information Center for Educational Resources (NICER) widely to the private sector for the public use from FY2011.⁴⁴

(Collaboration with families and local communities)

- Digital textbooks and other materials may also be utilized by children and their guardians at home and in local communities, while learning contents at home and in local communities can be digitalized and used for school education, with certain consideration to their copyrights. Digital materials are thus expected to organically link learning activities at school, at home, and in local communities.

⁴³

Recently, some systems to provide newspaper articles and broadcasted programs are archived and digitalized as educational materials to schools. These include a system to provide on-line access to past newspaper articles from the Meiji era to the present, and a service to provide education-related broadcast programs and video clips through the Internet.

⁴⁴

NICER's LOM information (metadata, for searching learning contents) should immediately be provided free of charge to private bodies or the education field so that they can actively use it in their education/research activities. See the website (http://www.nier.go.jp/nicer/nicer_top.html) for NICER.

2. Information Terminals, Digital Equipment, and Network Environment

(Information terminals)

- In order to promote learning responding to each child's abilities and personality, and collaborative learning where children can teach and learn among themselves, it is helpful that students solve problems by comparing and examining the information they themselves obtained and what the others found out, and that students deepen their understanding through the efforts to explain their own ideas to others in an easy-to-understand manner. At the same time, it is effective if teachers can ascertain each child's learning history on a daily basis. In addition, through the utilization of ICT, children may effectively learn to act in a collaborative manner in various scenes in their everyday school life.⁴⁵ Therefore, it is essential to arrange an environment that each child can own an information terminal.
- In recent years, highly-functional information terminals that are also highly portable have been developed, along with desktop computers and laptop computers. Such highly portable information terminals can be used in classes both inside and outside classrooms, as well as back at home or in local communities, enabling children to study the same materials as they do at school.
- Existing information terminals have both merits and demerits, such as being highly portable but with limited functions, or being highly-functional but hard to carry. This may partially be because their utilization in school education has not been fully considered in the process of the development.
- The above-mentioned empirical research should also focus on desirable purposes and scenes for proper and effective use of information terminals and necessary functions for class guidance, while reviewing the division of roles with functions of digital textbooks and other materials, and also considering school types, children's growth stages, educational effects, teaching methods, their influence on children's health, etc.

(Digital equipment)

- In order for teachers to realize effective class guidance and train children to acquire information literacy, such as the ability to express and transmit necessary information, it is important to immediately equip schools with necessary digital equipment, such as interactive white boards, projectors, epidiascopes, and terrestrial digital televisions, so that such equipment can be utilized in all classrooms. In particular, interactive white boards are expected to help realize more effective class activities, as they can be used to enlarge certain parts, show video, and provide narration, as well as enable the access to the Internet, where children's learning contents and thinking processes are displayed in real time, by connecting each child's information terminal, for the purpose of mutual communication between teachers and children and cooperation among children.

⁴⁵ Through utilizing information terminals, children can, for example, deliver their school news on the website, try to find answers to their questions by themselves, and exchange opinions among them under a system similar to "Jukugi Kakeai," or a school-type Mutual Deliberation Forum.

(Network environment)

- The rate of ordinary classrooms equipped with intra-school LANs was around 81%, that of schools equipped with fiber optic cable network was around 67%, and that of schools with an Internet connection speed of over 30Mbps was around 66% (March 2010). The environment has thus not been fully developed for schools to sufficiently utilize broadband Internet services, with significant regional gaps, which should be resolved somehow.⁴⁶ Ultrafast intra-school wireless LANs need to be constructed with ensuring high security, so that one information terminal can be provided to each child for learning at all schools.⁴⁷
- There are roughly two methods to provide and deliver digital textbooks and other materials: (i) via DVD, USB memory devices, or other media and (ii) via the network. The former has limits when using small-capacity media to save data, while the latter has an advantage that it is suitable for the use at many schools in wide areas and can update the contents flexibly. Therefore, also based on the results of empirical research under the “Future School Promotion Project” by the Ministry of Internal Affairs and Communications,⁴⁸ the latter method may be adopted in the future by using cloud computing technology,⁴⁹ while giving full consideration to cost-benefit performance and security, etc.

(School facilities suitable for ICT utilization)

- School environment as a whole needs to be arranged for the convenience of utilizing information terminals and digital equipment, including the width and shapes of classrooms. Therefore, it is necessary to show ideal school facilities suitable for the ICT utilization.

(Other matters to be noted)

- Ensuring one information terminal per child, and sufficient digital equipment and ultrafast wireless LANs for schools, as well as arranging a fast network environment to support the utilization of such equipment are the premises for realizing the enhancement of education by utilizing ICT. Concrete policies and schedules for condition arrangement and how to bear required cost need to be compiled promptly based on empirical research results and other circumstances.
- It is also significant to consider how to arrange an ICT-related environment at schools in preparation of future emergencies, taking into account both of the advantages and problems of ICT.⁵⁰

⁴⁶ Based on the 2009 “Survey Results Regarding the Informatization of Education”

The rate of ordinary classrooms equipped with school LANs is the figure as of the end of March 2010, and those of schools equipped with fiber optic cable network and schools with an Internet connection speed of over 30Mbps, respectively are the figures as of March 1, 2010.

⁴⁷ In order to ensure one information terminal for each child for learning, gigabit-class network bandwidth may be required, depending on school’s scale and circumstances. Therefore, the details need to be further reviewed.

⁴⁸ See Footnote 80.

⁴⁹ Technology that enables the utilization of various computer sources, such as data, software, and hardware, via the Internet

Users no longer have to process and save data on their own computer, but can utilize data “anywhere, anytime, and as much as they want,” so long as they are in an environment with access to the Internet.

⁵⁰ Regarding this point, we need to learn lessons from the Great East Japan Earthquake. For example, considering the possibility that schools may be used as evacuation centers in emergencies, schools need to be equipped with a disaster-proof information infrastructure, such as a optical fiber link, wireless communication facility, and

Table 1: Example of class activities responding to three factors of academic abilities

1. Acquisition of basic and fundamental knowledge and skills

	Utilization of ICT	Concrete class activities	Major type of learning
(i)	To share written data in learners' information terminals on interactive white boards, etc. by connecting the both with wireless LANs	<ul style="list-style-type: none"> In classes of all subjects at elementary, lower secondary, and upper secondary schools, answers of children responding to teachers' questions, which are written in individuals' information terminals, are displayed on interactive white boards and other information terminals. Based on various answers of others, children are guided to deepen their understanding. 	Collaborative
(ii)	To make it possible to review freely what children learn recently in the previous classes and difficult parts by connecting such contents with digital materials used for classes of other grades	<ul style="list-style-type: none"> For children who cannot understand the unit "Calculation of Fractions with Different Denominators" in 5th-grade Arithmetic, review guidance is provided across grades concerning "Divisors and Multiples" (5th-grade), "Fractions with the Same Denominators" (4th-grade), and "Fractions" (3rd-grade). 	Individualized
		<ul style="list-style-type: none"> In classes of upper secondary school Mathematics I, graphs of $y=ax^2$, which are to be learnt at lower secondary school, are used to confirm its characteristics, in accordance with students' achievement levels, aiming to deepen their learning thereafter. 	Mass
(iii)	For repetitive learning to have children acquire fixed knowledge and skills, to customize materials in accordance with individuals' achievement levels and provide achievement-based materials by using an automatic scoring function and error analysis function	<ul style="list-style-type: none"> Teachers of elementary, lower secondary, and upper secondary schools create customized digital materials in accordance with individuals' achievement levels and use them in class. 	Individualized
		<ul style="list-style-type: none"> Each child of elementary, lower secondary, and upper secondary schools is provided with problems to solve depending on their achievement levels, such as calculation problems in arithmetic or mathematics classes, <i>kanji</i> problems in Japanese language classes, and word and expression problems in foreign language classes. Furthermore, accumulated results of each child are analyzed to improve teaching methods. 	Individualized
(iv)	To enlarge and emphasize significant parts to deepen learners' understanding	<ul style="list-style-type: none"> In classes of all subjects at elementary, lower secondary, and upper secondary schools, part of materials and significant points are highlighted or clearly displayed by using a marking or highlighting function, and easy-to-understand guidance is provided by having children write or record their answers and comments on screens. 	Mass Individualized
		<ul style="list-style-type: none"> In Home Economics at elementary schools, the difficult part of backstitching or other stitching, or specific parts that individual children want to know are enlarged for better understanding. 	Mass Individualized
(v)	In addition to hands-on learning, such as observation and experiment, to use simple and easy-to-understand digital materials (sound, images, or	<ul style="list-style-type: none"> In the unit "Structure and Movement of the Human Body" in 4th-grade Science, video using computer simulation of skeleton models, etc. are used to help children's understanding of the structures of bones and muscles and their relations with exercise. 	Mass Individualized

video, etc.) to deepen learners' understanding	<ul style="list-style-type: none"> ▪ In Foreign Language Activities at elementary schools, and Foreign Languages at lower secondary and upper secondary schools, guidance to encourage better speech of children is to be provided by having them listen to native speakers' speech to confirm pronunciation, rhythm, and intonation; record their own speech to check pronunciation; and conduct role-playing activities with native speakers on screen. 	Mass Individualized
	<ul style="list-style-type: none"> ▪ In the unit "Injury Prevention" in Health and Physical Education at lower secondary schools, the significance and procedures of first-aid treatment are taught by showing video of coronary blood flow due to chest compressions and conducting practical training of cardio-pulmonary resuscitation. 	Mass Individualized
	<ul style="list-style-type: none"> ▪ In Physics at upper secondary schools, simulation software of kinetic theory of gas is used to deepen students' understanding of its relation with the Boyle-Charles's law. 	Mass Individualized

2. Development of the ability to think, to make decisions, and to express themselves

	Utilization of ICT	Concrete class activities	Major type of learning
(i)	To aim to enhance interactive class activities, so that children teach and learn among themselves by sharing written data in learners' information terminals on interactive white boards, etc. by connecting the both with wireless LANs	<ul style="list-style-type: none"> ▪ In classes of all subjects at elementary, lower secondary, and upper secondary schools, answers of children responding to teachers' questions, which are written in individuals' information terminals, are displayed on interactive white boards and other information terminals. Children are encouraged to point out and discuss differences in displayed answers. 	Collaborative
		<ul style="list-style-type: none"> ▪ In the unit "Measurements and Controls via Computer Programs" in Technology and Home Economics (Technology) at lower secondary schools, programs to control a robot designed by individuals are displayed on an interactive white board together with the actual motion of a robot. Devisable points of respective programs are shared and points to be improved are discussed. 	Collaborative
(ii)	To utilize the Internet to conduct classes so that children can exchange opinions with their counterparts at other schools and have contact with staff of social education facilities, such as libraries and museums, and research institutes, as well as people of local communities	<ul style="list-style-type: none"> ▪ In classes such as the Period for Integrated Studies at elementary, lower secondary, and upper secondary schools, multi-faceted thinking is to be fostered by having children discuss what they studied on the same themes as their counterparts at other schools and interact with the staff of social education facilities and research institutes, as well as people of local communities via the Internet. 	Collaborative

(iii)	To aim to enhance class activities, so that children are encouraged to express their ideas clearly by utilizing various types of software to save time for time-consuming duties and ensure enough time for analysis and interpretation	<ul style="list-style-type: none"> In Japanese Language at elementary, lower secondary, and upper secondary schools, children are to gather information by group, using digital cameras and videos as necessary, and present what they learnt in such forms as class newspapers, with the help of software. They are instructed to prepare a newspaper efficiently by using information terminals, firstly thinking of what to tell and then arranging amounts and the layout of articles by trial and error and improve wording. Enough time should be ensured for discussing how to design the paper. In that process, presentation software should be used to show devisable points clearly. 	Collaborative
		<ul style="list-style-type: none"> In the unit “Survey of Familiar Local Communities” in Geography at lower secondary schools, students are to make maps and graphs in groups by using map creation software, based on geographical information obtained through the geographical information system. 	Collaborative
		<ul style="list-style-type: none"> In Foreign Languages at lower and upper secondary schools, presentation software is used for class activities for students to effectively transmit information and ideas when making speeches and presentations. 	Collaborative
(iv)	To aim to enhance the ability of children to think, judge, and express themselves by enabling them to easily draw pictures and move figures, through trial and error, or by having them record their own movements with video cameras to make problems clearer.	<ul style="list-style-type: none"> In the unit “How to Determine the Area of Rhombuses and Trapezoids” in 5th-grade Arithmetic, children try equal-area deformation individually by making graphs and drawing functions. 	Individualized
		<ul style="list-style-type: none"> In Physical Education at elementary schools, and Health and Physical Education at lower secondary and upper secondary schools, individuals’ performances of apparatus gymnastics, etc. are visually ascertained by recording their movements, and thereby clarifying problems and encouraging them to make improvements. 	Mass Individualized
		<ul style="list-style-type: none"> In Art and Handicraft at elementary schools and Art at lower schools, and Art and Design at upper secondary schools, three-dimensional works are viewed from various angles with different backgrounds and children discuss their own impressions and opinions. 	Collaborative
		<ul style="list-style-type: none"> In Music at elementary, lower secondary, and upper secondary schools, children discuss their own originality and ingenuity regarding how to express themselves with music, by using recording, playback, and auto-play functions, and music composition learning programs. 	Collaborative
(v)	To aim to enhance class activities, so that children are encouraged to study various matters and compile their own ideas by utilizing the Internet and dictionary functions	<ul style="list-style-type: none"> In classes of all subjects at elementary, lower secondary, and upper secondary schools, children are encouraged to search various data by utilizing the Internet and dictionary functions, interpret such data, and compile their own ideas. 	Individualized
		<ul style="list-style-type: none"> In classes such as the Period for Integrated Studies at elementary, lower secondary, and upper secondary schools, children are encouraged to collect information by utilizing digital cameras and videos, and, based on the collected information, to have contact with their counterparts inside and outside Japan and staff of social education facilities and research institutes, via web camera or social networking services (SNS). 	Collaborative

3. Fostering of an attitude of proactive learning

	Utilization of ICT	Concrete class activities	Major type of learning
(i)	To use diversified contents and functions (for enlargement, reading, video, connection to the Internet, etc.) for the instruction of children at the introductory stage of classes	<ul style="list-style-type: none"> ▪ In each class at elementary, lower secondary, and upper secondary schools, at the introductory stage, children brainstorm, by using SNS, etc., about what they already know and what they are familiar with concerning certain themes. ▪ In national language classes at elementary, lower secondary, and upper secondary schools, main text, pictures, and photos in learning materials are enlarged in displays to arouse interests of children. ▪ In foreign language classes at elementary, lower secondary, and upper secondary schools, videos of the everyday life, habits, practices, traditions, and culture of foreign people, which are referred to in classes, are shown to heighten individuals' interests in the class contents 	Collaborative Mass
(ii)	To raise interests of children through collaborative learning, and thereby encourage them to further study matters they are interested in		

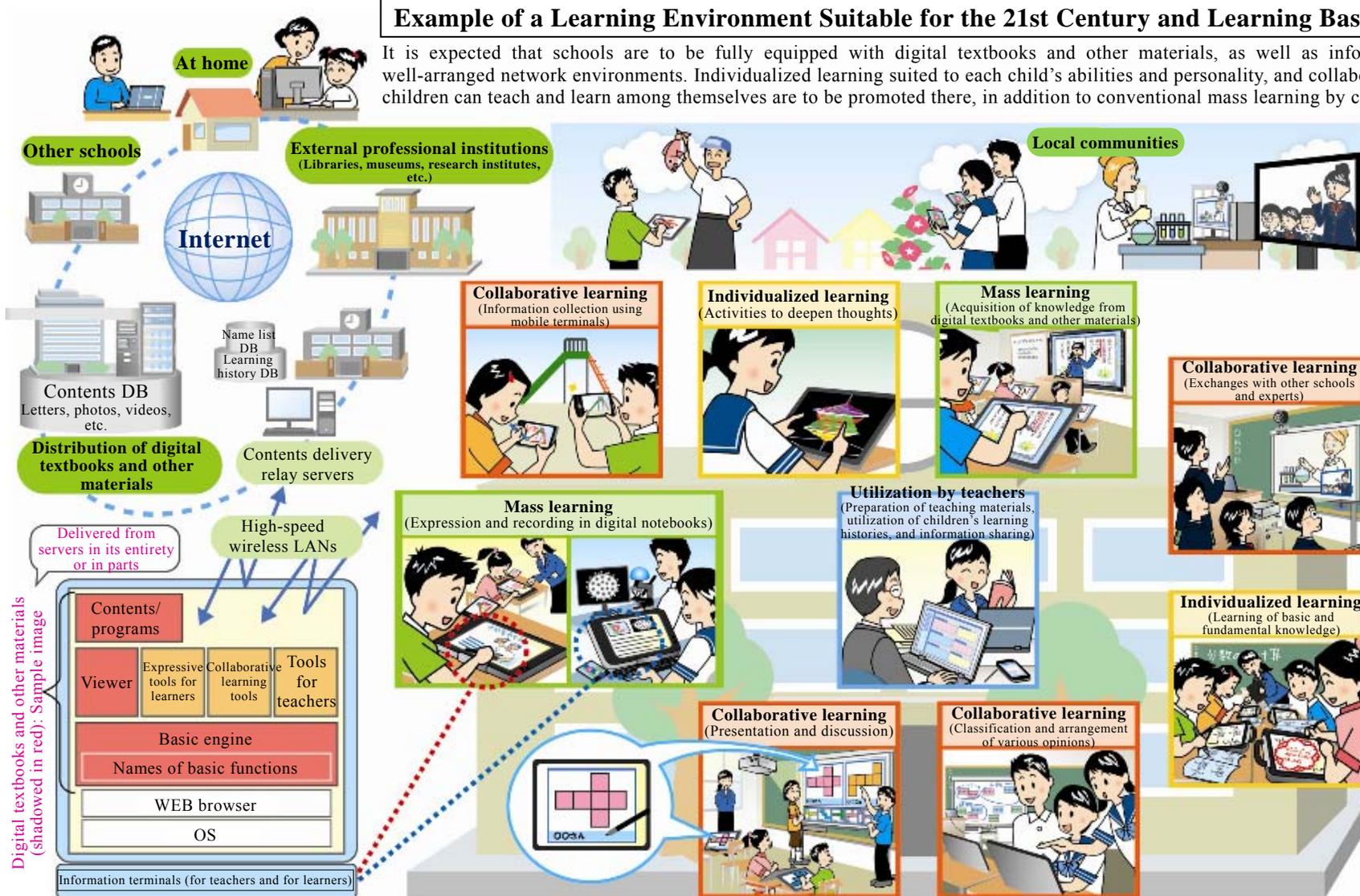
(The following points need to be noted when providing guidance as shown in Table 1)

- Individuals' information literacy differs by school stage, from elementary to lower and upper secondary schools. Therefore, guidance always needs to be based on children's development stages.
- Through the utilization of ICT, children's learning histories can be ascertained and shared, and teachers' guidance may be improved by analyzing such data. Furthermore, it will become possible to have each child review contents or go on to advanced learning, irrespective of his/her grade, depending only on his/her problems and achievement level.
- Children need perform activities to accurately understand events, consider reasons thereof, compile them, and make appropriate explanations through observation and experiments, as well as based on material data. It is not an appropriate use of ICT, if the class guidance is only provided in such manners as showing results of observation and experiments and conceptual diagrams in an easy-to-understand manner and making children learn them by heart.
- When teachers utilize ICT for class guidance, they need to make efforts to maintain links with real experiences (including experiments and observation) so that the use of digital textbooks and other materials, as well as information terminals, does not end up neglecting real experiences and face-to-face communication.
- The utilization of ICT will also enhance children's learning at home and in local communities. Specifically, by connecting school ICT systems to information terminals at home and at social education facilities or by letting children take information terminals home, even outside school, teachers may be able to review teaching contents of other grades, making preparations for classes, and promote the use of digital textbooks, etc., for learners by presenting learning materials responding to each child's situations and achievement levels.

Chart 2

Example of a Learning Environment Suitable for the 21st Century and Learning Based Thereon

It is expected that schools are to be fully equipped with digital textbooks and other materials, as well as information terminals, in well-arranged network environments. Individualized learning suited to each child's abilities and personality, and collaborative learning where children can teach and learn among themselves are to be promoted there, in addition to conventional mass learning by class guidance.



(Note 1) All titles above are provisional. For example, the basic engine may be called the platform.

(Note 2) Basic functions may include editing, transferring, adding, and deleting.

(Note 3) Digital notebooks and e-mails may be included in either the category of “expressive tools for learners and collaborative learning tools” or the category of “digital textbooks and other materials for learners.”

(Note 4) “Tools for teachers” to monitor or control children’s information terminals may be included in the category of “digital textbooks and other materials.”

(Note 5) The above images of class activities are just samples; they are not based on the premise of introducing any specific information terminals, etc.

Table 3: Examples of expected functions of digital textbooks and other materials, as well as information terminals

	Examples of expected functions
Digital textbooks for learners	<ul style="list-style-type: none"> ▪ Function to replay sounds reading various texts (including foreign languages) ▪ Function to display video, animation, and three-dimensional images that will help learners' understanding ▪ Function to enlarge letters and images ▪ Function to display sounds and video for role-playing activities ▪ Function to record remarks and display them in accordance with the loudness ▪ Function to create tables, graphs, charts, and drawings ▪ Function to write down data (including note function), and mark and highlight parts of the documents ▪ Function to ascertain and analyze learning histories ▪ Dictionary function and reference function ▪ Function to view instructional materials in their entirety and other related materials ▪ Function to edit and score ▪ Function to assist children's achievement-based learning and self-learning by presenting learning materials depending on individuals' level of understanding and problems
Digital textbooks for teachers	<ul style="list-style-type: none"> ▪ Same functions as those for digital textbooks for learners mentioned above ▪ Function to allow teachers to customize teaching materials as necessary
Information terminals for learners	<ul style="list-style-type: none"> ▪ Function to allow children to use the Internet, web cameras, e-mails, and SNS, etc., in a safe environment, enabling communication among children inside and outside Japan and between schools and families, as well as exchanges between schools with social education facilities, research institutes, and local communities, in real time ▪ Function to allow children to search websites in a safe environment ▪ Function to help children collect information by using digital cameras and video, etc. <p><Examples of matters to be noted></p> <ul style="list-style-type: none"> ▪ Equipment should be compatible with wireless LANs. ▪ Activation and shutdown should be prompt. ▪ Text direction may be changed to both vertical and horizontal. ▪ Screen size should be moderate and brightness adjustable. ▪ Equipment should be light, portable, and shockproof. ▪ Battery runtime should be long. ▪ Recognition accuracy of written data should be high. ▪ In the case of equipment using a pen tablet, the pen should be easy to grasp, the thickness of the characters adjustable, and the movement of the pen tip should coincide with the traces on the screen. ▪ A charge storage cabinet should be ensured.
Information terminals for teachers	<ul style="list-style-type: none"> ▪ Function to ascertain and analyze children's learning histories ▪ Function to control digital textbooks and information terminals for learners (including function to have children focus on learning) ▪ Function to share data written into learners' information terminals

(Points to be noted)

- Respective functions expected for digital textbooks are basically expected for other digital

materials as well.

- Digital textbooks and other materials, as well as information terminals, should be easy to operate to the extent possible. Consideration should be given to allow users to operate them actively.
- It is important that the interface for basic engines of digital textbooks and other materials (see Chart 2) is open, without depending on information terminals or material suppliers. Private companies are expected to positively develop digital textbooks and other materials, as well as information terminals helpful to children's education, taking into account their functions mentioned above and trends of empirical research results.
- When developing digital textbooks and other materials, as well as information terminals, special consideration should be given to children with color blindness, without depending only on presentation method by color distinction.
- Children with special needs are also enrolled in ordinary classes at elementary and lower secondary schools. For these children, the consideration explained in Chapter 4 needs to be given, in addition to ensuring the above-mentioned functions.
- As there is a possibility that some children may not be able to understand and utilize new contents sufficiently, teachers need to observe each child even more carefully.
- In general, digital textbooks and other materials consist of (i) functions common to contents of all subjects and (ii) functions to be added by each content item of each subject. In the process of carrying out studies on digital textbooks and other materials based on empirical research, the division of these two types of functions should be clarified.
- When using copyrighted works in classes at schools, appropriate use pursuant to the Copyright Act should be ensured and institutional problems concerning said use should be reviewed.

Chapter 4 Utilization of ICT in Special Needs Education

(Points to be noted in accordance with conditions and characteristics of disabilities)

- Children with special needs require different kinds of support depending on the condition and level of their respective disabilities. Children's disabilities include visual impairments, hearing impairments, intellectual disabilities, physical disabilities, health impairment (including constitutional weakness), speech impairment, emotional disturbance, and developmental disabilities (learning disabilities, attention-deficit hyperactivity disorders, and autism, etc.).
- As explained in Chapter 1, ICT works especially effectively, when used in accordance with each child's disabilities and characteristics, enhancing their achievements in each subject and in activities to promote independence. It is significant to note the following points, for example, depending on conditions and characteristics of the disabilities, when utilizing ICT in special needs education.
- Some children with developmental disabilities show strong interest in information equipment. ICT can be utilized for such children so as to arouse their motivation and intensify their concentration. Some of these children have difficulties in reading letters due to impairments in cognitive processing. ICT can compensate for their impairments and weaknesses and help develop what they are good at.
- For children with visual impairments, functions to enlarge letters, change layouts, or arrange color tones can be utilized to help them read information on screens. Alternative means using the auditory sense or tactile sense can also be employed to provide them information that they cannot obtain visually. Enlarged textbooks are being developed and published so as to support the learning of children with visual impairments.⁵¹ Such efforts should be enhanced by using digital textbooks and other materials, which allow flexible adjustments of the letter size, etc., depending on each child's disability level. For children with hearing impairments, information should be provided visually or through senses other than the auditory sense, while training children's hearing abilities appropriately. For children with intellectual disabilities, it is important to select user-friendly support equipment and appropriate contents in accordance with each child's understanding level. Regarding children with physical disabilities, appropriate support equipment needs to be applied and arranged carefully to make it fit for each child.⁵²
- Children with health impairment are apt to lack everyday-life experience, are often unable

⁵¹ Thanks to the efforts by textbook publishers, there are 280 types of enlarged textbooks for elementary schools, 99 types for lower secondary schools, and 38 types for upper secondary schools as of March 2011. Enlarged versions are published for most of the approved textbooks for upper secondary department of special needs schools (for students with visual impairments). However, approved textbooks for ordinary upper secondary schools are diversified and large in number, and only a few enlarged versions are published due to limited demand for each type of textbooks.

⁵² Some of the children with multiple disabilities or those with serious disabilities have particular difficulties in expressing their will or collecting information from the surroundings. Therefore, special consideration is required to combine or arrange support technologies in response to each child's disabilities, and thereby help them have enhanced communication with others.

to attend classes, or are restricted in their activities at school. Therefore, for supplementing the lack of actual observation and experimentation activities, teachers can arrange simulated experiences using computers, or enable the children to maintain or expand communications via the Internet or e-mails, or by using the TV conference system or Web conference system, etc.⁵³

- Based on past performances and results of efforts taken so far in schools for special needs education, the utilization of ICT should be further enhanced and promoted through empirical research utilizing digital textbooks and other materials. Such efforts are expected to create effective and important tools that can assist in the learning of children with disabilities at elementary and lower secondary schools, etc. in the future. The empirical research results should also be fully utilized to provide guidance models to related parties and expand the improvements of conditions.
- Based on the Act on Promotion of Distribution of Specified Books, etc. Used as Textbooks for Disabled Children and Students, MEXT has been offering support through means such as providing digital data of textbooks to volunteer groups that create specified books, etc. to be used as textbooks for children with disabilities, including developmental disabilities. MEXT has also carried out empirical research on ideal learning materials responding to the characteristics of children's developmental disabilities, and on effective teaching methods using such materials and the educational effects thereof.⁵⁴ Through these efforts, children with disabilities should be provided with further support for their learning. In the future, the provision of digital data of paper textbooks also needs to be discussed.
- Applications of various functions must be developed for digital textbooks and other materials, in accordance with the conditions and characteristics of each child's disabilities. It is necessary to ensure them with basic accessibility⁵⁵ to information terminals. When developing a favorable environment for the use of digital textbooks and other materials, as well as information terminals, through empirical research utilizing them, considerations as shown in Table 4 are to be given in accordance with disabled children's conditions and characteristics.

(Collaboration with related organizations)

- Special needs education requires teachers' sharing of learning goals and information on the situation of each child, and closer collaboration among schools, families and local communities, as well as with related medical care organizations, welfare organizations, healthcare organizations, and labor organizations. ICT will be very helpful in these

⁵³ The utilization of ICT will be also effective for the guidance for truants.

⁵⁴ MEXT has conducted empirical research on children's developmental impairments as follows: (i) Research on functions indispensable for digital textbooks, formats of electronic files, and means of production, delivery, and preservation, etc. through the use of the Digital Accessible Information System (DAISY), which is the international standard for talking books; (ii) Research on concrete measures to enable children having difficulties reading at school to utilize Assistive Technology (AT), such as personal computers; and (iii) Research on development and utilization of speech-synthesis software with which children having difficulties reading and writing can learn by using auditory sense.

⁵⁵ Basic accessibility means that everyone, including those with disabilities, can have access to and utilize information equipment and software without any difficulty.

processes, and enhanced efforts will contribute to more effective and efficient preparation and utilization of individualized teaching plans and individualized education support plans that enable careful teaching and support meeting individuals' educational needs. Furthermore, when the government considers the utilization of ICT in special needs education, it should work in close collaboration with the National Institute of Special Needs Education so as to fully utilize the Institute's research results.⁵⁶

⁵⁶ The National Institute of Special Needs Education carries out practical studies comprehensively as a national center for special needs education, while providing professional and technical training for staff in charge of special needs education. For example, regarding the informatization of education, the institute has promoted research on the informatization and education support equipment from a mid-to long-term perspective, and at the same time, it provides training on the utilization of information sources for teachers in charge of education for children with disabilities.

Table 4: Examples of expected functions to be added to digital textbooks and other materials for children with special needs

<ul style="list-style-type: none">▪ In addition to a function to read aloud the content with a speed adjusting device, a function to highlight the relevant part on screen and indicate only the limited information necessary (The read-out function should be made usable for anybody by developing high-quality and high-precision software.)▪ Function to adjust background colors and letter colors▪ Function to enlarge letters, change fonts, and space out accordingly▪ Function to add kana readings▪ Function to separate text by paragraph or word, etc.▪ Function to link text with video, still images, and sounds
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(Points to be noted)

- Preferably, functions of digital textbooks and other materials should be used together.
- Digital textbooks and other materials should allow teachers to flexibly arrange the layout, etc. in accordance with disabled children's characteristic manners in reading, and their content should be developed with due consideration toward readability for such children. Adding illustrations, pictures, and characters to material content may help to arouse the motivation of children with certain types of disabilities.
- For children who have difficulties in ordinary keyboarding, alternative support equipment, such as a special keyboard, joystick, switch using various sensors, or handwriting input device should be developed (such functions need to be made working also by software).
- It would be effective if teachers, who have accurately ascertained children's disabilities, can customize functions relating to text display, such as those to enlarge the letters, change fonts, or adjust letter colors, for each of them, and the display of all pages can be modified as necessary, based on such customization information.
- Function to link text with video, still images, and sounds is expected to deepen the understanding of children who lack everyday-life experience, due to disabilities, by letting them refer to related video, etc. as needed.

Chapter 5 Ideal Introduction of ICT for School Administrative Works

(Significance of introduction of ICT for school administrative works)

- Introduction of ICT for school administrative works will realize the sharing of necessary information among teachers and other related parties,⁵⁷ which will enable teachers to give more finely-textured lessons, as well as reduce teachers' burdens concerning school administrative works, which will increase time for them to face children and review their own classes and other teachers' classes. This will lead to the enhancement of the quality of education and the improvement of school management.

Specifically, introduction of ICT for school administrative works will contribute to the management of the school register, attendance, grades, health records, and books; the sharing of various information, such as guidance and teaching plans, digital teaching materials, and children' learning histories, among teachers; and the sharing of information between schools and families and local communities via school websites and e-mails.⁵⁸

- When the introduction of ICT for school administrative works progresses, it is expected that (i) information shared among teachers and between teachers and guardians will be enhanced; (ii) increased information sharing will raise awareness of related parties; (iii) reduction of time required for school administrative works will change people's way of spending time; (iv) the accuracy of works will improve; and (v) increased information transmission from schools will deepen the understanding of guardians and local residents concerning schools (see Table 5). It is important to promote the introduction of ICT for school administrative works by fully examining how school administrative works should be dealt with in the future in line with the advancement of ICT, instead of only trying to informatize present school administrative works as they are.
- As of the end of March 2010, public schools had been equipped with computers for school administrative works mostly at the rate of one computer per teacher. A school administrative support system needs to be further expanded to all schools including private ones. Managerial level teachers must position the introduction of ICT for school administrative works at the core of school management and try to have other staff members share the significance of it.

(Problems concerning the introduction of ICT for school administrative works)

- The necessity of the introduction of ICT for school administrative works is widely acknowledged by most of the boards of education and schools,⁵⁹ and some local governments and schools have already introduced a school administrative support system.⁶⁰

⁵⁷ In addition to teachers, children, their guardians, local residents, and boards of education, etc.

⁵⁸ For example, through handy portable information terminals, children's attendance records can be automatically integrated and processed into significant information, which teachers can utilize. Another example is that guardians can access necessary information on schools and children, or schools can receive responses from guardians via information terminals at home.

⁵⁹ According to the "Report of Studies on the Current Situations and the Future of the Introduction of ICT for School Administrative Works" (FY 2006 project commissioned by MEXT), over 80% of schools and over 90% of boards of education responded that the introduction of ICT for school administrative works is "definitely necessary" or "necessary."

⁶⁰ There are a school administrative support system developed by the Kumamoto Prefectural Board of Education

It is expected that schools and school establishers prioritize the introduction of ICT for school administrative works as the core of school management; not only teachers but also related municipal bureaus, guardians, and local residents share the significance thereof; and based on such awareness, a school administrative support system is disseminated to all schools nationwide. It is also effective that boards of education and schools digitalize necessary educational information and put it into a database to be shared, while paying attention to original efforts at each school.⁶¹ Furthermore, the standardization of items of educational information to be shared and data formats needs to be promoted.

- For example, the government stipulates the items to be entered into the Cumulative Records of Education as a reference for school establishers to decide upon formats and for schools to prepare records (hereinafter referred to as the “reference format”). When promoting the computerization of the Cumulative Records of Education (the original text and copies or extract copies), each school should devise means in setting items to reflect originalities in its entry, with the reference format as the basis. Schools that jointly use the same system should basically use the same items,⁶² and the process of affixing seals can be skipped by guaranteeing other corresponding functions to ensure the authenticity of documents and proper procedures.
- Boards of education, etc., are also required to establish a school information security policy so as to ensure organizational information security.⁶³ Administrative examinations on schools can be carried out more efficiently by making them online.
- Utilizing cloud computing technology for the introduction of ICT for school administrative works will have merits, such as that time and costs can be reduced, schools and school establishers’ burdens of school management will be alleviated, massive data can be utilized and shared, data can be preserved safely, and necessary information can be transmitted upon emergencies.⁶⁴ However, problems of ensuring network security and business

as a part of the MEXT’s Program for Promoting Leading Informatization of Education; a next-generation information-sharing infrastructure system (Net Commons) developed by the National Institute of Informatics; and other types of commercial software. The school administrative support system here includes the network that teachers and school staff use for school administrative works.

⁶¹ According to the FY2008 “Study on the Current Situations of School Libraries,” only 44.5% of books in libraries at elementary schools have been managed in a database as of May 2008. The percentage was 44.7% for lower secondary schools and 77.9% for upper secondary schools. The informatization of school libraries is also required. Furthermore, the possibility of linking digital textbooks and other materials with such a database can be considered.

⁶² At present, the Association for Promotion of Public Local Information and Communication (APPLIC) has been discussing standardization of the computerization of the Cumulative Records of Education and is expected to obtain results that can be applied broadly nationwide.

⁶³ From the viewpoint of ensuring security in transferring the processes of school administrative works to a network, one possibility is the utilization of such services as the existing Local Government Wide Area Network (LGWAN) and the Local Government Public Key Infrastructure (LGPKI) provided on said network. Furthermore, appropriate measures should be taken for ensuring the authenticity and confidentiality in general administrative works based on the “Guideline on Information Security Policy in Local Governments” by the Ministry of Internal Affairs and Communications. At the same time, matters necessary for a school information security policy should be specified and shared among teachers and other school staff.

⁶⁴ Upon the occurrence of the Great East Japan Earthquake, lots of school documents were scattered and lost. Some say that if such documents had been preserved in the cloud, this could have been avoided. It was also

sustainability of service providers need to be solved. Therefore, experimental studies⁶⁵ must be carried out concerning the feasibility of utilizing cloud computing technology for the introduction of ICT for school administrative works.

- In South Korea, the National Educational Information System (NEIS) is installed in all schools nationwide, and the Ministry of Education, Science and Technology (MEST),⁶⁶ which is the Korean counterpart of MEXT, manages information on school administrative works collectively via the Korea Education and Research Information Service (KERIS).⁶⁷ In the medium- and long-term, overall optimization of cost-effectiveness and security risks should be considered, while ascertaining and analyzing requests from local communities, and the possibility of building a general school administrative work management system applicable nationwide may also be discussed.⁶⁸

Table 5: Examples of functions of school administrative support system

	Examples
School documents	When preparing report cards or Cumulative Records of Education, information of other school documents can be used repetitively (ex. children’s names, addresses, attendance records, etc. can be transcribed automatically), which saves lots of trouble.
	Teachers can process children’s registers, attendance, and grades, as well as information on health records and school books, by utilizing common application software, and personnel other than homeroom teachers can input information upon receiving an absence call from a guardian, which reduces errors.
	When children go on to upper schools or change schools, their related school documents can be transferred as digital data. Boards of education and schools that receive such digital data do not have to transcribe them any longer.
Information sharing among teachers	Groupware can be used not only within a school, but also between boards of education and schools, or among schools. Guidance and teaching plans, for example, can be shared among schools in the same area and information concerning a meeting or training session can be shared among related parties. Information transmission and communication among teachers may be thus promoted.
Information transmission to families and local communities	Information can be transmitted to guardians and local residents via school websites, thereby deepening their understanding of schools.
Service management	Teachers’ holidays and business trips can be applied for and settled online.
Management of facilities, etc.	Reservation of facilities and equipment can be made on the system.

pointed out that groupware and school websites on the cloud helped a lot in transmitting information on people’s safety, etc.

⁶⁵ The government may be able to grant incentives to local governments that make experimental efforts actively.

⁶⁶ Ministry of Education, Science and Technology

⁶⁷ Korea Education and Research Information Service

⁶⁸ In that process, discussions may be held not only on the utilization of cloud computing technology but also on the appropriate management of children’s learning histories by utilizing computer resources with advanced computing power.

Chapter 6 Ideal Support for Teachers

1. Roles of teachers and fostering of their ability to utilize ICT in teaching

- In order to create a learning system and schools suitable for the 21st century, as explained in Chapter 1, teachers are expected to play further significant roles in ascertaining respective children's abilities and characteristics, in order to prepare learning opportunities for them accordingly.

At the same time, there remain scenes where conventional teaching methods work better, where instead of using ICT teachers encourage children to have real experiences and face-to-face communication. Teachers need to adopt appropriate teaching methods flexibly, while paying attention to both the potential and limits of ICT.

- When training and fostering teachers, lectures on how to operate information equipment alone are not sufficient. Teachers should be trained to have an attitude not only to foster children's appropriate information literacy through the utilization of ICT but also to improve their own teaching methods as a whole to ensure high-quality education.

(Teacher training)

- According to the survey based on checklists prepared by MEXT, the percentages of teachers who had the ability to utilize ICT in teaching was around 60 to 70 % on average for each survey item (March 2010), and regional disparities were rather significant.⁶⁹ In FY 2009, only 19.2% of teachers received training on the ICT utilization in teaching.⁷⁰ It is urgently necessary to enhance teachers' ability to utilize ICT in teaching and to redress regional disparities. The government must make efforts to provide training to in-service teachers, in collaboration with universities as necessary, while paying attention to the division of roles with local governments.
- The government may be able to take such measures as providing e-learning training via the Internet,⁷¹ fostering training leaders of local governments mainly by face-to-face exercises,⁷² preparing and providing textbooks, and providing opportunities to exchange information on teaching methods via social networking services (SNS), etc.

⁶⁹ According to the 2009 "Survey Results Regarding the Informatization of Education," as of March 2010,
(i) The ability to utilize ICT in studying teaching materials, preparing classes, and evaluating students: 73.9% (by prefecture: max. 86.8% and min. 67.9%)
(ii) The ability to utilize ICT in class guidance: 58.5% (by prefecture: max. 78.2% and min. 50.5%)
(iii) The ability to teach children how to utilize ICT: 60.3% (by prefecture: max. 78.0% and min. 53.2%)
(iv) The ability to teach information morals: 68.6% (by prefecture: max. 84.0% and min. 60.1%)
(v) The ability to utilize ICT in school administrative works: 69.4% (by prefecture: max. 83.1% and min. 60.5%)

⁷⁰ Based on the 2009 "Survey Results Regarding the Informatization of Education"

⁷¹ For e-learning training, the method of instructional design (a systematic methodology to enhance effects, efficiency, and attractiveness of training, where the most effective and attractive training methods are selected, designed, implemented, and assessed in accordance with trainees' characteristics and given environments and resources) can be adopted, along with face-to-face training, while giving due consideration to the provision of opportunities for exchanges among trainees and the improvement of training contents based on the analysis of training results.

⁷² For example, training sessions targeting supervisors which are conducted at the National Center for Teachers' Development

- In the meantime, local governments can provide mainly exercises helpful for concrete class activities, through such means as holding training at boards of education or education centers by utilizing leaders trained by the government, fostering leaders for in-school training, offering lectures and classwork studies for enhancing the ability to utilize ICT in teaching in collaboration with universities. The results of these training sessions should be disseminated widely to the overall schools through in-school training.⁷³ Furthermore, “training for teachers with 10-year experience” and “lectures upon renewal of education personnel certification” should also contain enhanced lectures on the utilization of ICT. As ICT advances constantly and is supposed to be utilized in various scenes at schools, temporary teachers and clerical staff should also be provided with appropriate training opportunities.

(Training and recruitment of teachers)

- At universities that have accredited teacher-training courses and train teachers, as a unit of “Operation of Information Equipment (2 credits)” or “Subject concerning Curricula and Teaching Methods,” the subject of “Educational Methods and Techniques (including the utilization of information equipment and materials)” is compulsory, pursuant to the Act for Enforcement of the Education Personnel Certification Act. However, concrete class content is up to each university and what is actually taught in these subjects seems to be limited only to how to utilize information equipment and software.
- At present, the Central Council for Education is discussing how to improve the general quality of teachers,⁷⁴ and the ideal education personnel certification system should be well discussed from the viewpoint of fully utilizing ICT in information education and course instruction and promoting the introduction of ICT for school administrative works. Based on discussions at the Central Council for Education, universities that train teachers and graduate schools for teacher training are expected to develop new teacher training curricula and establish effective course systems based thereon, in collaboration with boards of education and education centers.
- Various types of university teaching staff are in charge of teacher training courses nationwide, but their ability to teach how to utilize ICT depends on the individual. Students will learn how to utilize ICT in teaching more effectively, if being taught not only in information-related classes but also in other classes in teacher training courses, where university teaching staff members actually utilize ICT. They will thus be trained to be able to utilize ICT sufficiently in teaching in the future.

⁷³ In particular, with regard to the subject “Information” for ordinary courses in upper secondary schools, how to train and secure enough teachers needs to be discussed from the viewpoint of securing sufficient teachers qualitatively and quantitatively.

⁷⁴ According to the interim report of discussions at the “Special Committee on the Enhancement of the Quality of Teachers” of the Central Council for Education, which was publicized on January 31, 2011, the following were cited as the qualities required for teachers in the future, considering increasing diversification of problems, including the utilization of ICT, that teachers are to cope with: (i) advanced expertise and sociality; (ii) practical ability to teach; (iii) communication skills; (iv) the ability to work on a team; and (v) the ability to flexibly respond to the demand for creative and collaborative learning and communicative learning, as well as for conventional mass learning.

- In order to assist students who intend to become teachers in acquiring an enhanced ability to utilize ICT in teaching, best practices for training should be shared among universities. At the same time, it is also important to promote the recruitment of university staff members who can provide proper training on the ICT utilization in education, and to facilitate collaboration with education centers where high-quality training on information education has been provided.
- In teacher training courses and faculties (including affiliated schools), students need to have enough opportunities through classes and exercises in which they can touch information terminals, digital equipment, and software. Affiliated schools that have long conducted practice teaching and educational research, in close collaboration with teacher training faculties, in particular those that have made advanced efforts are expected to play a leading role in the future course of the ICT utilization in education and the creation of a learning system and schools suitable for the 21st century.
- Local governments are also expected to take into consideration the ability to utilize ICT in teaching when recruiting new teachers. For example, recruitment examinations may include the evaluation of examinees' ability to prepare a teaching plan that utilizes ICT in course instruction, or trial lessons where examinees can utilize ICT. Their records of teacher training courses at university may also be used as a reference for selection. Teachers in charge of "Technology of information processing" in technology and home economics (technology) in lower secondary schools and "Information" for general education courses in upper secondary schools are to have advanced expertise and such teachers need to be secured. The government should collect best practices concerning means to recruit new teachers and disseminate them nationwide.

2. Ideal support system for teachers

(System development by boards of education and schools)

- In order to integrally promote the ICT utilization in education, while building necessary systems for management and evaluation, education Chief Information Officers (CIO) need to be appointed in boards of education, etc., as responsible directors. Education CIOs are expected to supervise the ICT in education at the local level, and optimize it throughout the overall local organization, including boards of education and schools, through building visions and implementing measures based thereon.

For ensuring that the education CIO system fully functions in all fields of education, technology, and administration, school teachers, clerical staff, and technical staff familiar with ICT are expected to employ their respective specializations, and other staff who support education CIOs together with them also play a significant role.

Local governments may establish an organization, such as the Headquarters for the Promotion of the utilization of ICT in Education, and develop a cross-sectoral framework covering government agencies and boards of education, aiming to make the education CIO system function as a whole.

- It is important for managerial level teachers to work as school CIOs, arranging communication inside and outside schools, fully understanding the significance of the utilization of ICT, prioritizing the ICT in education in school management plans and school evaluations, and thereby building a system to promote the utilization of ICT in the school. In that process, librarian-teachers are expected to take the initiative in further strengthening the functions of school libraries as learning and information centers, where children can collect and select information by utilizing various types of media.

Education CIOs and school CIOs must exercise strong leadership in promoting the utilization of ICT in education. The government needs to offer support so that they can play their respective roles properly, by such means as collecting and providing best practices at boards of education or schools, and providing training for managerial level teachers.⁷⁵

(Utilization of external specialized staff)

- For stably disseminating the utilization of ICT, external ICT advisors should be deployed and wide-area help desks need to be established in accordance with the circumstances of each region. Through technical support for dealing with the troubles of information terminals and digital equipment, and disorders of communication networks, as well as consultations and support concerning classes utilizing ICT, all teachers need to master how to provide course instruction independently by utilizing ICT. External ICT advisors may include adequate retired teachers who have educational know-how, persons with education personnel certification, and retired private company workers who have technical know-how.
- In recent years, some universities have started to train ICT advisors to prove their

⁷⁵ MEXT may hold CIO functions concerning the informatization of education in itself. This will help to ensure that the infrastructure to research and promote the informatization of education comprehensively and continuously (see Chapter 7) may be realized.

capabilities.⁷⁶ ICT advisors are also required to have educational and technical know-how, communication skills, and problem-solving abilities. Universities' efforts in this field need to be promoted for the purpose of ensuring their quality.

- Prefectures and municipalities that deploy ICT advisors account for only 55% and 16%, respectively (FY2009). This may suggest that local governments do not fully understand the significance thereof. Therefore, it is important for the government to positively publicize the significance and best practices concerning the deployment of ICT advisors. In particular, sustainability is important in deploying ICT advisors, and the government should offer support to boards of education, etc., so that they can guarantee stable employment of such staff. Furthermore, the government can help facilitate smooth matching between schools and ICT advisors, and give support for their training and information sharing.
- Some small boards of education have difficulties in developing an appropriate system for the ICT in education. It is expected that a prefectural board of education, multiple small boards of education, and universities gather and form a consortium to share know-how among them.

⁷⁶ One example is the Kyushu Institute of Technology, which grants the title of “information educational support personnel” to adult students who have taken a total of 200 hours of classes on computer literacy, information networks, information ethics, theory on teachers, practical training for assisting information education, programming, multimedia technology, and course instruction methods (information). The university thus contributes to the fostering of ICT advisors and the promotion of information education in life-long learning.

Chapter 7 Toward Steady Promotion of the ICT Utilization in Education⁷⁷

(Promotion of the ICT utilization in education from the aspects of software, hardware, and personnel, comprehensively in a planned manner)

- It is important to promote the utilization of ICT in education comprehensively in a planned manner, from the aspects of software, hardware, and personnel. Providing local tax grants alone is not enough for effectively promoting informatization and redressing regional disparities.⁷⁸ In the UK, grants to be used only for digital content were established.⁷⁹ Such an example can be utilized as a reference in intensively promoting the ICT in education. One option might be to make arrangements through measures to provide subsidies with certain limitations on usage, along with ordinary local tax grants.

(Implementation of comprehensive empirical research)

- Based on the “New Growth Strategy” and the “New Strategy in Information and Communications Technology,” the ICT utilization in education should be promoted effectively, in line with the policy aiming to create a learning system and schools suitable for the 21st century by ensuring one information terminal per child. For this purpose, considering school types, children’s growth stages, and subjects, and in collaboration with MEXT’s “Learning Innovation Project” and MIC’s “Future School Promotion Project,” comprehensive empirical research needs to be conducted in model regions and model schools, from multifaceted viewpoints, while noting the points shown in Table 6.⁸⁰
- Not only experts in the fields of education and ICT, but also other related parties in wide-ranging fields should be involved in this process. Specifically, the “Council to Promote Learning Innovation (provisional title)” needs to be established in FY2011 to reflect opinions widely from academic experts, staff of local educational administration agencies, teachers, private companies, and related parties of local communities and families, as well as from members of the younger generation who are familiar with recent advancements in ICT. The results of the empirical research should be publicized and shared broadly among people. Some private companies recently started to provide information terminals at schools so that each child can use one information terminal. It would also be effective to collect and review the results of such experimental initiatives.

⁷⁷ In this Chapter, matters that are necessary for the informatization of education, in addition to those covered in Chapter 1 to Chapter 6, are explained from a cross-cutting standpoint.

⁷⁸ Computers for school administrative works newly equipped with local tax grants increased only by a little less than 4% in FY2008 from the previous fiscal year, while the increase was around 35% under the FY2009 first supplementary budget.

⁷⁹ In the UK, a total of over 500 million pounds of special purpose grants called eLearning Credits (eLCs: for the sole purpose of purchasing digital content) was provided in three years from 2005.

⁸⁰ The empirical research is to be conducted comprehensively by providing digital textbooks and other materials, ensuring one information terminal per child (see Chapter 3 for details), equipping a school with digital equipment, constructing wireless LANs, introducing ICT for school administrative works, providing teacher training, and building a teacher support system. MEXT has decided to conduct research, in close collaboration with MIC, at the same school, responding to the environment where one child is provided with one information terminal. In FY2010, MIC started empirical research mainly in the aspects of software, personnel, and ICT under its “Future School Promotion Project.” In FY2011, MEXT is to conduct empirical research mainly in the aspects of software, personnel, and education under its “Learning Innovation Project.”

- Schools that will be newly constructed in areas devastated by the Great East Japan Earthquake are expected to be new models that promote a shift toward the creation of a learning system and schools suitable for the 21st century, in accordance with needs of respective local communities and schools, as well as the details explained in the “Vision for ICT in Education.”

(Building of a comprehensive promotion system)

- As in the cases of the Korea Education and Research Information Service (KERIS) in South Korea and the British Educational Communications and Technology Agency (BECTA⁸¹) in the UK, some foreign governments take the initiative in comprehensively promoting projects for the information provision, research and studies, training, and introduction of ICT for school administrative works. We should learn from these examples to seek measures to ensure an infrastructure that enables us to comprehensively and continuously research and promote the ICT utilization in education.
- The ICT utilization in education must be promoted in a concerted manner by academic experts, the staff of local educational administration agencies, teachers, private companies, and related parties of local communities and families. Therefore, social momentum for the ICT in education must be created through the formulation of a wide-ranging network built upon government-industry-academia collaboration, and the dissemination of this Vision in an easy-to-understand manner.⁸²
- Table 7 shows major measures to be taken toward FY2020. Based on the road map⁸³ of the “New Strategy in Information and Communications Technology,” we will take necessary measures accordingly and will take prompt actions for matters that are explained in this Vision and can be dealt with immediately.

⁸¹ The British Educational Communications and Technology Agency (BECTA) was closed as of the end of March 2011 as part of the administrative reform, but its major duties were passed on to the Department for Education and the Department for Business, Innovation, and Skills.

(<http://www.education.gov.uk/schools/adminandfinance/procurement/ict/a0073825/becta>)

⁸² At such occasions as symposiums and forums, efforts can be made to widely share information on the roles of ICT in creating a learning system and schools suitable for the 21st century, reasons why the informatization of education has not progressed in local communities, best practices concerning the utilization of digital equipment purchased under the FY2009 first supplementary budget and effects and problems thereof, etc.

⁸³ See attached reference materials.

Table 6: Examples of points to be noted in empirical research

- Detailed analysis should be made in accordance with school types (elementary, lower secondary, and upper secondary schools, as well as schools for special needs education), children's growth stages, and subjects.
- Regarding children with special needs, means to respond to the condition and characteristics of respective children's disabilities should be reviewed.
- Comparisons should be made between the case of using digital textbooks for learners and information terminals and the case of using only paper textbooks.
- By using objective tests and worksheets, differences in children's achievement levels before and after the commencement of the empirical research should be compared. (Not only basic and fundamental knowledge and skills but the ability to think, to make decisions, and to express themselves should be examined.)
- When evaluating children's problems that are hard to ascertain through objective tests, the method of intra-individual evaluation may be employed, with regard to awareness surveys targeting teachers, children, and guardians, and individual children's growth, etc.
- As the technology of information terminals advances constantly, the use of multiple modes of equipment can be tried to review expected functions, depending on the situation of technology development.
- Reference materials for teachers concerning what may be taught most effectively in what manner (manual for teaching methods) should be prepared, and ideal teacher training methods and ICT advisors should be studied.
- Research should be conducted continuously over multiple years.

Table 7: Major measures to be taken toward FY 2020

[Comprehensive empirical research, etc.]

- Empirical research under the “Learning Innovation Project” (in collaboration with the “Future School Promotion Project,” under which MIC conducts empirical research mainly on the aspects of software, personnel, and ICT) (FY2011 to FY2013)
 - Under a safe and secure environment, education utilizing one information terminal per child will be commenced in earnest.

[Promotion of the dissemination of digital textbooks and other materials and development and enhancement of information terminals, digital equipment, and overall network environment]

- Taking into account the educational effects of digital textbooks and other materials, as well as the trends in the computerization of other books in general, computerization and multimedia application of textbooks and other materials shall be discussed, including the modification of the relevant systems.
- Promotion of the construction of intra-school wireless LANs and the environmental development for ultrafast Internet access (utilization of cloud computing technology, etc.)

[Enhancement of support concerning school administrative works]

- Promotion of standardization of items of educational information to be shared and data formats
- Dissemination of school administrative support system to all schools (utilization of cloud computing technology, etc.)

[Enhancement of support for teachers]

- Fostering of the ability to utilize ICT in teaching in teacher training courses and the establishment of a teacher training system
- Improvement in methods to recruit and select teachers
- Promotion of the deployment of ICT advisors

[Enhancement of children’s information literacy (including education on information morals)]

- Smooth and steady implementation of the Courses of Study
- Studies concerning the enhancement of information literacy (FY2011 to FY2012)
- Dissemination and awareness-raising activities concerning information literacy (FY2011 to FY2012), further dissemination and awareness-raising activities based on the study results (FY2013-)
- Commencement of the deliberations on the revision of the Courses of Study in response to the informatization (including the development of a digital “Information Utilization Notebook (provisional title)”)

[Comprehensive promotion system]

- Deliberations on grants with certain limitations on usage
- Ensuring of the infrastructure to comprehensively and continuously study and promote the ICT use in education
- Formulation of a wide-ranging network in government-industry-academia collaboration and creation of social momentum for the ICT in education