

Social and political influences on the integration of informatics into Japanese education

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ABSTRACT

Government and other segments of society have been taking a leadership role in integrating informatics into Japanese education. Reports of educational councils, reports of task forces, consigned research studies, financial support, teacher training, catalogues for educational software, and other support provided by the government have influenced the integration of informatics into Japanese education in a positive manner. This paper address the brief history of Japanese computer education, how computers are integrated into the school curriculum and school subjects, and current governmental initiatives.

Keywords: government, national policies, curriculum development, information society

INTRODUCTION

Information technology has been rapidly developing. Especially noticeable is the fact that computer hardware has been improving every day. It might be said that today's technology is no longer useful for tomorrow. People have to educate themselves using appropriate information technology in order to actively cope with the dramatically changing modern society as well as to participate in changing society itself. In Japan, educators have been trying to foster students' self-teaching abilities and information literacy. These abilities will be needed by the students in the future when they become adult citizens.

HISTORY OF JAPANESE EDUCATIONAL COMPUTING

Philosophical background

The Ministry of Education, Science and Culture of Japan (Monbusho) has taken a leadership role in guiding the use of computers in Japanese schools. Several different divisions of Monbusho are now related to Japanese educational computing. In 1985, the subcommittee on Educational Media of the Social Education Council published "The Report on the Use of Microcomputers in Education," and this report became the general guidelines for the introduction of computers into schools [1].

The National Council on Educational Reform produced four reports (1985, 1986, 1987 and 1987) which laid the foundation for the rapid introduction of information technology into Japanese schools during the 1990s [2]. In the first report, "to cope with informationalization" was identified as one of eight important issues. In the second report, three principles for informationalization and the need for teaching information literacy were mentioned. In the third report, a plan for intelligent schools was discussed, and in the final report, internationalization and informationalization were mentioned as the most important issues of education. The three principles for informationalization noted in the second report [3] were:

- to promote eagerly the cultivation of information literacy;
- to utilize the potential of information technology in all educational institutions; and
- to reduce the negative effects and increase the benefits of information technology.

Corresponding with the work of these councils, the Task Force on Elementary and Secondary Education in the Information Society also played a major role in developing Japanese computer education. In the first report which was published in 1985 [4], the basic philosophy of how computers should be introduced into different levels of the schools was noted:

- *Primary school*: To familiarize pupils with computers thorough their use as teaching tools;
- *Lower secondary school*: To help students acquire computer awareness and literacy by making greater use of computer functions such as simulation and information retrieval.
- *Upper Secondary School*: Special consideration to the progress of the information society and the effects of computers on individuals and society.

These reports have been influencing the development of Japanese educational computing today.

EDUCATIONAL COMPUTING TODAY

Computers in the school curriculum

In 1987, the Curriculum Council published the final report on "The Improvement of Standards for the Curriculum for Kindergarten, Elementary, Lower Secondary and Upper Secondary Schools." [5] Two recommendations in the report were:

- to emphasize the development of self learning motivation and competence in active adaptation to society; and
- to consider the development of fundamental abilities necessary for adapting progress of science and technology to information.

The second recommendation was not included in the interim report which was published in 1986. However, since the importance of active adaptation to informationalization was discussed during 1986, the sentence, "to consider the developmental levels of students and appropriate guidance in dealing with computers" was added and became the foundation of the Standard Course of Study.

In 1989, the Standard Course of Study emphasized incorporating educational information. The Task Force on Elementary and Secondary Education in Information Society influenced the Standard Course of Study [6]. The Curriculum Council mentioned that "information literacy " were

not only the abilities to use computers but also the abilities to judge, to select, and to process information. Moreover, the Council suggested that several important abilities such as creating new information, communicating using information, understanding the importance of information in society, understanding the importance of information property, and obtaining responsibility toward information, should be taught.

In 1993, "Fundamentals of Informatics" was added to the lower secondary school curriculum as an option in Technology and Home Economics, which is one of the compulsory subjects. "Developmental processes of computers" was added as an option area of Science and "Computers and Tiredness" was added to Health Study in the lower secondary school curriculum. At the upper secondary school level, the use of computers was encouraged in the curriculum of Science, Mathematics and Home Economics. Moreover, computers have been integrated into several school subjects, such as Social Studies, Geography, Political Science, Physics, Mathematics, and Music.

Fundamentals of informatics

As previously mentioned, "Fundamentals of Informatics" was added to the lower secondary school curriculum. Students learn computer systems, computer programming, utilization of hardware and software, social influences of computers, and the importance of computers.

First, students learn how computers are related to their daily lives, and are motivated to learn about computers. Regarding understanding computer systems, students learn the basic structure of computer systems and the function of software. In the area of computer programming, first, the students learn basic operations of computers. They learn how they can turn on the switches of each device, start and reset the computers, and use floppy discs. Then they learn the use of a keyboard. Since Japanese use several different alphabets, the students can input words using either the English alphabet or Japanese alphabets. Then students try to use several basic applications such as Japanese word processing software, database software, spreadsheet software, and graphics software. The objective of using these applications is that the students should be able to select information, arrange information, manage information and express their thoughts. The students also learn introductory programming, such as a programming language, BASIC.

Finally, the students learn the role of computers in industry and in their daily lives, and social influences of computers. This part is strongly related to the third principle for informationization, "to reduce negative

effects and increase benefits of information technology," which is in the second report of the National Council on Educational Reform. The students learn a brief history of computer developments. Then they learn several examples of the use of computers in their daily life. For example, the use of computers in banking systems and reservation systems for transportation are discussed. The students learn the importance of computer networks. They also learn that many industrial designs such as automobile parts and bodies are developed with computers, and that the distribution system of our daily goods has been improved with the use of computers. Re-grading negative effects of information technology, the students learn some health problems and some crimes which are related to the use of computers. They learn the value of information and the importance of managing information. The copyright of software, illegal copying of software, and computer viruses are discussed. Students are encouraged to use information appropriately in order to develop a future information society.

A new concept for achievement

According to the new Standard Course of Study," in order to improve educational activities, educators need to help students develop their motivation for self learning and their abilities to actively cope with a changing society, to teach basic fundamental content, and to make an effort to deal with the students' individual characteristics." This sentence is related to objectives in each subject area of the Standard Course of Study. These objectives are to develop interest, motivation, and positive attitudes toward the subject areas, and to foster thinking skills, decision making skills, and skills of expression.

Japanese education has been moving away from behaviourism toward constructivism. Computers in education had also mainly been used with behavioristic theory. Therefore, most research studies were conducted in order to develop drill and practice, and tutorial types of CAI, and they contributed to the learner's acquisition of basic knowledge and skills using computers. The results of these research studies were important and influenced computer education in Japan. However, according to the constructivistic point of view, it is desirable for the learner to think, decide, and express by themselves. Therefore, today computers are being used as tools for student expression, for problem solving, for discovery learning, and for investigating.

Computers as educational tools

Formerly, students developed their knowledge acquisition abilities through computer experiences. In addition, today's students also develop their creative expression abilities through computer experiences. Computers are now being used to help students develop self learning abilities, self expression abilities, and problem solving abilities.

With respect to the Standard Course of Study, computers have been integrated into many school subjects. The Japan Association for Promotion of Education Technology published "Ideas for Using Computers in the Classroom." [7, 8] Several examples from different schools were gathered for these books. Some examples are discussed in the following section.

Science

Computers are widely used for science experiments. Students measure the conditions of nature using sensors, investigate a principle of nature using graphics and charts of these data, investigate rules of nature using simulations, and solve problems collaboratively using information in a data base. For example, in one lower secondary school, the students experimented with the boiling point and the melting point of several materials using a thermal sensor which is connected to a computer. Since the data for the experiments was presented in graphs by the computer, the students could concentrate on the change in the data. Then they could discuss their thoughts about the data. Other experiments, which are conducted for investigating the changes in temperature due to expansion and compression, and for investigating the body temperature of different types of animals, are also carried out with computers and sensors. Data base software is used for studying about plants, animals, rocks and fossils. In one lower secondary school, the students made a field trip to research rocks and fossils. They used a data base in order to classify the kind of rocks and fossils which were found, and made reports using computers. Computer simulations are widely used for the study of planets and stars.

Social studies

Students learn historical issues using a database, social systems using game type software, and discuss some social problems using multimedia. For example, the students in a lower secondary school worked on a group project about the history of the Meiji Era in Japan using a data base. They could search the necessary items and data in a short time. The students in another school used a computer simulation game in order to understand the role of the mayor and members of a city council, the administration of

the city, and elections. The students became a mayor during the simulation game called TOKIO. As a mayor, the students considered many issues and tried to be re-elected at the end of the game. They developed a high level of problem solving skill during the activity. Multimedia was also effectively used in one school. The topic for the activity was Japanese car export problems with the United States. The students developed multimedia using several different types of sources, such as video tapes of TV news, graphics, newspaper articles, and so on. After making the multimedia screens, the students used the material for developing their opinions about the topic, and discussed these in the classroom.

Other subjects

Computers have been integrated into several other subject areas such as Mathematics, Music, Art, English, and Technology and Home Economics. The students in one school studied geometry and functions using simulation and graphics. At one school, the students composed music using computers and played some instruments with computers. At several schools, computers were used as a presentation tool. The students typed using word processing software and made spread sheets and graphics. Some schools encouraged the students to communicate with the students in other countries using computers. Students in these activities were motivated to study English and learned many things from friends in different countries. The students in one upper secondary school made a questionnaire and sent it to schools in foreign countries using the computer. The information from different countries helped them to discuss the similarities and the differences in each culture. For Ecological issues, computers were used in several schools. At one school, the students researched separate topics and input their data into a computer. Then they used other students' data in a data base to understand some other ecological issues. In another school, the computer simulation game BALANCE OF THE PLANET was also used for the study about ecological issues. After playing the game, the students in the class discussed the issues.

Computers became powerful educational tools in many schools. In summary, computers have been used to help students develop self learning abilities, self expression abilities, and problem solving abilities.

TODAY'S ISSUES

Some problems in schools

In the earlier period of introducing computers into schools, some of the experienced teachers were unwilling to use them for class teaching. But now where there are many computers, these teachers now make use of them.

Concerning hardware diffusion, for the last five years, the governmental budget had supported 22 units for all primary schools and 42 units for all secondary schools. One third of the budget for matching funds came from the ministry of education and another two thirds should have been paid by block grants from the ministry of local affairs to local authorities. One of the big problems has been a failure to understand about the availability of this budget from block funds. Many educators in the local districts usually do not know about this system for getting computers. As they do not make demands from this budget, in many districts much of the money for computers has been directed instead to the construction of bridges, roads and buildings. In order to improve this situation JSPET has published and distributed a booklet describing this budget system to local educators, encouraging them to use it. But from this year, all expenses will be provided by block funds for a lease/rental system.

Another problem is the lack of an infrastructure for supporting initiatives in learning. Ordinary schools have only two or three-telephone lines and one computer room. There are few computers in science laboratories, music classrooms, fine art rooms or other special areas. So teachers and students experience difficulties using computers as tools for creative study and communication.

Concerning software, the amount of good commercial software has increased over these ten years. In the earlier stages, many teachers developed and used their own software. The ratio of teacher-made software to commercial software in lower secondary schools was 37% to 23% in 1985, but it became 6% to 86% in 1992. At the moment, the average lower secondary school has 33 kinds of software and 200 pieces of software. This figure shows the number is still small and teachers cannot always use suitable software.

Concerning teachers, one third can use computers, but only 10% can teach students to use computers in their schools. In the pre-service teacher training, there is not yet enough computer education. Many students in the teacher training courses in ordinary universities study only a few hours on educational methodology including computer use, as a compulsory

subject. Some of them just watch video programmes of school children using computers in their classrooms.

Among enthusiastic teachers some only use computers for all kinds of presentation which could be done more efficiently by a different media. Finally, in most schools, teachers usually do not allocate a budget for upgrading software versions, for buying new software or even for maintenance. As a result they often still have the same configuration of hardware and software as they did in the first introductory phase.

CURRENT GOVERNMENT INITIATIVES

The age of "ubiquitous computing " is just beginning. This concept comes from the fact that everybody will be able to use computers everywhere. The technology which leads the age of "ubiquitous computing" is the work station, down-sized personal computers, networking by telecommunication, and multimedia.

Today, computers are being widely used in business fields in Japan; however, the use of the computer for planning, management, and administration is less widespread than in the other countries. In 1993, the Information Industry Committee of the Industrial Structure Council which is in the Ministry of International Trade and Industry, (MITI or Tsusansho) reported on the analysis of the present situation and suggested ways to improve the current situation. At the same time, the sub-committee for Development of Human Resources in an Information-Oriented Society, part of the Information Industry Committee, suggested the necessity of developing several types of information engineers and the curricula to educate them in order to improve the quality of system engineers [9]. According to this report, there should be 13 different curricula for educating information engineers, 2 common curricula, and 2 curricula for the users. These different types of information engineers are:

- system analyst,
- project manager,
- application engineer,
- production engineer,
- technical specialist
- system use and management engineer,
- development engineer,
- system administrator, and
- educational engineer.

Educational engineering was pointed out as a profession, and the curriculum and the qualifying examination are being developed now. The skills which are needed to become an education engineer are:

- skill for making another person's teaching plan,
- skill for educating knowledge and techniques to others,
- skill for making presentations with technical writing,
- skill for developing high quality educational materials such as multi-media materials using information technology.

It is a remarkable development that educational engineers will be included with information engineers in those certificated by the Ministry of International Trade and Industry.

The other major governmental movement today is toward multimedia. Many research studies have been conducted about multimedia. The Japan Audio-Visual Education Association has been developing "Science Hyper Media" as a teaching material. Moreover, the Japanese Educational Materials Research Institute has been exploring appropriate uses for multimedia type data-bases. The Research Institute for Software Engineering also made a report on a new informational education system. The new system is game type English education material. The Center for Educational Computing has been developing several educational software products, such as software which uses multimedia, expert systems, and simulations, intelligent adventure software for the music world, sound adventure software, software which deals with energy and ecology, and many other types of software. As this research which is related to multimedia is becoming further developed, it is necessary to have specialists who produce the multimedia software. The International Multimedia Association conducted research on the usage of hardware, diffusion rates for software, consumption and development of software, and the present status of multimedia development specialists. It suggested the importance of promoting and educating many specialists.

Research studies related to The Ministry of Post and Telecommunication (Yuseisho) have been conducted recently. The Telecommunication Advancement Cooperation published a report [10] suggesting that educators needed to teach information technology, including telecommunication and broadcasting, appropriately. It also mentioned the importance of developing a policy which dealt with networks for telecommunication and broadcasting, since informationalization of education has been moving toward the use of networks. Moreover, the International Communication Fund has been

conducting research on international distance education and conducting pilot research studies.

CONCLUSION

As shown in the Figure below, government and other segments of society have been taking a leadership role in integrating informatics into Japanese education. Reports of educational councils, reports of task forces, consigned research studies, financial support, teacher training, catalogues for educational software, and other support provided by the government have influenced the integration of informatics into Japanese education in a positive manner.

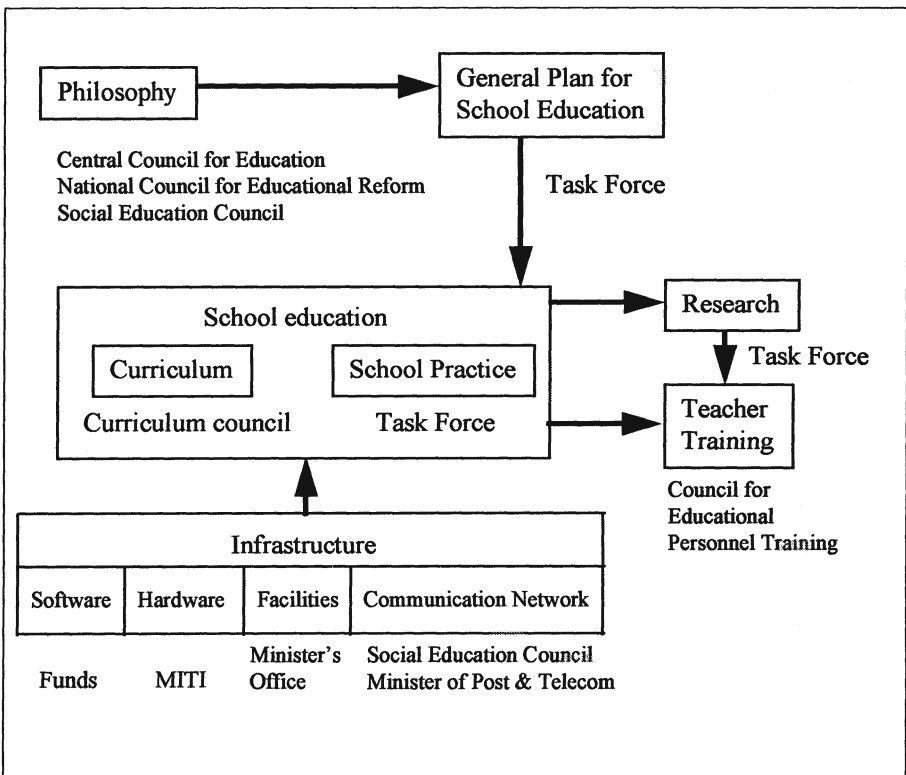
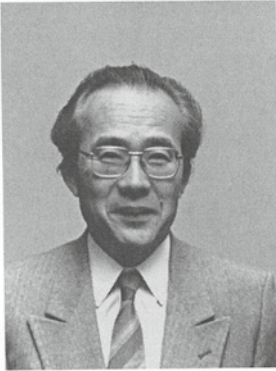


Figure 1: Leadership roles in integrating informatics in Japan

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