

SOME VIEWS ON SCIENCE AND TECHNOLOGY EDUCATION IN JAPAN

—Computer Education from the View Point of Foreign Participant —

Ryoichi SUGIMOTO*

Department of Science Education, Faculty of Education, Tottori University

Thongmuan Nasa-ngium**

Mahasarakam Teachers College, Rajabhat Institute, Thailand

Abstract

Despite there is no comparison of the computer education system between in Japan and in Thailand, because of its difference of economic system and culture. However, some viewpoints could be determined some information to the Japanese education system as follows;

1. Japanese government gives the high priority of educational school levels by established Prefectural Education Center for promotion of science and technology education.
2. Curriculum management in all universities, it is compulsory that all students are required to submit a graduation thesis / project in their final year, in close working association with a faculty advisor or in an experimental combination on a specific theme.
3. There are a lot of educational technology researches concerned with computer education.
4. 'Keep Time' is the first priority of systematic work in Japanese educational system and not change the time-tables as possible.
5. The students come from some 90% of families of middle class, and never seen their eyes performing worried about hungriness or tutorial fee.

INTRODUCTION

Thailand is changing from agricultural country to industrial country. There is a great need to develop the country through Science and Technology. The government gives this field a high priority, as well as, in education, are carried out in primary up to higher education level. COMPUTER is one of new field of Science and Technology, it now penetrates into every field of society. We have urgent need to provide knowledge of computer / computer education to people as other countries in the world. Japan is a leading country in Computer Technology and Computer Use, and contributing to the international community such as cooperating for peace,

* 杉本良一：鳥取大学教育学部理科教研究室，〒680 鳥取市湖山町南4-101

** トンムアン・ナサンギウム：タイ国ラジャバートインスティテュート，マハサラカム教育大学コンピュータ学科

expanding official assistance, and promoting international cultural exchange.

Teachers Colleges, the Ministry of Education of Thailand, have long history as institutions of education and research with the purpose of providing academic knowledge and training qualified teachers to the bachelor's degree level, to conduct research, to promote the quality and status of the teaching and administrative personnel, to maintain and conserve culture as well as national identity, and to provide academic services to the community[1]. Since in 1984, the Teachers Colleges have diversified its curricula to train personnel in fields other than education [2].

In 1992, the Teachers Colleges and the Department of Teacher Education in Thailand have transformed themselves into higher education institutions as national university, for the sake of community development. Also emphasized is the distribution of more educational opportunity in various levels of society, the production of more graduate research, provision of academic services to the community and promotion of arts and culture according to development projects. On February 14, 1992, His Majesty King Bhumipol Adulayadej graciously conferred the name "Rajabhat Institute" to the Teachers Colleges[1].

The various subject areas now offered in Teachers Colleges are in accordance with the needs of the locality, base on research conducted prior to curricula design. The curricula aim to equip the learners with competence, knowledge and skills and good attitudes towards their future profession, as well as management skills and creativity. They also provide learners with continuous practice and on the job training opportunities. Graduates from Teachers Colleges are well prepared to work in these new, non-teaching areas.

COMPUTER is in a non-teaching area in Teachers Colleges, and very fast growing field. The demand of community for computer training by every type of organizations is very high. Our institution serves their needs but do not enough personal. COMPUTER SCIENCE is very popular field among students today. We cannot fulfill the need of computer training in our community. For instance, in the academic year 1993, Mahasarakam Teachers College enlisted 25 students. There are more than 1,000 applicants. We plan to expand our services if we have enough personnel and equipment to do so. Up to date, 6 years long, Mahasarakam Teachers College / Rajabhat Institute has been promoted cooperation by Japan Government through the JICA (the Japan International Cooperation Agency) providing equipments, dispatching 4 experts (including 2 JOCVs / Japanese Overseas Cooperation Volunteers, now being there), and accepting trainee as one of the author to Japan. Besides JICA is running the REC's (Regional Education Centers) project at United Colleges and Southern United Colleges to pilot and test the program 'the Development of Higher Education Institution in Rural Communities.'

TRAINING COURSE ASPECTS IN JAPAN

About the Participant (Mr.Tongmuan Nasa-ngium)

Education : Graduated bachelor and master's in Physics Education.

Experience in Teaching : 4 years of Elementary school.

- 13 years of Teachers Colleges in Physics.
- 1 year of Affiliated Nursing Colleges in Physics for Nursing.
- 6 years of Teachers Colleges in Computer.
- Experience in Computer areas: Counterpart of Japanese Experts:-
 - 6 months of Ryoichi Sugimoto(1988)
 - in Computer Interfacing for Science Teaching.
 - 2 years of Satoshi Yahata (1990-1992)
 - in Computer Hardware.
 - 1 year of Yuko Yasui (1992-1993)
 - in Library System Analysis.
 - system manager, Computerized Library system.

Present Posts held: Head / Instructor of Computer Department, its functions are; -academic management.

- to teach in Computer System & Data communication and Computer Hardware for Computer Science students, and in Computer Education for general education students.
- to conduct short-term Computer Use for educators / special program participants such as Hotel Management Program etc.

Details of the training course

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|-------------------|--|
| Course Title | : Computer Education in Japan. |
| Trainee | : Thongmuan Nasa-ngium, Mahasarakam Teachers Colleges / Rajabhat Institute, Thailand. |
| Course Supervisor | : Ryoichi Sugimoto, Associate Professor. |
| Place | : faculty of education, Tottori University. |
| Time | : 2 months (Aug.-Sept.) for Japanese Language
5.50 months (Oct.-Mar.) for Computer Education. |
| Scholarships | : JICA (Japanese International Cooperation Agency). |
| Training Type | : Individual Study. |

Course Descriptions

Refer to the paper; "PRACTICAL USE OF PERSONAL COMPUTER IN SCIENCE TEACHING"[3], the meaning of Computer Education in Japan is followed:

There are two meanings in 'COMPUTER EDUCATION' in Japan. One is the education of how to use the computer, what is the computer, what is the BASIC Language, ASSEMBLY Language, etc. The another is the education concerning how to teach subjects by means of computer, how to teach SCIENCE by using personal computer. The latter one is now more important in Japan.

The Ministry of Education of Japan (MOMBUSHO) is conducting the project of computer education from primary school to upper secondary level.

Aspects of Contents

The contents for training of this project were designed:

- Computer education carrying out in Japan.
- The teaching methods of Computer.
- The concepts of electronic parts of devices.
- The methods of researching.

OBJECTIVES

After training, the trainee should be able to:

- understand the concepts of Computer Education.
- conduct the Computer Education program more effectively and efficiently.
- improve the way of professional working with competence.

ACTIVITIES

In order to achievement in training, the activities designed as following :

1. Visiting study.
2. Guest lectures.
3. Participating in academic workshops.
4. Observations.
5. Laboratory experiments.
6. Researching Training.

DETAIL OF ACTIVITIES***Visiting Study***

Its procedure is generally sight-seeing, briefing and some discussion in special contents according to the trainee mentioned, as following:

Table 1. List of Visiting Study

place	special contents
1. Affiliated Elementary & Junior High school, Tottori University.	1. Assessment of teaching practice student. - Conducting of Compute Education Curricula.
2. Yonago, Junior High school, Tottori Prefecture.	2. Trying out "the CAI (Computer Aided Instructions) use in various subject areas".
3. Fukube, Local Government, Elementary Prefecture.	3. Trying out "the CAI use school, Tottori in Science" subject.
4. Educational Center of Tottori Prefecture & of Hiroshima Prefecture.	4. Carrying out "the In-Service Training Programs". -Educational Information Services Center.
5. Kurayoshi, Women's Vocational Junior college, Tottori Prefecture.	5. Computer use in Vocational Education.

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|-----------------------------------|---|
| 6. Yamaguchi University. | 6. Computer Science Curriculum study and the managing of this programs. |
| 7. Hiroshima University. | 7. Computer Use in Laboratory Physics Experiments. |
| 8. Aichi University of Education. | 8. Computer Interfacing Technic in Science Teaching in school. |
| 9. Kyoto University of Education. | 9. Multi-Media Techniques. |

Guest Lecturers

Its procedure is to invited the expert in computer field, particularly in computer interfacing, having a lecture as one by one. There are as following:

Table 2. List of Guest lecturers

Title/Place	Lecturer
1. Computer Interfacing for Laboratory science experiments in secondary school. Held at Aichi University of Education.	1. Akitsugu Fukaya, Educational Center, Aichi prefecture.
2. Computer Interfacing techniques via RS-232c Ports for laboratory science experiments. Held at Tottiri University.	2. Ashikaga Hiroto, Kobe high school, Hyogo Prefecture.
3. The productions in Educational Teaching Media of Fujitsu. Held at Kosei Nenkin Kaikan, Tottori prefecture.	3. Tenra Kazuo, Hiroo high school, Tokyo.
4. Application Techniques of One Chip Micro-computer. Held at Tottori University.	4. Satoshi Yahata, Engineer, RCC, broadcast company of Hiroshima.
5. ADC&DAC Interfacing Techniques to computer for Physics Teaching. Held at Tottiri University.	5. Yasushi Ogura, Assistant Prof., Hiroshima University.

Participating in Academic Workshops / Conferences

Its procedure is to attended in academic workshops or conferences as one of participants as following:

Table 3. List of Workshops / Conferences

Title	Place held
1. Practical Use of Personal Computer in Science Teaching.	1. Education Center of Tottori Prefecture.
2. Chugoku Science Conference in 1993.	2. Yamaguchi University.

Observations

Its procedure is to be in the real situation as one of the members of these events , as following:

Table 4. List of Observations

Events/Held	Period
1. Sugimoto's class; The methods of science teaching in secondary school.	1. 1-semester long.
2. Yamagishi's class; Introduction to Computer.	2. Half-semester long.
3. International Conferences 1993; Information Technology, held at Tottori University.	3. 3 days.
4. CAIs Use in Secondary school. Held at Yonago, Gotougaoka Junior High school.	4. 1 day.
5. Assessment Research Project; CAI Use in Science Teaching in Elementary school. Held at Fukube Local Government school; Tottori Prefecture.	5. 4 hours.
6. Ishida's class; Physics in Technology, Optics Principles. Held at Aichi University of Education.	6. 4 hours.

Laboratory Experiments

Its procedure is; the trainee proposed the topics intended to course supervisor. Supervisor provided papers / documents related, and some parts or equipment. After that the trainee started learning by himself and some discussion if any problem; as following:

Table 5. List of Laboratory Experiments

Topics	Main Concepts
1. MAMEDAS on MSX. By Sugimoto.	1. Simple sensors but powerful; interface to MSX as PC.
2. Mouse Interface on NEC.	2. Modifying system in (1) to NEC.
3. RS232 Interface on NEC.	3. Same as in (2).
4. EPROM Writer.	4. Practical use of EPROM Write, Commercial one.
5. Commercial One Chip Micro computer.	5. Cheap but available for elementary or lower secondary school.
6. Disk drive-motor control.	6. Motor controlled by simple switches made of paper and clips.

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|---|--|
| 7. The characteristics of Transistors and Op Amp. | 7. The foundations of concepts of electronic devices. |
| 8. Humidity sensor. | 8. Interfacing circuit design. |
| 9. Commercial LCD display control. | 9. Controlled by common switches directly not by computer. |
| 10. Watering system control. | 10. Circuit design. |
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Researching Training

Its procedure is the same as in *Laboratory Experiments*. The title of the research is "The optimum voltage is available to Watering system controlled circuits as designed in (10) of Table 5."

The main points of this research are to :

- design the detection circuit of moisture of soil.
- find the relative water absorption of sand in samples / soil.
- design automated data acquisition system with one chip microcomputer.
- design data transfer from One Chip to PC system for data analysis on PCs.

The process now running is collecting the data by manuals not start One Chip system yet, and also practicing writing the papers such as this report.

RESULTS AND DISCUSSIONS

After study such reported in *the Details of Activities*, we would like to express about the Potentials of Computer Education curricula in Japan, is depend on 5 categories as discussed below.

By the way, in fact, social system and education system, in society structures, are interrelating. That is the main viewpoint and mentioned in the discussions.

Curriculum Management

Since Japanese societies have been enormous, as well as, new fields of science and technology have emerged while computerization continues to penetrate into every field of society.

One of the aims of Japanese educational reform in 1989 is 'to cultivate information literacy and internationality to live together as a global citizen.'

According to previous reasons and from study refereed to the section of Activities found that the curriculum management in school levels is according to Sugimoto's papers; Practical use of personal computer in science teaching[3], as following:

Primary school : Only provides the students familiar with computer and assist teaching by CAI as other educational instruments such as Video, TV, OHP are used systematically, such as Fukube, Local Government, Elementary school.

Lower secondary school : In the subject called "JOHO-KISO" in Industrial arts, students

will learn how to use the computer. However, in other subjects such as mathematics and science, computers are used as a tool for problem solving and CAIs, such as Yonago, Gotougaoka, junior high school.

Upper secondary school : Mathematics, students learn about programming, algorithm and problem solving methods. Science, in Physics IA subject provides computer system and data communication.

But in the other fields of science subjects using for skill practice, particularly for data processing such as graphing, calculating, interpreting and so on, and for direct measuring data in laboratory experiments, such as Kobe High school, Hyogo Pref. and Hiroo high school, Tokyo (information from guest lecturers).

In the other field subjects ; home economics, engineering, agriculture properly be taught as computer science. However, computer education in college and university levels provide general education as computer literacy to all students, as well as in education centers provide in-service training and educational information service for school teachers.

The impressions, from the observational studies found that:

1. The trying out of CAIs use in junior high schools, held at Yonago, Gotougaoka, junior high school. There are many softwares covering almost in every field subject area.
2. The method of the carrying out of one-day workshops for 'Practical use of PCs in Science teaching', held at Educational Center of Tottori Prefecture, was efficiently.

The Method of Teaching Development

Since Japan as poor material resources[4]. The only way, it began actively to seek at the Knowledge, could socially and economically was through technological advances achieved by people-its only real resource, and its now ranks as one of the world's major industrial country.

Educational background is and important factor in Japan's lifetime employment system as: to land a job in a top-ranking company, it is necessary to be the graduate of a leading university. A qualification that is dependent in turn upon graduation from top-level upper and lower secondary schools. That is subject to a fierce competition in the entrance examinations of every level.

One of the aims of educational reform is to 'learn problem solving method and cultivate each self-educational ability for living as a citizen of good character.'

According to previous reasons and from direct experience in training activities found that the method of teaching in computer education is emphasis of learning by doing with computer machines directly. The numbers of machines are sufficient according to considerable needs.

The impression, from the observation the atmosphere of science teaching by means of computer at Fukube, Elementary school. The pupils could use the computer skillfully finding the answer for geological experiments.

Manpower in Educational System - Teachers

Refer to the Japan working ethics in 'JAPAN AS IT IS'[5]; Japanese people as hard workerers, pursue their work are based on the value of working, not so much on profit motive. They devoted their life for the benefit of the companies. The teacher's profession is high potential-ranks in society and high salary concerning other public officials.

According to previous reasons and direct experience found that the Teachers are high quality as refer to academic works / products of each lecturer, and they are good graduated backgrounds such as from science, engineering, etc. Not only responsible of teaching development but also do researching. Impression of the idea of Sugimoto; 'apply the high technology into cheaper and simple ones for teaching,' such as one-bit interfacing [3].

Students

According to the reasons discussed in the former section and because of 'educational background is an important factor in Japan's lifetime employment system,' and the educational system concentrates on preparing students for entrance examination. So these make Japanese children are probably the world's hardest-studying. They pay much attention in the class system and themselves study or went to 'cram schools,' are set up to provide supplementary after-school instruction.

The impressions, from visiting at Hiroshima university found that; the students of Physics Education programs are making CAI softwares and Computer Interfacing in Science teaching vigorously.

Budgetary Supports

Now Japanese economy becomes more domestic-demand orientation to the improvement of the quality of life for final consumption, including medical care and health maintenance, education and leisure[5].

As well as, the quality of citizen depend on their educational background as only real resource of the country.

So refer to statistical handbook of Japan (1993) ; the government provide public expenditures for education of 20, 258 billion yen, constituting approximately 16.5% of combined net total figure of the fiscal 1990[6]. About the computer education supports, refer to Sugimoto's papers:

Now almost of the schools in Japan have at least more than one microcomputer. Some schools have 24 to 50 sets of micros in each school. Vocational upper secondary schools have already many computers including the Mini-scale main frame computer. The 100% of schools have more than 50 sets in 1994 according to the future planning of MONBUSHO, all schools will have more and more computers for teaching in all fields.

CONCLUSION

Despite there is no comparison of the computer education system between in Japan and in Thailand, because its difference of economic system and cultures. However, some viewpoints, in the next *General Impressions*, could determine some information to the Japanese education system.

The General Impressions by the Participant

1. Japanese government gives the high priority of educational school levels by established the Educational Center of Prefectures for promotion of education.
2. The private sectors take apart for promotion of curriculum management such as FUJITSU, etc.
3. Curriculum management in all universities[7], it is compulsory; all students are required to submit a graduation thesis / project in their final year, in close working association with a faculty advisor or in an experimental combination on a specific theme.

From the observation study found that there are many projects by means of computer in their thesis or projects.

4. There are a lot of educational technology researches concerned with computer education.
5. "Learning by yourselves" is still reality in Japan and there are many kinds of mass communication media sufficiently supporting it. The figures in publishing better presentation could communicate to the trainee.
6. 'Keep Time' is the first priority of systematic work. Not change the time-tables as possible.
7. There is no system such as giving a double-grade in an annual rise of salary system. So no competition is in their team-work system, and good teams working exist as well.
8. The students come from some 90% of families of middle class[4], Never seen their eyes performing worried about hungriness or tutorial fee.
9. In affiliated junior high school of Tottori University, there are many color monitor personal computers for computer education study.

By the way, a part of time for the participant was spent for study in Japanese arts and cultures; particularly in Japanese language, administrative structures of Tottori University and in the concepts of computer engineering in Japan.

Lastly, the participant would like to introduce the computer science curriculum, it aims to develop good citizenship, and equip students with knowledge, skill and abilities as well as techniques for their future career. The curricula also instill among learners good attitudes toward their subject area specialization. It provides learners with emphasis of the anatomy of computer system, training in programming, digital circuits and continue practice and on job of computerization training opportunities.

Projects, other than the present, will carry out after return from Japan : -conducting Short-terms workshop of "Practical Use of PCs in Science Teaching" for secondary school

teachers. - conducting activities of "Hardware Groups (called Yahata Groups)" as a supplementary curriculum's activity.

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要 約

我が国の科学技術教育の課題と展望

—外国人研修員から見た日本のコンピュータ教育—

理科教育研究室 杉 本 良 一
受託研修員 トンムアンナサンギアム

我が国の科学技術教育について、外国人研修員の目から見たコンピュータ教育の現状と課題、特に教員養成、教員研修、学生の教育等について、日本の優れた面及び問題点や課題について検討した。

日本の科学教育、特にコンピュータ教育の優れた側面としては、カリキュラムマネジメント、指導方法の改善、教員養成システム、学生の教育システム、財政的背景などが考えられる。タイと日本では文化的・経済的に大きな違いがあるため、コンピュータ教育のシステムを並列的に比較することは難しいが、途上国の研修員による日本の科学技術教育に対する見方として、以下のようなことを分析・考察した。

まず、教員養成や教員研修に関して、日本の教師の指導技術レベルが高いのは、教育研修センターの役割が大きいこと。私的な部門でのカリキュラム開発の推進に、民間企業の役割も大きいことなどがあり、さらに、学生の教育に関して、ほとんどの学生は中流階層からきており、タイに見られるような空腹や授業料の心配がないこと。日本の大学のカリキュラムでは、卒業論文が必修となっており、また、コンピュータを効果的に用いて卒業論文を上げていること。コンピュータ教育に関する卒業論文には多くの教育工学的視点からの研究が見られることなどが挙げられた。

次に教員の管理システムについて、日本では時間を守ることがシステムティックな仕事の第一のプライオリティであることを挙げられ、大学などの時間割はあまり変更されないこと。また、教官の給与システムが体系化され、昇級システムがしっかりしており、日本はタイに比べてチームワークがとりやすいことなどが挙げられ、さらに、施設・設備や教育環境に関して、日本では自ら学ぶということが現実のものになってきていること。教育テレビなどたくさんのメディアからの情報を得ることができ、また、国立大学の附属学校ではコンピュータ教育のためのコンピュータが整備されている等が挙げられる。

以上のような視点は、日本側から眺めたときには正確さを欠く部分もあるが、途上国から見た我が国の科学技術教育の現状は必ずしも悲観的でないことが分かる。しかし、良い面だけでなく、裏返しの側面、例えば時間を守るといった言い換えればゆとりがないことを示しており、また、日本の学生にはハングリー精神が欠けているなど、途上国の教育の現状から学ぶべきことも少なくないと考えられる。