Views of Japanese Aboriginal Technology and Science Education

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Abstract

This paper examines the unique characteristics of Japanese school science (*Rika*) and technology (*Gijutsu*) education. In this study the main stress fell on socio cultural contexts of each type of education. This paper proposes the existence of "indigenous technology" and "neo-technology" in *Gijutsu*.

Background

In order to show educational direction of the Japanese national curriculum, the

Central Council in the 15th session (1996) as an advisory body to the Ministry of Education, Science, Sports and Culture (MESSC) submitted an interim report (Yamazaki, 1999b). The MESSC announced a new course of studies for next national curriculum at elementary and lower secondary schools in 1998 (MESSC, 1998a,b) and at upper secondary schools in 1999 (MESSC, 1999). The MESSC has also posted the abstracts in English at the website: http://www.monbu.go.jp/. The national curricula will be introduced commencing in the school year 2000 and will allow for a period of smooth transition. It is anticipated that the programs will be fully implemented in the elementary and lower secondary schools from 2002 and in upper secondary schools from 2003.

The remarkable point about the first report submitted by the Council was that it strongly encouraged the reorganization of subject structures in second national curriculum. However, the MESSC has not yet announced the concrete and detailed direction or rationale about the nature of the reorganization. Referring to international points of view, there has been crucial controversy on changing the school subjects related to science, mathematics and technology education (Black *et al.*, 1996).

Purpose

The question we have to ask here is “what is technology and science” and “what is the relationship between science and technology education”? It has been proposed that view of Japanese indigenous science has been different from Western science (Ogawa, 1995). It has also been demonstrated in various researches projects that the view of Japanese indigenous science education has been different from Western science education (Ogawa, 1995; Kawasaki, 1997; Ogawa, 1997; Nakayama & Takemura, 1998). However, there has been little international reporting on the relationship between views of Western and Japanese technology education. The purpose of this paper is to discuss the indigenous views of Japanese technology education.

Discussion

International Trends of Science and Technology Education

The Scottish 5-14 Curriculum has introduced a new area “Environmental Studies” consisting of “scientific studies and applications, including Health Education”, “social studies, including History and Geography” and “technological activities and applications, including Information Technology” (the Scottish Office Education Department, 1993). McClelland (1993) noted a warning to Environmental Studies as a whole:

> If the subjects are taught separately, specific subject knowledge and progress in that part of the curriculum are easier to see, but the studies may seem less relevant to real rife and so less motivating to some children. ...If the subjects are taught in an integrated way, the studies can often be made to link more directly with pupils’ experiences and the interrelatedness of separate subjects is easier to maintain (McClelland, 1993: p.18).

Some countries have already introduced a combined science and technology curriculum as a single subject or area. For example, the Northern Ireland new curriculum has introduced science and technology at key stages 1-2 (5-11 years old) (Department of Education Northern Ireland, 1999).

The Relationship between the Science and Technology Curriculum in Japan

In Japan, a new national curriculum was announced in 1998 but has not yet included technology education as a general education subject in elementary and upper secondary schools. On the other hand, there are technical or industrial education related subjects in vocational or integrated upper secondary school courses. These are offered as special education subjects. However, there are no technology education related subjects as ordinary education in upper secondary schools although there are compulsory homemaking related subjects as general education.

Recently, the MESSC has also encouraged each governing board to introduce 6-year comprehensive school throughout lower and upper secondary school level. There is now a few secondary comprehensive schools in Japan. The 6-year comprehensive secondary school attached to the Faculty of Education, Tokyo University, was introduced in 1966 (Arikawa, 1999). The "Science and Technology" subject has been set up for both male and female students from 7- 12 grades at the school as part of the students' general education. In my understanding, there has not been an authentic educational contents based integration between science and technology in the curriculum. It seems that the main purpose has been to combine science and technology and separated it from homemaking. Indeed some Japanese technology educators have insisted that technology should be separate from homemaking. Others have argued for a single subject comprised of technology and homemaking at lower secondary school.

What is *Shizen* Education in *Rika* as a Japanese Science Education

In general, many Japanese science educators have not agreed to the combination or integration of both science and technology subjects at the lower secondary school level. One of the main reasons involves their concern that there will be a marked decline in the students' scholastic attainment. The other reason is they worry about treating "*shizen*" lightly. They argue that if the Japanese school science (*Rika*) is changed to science and technology, the nature of the subject will be diminished. In order to discuss the rationale of *"Rika"*, it is necessary to understand the concept of *shizen*. *Shizen* is an old Japanese word that originated in the old Chinese, "*tzujan*." It means 'far from that of nature'. Caution should be taken in that the words "nature" and "natural" may tend to give a negative image for Westerners, in the sense, for example, "not cultivated". *Shizen* gives a positive image from the Japanese perspective, for example, "*Shizen* is the ideal of what everything should be" (Ogawa, 1997). The traditional Japanese word, *Shizen* means "under the state of unaffected by human activity or human art," or "of itself," or "spontaneously." The Japanese are willing to accept the phenomenal world because of their disposition to lay a greater emphasis upon intuitive sensible concrete events, rather than upon universals (Nakamura, 1964).

Japanese indigenous cosmology regarding *shizen* is also related to "*wabi*." Originally it meant the misery of living alone away from society. Later, it gained a positive aesthetic meaning; the enjoyment of quiet, leisurely, and carefree life. Japanese found a solitary life attractive and blessed with opportunities for enjoying freedom from materialism and for cultivating the sense of oneness with "*shizen*" They valued a simple, austere type of beauty and a transcendental attitude toward life. (Honna and Hoffer, 1986, p.342)

Importance of Views of S*hizen* in R*ika* as School Science in Japan

The new overall objectives of *Rika* at the elementary school level is:

> To develop the ability of problem solving and <u>a rich sensitivity to love *shizen*</u> through observations and experiments with own prospect by pupils and in a friendly <u>manner toward *shizen*</u> as well as to enhance their understanding of natural things and phenomena, thereby, nurturing a way of looking at and thinking scientifically. (emphasis added)

The objectives at lower secondary school is:

> To develop students' ability in and <u>positive attitude towards making inquiries about *shizen*</u> through observations and experiments as well as to enhance the understanding of matters and phenomena in *shizen*. Thus to have students realize the relationship between *shizen* and human beings.

The objectives at upper secondary school is:

> To develop students' ability and positive attitude to inquire into *shizen* through observations and experiments, to enhance their understanding of fundamental concepts of matters and phenomena in *shizen*, and to develop students' scientific view of *shizen*.

The information about the previously mentioned objectives seems to be of value for discussion on multi-science perspectives in Rika. Ogawa (1997) also noted that "Neo-science" education is popular in *Rika* classes:

> However, most science educators as well as science teachers are never aware that the observations and experimentation pupils perform in *Rika* classes are a kind of "pseudo-observations" and "pseudo-experimentation". They believe that while pupils' performance is real "scientific" reaching a kind of scientific theory. What the pupils performs is "pseudo-observations" or "pseudo-experimentation. In fact, after finishing the performance pupils do feel satisfaction, but never come to the point of considering the process. (Ogawa, 1997, p.110).

The objection will no doubt be raised that it has been easy to get high scholastic achievement scores in *Rika*.

Public Understanding and Interest of Science and Technology

The OECD (1997a,b) reported that the percentage of Japanese citizens with some knowledge about science and technology was the second lowest among 14 countries. It also published that the percentage of Japanese citizens with an interest in science and technology was the lowest amongst them. These data have shown us some important considerations. However, it is well known that Japan has been highly influenced by a scientific and technologized society in both daily life and industry.

A Japanese society that demands a heavy emphasis on one's academic career, in which graduating from a first-rate and famous universities is amongst the first requirements to get promoted quickly. There has also been severe competition for gaining entrance into the famous universities. This competitive trend is evident even though famous kindergarten – and secondary schools. Furthermore, there have been quite a few ‘cram’ schools that have been successful in competing for students. Japanese people have unfortunately paid too much attention to memorizing knowledge or rote learning on paper and pencil tests. The pencil test knowledge is easily acquired but such learning lacks relevance to real life and practice.

Industrial, Vocational and Technology Curriculum in Transition in Japan

Murata and Stern (1993) summarized the history of *Sangyo* (Industrial), *Shokugyo* (Vocational) and *Gijutsu* (Industrial Arts/Technology) curriculum in transition in Japan. Regarding the transition, this paper would like to emphasize the present socio cultural contexts.

Generally, “*Gijutsu”* includes two meanings; one is technique, the other is technology. By the time of the Edo era (1603- 1867), Japanese generally used “*Waza”* (skill) and “*Takumi”* (how to make artifact) instead of “*Gijutsu”* which was more commonly used by 1870 (Watanabe, 1985). Nishi (1870), a Japanese philosopher, translated technique as “*Gijutsu*” in Japanese. But more recently the government starting from 1968 encouraged productivity in industry; and commenced a national enrichment and security program by imitating Western science and technology models.

In “Kojien,” (a well known Japanese dictionary) one of the meanings given for *Gijutsu* states that it involves “Changing and manufacturing natural things by applying science, and *Waza* is the ‘skill’ for utilizing human life.” (Niimura, 1998; author’s English interpretation). The Japanese people have not been familiar with the relationship between “*Gijyutsu*” and “*Waza*”, the application of science and productive skill.

In 1947, “*Shokugyo* (vocation)”, a new single subject was introduced into the new national curriculum. However, the subject still comprised of agriculture, industry, business, fishery and homemaking. In 1951, the subject name was changed to *Shokugyo* and homemaking. Resulting from the successful launching of the Soviet satellite Sputnik, Japan tried to improve the standard of science and technology educational programs. In 1958, the “*Shokugyo* and Homemaking” subject was changed to “*Gijutsu* and Homemaking.” We clearly had gender problem as the *Gijutsu* was for boys only and Homemaking was for girls. The *Gijutsu* was composed of 7 areas: design and drawing; woodworking; metalworking; machine; electricity; cultivation; and integrated practice.

It is important to note that the total percentage of students going on to upper secondary schools in 1955 was about 51.5 % and in 1975 this figure had increased to 91.9 % of all students (Murata and Stern, 1993). As the result, what is significant in this argument is that almost all teachers and students realized that *Gijutsu* was much more culturally entrenched. In other words, it is the attitudes to the love industrial labor and the morals relevant to the pupils’ own “daily life” rather than contexts of Western technology education. Even Japanese who are responsible for a certain job are not supposed to have their own way, but to create consensus in a harmonious way. In 1989, “*Gijutsu* and Homemaking” became compulsory for both boys and girls although the time allotment of the subject was never increased (Murata and Stern, 1993; Okuya *et al*., 1996; Yamazaki and Savage, 1998). As Lee (1998) pointed out, the main characteristic of “*Gijutsu* and Homemaking” was its focuses on “daily life” and productive “*Waza”* (skills). This stands in stark contrast to seven other countries were compared.

Students' Word Associations with *Gijutsu*

In order to investigate Students' word associations with *Gijutsu*, Yamazaki and Yamada (unpublished data) carried out a word association method (White, 1989, p.67) in 1998. The participants involved 137 students (male, 69; female, 68) from two "*Gijutsu* and Homemaking" classes at a lower secondary school. The students completed the questionnaire that asked about 3 words associations: "*Gijutsu*", "*Gijutsu-sya* ('*sya*' means –ist)" and "*Ginou (skill)-sya*." As the result the students used words on "*Gijutsu*", that have been ranked in a descending scale: 1) wood, 2) saw, 3) hammer, 4) *tsukuru* (produce), 5) iron, 6) electricity, 7) computer, 8) nail, 9) woodworking, 10) machine, ...18) person who is smarts with her/his hand. It was a clear that many students associated words that are related to materials and tools rather than technological competency. This paper suggests that each pupil has their 'own personal view' of *Gijutsu*.

Pseudo-Technological Problem Solving at Gijutsu Class

As *Gijutsu* is made up from many Japanese indigenous contexts like Japanese indigenous science (Ogawa, 1997), this paper would like to be stress that *Gijutsu* is "Neo-Technology" subject. Most educators as well as teachers have never been aware of the technological problem solving activities that pupils actually engage in *Gijutsu* classes therefore tend to foster a kind of "pseudo-technological problem solving" approach to learning that is time consuming and process oriented. Teachers tend to believe that while pupil performance is real, "technological" achievement is guided by a kind of technological rational. In fact, it has been pleasant for pupils to finish their problem solving and have something to show for it at the end of their learning experience. However, many *Gijutsu* teachers have concerns that the 'new' approach diminishes the possibility that students will have something useful to take home in the end, because some students are unable to complete the artifacts that have been produced in the *Gijutsu* class. The "pseudo-technological problem solving" approach has almost completely dominated the whole process of technological designing and making. The emphasis is now on process, whereas in the past focused on the product.

Implication

In general, many Japanese science and technology educators have disagreed on the interrelation or integration of both science and technology subjects. One of the reasons is that technology is apparent quite different from science as shown in Table 1.

Table 1. Differences between Science and Technology. (Yoshitani, 1980, p.10)

	Purpose	Economic and time limits	Method
Science	pursue and throw an objective light on the principles and rules	little	logical
Technology	solve problem for human needs and requirements	much	integration between experience and logic

In order to progress into a higher scientific, technologized and internationalized society, humans have faced more interdisciplinary and comprehensive issues that are very complex. In order to solve human the problems, humans need to develop their active ingenuity and creativity in problem solving and heuristic activities. It is very important for all citizens to have competence in mutual and international understanding. In *Gijutsu* and *Rika*, it is the great values of interdisciplinary and comprehensive studies comprising Western, indigenous and personal science and technology that create the logistical complexities for technology educators. Current society requires that all citizens develop a coordinated competency between each context. Indeed, It is evident that we face the challenge to move technology education beyond the “technology as applied science” paradigm (de Vries, 1996).

Takemura (1996) proposed a fundamental plan on development for “New Integrated Science Intelligence and Literacy” in Science and Technology subjects throughout the elementary to upper secondary school. Whereas this paper has recognized the importance of his suggestion, much more discussion between science and technology educators is required before we have anything like a smooth transition to an integrated approach to science and technology education in Japan.

Some companies in Japan have changed to operate on a system of contract employment and promotion is gained according to competency and length of service. The view of indigenous career paths in Japan that required dedicating oneself to a particular company for life has been losing popularity. The annual salary system has become more widespread. It is expected that more people will change jobs to make the most of their competence. It is also important to interlink between technology and career education based on a society of life long learning.

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