

A New Rationale For Science Education In A Non-Western Country - A Japanese Perspective

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ABSTRAK.

Artikel ini berdasarkan kepada pandangan-pandangan Profesor Kawasaki Ken dari Universiti Kochi, Profesor Madya Ogawa Masakata dan Profesor Madya Otsuji Hisashi dari Universiti Ibaraki. Mereka berpendapat terdapat konflik dalam pendidikan sains di Jepun pada masa kini yang menyebabkan kekeliruan dalam kalangan pendidik-pendidik sains dan pelajar-pelajar. Ini adalah akibat daripada penerapan sains dari Barat tanpa mengambil kira falsafah Jepun yang intrinsik. Khususnya, artikel ini membincangkan perbezaan maksud apabila konsep-konsep 'nature', 'experiment' dan 'observation' diterjemahkan dalam Bahasa Jepun sebagai 'shizen', 'jikken' dan 'kansatsu' masing-masing. Daripada kajian ini, artikel ini mencadangkan satu pendekatan baru untuk pendidikan sains bagi negara-negara selain Barat.

Introduction

At present a growing number of science educators in Japan feel that the science education being conducted in Japanese schools do not adequately take care of the intrinsic Japanese philosophy. Foremost among them are Professor Kawasaki Ken of Kochi University, Associate Professors Ogawa Masakata and Otsuji Hisashi of Ibaraki University. They are members of the project "Effects of Traditional Cosmology on Science Education" approved and funded by Monbusho of Japan.(see Appendix).

This paper is based on the study of the opinions of Kawasaki, Ogawa and Otsuji . This study was based on personal interviews and their papers published in English and Japanese. For his investigations, Kawasaki uses his container-contents model based on structural linguistics (Kawasaki 1996). A small survey was also conducted among 350 Japanese science educators who attended a conference in Mito from 28th July till 31st July 1997 organised by the Japan Society for Science Education. It is hoped that this study on the Japanese perspective may provide a new rationale for science education in non-Western countries.

Shizen and Nature

As pointed out by Hasegawa (1986, pp.42-43), it is an important fact that the Japanese have a tradition to learn about the foreign culture not through its language but through the Japanese language. The oldest and most important aspect of the study of a foreign culture was the import of Chinese writing characters in the 5th century. The Japanese

imported the Chinese characters as a tool for expressing the Japanese language but did not import the Chinese language. Japan imported many documents written in Chinese but did not try to read and understand these documents in Chinese. The documents were studied after translating them into Japanese language. This tradition is alive till today where a lot of English words and concepts are written in Katakana and pronounced according to the Japanese phonetic system and a lot of times understood differently. In this process a lot of foreign concepts are Japanised.

During the late 19th century, when science education was introduced in Japanese schools by using textbooks translated from the Western countries into Japanese language, 'nature' was translated as 'shizen'. All the three of them feel these two words are not equivalent and are causing a lot of confusion among Japanese science educators and students.

Shizen is an old Japanese word that originated from the Chinese word 'tzujan'. Lao Tzu, an ancient Chinese philosopher, regarded everything ultimately comes from 'tzujan'. As mentioned earlier, even though the word 'shizen' originated from China, it has assumed an intrinsic Japanese sense and meaning in Japan. Shizen is a state of spontaneity that stands for the highest virtue. It is an ideal of what everything should be and does not suggest any other superior existence like God the Creator. The base culture of Japan rests on the Jomon era and Yayoi era. During the Jomon era (12000BC to 300BC), when the people lived by collecting nuts and hunting wild animals, the Japanese had some kind of animistic belief with the surroundings. During the Yayoi era (300BC to 300AD), the Japanese settled in flatlands and started rice cultivation, which is dependent on the climate. This base culture may have contributed to this feeling of oneness of the Japanese people with the surrounding which is an aspect of shizen. The subject (human) and object (surrounding) are not differentiated and there is always a positive interplay between both of them.

The origin of the Western concept of 'nature' is closely linked with the Greek idea of 'logos' and the Judeo-Christian doctrine of God the Creator. The Greek philosophers used 'logos' to mean statement, word, principle, law, reason, reasoning, rule and proportion. In Judeo-Christian doctrine, God created man and nature. An aspect of logos enables us to apprehend the principles and forms. This view becomes fused with the Christian doctrine when logos is God's instrument in the development (redemption) of the world. The notion survives in the idea of laws of nature, if these are conceived as independent guides of the natural course of events, existing beyond the temporal world that they order (Blackburn 1994, p.225). The endeavor of science is to unravel these laws of nature.

Since the Western concept of nature and the Japanese concept of shizen have different meanings, Kawasaki feels an appropriate superordinate is necessary to discuss these concepts in the correct context (Kawasaki 1997b).

Jikken and Experiment

Experiment is a very important activity in science. 'Experiment' is translated as 'jikken' in Japanese. In the Japanese writing system, 'jikken' consists of the two kanji characters 'ji' and 'ken' as shown below.

実

ji

験

ken

The pictograph of 'ji' means a house filled with treasure. This kanji character may mean fruit, harvest, faith or a true aspect of something. The meaning of 'ken' is omen, evidence or a trial. Kawasaki disagrees with this translation. According to him, the aim of doing an experiment in Western science is to find a law which establishes relationships between physical quantities in the ideal world based on the results obtained in the material world. This implies an ideal world hidden from direct observation. The Japanese do not have a concept of an ideal world. According to Nakamura (1993, p.351), in Japanised Buddhism, nothing is hidden from one's self and the material world is important. According to Kawasaki, the original meaning of jikken is one's direct experiences in the material world only.

Kansatsu and Observation

Observation is another very important component of science activity. In Japanese science education, observation is translated as 'kansatsu'. This is another point all the three of them disagree.

In an observation, there is a separation between the observer (subject) and the observed (object). They accept the following definition from The Collins Cobuild English Dictionary (1987). 'An observer is someone who spends time watching an activity or event in order to see what happens, but without actually taking part.' The observer should be insulated from the activity or event that is being observed.

In the Japanese writing system, 'kansatsu' consists of the two kanji characters 'kan' and 'satsu', as shown below.

観

kan

察

satsu

The right half of the first kanji 'kan' stands for 'seeing'. The pictograph of an eye is set on the pictograph of two legs. Consequently, the right half means the human act of seeing. The left half is based on the pictograph of a stork. So, the first character 'kan' means to see carefully, just like a stork does. The second kanji stands for 'contemplate'. The top of the kanji symbolizes a cover to hide something. To understand something, which is covered, one has to contemplate. Therefore, the unified term 'kansatsu' refers

contemplation by means of an activity that is more than just seeing. From cultural and historical perspectives of the usage of the concept 'kan' (Kawasaki 1997a), a closer English equivalent should be the word 'gaze'. The difference between 'gaze' and 'observe' is clearly seen through the explanations cited below.

If you gaze at someone or something, you look steadily at them for a long time, for example because you find them attractive or surprising, or because you are thinking about something else:

If you observe someone or something, you watch them carefully, especially in order to learn something about them. (The Collins Cobuild English Dictionary, 1995)

Behind the activity of 'gaze', there lies an emotional motivation. Someone or something that is being gazed at, must be 'attractive' or 'surprising'. In this state of mind, he/she cannot draw sharp distinction between himself/herself and someone/something that is being gazed at; he/she is obliged to take part in that situation he/she gazes at. On the other hand, the term 'observe' implies the activity performed 'in order to learn or understand something about them'. According to Hanson (1961, p.20), 'The observer may not know what he is seeing; he aims only to get his observations to cohere against a background of established knowledge'. An observer must try to be free from any sympathetic relationship with the observed. In kansatsu, on the contrary, he/she never wants to be isolated from them sympathetically.

Contemporary Japanese Science Education

Japanese children get an exposure to an understanding of shizen by the following, among others:-

- (a) In schools, when learning subjects like, Moral Education, Japanese Language, Art and Social Studies.
- (b) In 1st and 2nd Year Elementary, the pupil studies Seikatsuka (Living Skills). In this subject, there are three main sections. They are i) one's relationship with shizen, ii) one's relationship with society and iii) one's relationship with one's self.
- (c) At home, when participating in activities like i) hanami (cherry-blossom viewing), ii) ancestral worship during O-bon festival, iii) yama matsuri (mountain festivals), iv) umi matsuri (sea festivals) and v) tea ceremony.

In Japan, science education is called Rika. All the three of them feel that, to a certain extent, the spirit of shizen is reflected in the science syllabus of elementary schools but that spirit is completely ignored in secondary and high schools. According to the

Gakushu Shido Yoryo (course of study) for elementary schools, which was put into force in 1989, the overall objective of Rika is as follow:

Rika aims at fostering pupils to: commune with Shizen (nature), perform observations and experiments, acquire the ability of problem solving, acquire the feeling of loving Shizen (nature), understand natural things and phenomena and acquire the scientific view and way of thinking. (Ogawa 1997)

According to Ogawa, the overall aim has six objectives that can be grouped as objectives related to science education and objectives related to shizen education. 'Commune with Shizen' and 'acquire the feeling of loving Shizen' are related to shizen education while the others are related to science education. According to the courses of study of secondary and high schools, the overall objectives of Rika do not have objectives related to shizen education.

Since the Japanese science educators are not aware of the significant difference between the Western concept of nature, which is translated as shizen in Japanese science education, and the intrinsic Japanese meaning of shizen, there is a hidden conflict which is causing confusion among the students during science lessons. At times, they were taught science in accordance to the concept of nature as in Western science and at times in accordance to the intrinsic Japanese spirit of shizen. As an example, according to Kawasaki, in one class in a secondary school, while studying about the movements of an earthworm, the class was unruly. To bring order to the class the teacher shouted, "Have some empathy for the earthworms!" Clearly this is a shizen attitude. On the other hand, Otsuji recollected an incident that happened to him during a science lesson in elementary school. The teacher gave a flower to each pupil in the class. While Otsuji was admiring his flower, the teacher told them to pull out the petals to study the structure of the flower. Otsuji felt very confused at this, for it was contrary to what he was taught to feel towards things around him. This is an example of teaching science in the Western sense.

Survey

About 350 science educators, comprising of science teachers, science teacher trainers and university lectures, from throughout Japan, gathered in Mito for a conference from 28th July, 1997 till 31st July, 1997. This is the 21st annual conference organised by the Japan Society for Science Education. To ascertain their thinking regarding the present Japanese science education 66 of them were given a simple questionnaire with the following question:

In the present science education being conducted in Japan, 'shizen' is equated to 'nature'.

'Shizen' is a Japanese concept while 'nature' is a Western concept.

Do you think 'shizen' and nature is the same?

Yes No I do not understand the question

If you answer 'No', please state the difference.

Out of the 66 respondents; 32 of them answered 'Yes'; 30 of them answered 'No'; 4 of them answered 'I do not understand the question'. The following are the responses to state the difference between 'shizen' and 'nature'.

- nature implies a surrounding untouched while shizen implies natural things controlled by Man.
- nature means manipulating the surrounding while shizen means coexistence with the surrounding.
- nature is created by God while shizen is untouched by Man and also includes gods.
- nature is a global concept which was created before me while shizen is a rural concept which means coexistence between Man and the surrounding.
- shizen refers to the mountains and rivers that exist by their own right while nature implies Man has control over his surrounding.
- nature is created by God and there are hidden laws behind nature while shizen implies identifying one's self with the surrounding.
- nature is opposed to Art while shizen means spontaneity that does not oppose Art.
- shizen includes nature and what is man-made.
- nature has characteristics while shizen does not have characteristics.
- nature means no sympathy with the surrounding while shizen means having sympathy with the surrounding.
- shizen has spontaneity while nature has no spontaneity.
- nature is bigger than shizen but in the field of science they are the same.
- shizen lets matter take its own course while nature does not.

- shizen involves human relationships in society and psychological matters while nature does not.
- in shizen, man, plants and animals are at the same level while in nature, Man is superior to plants and animals.
- some of them answered shizen is bigger than nature while some answered nature is bigger than shizen.

About 45% of them answered that there is a difference, which shows the studies of Kawasaki, Ogawa and Otsuji are very important. Their confusion to identify the difference between shizen and nature shows that they need a proper exposure to these concepts.

Proposed Changes to Japanese Science Education

Kawasaki, Ogawa and Otsuji propose that the present courses of science education should be restructured to reflect Japanese intrinsic philosophy. Based on the incommensurability of shizen with nature proven by structural linguistics, Kawasaki goes further to suggest that science education in Japan should be conducted as a foreign language education. For a start, they suggest that a good preface should be written in the science teachers' guides to explain the differences between shizen when used to mean nature in the Western sense and shizen when used in the Japanese sense. With this awareness, the teachers will be able to point out the differences to the students. Only then Japan may be able to produce scientists who can make significant contributions to the world. A similar opinion had been expressed by Yukawa (1992, p.59), Noble Prize laureate for Physics 1949, as follows:

At present, we note the dangerous tendency in Japan to disregard uncritically the peculiar elements of its own culture in order to conform to patterns of Western civilization. Instead, there would seem to be an urgent need of searching out the possible ways in which Japanese cultural elements may contribute to the dissolving of the worldwide predicaments of today.

Conclusion

Science education is given great importance in almost all the countries in the world. Since science is based on the Western culture, it has disrupted or has the potential to disrupt the intrinsic culture of a non-Western country. This short study has highlighted some of the hidden conflicts of science education in Japan. This Japanese perspective shows that :-

- 1) A non-Western country wishing to maintain its own intrinsic culture must formulate science education that incorporates elements of its own intrinsic culture.
- 2) If possible, science education should be conducted as a foreign language education.
- 3) The science educators must be aware of the difference of the key concepts like nature, experiment and observation between Western science and the equivalent concepts or lack of concepts in the intrinsic culture. With this awareness, the science teacher will be able to mention the differences in
- 4) the science class so that the students will not feel disoriented but learn to nurture their own intrinsic culture and finally make significant contributions in the world of science globally which reflects their culture.

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Appendix

Description of the Project

Purpose of the Project

When we consider the rationale of science education in the near future, an important issue is that how the relation of scientific cosmology, which is constructed by the scientific community and the traditional cosmology, which is held by lay-people in their daily lives, should be. The purpose of this project is to compare how the conflict of the two cosmologies appears and how it is being dealt with in the science education programs for Japanese, African, Middle Eastern and First Nation's people, who received Western modern science as a foreign culture, and come to mutual understanding of the situation. Through this process, the ultimate goal of the project is to establish a new rationale of science education, which is suitable for a non-Western society.

Outline of the Project

The project aimed at clarifying how traditional cosmology of a certain people affects the enterprise called 'Science education' in the society concerned. For that purpose, we examined, at first, several fundamental issues, definitions of science, relationship between indigenous science and Western science, natural philosophy and science, worldview, traditional cosmology and rationality, structural linguistics, negativity, etc. Then the discussion proceeded to the issues relevant to teaching and learning science, that is, collateral learning, border-crossing, co-participation, symbolic violence, cultural fit and integration, Fatima's rule, etc. The process was performed firstly by brainstorming the members for about 3 months through the Listserve, TRACOS - L, then by a one week meeting at Mito in September 23-27, 1996, which is followed by the synthesis process, again by a discussion through the Listserve. One of the results of the synthesis was compiled by Jegede, Aikenhead and Cobern as the Mito Document on Research Agenda under the title, 'Cultural Studies in Science Education'.

Members of the Project

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