

Utilization of Rice Field and Swampy Land for Environmental Education in School: Concept and contents of the project

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Abstract

The Environmental Education Center (EEC) was established in Miyagi University of Education in 1997. The center aims to provide students and teachers in this area with a facility in which they can study and do some research on the environment in cooperation with the city and prefectural governments. Environmental problems are now issues all over the world. We believe that environmental education will play a significant role as an effective means to change our awareness and behavior for our surrounding environment. Our activities are based on three fundamental pillars: (1) Field Museum Plan, (2) School Education Supporting System by use of Internet, and (3) Friendship Project. We are doing some research projects of the field museum plan. One of these plans is "Utilization of rice field and swampy land for environmental education in school". First in the present paper, concept and contents of the project is mentioned. In the project, remote - sensing techniques was used to collect data on the environmental factors. To assist children's learning at school, we made CD - ROM pictorials and cyberpedia of the microorganisms in the field. In the friendship project, students learned the environment of the field with children. These activities have been continued for three years by supporting many persons of Prefectural government, City government, a NGO, an enterprise and farmers.

1 . Introduction

Environmental problems are now issues all over the world. We believe that environmental education will play a significant role as an effective means to change our awareness and behavior for our surrounding environment. In Japan, the environmental education started with the education against "Kougai" which means the social problems brought mainly by industrial pollution over 30 years ago. At that time, Japan developed economically and became abundant materially. However, it threw a shadow on our environment and brought environmental disruption and environmental pollution. The pollution caused many people to injured their health. The environmental education was to solve these environmental problems. Therefore, class works of environmental education were sometimes rather gloomy and pessimistic at school. In an extreme case, I have ever heard that the class was a kind of court to try a criminal of "Kogai". Actions against environmental problems often gave rise to antagonisms between citizens and the administration or enterprises in the area. At that time, the citizens as suffers had only to criticize the administrations and the enterprises. However, recent civic life itself influences our environment and gives rise to local and global environmental problems not only in Japan but all over the world. Especially in the large cities, there are many kinds of environmental problems such as refuse, waste water, CO₂, energy consumption. Nowadays, people know well that they are now assailants as well as sufferers and begin to think about how or what they can do for the improving their environment.

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2 . Present situation of environmental education in schools

Now in Japan, many kinds of teaching program on environmental education are put in practice in schools. In the secondary school, for example, most popular subjects are "environmental problems on global level", "relationship between human being and nature" and "the assortment of refuse or waste materials, and recycling" (Hatogai, 1998). The subject on consuming energy and exhaust of fossil fuel are, rather less popular, fourth or fifth of the subjects. It should be much discussed in the class, because Japan is one of the leading car-producing countries and is the country of massive energy consumption in the world. Japan's self sufficiency rates of food and energy are among the lowest in the world. These educational subjects of environmental problems are important for students in the secondary school and for elder children in the primary school. However, we should not emphasize ugliness of human beings that are avaricious for comfortable life. Children should not be encouraged to deny their existence through overemphasis on the myopic egotism of human beings in the pursuit for greater convince. They should have a dream for their future. To overcome this difficulty, learning and experiencing nature may be important, especially for very young children. Recently, many teachers seem to think about that it must be very important for children to have much experience in the open air and to know much about the nature. Now in Japan, some schools are making Biotop which was originally suggested in a program "Species and Biotop Protection" in State Bayern, Germany. Some schools are learning Natural school that is learned from United Kingdom. And results on these activities were reported for example at the annual meeting of the Japanese society of environmental education. It is very important for teachers to incorporate these advanced systems from other countries into their activities. However, it does not always take root in Japanese school if it does not base on the regional culture and custom. In Japanese school, "environmental education" is not the name of a course of study. It is taught in some courses of study such as science and social studies. Recently, "SOGO - TEKI GAKUSHU NO JIKAN" (the period of comprehensive learning) was established and it start in 2000. The course of study deals with the subjects beyond the frames of traditional courses of study. However, teachers do not know what to do at the period of comprehensive learning in school. Is it possible for universities to support these teachers? This is the subject for the newly established Environmental Education Center.

3 . Activities in EEC

In these circumstances, the Environmental Education Center (EEC) has been established in Miyagi University of Education in 1997. This is so far the biggest institute among the national institutes of environmental education in Japan. The center aims to provide not only school teachers and students but also citizens with a facility in which they can study and do some research on the environment in cooperation with the city and prefectural governments. Our activities in EEC are based on the situation of the social consciousness as mentioned above.

One of our activities is to organize meetings on environmental education. A symposium entitled " the APEC symposium on environmental education towards sustainable cities" was organized by the Environment agency, government of Japan and the City of Sendai and held in Sendai in 1998. Some members of the EEC supported the symposium. Prior to this APEC Symposium, Japanese and foreign university students in Sendai took part in a forum. The forum is " Asia Pacific Environmental Education Youth Forum; environmental education towards sustainable cities", which was held as one of the supplementary events of the above symposium by Sendai city Government and supported by EEC of Miyagi University of Education (Aoki et al., 1998). Although the debates in the forum tended to focus on the mass disposal problem, participants developed a common

awareness that the actions of each citizen are important. The conference demonstrated the importance of people developing more environment-friendly habits in everyday living from childhood towards sustainable cities. In the forum, it was also emphasized that children must learn to interact with the beauty of nature and lay the earth to heart. One of the attendants said that the person who has known a beautiful sea does not want to pollute it. Once a person recognizes the beauty or the wonder of the nature, the person wants to recover the nature from the pollution.

In the EEC, the section of Fundamental Research of Environmental Education to which the author belongs aims at developing teaching materials for environmental education in school. The teaching materials are developed on the strength of the data of life and material sciences. In the EEC, our activities on environmental education follow three fundamental plans; **(1) Field Museum Plan, (2) School Education Supporting System by using Internet, and (3) Friendship Project.**

4 . Research projects of the field museum plan

Nature is a good mother. When the children are brought up in the abundance of nature, they can easily notice the importance of the nature. Sendai city has a population of one million that is the largest among cities in the Tohoku district. However, nature still abounds in the suburbs. In the Field Museum Plan, we select appropriate and typical places for "field museums" as a natural teaching material mainly in Miyagi prefecture. The fields are, for example, river, swampy land and rice field, seashore and rural forest and so on. Focusing on the representative local natures, this project is doing researches such as 1) to collect and arrange of the scientific data on the natural environments (geography, geology, climate, vegetation, fauna and flora), to trace the transitional history of the environments changed by human activities and to exhibit and utilize the scientific data for the teaching materials in school and life-long education. The data obtained are offered to the classes at school. The field museum will be training place for field works not only for children but also for university students and citizens, contributing to life-long learning activities for environmental awareness.

5 . The project of swampy land and rice field

The project of swampy land and rice field is one of the projects of the field museum plan. For developing teaching materials in a natural field for environmental education, our group is studying "Kabukuri Numa area" as a swampy land and rice field. In Japan, people cultivate rice plant since ancient time. We Japanese call our county " Mizuho-no-kuni" (the land of vigorous rice plants), though recently young people do not know the meaning of the word. Rice fields are typical landscape of Japan. In Japan, rice field is a half of the total acreage under cultivation and reaches 270 hectare. The water is irrigated into rice field in the end of April or early May in Sendai district. The water influences the climate of the area. We can find many microorganisms that appear in the science textbooks of primary or secondary high school (Mikami and Koizumi, 1984; Mikami and Shishido, 1988; Mikami, *et al.*, 1992). Therefore, we believe that rice fields provide good opportunities to know the relationship between life and environment. Sendai area is the granary of Japan. However, young people even in this area believed that engaging in agriculture is very hard, dirty and occupation of small income. Therefore, they want to go out of agricultural life to urban life. They do not want to stay in countryside. However, I know some young people have some interests in changing the traditional style of agriculture. To see with my favorable eye, the number of such person is increasing now.

Recently, farmers incline to use organic fertilizer in stead of chemical compounds. The amount of herbicides and insecticides are decreasing. The quality of water in rice fields changes tentatively immediately after

manuring and plowing, but as a whole it shows a stable biota and view. Similar agricultural works were done on rice fields all over Japan at regular intervals. Therefore, the difference of environmental condition is not significant among the rice fields regardless of the location. We collected data on some factors of the environment of rice field. Fortunately, this plan was supported by Sendai City Museum, primary schools in Sendai, private enterprises and farmers. We learned that cooperative works beyond organizations were very effective to do environmental education in a local area.

The point to be investigated in the rice field and swampy land are followings.

- 1) Growth of rice plant and works in rice fields during a year
- 2) Plants growing in rice fields and swampy lands
- 3) Change of quality of water from rice fields to river and vice versa
- 4) Microorganisms dwelling in rice fields
- 5) Birds gathering in rice field and swampy lands
- 6) Influence of the water on the local climate

These investigations have just started. Many subjects remain to be examined.

6 . Remote-sensing system for natural environmental education

We tried to collect data on environmental condition of rice field water. Real time data were considered to be important for school children as well as data compiled to be a database. We thought that the real time data are very useful for students in a class if they are available. Remote-sensing system by using Internet made this idea possible. We set a video camera and an auto-sensor to survey environmental condition at a rice field in the suburbs of Sendai (Mikami *et al.*, 1999). The camera was controlled through the web-server that was set at the EEC in Miyagi University of Education. The camera sent the scenery of rice field in front of a farmer Mr. Abe's house every hour on the hour all day long. Environmental factors measured by the auto-sensor are temperature, depth of water, pH, oxidation-reduction potential, electric conductivity, DO, salinity. The equipment for the sensing was given gratuitously by NTT Co. Ltd. (Nippon Telephone Telegram). Each values of the factors was measured automatically and sent to the web-server computer at EEC through a telephone circuit (ISDN) every hour on the hour all day long. These real time data are available any time at school by Internet. At the same time, these data were recorded in the computer. Then the accumulated data were also compiled to be a database. The database is also available in school through the home page of EEC by using Internet. This is a part of " the School Education Supporting System by Internet" that will be mentioned later. Some primary schools in Sendai used these data practically through internet.

7 . Micro-organisms in rice fields

The rice fields are filled with water 10 to 20 cm in depth from the planting season at the end of April to the beginning of August. In the water, many kinds of microorganisms those are appear in the science textbook of the secondary school. For example, much amount of diatoms and flagellates appeared in May to June but decreased in July. Then, its predator *Amoeba* and other protozoa appear in much amount and in number of species when the amount of diatoms and flagellates. Blue green algae (cyanobacteria such as *Oscillatoria*), and conjugatae such as *Spirogyra* and *Zygnema* appear in late May and June. The most favorite protozoa for children *Volvox* often appears in June. At the end of June, *Spirogyra* shows sexual phase of conjugation. The rise and fall of the microorganisms seemed to depend on the growth of rice plant and agricultural works.

8 . Developing CD - ROM pictorial of the microorganisms in fresh water

When we have a class of environmental education in a secondary school, we noticed that there was no appropriate book of reference that was on the market. Then we decided to make a CD-ROM that contain photos and movies of microorganisms in fresh water. The accomplished CD-ROM contained over 100 photos and about 50 movies with explanation on about 40 species of microorganisms. The original version (500 pieces) of the CD-ROM entitled "Microbio" were made and distributed to the schools all over Japan.

In the laboratory class of the primary and the secondary schools, children take some sample of water from pond, river or rice field and observe these samples under the microscope. The CD-ROM is available as a supplementary teaching material when they observe them under the microscope. They can consult with it on identifying the group (species, genus, family and so on). The feature of this CD-ROM is to contain short but many pieces of movies. The movement of the microorganisms is very attractive for children and very important to identify it. The original version was revised after practical use at schools. Many suggestions and comments those were sent from the users are incorporated into the new version. Two thousands pieces of the revised version of the CD-ROM (Ver. 4) were distributed to many schools all over Japan. The CD called forth a response. Now we are planning to make a new version written in English.

9 . School Education Supporting System by using the Internet

How can each school use these data collected by the remote-sensor? Children are able to know that the temperature began to increase 1 to 2 hours after dawn and reached to the maximum about at 2 pm. The lowest value appeared just before dawn. Of course, these changes depended on the weather. In case of pH, the values were about 6.5 in the morning and increased to pH 9 around at the noon. The maximum value appeared at about 3 pm. Thereafter, the value decreased gradually and returned to be acidic. These changes must be astonishing for children. The value of DO was low in night and high during daytime. The children are able to discuss on the relationship between these data and photosynthesis. The discussions on these data lead to knowing about the relationship between the rice fields and oxygen supply at global level. The pupils are also able to discuss on the relationship between agricultural works and the change of water quality. Any way, how to use these data is given into the hands of teachers.

To use the content of CD-ROM pictorial by Internet, cyberpedia (an internet-based contents-growing encyclopedia) of microorganisms was developed by the collaboration with NTT (Takahashi *et al.*, 1998). Pupils take pictures with the digital camera. They can send them to the server computer by Internet. The pictures are incorporated and added to the cyber pictorials in the server computer. Like this way, pupils can make their own pictorials on Internet page and uses anytime they want. This is the cyber specific feature. These are the examples of " the school education supporting system by using Internet".

10 . Friendship projects

Experience in nature is very important in environmental education as mentioned above. Teachers should know how they experience the nature with children and behave in the nature. We offered chances for the students of teacher's college to contact with children in the field. This is called "Friendship Projects". The project was proposed and financially supported by the ministry of Education, Science and Culture of Japan. This is aimed to make valuable opportunities for students of teacher's college to communicate with pupils. At the college, students learn about the rice field and swampy land of Kabukuri-Numa. They also learn how to teach them the field. Then, the students went to the rice field and learn the biota, the environment and

agricultural works. In the final step of the class, they lead pupils to the rice field and teach pupils there. The pupils can find many kinds of plants, animals and microorganisms and have much experience there.

Many of the students who attend this project reported that they were able to set much value on children's sensitivity and their contemplative faculty on subjects in the field. One of the students who was born and have grown in this area said " Now I noticed that my native place was so valuable and attractive when I observed carefully with the children". About 80 students have has the class of friendship project for 3 years.

1 1 . What is environmental education?

What is the environmental education? It is very difficult for me to give it a definition. But I believe that cultivating the ability to image own utopia is very important for environmental education. Every body want to live by the beautiful seashore, river and lake, under the bright sun, on the blessed fertile ground and in a fresh air. To image their own concrete utopia, the experiences in the ideal environment must be quite helpful. Moreover, the ability must be helpful to notice an unknown danger in the environment in future. I hope that our activities are helpful to promote the ability.

Most of aged persons say that the environment at their childhood was better than the present. Of course, this is mainly because the environment was getting worse all over the world. But this is partly because the sharp sensitivity in childhood makes the full memories wonders. As mentioned above, children should not be encouraged to deny their existence through overemphasis on the myopic egotism of human beings. When ugliness of human being is emphasized too much, it may be difficult for children to have their dream. Human being cannot alive without other life. We depend on plants, other animals, microorganisms and resource materials. We should learn these things and sense wonders in the nature close to us.

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