ENVIRONMENTAL EDUCATION FOR SCHOOLCHILDREN IN A SEAWATER POND FOR CREATING A SATOUMI

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In 2006, Hyogo prefecture opened the “Arai hamakaze” park on reclaimed land leased with cooperation from some companies, and set up a seawater pond called “Konourafuna Ike” in the park. The initial plan was to make this seawater pond into a Satoumi, but since the water in the pond was stagnant, algae flourished making it uninhabitable for other living creatures. The authors conducted investigative research to implement activities for improving the environment and popularizing the park. This report is a summary of the results obtained and challenges faced while conducting these activities in the area over one year, which included involving the local schoolchildren in constructing tidal flats.

The answers to the questionnaire revealed that schoolchildren understood that the nutrients in the seawater pond “go round and round” through the food chain and are utilized by living creatures. They realized that this process is called “circulation.” To the question, “Do you want to develop tidal flats?” 9 of the 10 children answered YES. However, only 50% of the children understood that a measure to prevent the degradation of the environment of the seawater pond is to “Construct tidal flats,” which suggested that there is a need to correlate the issues and the solutions to enhance their understanding.

Key words: seawater pond, park, tidal flats, circulation, schoolchildren

I. BACKGROUND AND OBJECTIVES

Previously, in Takasago city, there was a “beautiful stretch of sandy beach lined with pine trees” facing the Seto Inland Sea. However, during the reclamation period in the wake of rapid economic growth, most beaches became sites for constructing factories. Citizens protested through the “coastal access rights movement” initiative, to ensure that people could take a stroll on the beach, go swimming, or simply relish the scenery [1]. In 2006, Hyogo prefecture opened the “Araihamakaze” Park on reclaimed land leased with cooperation from some companies, and set up a seawater pond called “Konourafuna Ike” in the park. The purpose of creating “Araihamakaze” Park was to secure access to the seashore and create a place to come in contact with the sea. This is Japan’s second nationwide “Public access project”. The parks’ “Konourafuna Ike” seawater pond is connected to the open sea. The initial plan was to make this seawater pond into a Satoumi, but since the water in the pond was stagnant, algae flourished making it uninhabitable for other living creatures. Consequently, the environment around the pond soon started to degrade. In this way,
seaside parks have been under development in various places for outdoor recreation in recent years, but there are many places where environmental problems have cropped up. The authors conducted investigative research to implement activities for improving the environment and popularizing the park. This report is a summary of the results obtained and challenges faced while conducting these activities in the area over one year, which included involving the local schoolchildren in constructing tidal flats. This was a unique education concept in Japan.

II. AN OVERVIEW OF “KONOURAFUNA IKE” SEAWATER POND

An overview of “Konourafuna Ike” is shown in Fig. 3. The pond is a stone-clad cement structure and is made up of two ponds: the 47 m² pond C and of the 272 m² pond D, both of which are connected by a waterway. The water inflow and outflow consists of fresh water flowing in from waterway A at a rate of 3.06 m³/h and seawater from pump B flowing in through waterway A at a rate of 7.46 m³/h to pond C. Moreover, 1.33 m³/h of ground water from the pump F passes and flows into pond D. The duration for which seawater remains in the pond is approximately 8 hours; obtained by dividing the volume of the pond by these inflow amounts. Also, seawater starts to flow
into the pond when the tide level is above 1.45 m because the inflow-outflow opening E, which is at a height of DL+1.45 m, is connected to the open sea. The inflow-outflow opening E is located at a height of 15 cm from the bottom of the pond when the relationship with the bottom of the pond is considered. In other words, 15 cm of water is present at all times in the pond, and the pond does not dry up. Water temperature in such seawater ponds increases in the summer when the water is shallow, causing the death of crabs and small fishes. Moreover, there is a possibility of “self-polluting action” caused by the deposit of organic substances in the pond because biomass feeding on attached algae is less[4][5].

![Diagram of Seawater Pond]

**Fig. 3. An overview of Seawater pond.**

III. THE DETAILS OF THE ENVIRONMENTAL EDUCATION PROVIDED TO SCHOOLCHILDREN

A two-hour educational session was held once every month for schoolchildren from grades 1 to 4, either on the school premises or at the “Konourafuna Ike” or the estuary. A friendly character (Midori-chan) was created to represent the algae, which forms the basis of the matter cycle. The authors developed educational materials, such as cycle puzzles and picture stories, to aid classroom learning. The children learnt from these educational materials about the ecosystem of tidal flats, matter cycles, and the causes of environmental degradation. These sessions were followed by observational classes to study these organisms in the tidal flats. In addition, schoolchildren performed activities such as collecting the algae from the pond and using it as raw material to prepare compost, constructing tidal flats of paddy fields, and cutting the reeds and using them to make handicrafts. The learning assessment of these tasks was based on a questionnaire given to the children, instructors, and parents after the activities were over. Furthermore, the authors also evaluated the effectiveness of improving the environment by constructing tidal flats.
IV. RESULTS AND DISCUSSION

(1) Strong impression on the children and continued motivation

The answers to the questionnaire revealed that schoolchildren understood that the nutrients in the seawater pond “go round and round” through the food chain and are utilized by living creatures. They realized that this process is called “circulation.” For example, they understood that crabs make sand balls and dance, reed's seeds are small, crabs eat Midori-chan (the algae character), and crops grow using seaweed compost. The circulation process fascinated them and made a deep impression on them. The children expressed a desire to participate in more such activities in the future. To the question, “Do you want to develop tidal flats?” 9 of the 10 children answered YES. Further, many children answered, “I want to work with my friends,” and “I will discuss the activities with my parents and siblings.” They seemed to be building relationships with others using the knowledge from the studies.

(2) Degree of understanding of the learning content

The authors prepared 10 questions on the seawater pond environment to measure the degree of environmental education the children had gained over one year. It was found that approximately 70% of the children had understood that “A large amount of algae flourishes,” “Sludge is
deposited,” “The temperature of the seawater in the seawater pond is high,” and that “Few organisms live in the pond,” realizing that these are the characteristics of a seawater pond and the reasons for its environmental degradation. However, only 50% of the children understood that a measure to prevent the degradation of the environment of the seawater pond is to “Construct tidal flats,” which suggested that there is a need to correlate the issues and the solutions to enhance their understanding.

Step 1
- 72%
- Q: What is the feature of seawater pond?
- A: algae flourished, sludge

Step 2
- 68%
- Q: What is the cause of environmental degradation?
- A: high seawater temperature, few organisms

Step 3
- 54%
- Q: What is the way to improve the environment of the pond?
- A: Construct tidal flats

Fig. 6. Degree of understanding of the learning content

(3) Opinion of the parents (15 children)
The parents noted a change in the conversation and behavior of their children. They were all in favor of environmental education for their children. They began to show an interest and willingness to participate in learning more about this form of environmental education.

Fig. 7. Questionnaire of parents
V. ACKNOWLEDGMENT

I thank to: Shizuo Yoshimasa, NPO kids space, Nakashuzi after-school childcare, Arai after-school childcare, Sadao Nakaoka, Kakogawa civil engineering office of Hyogo and Takasago City for their friendly cooperation.

VI. REFERENCES


