Proposal on learning program with observation supported by simulation contents

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1 Introduction

The main purpose of this research is to propose an educational program which will utilize the simulation contents focused on the workshop program in a public aquarium.

Many of the Japanese aquariums prepared workshop programs in the intense of observing living aquatic animals. In order to settle such kind of observation as an experience, it is necessary to focus on the process through the program that enables to study and learn it repeatedly with the experimental trial and error.

So, I planned to propose an educational program focused on utilizing the 3-D simulation contents that would be effective to study and learn repeatedly the target in the mode of experimental try and error.

The advantage to focus on the simulation contents in the process of workshop programs is that it can provide the observing points of view which cannot be provided in the observation of actual aquatic animals in a limited time and location.

As for the background of my proposal, there are investigations on existing workshop programs in order to analyze our simulation contents we have already developed, so that I can investigate the points of view that may particular to the simulation contents. This investigation showed us also as a result that it is important to reinforce the ways of representing and expressing information and to equip the operating rules that are suitable for our reconfirmed programs.

I propose an educational program which is effective to the observing study, which would activate the potency of the simulation contents in a performance of the workshop programs.

2 Classification of the educational program in the aquariums

Many aquariums are preparing various kinds of educational program and most of them aim to guide the visitors to observe the actual living aquatic animals in the exhibiting water tank. They are providing information such as points of view to watch the living aquatic animals in order to arouse curiosity towards them and to lead to settle the knowledge resulted from the observation. Recently, there is an inclination to prepare the programs to make students experience the trial and error, because it is thought to be effective for the observation. Some of the programs aim to represent the knowledge from the observation not only to study the ways for observation.

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Here under are the two main features of the existing workshop programs;

(1) Programs that aim to root knowledge with the observation
(2) Programs that aim to represent knowledge attainments by the observation

Chief examples of former group are the guide programs for touring in aquarium, explanations by fish fanciers in front of the water tank and the programs with work sheets indicating notable points for observation. In these types of programs fish fanciers mainly explain the characteristics of fish habits by showing the feeding scene or swimming fish forms in a tour. Recently, there is a tendency that aquariums hold tours to observe the night ecologies of aquatic animals or hold programs to experience the ecological environment outside the aquariums. As for the example of program using work sheets, the programs for children are most popular that uses questionnaires with graphical illustrations to help to find out the answers in water tanks. It is expected for children to be aware of forms, pattern or nature difference between each fish by themselves during close observation to find out answers. Thus we see that the programs divided into first group put an emphasis on the result of the observation to make the children have observing points of view and learn the knowhow for observation.

The workshops are typical examples of programs divided into second group that aim to enhance to express the result of the observation in various media or techniques. In most case of these types of workshop, there are not prepared only one correct answer in the final step, because the most important aim of such workshops is on the process to make children discover, ponder and express something all by themselves. Generally, curators would guide the process to achieve the goal set along with the levels of intended children. Curators could freely compose the process for intended children by setting various exercises and challenges in order to make them express something based on the knowledge through the observation. Let's presuppose that children are observing a shape of a fish mouth while listening the fish fancier's explanation about fish feeding. If the children are second grade pupils, in the scope of Japanese program, curator could set the challenge to organize an illustrated diary with their remarks and drawings. If the target is fifth grade pupils, curators could set the challenge at higher stage like getting them write a free composition to have a presentation. It is possible for sixth grade pupils to have presentation on the illustrated book or guide book by their own arrangement of illustration and documents resulted from their observation. In these cases, the final hand outs are not so much important, instead, the processes that the child managed to grasp the ways of representation would be praised. With the variation of the aims, there are many possibilities in representing techniques such as writings, graphics, photographs, illustrations, models and so on.

3 Utilize the simulation contents within the existing educational programs

From those surveys on the educational programs executed in the aquariums as mentioned above, however, it turned out that both types of programs have problems to be improved.

As for the programs in first group that aim to root the learned knowledge by observation, it is possible to indicate the points of view that the children should observe, but it can not lead them to the step for expressing something based on the observation, thus it becomes difficult to evaluate how the pupils understand the results or how the learning result rooted in pupil's mind.

As for the second group that aims to express the rooted knowledge in using different media or technique, the problem is that the final hand outs do not give the evidence to teachers or curators that the prepared challenges and processes are really appropriate for the intended pupils to achieve the goal. Teachers or curator can not have confidence without any verification that the knowledge resulted from observation in workshop rooted in the pupil's mind as learned matter.

Here, I assume that the 3D simulated underwater contents should be effective if it is involved in a educational workshop program. Simulation contents can provide the same situation repeatedly for the pupils as they have experienced in an actual aquarium space. It is also make it possible to trace the observation experience to reconfirm the knowledge from the workshop. Such action reminds workshop processes and cultivates the pupil's memory to reassure the knowledge. The utilization of 3D simulation contents with limited time and requirement would helpful to identify how much of processes has been learned by pupils through the workshop as well as to evaluate the prepared processes. It would be reasonable to say that the realization of the environments that enables intended pupils to have the repeated observation experience with try and error make it possible to ensure the understanding by observation.

4 Features of the simulation contents

Following four items are the characteristic points of view of simulation contents;

(1) Passage of the time
(2) Timing
(3) Structure
(4) Ecological Factor

The first item of the "Passage of the time" means the observational points of view that can show the growth of fish, for example. Controlling the time in the contents can show the aspects that the living animals cannot show in the limited time span.

The second point of "Timing" means the timing of observation such as season and conditions of the aquatic animals. For example, in the actual water tank, it is often happen that the target fish hides behinds the rock. If the target fish changes the body marks or patterns seasonably, visitors cannot always see that characteristics of the fish. Controlling the timing of observation gives another point of view related to the first point.

"Structure" means the point for observing inside of the individual animal that usually we cannot see such as functions of skeleton or internal organ. Providing the simulated motion of living skeleton or internal organ gives different points of view that the photographs provide.

"Ecological Factor" of the forth point means the points to observe the difference of individual aquatic animals caused by the inhabiting ecological environment. For example, the fish belong to the same species often show different pattern depends on the inhabiting ecologies. In the simulated contents, it is possible to observe those differences in comparison with the living individuals.

These ways of showing points of observation, with controlling the simulated conditions or parameters for representing the sample, are characteristics of simulation contents. It can provides various points of view that the actual water tank cannot.

5 Educational program to be referred

The educational programs I took up this time are provided in "Aquamarine FUKUSHIMA," the aquarium located in FUKUSHIMA Prefecture, northeast from Tokyo. The programs have prepared for cooperation between the schools in the area and the aquarium as a public facility for lifelong learning. Sixteen programs for elementary school children and fourteen for junior high school students are including various subjects including Japanese, English, sociology, science, music and so on, so that the school teacher can make them use. The program that I took up is the one prepared for the elementary school children in the class of "General nature experience." It treats the color, size and shapes of the fish as a main term and finally to lead the pupils' interests toward environments that the aquatic animals inhabiting.

Here under is the composition of the program;

(1) Know the variations of color, shape and size of fish (introduction); 1 hour
(2) Observation of the fish; 3 hours
(3) Illustrate the fish as they remember; 1 hour
(4) Have a presentation on the character of the fish; 1 hour

This program is planned to spend six hours. An hour introduction is spent to arouse the curiosities and interests to the fish. As a next step three hours will be spent to observe the fish. Along with the observation of the fish, participants are expected to watch the video or/and to ask questions to the staff during this step. Last two hours are prepared for participants to illustrate the fish or animals in mind and explain the characteristics of them to others. This program requires curator or teacher who will instruct participants because it is planned not for individuals but for group study.

6 Analysis of three existing contents

Along with the points of view of the educational program provided in "Aquamarine FUKUSHIMA" mentioned above, I analyzed three contents our project has developed. The subjects of those three contents are as follows;

(A)"aqua place" is a content that was accepted SIGGRAPH 2003 Web Expo. It is a content for studying fish information in the simulated underwater space realized on internet.
(B)"aquanaut" is a content exhibited in a HACHIO-JI science museum for children that simulate the four different oceans

and sea for studying fish information.

(C)"aqua surf" is a content exhibiting in ENOSHIMA aquarium that simulates an actual water tank for exhibition.

The contents (A), "aqua place," provides the view for rotation, close-up or telescopic view against the target fish that is impossible to observe in the actual water tank. It can provide the detail observation as well as the points of observation on colors and shapes of the fish with 3D models. It also prepares the general information in text that would be required for elementary school children. However, it illustrates the target fish model in the new window when user wants to observe the target closely, so it is not suitable to realize the size of the individual target.
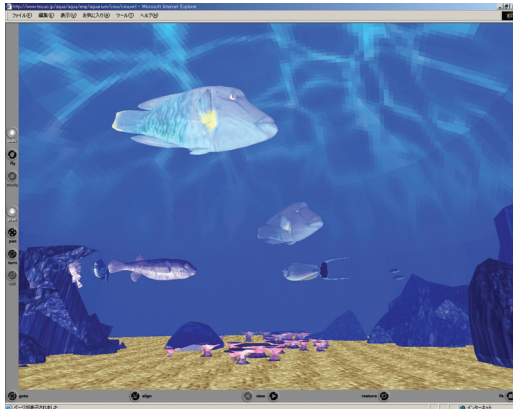

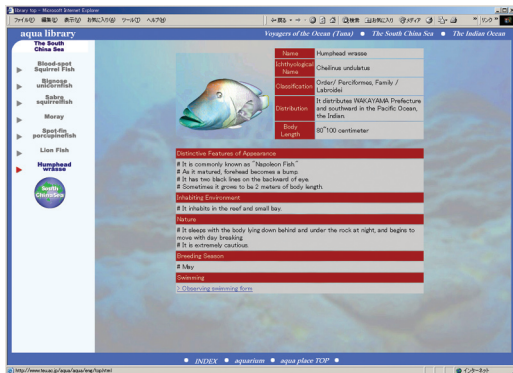Figure 1 : Simulated underwater world of "aqua place"

Figure 2 : Information serching window of "aqua place"

As for the second contents, "aquanaut," it indicates the simulated fish as icons on the bottom of the window, so that the users can easily catch the target fish without searching the simulated underwater space. It prepared the function to trace swimming fish, so that users can observe the motion, shape and the color of the fish in the conditions of swimming underwater. Text information of the target will indicate in the same window to confirm the information in comparison with the swimming fish. However, it shows the target fish from the same direction and not suitable for detail observation because the angle and range of the tracing camera is fixed.

Figure 3 : Simulated underwater world of "aquanaut"

Figure 4 : Information serching window of "aquanaut"

The third one, "aqua surf," also prepared the function for observe the target fish in the new window.

This content provides the comparative observation with the living fish, for it was installed beside of the exhibiting water tank in aquarium. It simulates the whole exhibiting water tank so users can search the target fish from the inhabiting location, size of the fish and from the name. It is not only for the searching but effective to gives the motivation to observe the actual water tank more closely.

However, this has not supplement the functions for close-up or telescopic view so it is not suitable for observing detail of the fish.

Figure 5 : Simulated underwater world of "aqua surf"

Figure 6 : Information serching window of "aqua surf"

7 Result of the analysis

As a brief result, from the study of educational workshop programs and three simulation contents, it can be said that simulation contents could be effective supplements for the workshop programs that would be held in a limited time and place. However in the detail, the three simulation contents I took up this time were not enough to fulfill the four characteristic points of simulation contents as I mentioned before. The techniques and functions for close observation toward the target were equipped, but they haven not realized yet to show the users what they can observe with those functions.

It can be concluded that it is important for realizing the characteristics of simulation contents to investigate the ways for representing the result of the observation by the operation of close-up, telescopic view and the rotation, in the forms of making the result compare. At the same time, it is also important to investigate the ways to combine the result of the operation such as passage of the time and/or timing with the observational points of view.

As I resulted, simulation contents are helpful for reconfirming the learned knowledge by watching repeatedly the same situation as an actual experience. However, not only for retracing the memory but also for having additional view points that the actual situation impossible to provide for the observation, simulation contents enhance the unique observing points of view. This analysis shows another possibility to set the various learning program by combining the observation of actual fish habits with that of simulated fish ecologies.

Thereupon, as a next step, I examined educational workshop programs that might utilize the simulation contents not only as review tools of experimental observation but as supplemental searching tools.

8 Proposal on educational program suitable to observation

The effective educational program that would utilize the simulation contents is not the one that will complete the observing study within that program, but the one that make the participants compare the simulation content and actual water tank both together.

It is necessary to plan the program that it make participants confirm their questions repeatedly that arouse from both of the actual observation and operation of the simulation contents. By designing such program, experimental trial and error would be rooted in the participants' mind.

Now think over the program for instance under the theme of "patterns of the fish." In this program, it is expected to draw the interests in the patterns itself as well as to elevate the interests to the wants to know the nature and the character of the fish, or to know other patterns and meaning of them.

As for the patterns of fish, there are so many variations such as vertical stripes horizontal stripes or spotted, moreover there are ones that have patterns of combination. Observation on the pattern is very simple challenge, but still it can give many discoveries. For examples, from when the fish has the pattern or what kind of the changes would happen or not, simulating the individual fish show the answers to these questions. Then the answers lead the interests to confirm that the answers really correspond to the living fish in the water tank.

In the case of workshop, teachers or curators could set the further challenge such as collecting and illustrating the fish that have vertical stripe, collecting the variations of the fish pattern as many as possible or grouping and analyzing the collected fish pattern.

As for another example, think over the program under the theme of "teeth of the fish." In this case, participants made to observe the shape and form of the fish mouth in the actual fish tank. Then they are expected to study inhabiting customs or kinds of the foods. After those observations, operating the simulation content, participants could search more in detail such as the skeleton or the close-up mouth details. Repeating these trials, they could reach the answers that would not gain only by observing the actual water tank. Such answers are given by the combination of observations both to real and simulated fish.

By setting the challenges that could not answer only with the actual observation in the educational program, it become possible to prepare more complicated educational programs.

9 Conclusions

It can be concluded that the combination of the real observation and operational study with the simulation contents enables the observation to be the study or learning something with experimental trial and error. Preparing the points of view that is difficult to observe in the actual experience in the simulation contents would be helpful for planning the educational programs that will not evaluate the result of children's work by the memorized knowledge only.

Aquariums are the public space and of course general people visit there. Designing the programs depends on the participants, such as the programs for family and/or for university students, there could be the possibilities to have a new relationship for communication.

Considering the result of these investigations, I will continue the investigation on the educational workshop programs that utilize the simulation contents, by executing some programs in an aquarium.

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