Chen, W. et al. (Eds.) (2017). Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

Educational Effectiveness of a System for Scientific Observation of Animals in a Zoo

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Abstract: Tanaka et al. (2017) developed a system using animation to help children observe the anatomy and behaviors of animals in zoos. A zoo is an informal learning place providing children a chance to observe animals scientifically and systematically. However, most zoos fail to support the observation of animals, and hence there is a need for more research on supporting observation in zoos. Animation is a useful tool to support observation of animal behaviors. The system developed by Tanaka et al. (2017) supported children in noticing not only the outward features and behaviors of animals but also their anatomies and movements. A workshop was held at Kobe Municipal Oji Zoo in Japan, in which children used the system to observe how penguins swim and walk and to note the features of the bones in their legs and flippers. The participants were 19 children, average age 8.1 years (*SD* = 0.6). In this paper, we examined the percentages of children's scientific answers to questions incorporated in the prediction, observation, and subsequent interview one month after the workshop. There were four questions on swimming, walking, leg bones, and flipper bones. Each question had three choices. The percentage of scientific answers during prediction, observation, and interview was different for each item. This system was effective for some items, but not for all. In future work, we need to improve the contents and the animations of this system.

Keywords: Zoo, scientific observation, animation

1. Introduction

One of the places of informal science learning is the zoo, where children can observe animals in their natural habitat and become interested in nature (National Research Council, 2009; Falk, 2014). Eberbach and Crowley (2009) point out that observation requires the ability to organize phenomena into scientifically meaningful patterns, and as a preliminary step toward learning scientific observation, children should be able to connect features of animals to their function and behavior. Patrick and Tunnicliffe (2013) said that zoos should help children observe the real-life correlates of simple morphological and taxonomic terms. They also note that taxonomic judgments about organisms cannot be made without understanding their anatomy and behavior. However, children lack knowledge of such matters and need support to notice those (Prokop et al., 2007). In addition, zoos are generally considered a place for leisure; so, most visitors come only to look at the animals and be entertained by them (Clayton et al., 2009). Some of the educational programs in zoos may not impart much knowledge about animals' habits, and therefore research is needed to develop programs that support learning about animals (Patrick & Tunnicliffe, 2013) to make zoos an effective place for science learning.

Tanaka et al. (2017) developed a system using animation to help children observe the distinctive anatomical features and behaviors of penguins. Technology-based education in a zoo has a greater impact than static signage and attracts the attention of young people more easily (Webber et al., 2016). Animation helps children visualize and motivates them to learn the movement of an animal (Betrancourt & Chassot, 2008; Patrick & Tunnicliffe, 2013; Shreesha & Tyagi, 2016; Tanaka et al., 2016), its outward features, as well as its internal structure.

The aim of this paper, therefore, is to examine the effectiveness of this system, by making children observe and learn about penguins and their skeletons. Finally, a comparison is made of the percentage of scientific answers to questions asked at prediction, observation, and interview phases.

2. Methodology

2.1 System Overview and Workshop

Tanaka et al. (2017) made up four multiple-choice questions on the anatomy and behavior of penguins, respectively covering swimming, walking, leg bones, and flipper bones (Figure 1). Each question has three answer options, which were emphasized for children to gain a better understanding.

To ascertain the effectiveness of the system, Tanaka et al. (2017) held a workshop using the system at Kobe Municipal Oji Zoo, in Japan, on December 1, 2016. The participants were 19 children, average age 8.1 years (*SD* = 0.6). One tablet running the system was provided to each child.

First, children were asked a question about penguins' anatomy or behavior. Children watched the animations for each choice and chose one prediction. Following this, they observed the actual penguins or the skeleton of a penguin; they also watched an animation during the observation phase. They then selected the answers from among the choices once again based on the observation. Last, the staff members explained the feature or behavior with scientific details.

Figure 1. The page about flipper bones of the system, by Tanaka et al. (2017).

2.2 Evaluation

For evaluation, the percentage of scientific answers children provided during prediction and observation was analyzed. A month after the workshop, the children were interviewed. They selected a scientific choice relating to the anatomy or behavior of penguins and explained it.

3. Results

Table 1 shows the percentage of scientific answers to each question. On swimming, the percentage of scientific answers in the observation phase (100%) was higher than that during prediction phase (63%); the interview rate was 47%. On walking, the prediction rate was 95%, observation was 100%, and interview was 95%. On the leg bones, observation (95%) and interview (82%) results were higher than the prediction phase results (16%). On flippers, observation phase results (32%) were lower than prediction phase results (53%), but the interview results (78%) were higher.

Table 1: The percentage of scientific answers.

Items of questions	Prediction	Observation	Interview
Swimming	63%	100%	47%
Walking	95%	100%	95%
Bones of legs	16%	95%	82%
Bones of flippers	53%	32%	78%

4. Discussion and Conclusion

This paper described the evaluation of a system using animation to support children's observations at a zoo, specifically, to observe penguins' anatomy and behaviors. The effectiveness of this system was different for each item observed. On swimming, children related to swimming using legs and about half of them gave a non-scientific answer at prediction and interview phases. By using this system, children could temporarily change their thinking. It implies they have a misconception that penguins swim using legs. In order to change this misconception, there is a need to improve the system, for example, by asking them to compare the motions during swimming by the penguin to the flight of birds. On walking, the prediction rates and interview rates were high implying this knowledge was not because of the system. Regarding the bones of the legs, the rates at observation and interview were higher than at prediction, proving the effectiveness of the system. Regarding the bones of flippers, the rate at observation was lower than that at prediction. This is because the options were emphasized and therefore, children found a difference between what was emphasized and what was real. It created confusion in the minds of the children. However, one month later, children gained knowledge about bones on the flippers, and hence the system was considerably effective. In future work, we need to improve the contents and animations of this system for each item.

Acknowledgments

This research was supported by JSPS KAKENHI Grant Number 16H01814. We are grateful to Kobe Municipal Oji Zoo, which made this study possible.

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