Chapter 15

Identification and Analysis of Primary School Children’s Knowledge Acquisition: Using Knowledge Visualization Scenarios and Information Visualization Methodology

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ABSTRACT

Measuring a learning effect can be a difficult task and is not made any easier with all the parameters that can be taken into account. This chapter provides an insight into what to consider as interesting parameters when evaluating an interactive learning tool. The authors introduce a visual approach to enlighten children and teachers. This is done by visualizing logging data that has been collected during learning sessions with the Virtual Savannah software. They do not leave out traditional means like observation and usability testing, since they believe a holistic view is important, and a single method of data collection is not enough to base conclusions on. To understand the authors’ approach, a short introduction on various perspectives on visualization is essential. The authors also discuss how multimedia can be used on a cognitive level to satisfy more pupils with different learning styles. Lastly, the authors present their approach and results from an in situ evaluation on primary school children.

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INTRODUCTION

A zoo presents its visitors with living animals such as roaring lions, majestic giraffes and playful elephants. This constitutes a rich multimodal experience for the visitor enhancing his knowledge about the animals by observing them walk or feed. Still, he gets only a somewhat distorted perspective on what it means to be a lion because of the following features of the zoo experience:

- **Confined space:** The space restrictions on the animals’ habitats in the zoo inhibit the visitor to experience relevant spatial behavior of the animals, e.g. migration patterns across the Savannah due to climatic conditions.
- **Small number of animals:** Most animals live in larger social environments, e.g. zebras are rarely found individually but wander the Savannah in large herds. In a zoo this social environment is often much smaller inhibiting the visitor from experiencing social behavior between the animals.
- **Different routines:** A large part of an animal’s life in the wild is dedicated to finding food. This essential routine that has relevant percussions on the animal’s behavior is alleviated in the zoo environment, where food is served according to the dietary requirements of the inhabitants. Again, this inhibits the visitor from experiencing essential behavior of the animals.
- **Different environment:** Animals in the zoo live in designed environments that may easily lack features that are found in the animal’s original habitat, e.g. selection of plants does not mirror the wild conditions. Thus, the visitor experience lacks the relation between the animal and its environment and has e.g. to acquire the knowledge that elephants prefer Acacia trees through additional information channels.

The Zoo embraces this challenge by providing the casual visitor with factual information, often in the form of text plates adjacent to the animal habitats. Additionally, they run educational programs often tailored to school children, where they are presented with factual knowledge in lessons before they visit the animals.

In the first part of this chapter, we examine how this factual knowledge can be conveyed in a more exploratory manner. As a means to this end we developed an interactive system for knowledge visualization allowing for instance expressing the speed of a cheetah’s kill, explaining the hunting patterns of lions and transferring knowledge on animal migration. Our research project collaborates with a zoo with more than 400,000 average visitors per year and approximately 10,000 school children partake in learning programs partly situated in respective public schools and partly in the zoo’s educational facilities.

The second part of the chapter focuses on a different type of visualization, i.e. information visualization. To gain insight into how the children use and navigate the virtual environment developed for them; their interactions with the system have been logged. This information is extremely valuable in deciding if the children discovered the knowledge implemented in the system and which kind of media they prefer to acquire this knowledge. Information visualization needs different methods and tools, and in the second part of the chapter we are going to explore the value of some of them.

Listed below are key points investigated in this chapter:

- An investigation of methods on how to gain insights into children’s usage of an interactive learning system.
- How the integration of knowledge and information visualization on the one hand strengthens the applicability and evaluation of the system and on the other hand impact the approaches incorporated in the proposed learning environment.
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