Interactive and Enjoyable Interface in Museum

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ABSTRACT

Exhibitions at a scientific museum are usually difficult for ordinary school pupils. To improve the issues of current explanation systems, we use Personal Data Assistant (PDA) devices. Recent PDAs have enough functionality for people to interactively, individually, but it is not easy to assist that school pupils learn scientific knowledge merely using PDA .

This research examined the main focus of the design and implementation of visual interfaces for PDAs for such a learning system. We aims the visual interface for PDAs have more interactive and entertainment to engage for learning scientific knowledge. Experiments using two prototype systems(Pi-book and Pit A Pat)implemented in the Flash/MX software toolkit have suggested the effectiveness on the performance and functionality of the proposed method.

Categories and Subject Descriptors

[D5 INFORMATION INTERFACES AND PRESENTATION.3.3]: *User-centered design, Evaluation/methodology, Graphical user interfaces,*

General Terms

Design, Experimentation, Human Factors, Verification.

Keywords

PDA, RFID CoBIT, animation cintents, usabilty,Pi-Book,Pit A Pat

1. INTRODUCTION

So far, hand held devices such as Personal Data Assistants (PDAs) have been considered to be individual information management tools. However, they are also useful for collaborative learning of elementary school pupils. Science education in Japan in the last few years requires new curriculums to engage students by self experimenting and observing outside the classroom lectures[1]. This means that the roles of a science museum will be much more important [2][3][4]. However, exhibitions at most museums are unattractive and too difficult for them, thus, they fail to keep their motivation. Based upon this background, we are conducting a joint research project to develop a novel collaborative learning tool to be used at exhibitions for science education[5-7]. So far, we have developed Musex: a PDA-based collaborative learning system with question-answering interfaces[8] The experience has suggested that such collaborative learning systems are useful for their interactivity, however, the static and character-based information provided by Musex is not enough to deeply understand its meaning. This paper reports on a novel tool called Pi-book and Pit a Pat that improve the defects of Musex. Pi-book attempts to provide pupils with book-like devices for learning. To cope with the defects, Pi-book is equipped with three kinds of portable devices: PDAs (Personal Data Assistants), CoBITs (Compact Battery-less Information Terminals), and RFID (Radio Frequency Identification) as its user interface; Displayed animation images on the PDA change in a given situation; Pi-book also guides the users with phonetic information. Pit A Pat is aimed to make the user interact with the exhibition topic with an easier interface. We focus for only a lower age user target group by Pit A Pat.

2. SYSTEM ARCITECURE

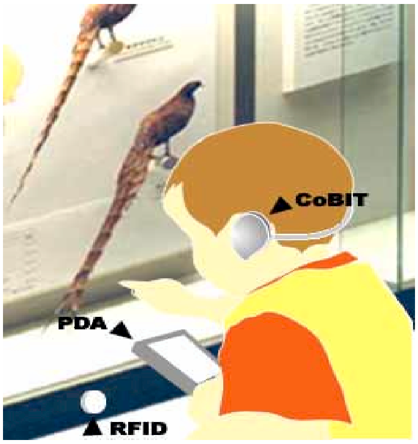

Fig 1. **System Architecture of Pi-book**

The architecture of Pi-book is shown in Fig 1.Pupils put on an earphone of CoBIT and have a PDA with RFID reader.

2.1 How Pi-book works at exhibition

Pi-book is a hand-held tool using PDAs, RFID tags, and CoBIT. The RFID tags are connected to the PDAs accordingly. Users or pupils will borrow the devices from the registration desk of a museum and explore the exhibition. Every PDA has Macromedia Flash Player installed as interactive software. Pupils interact with the animation via a standard web browser. Every exhibition place also has light sensors to transmit CoBIT information and RFID reader/writers to transmit RFID information [9][10].

Pupils wear CoBIT devices as shown in Fig. 2 and walk around the exhibition hall. When they approach the appropriate exhibitions, they can listen to the corresponding phonetic explanation through the CoBIT device. The explanation contains information about how to operate their PDAs.

CoBIT ¢Compact Battery-less Information Terminal £can communicate with the environmental system and with the user by only the energy supply from the environment[3][4]. It has a solar cell and receives modulated light from an environmental optical beam transmitter. The current from the solar cell is directly (or through a passive circuit) introduced into an earphone, which generates sound for the user. The current is also used to generate a vibration, a LED signal or an electrical stimulus on the skin. The sizes of CoBITs are about 2cm in diameter, 3cm in length, which means they can be hung on ears conveniently. The cost of it would be only about one dollar if mass produced. The CoBIT also has a sheet type corner reflector, which reflects the optical beam back in the direction of the light source. Therefore the environmental system can easily detect the terminal position and direction as well as some simple signal from the user by multiple cameras with infra-red LEDs. The system identifies the sign by the modulated patterns of the reflected light, which the user makes by occluding the reflector by the hand. The environmental system also recognizes other objects using other sensors and displays video information on a nearby monitor in order to establish location dependent support.

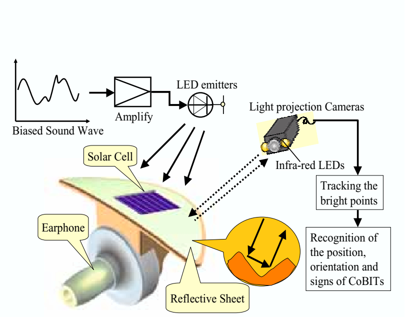

Fig. 2 Configuration of CoBIT System

2.2 Animations of PDA

Sample PDA screens are shown in Figure 3. The left-hand side of the figure displays what pupils see on their PDA when they approach, an RFID reader/writer near the corresponding exhibition topic. The display shows the mimesis of helium pulchrifolium. Pupils must select the two materials which they consider to have the closest relationship with one another. After the operation, the displayed image is changed to the right hand

side of Fig. 3.

Fig. 3 Animated Display of the Exhibited Materials (Left: The mimesis of hyllium pulchrifolium ; Right: The behavior of butterflies)

Attending these listen-select-read cycles at science museums, pupils are learning about the exhibition on contents in a very natural and simple manner. Phonetic information is a cue to generate interest in the content. RFID tags and reader/writers are used to anchor their interests to the exhibited materials. PDA animations attract the pupils' interest to study scientific matters.

3. Experiments and their results

3.1 The experiment

The application system contains eight topics (Fig.4). The curators of the science museum helped to construct the application system [11]. 162 participants worked with the system in the Tokyo science museum in March 2003(Fig.5). Many of the participants were families or children They experienced the operation of the system and answered questionnaires before and after the experience.

3.2 Analysis

Before using the system as an experiment, we asked users through questionnaires, whether they knew the eight exhibitions. Many users knew only two of the exhibitions (No4-protecting coloration and No9-pheromon).

From the questionnaires after the experiment, we found that many users were younger than 12 years old.(Fig.6) Most users enjoyed the Pi-book system (Fig. 7). Many users found the system easy to operate (Fig. 8).

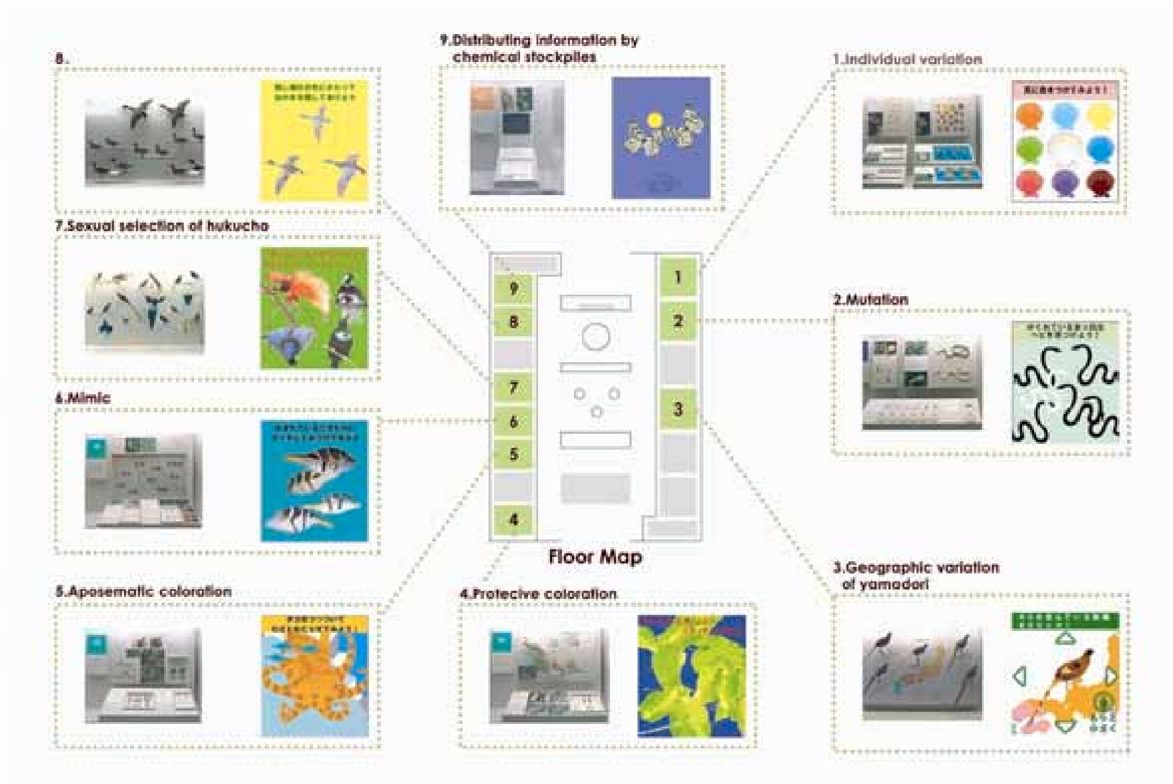

Fig. 4The eight kinds of contents on the floor

Fig. 5 Participant operating the system

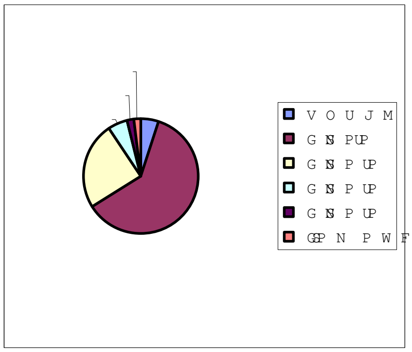

Fig. 6 the age of participants

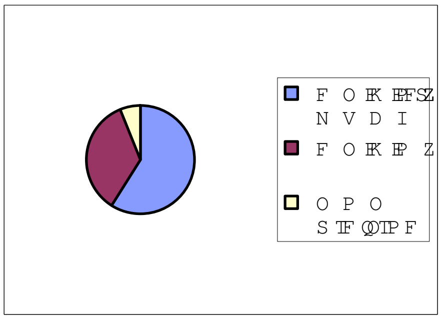

Fig. 7The questionnaires after the experiment [Did you enjoy the system?]

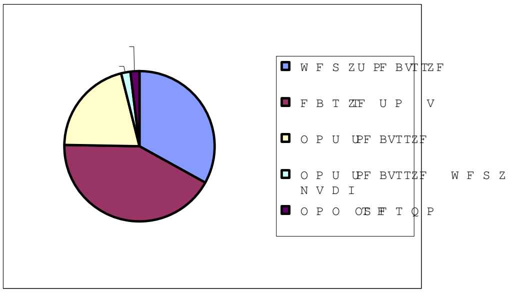

Fig. 8 The questionnaires after the experiment

[How easy was it to use the system?]

Here is a Fig.9 showing the user's understanding of the contents of the exhibition.

From this figure, it is clear that users can understand each exhibition using the system.Exhibitions-2,and 9 were an exception because they knew before.

We got an impression of the user's behavior from a video analysis of experiments.

Here is a table of an analysis of conversations. ¢Fig.10 £ We distinguished the conversations of users from their PDA operation and their understanding of exhibition topics . Fig. 10 provides this according to age brackets. Black part is conversation of operation about systems and white part is about content of animation. From fig.9, boys have conversations about each contents. boys of elders have many conversation of contents without 2 and 9 contents of the exhibition. By contrast girls have few conversations.

Girls have more conversations of contents than conversation of operation about system.

From the analysis of video data we show that the system interface was useful by engaging motivation, but for younger users this system is too difficult to operate.

Because it is a cumbersome procedure putting the RFID-reader to the IC-tag and secondly operating the PDA interface. So next we decided to construct a system called Pit A Pat that aims to make the user interact with the exhibition topic via their PDA with an easier interface.

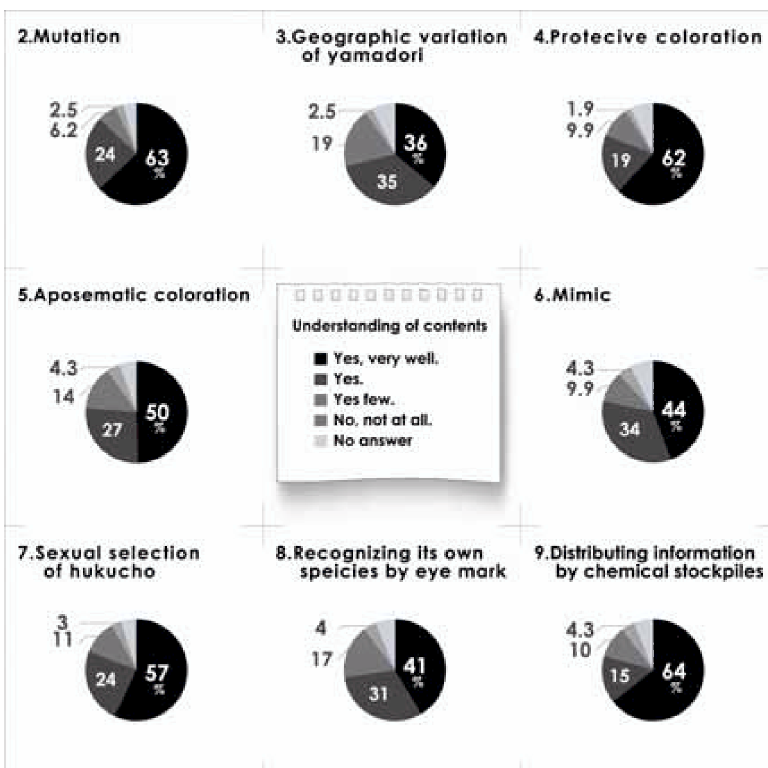

Fig. 9 The user's understanding of the contents of the exhibition.

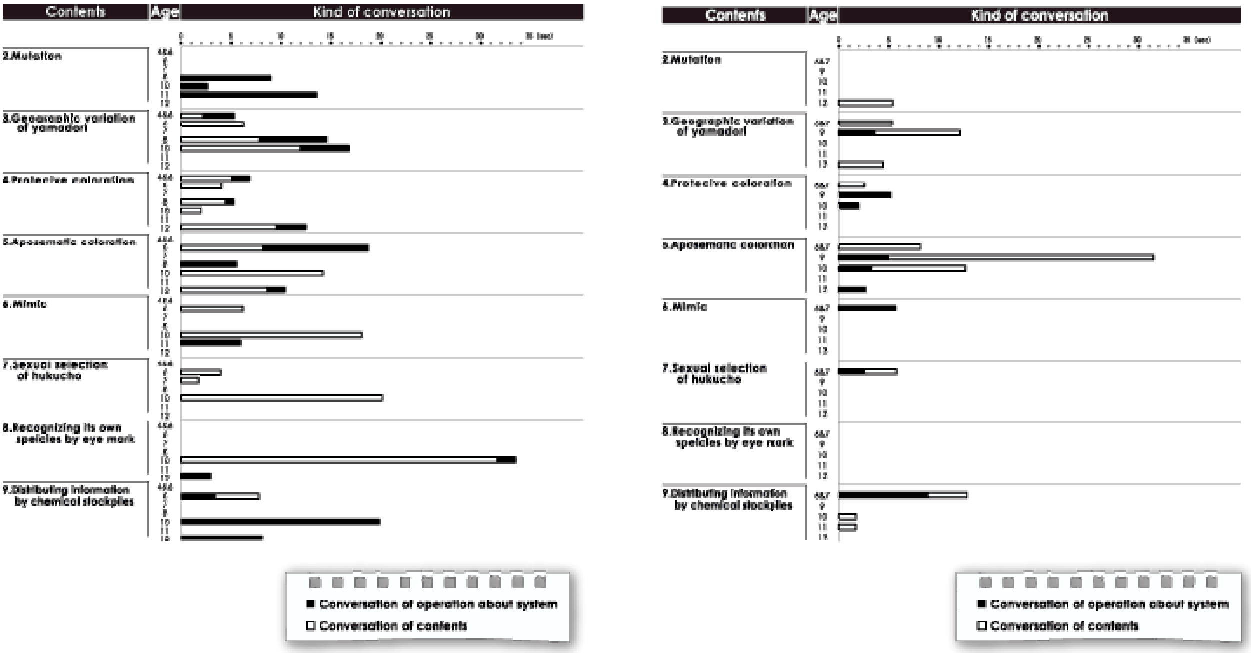

Fig. 10 The user's conversation of eight contents (left is boys and right is girls)

4. Pit A Pat

So next we decided to construct a system called Pit A Pat that aims to make the user interact with the exhibition topic via their PDA with an easier interface. We aimed for only a lower age user target group by using animation strongly linked to the exhibitions. . Pit a pat system contains four topics (Fig.12). The curators of the science museum helped to construct the application system.

We have experienced with Pit A Pat system. in the Tokyo science museum too. Users answered questionnaires before and after the experience.

4.1 Improve point

(1) Improvement of the system design

The following year we constructed an interface of animation contents with the analysis of Pi-book in our minds. From the analysis we found that it was difficult for younger pupils to use the RFID-tag solution. So we changed the design to use a PDA without an RFID-tag and CoBIT. Users or pupils will borrow the devices from the registration desk of a museum and explore the exhibition. Every PDA has Macromedia Flash Player installed as interactive software. All animations are set up beforehand in the PDA. Therefore, children can concentrate on the contents without operating the RFID-tag.

(2)Improvement of the animation design

This time, we incorporate edutainment in the story navigation. We made a user watch both the animation and contents, so each animation content is set to navigate an exhibition. As there are only four topics on the floor, a user can find the stop point and stay a long time at the same position.

4.2 The experiments and analysis

95 participants worked with the system in the National science museum in Tokyo in July 2004. They experienced the operation of the system and answered the questionnaires after using it. Many of the participants were families or children. Many users were younger than 12 years old. Figure13 shows the steps of the user interface. The user can stop at a point in front of each exhibition site. Most users enjoyed using the Pit a Pat system. The user looks at the animation on the PDA, and may select the topic of the exhibition he wants to know more about.

4.3 Interviews

We interviewed users after the experiment. The following answers were recorded:

- We were very excited with the system and enjoyed using it
- We enjoyed to go and return around 4 points with the system
- We gained new knowledge about the exhibition.

On the other hand, the following issues also arose:

- The answers were given too quickly
- We are too attracted to the animations and we do not pay enough attention to the exhibition.

Fig. 11 The steps of the user interface

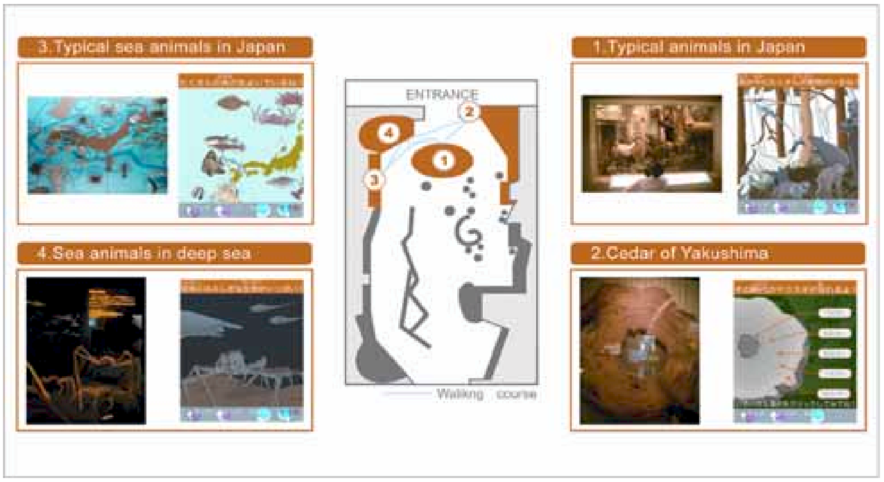

Fig. 12 The floor map with four topics

4.4 Analysis of video data

Figure 14 shows that the user look at both PDA contents and the exhibition or only look at the PDA. This confirms that the PDA contents are effective for higher and middle aged users. Although the PDA is meant to support the exhibitions, there is a tendency for lower aged users to get too excited about the animations. Actually Lower aged users have immersive experience about practical visualization like the topic of “typical animals in Japan”.

Interestingly the topic of animation “sea animals in sea” is an exceptional case and all ages tend to look at both PDA content and exhibition(Fig.13)It is difficult to look for the same sea animal that is moving in PDA in the exhibition, but many users say looking for sea animal in the exhibition is fun. This means it is very important to search for good animation stories. Many users come in predisposed to gather around in front of the topic of “sea animals in sea” and advice each other to look for sea animals in the exhibition. It is interesting that collaborative work occur among users unintentionally.

From video data, the system is more easy for users to operate than Pi-book and the animations in the PDA are effective to understand in each exhibition topic.

Fig. 13 The user in front of “sea animals in sea”

5. Conclusions and future work

In this paper, we report on a tool called Pi-book and Pit a Pat that have described the principles, architecture, and usage of a novel learning tool for science education at museum exhibitions. From the analysis we show that Pi-book interface was useful by engaging motivation, but for younger users this system is too difficult to operate. We focus for only a lower age user target group by Pit A Pat. Pit a Pat aims strongly linked to the exhibitions and with fun. As a results, the system is more easy for users to operate than Pi-book and the animations in the PDA are effective to understand in each exhibition topic.

Future work includes (1) carrying out more intensive experiments about how effective our system is for science education, and (2) extending our architecture to other domains for pupil education (3) Furthermore we will improve the system more easier for pupils to learn at museums exhibition.

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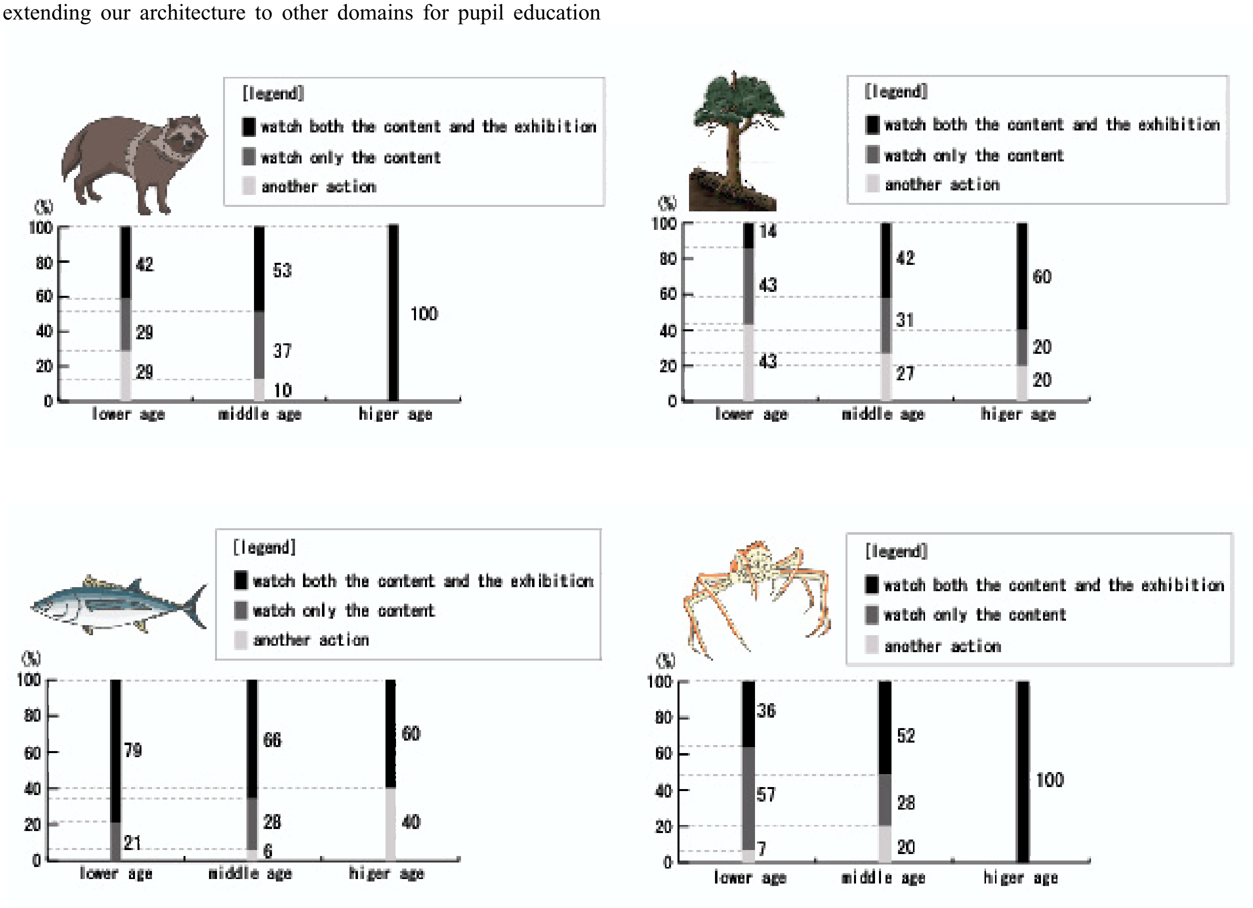

Fig. 14 The analysis of each content from video

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