Proposal of Educational Curriculum of Creating Hazard Map with Tablet-Type Device for Schoolchildren

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Abstract. In this paper, we propose a new educational curriculum of creating hazard map with tablet-type device for disaster prevention especially for schoolchildren and a application software as the educational tool. To create educational curriculum and application, we interviewed the elementary school teachers and found features schoolchildren. In addition, we experimented in order to evaluate the educational curriculum and the application, and reveal new features of schoolchildren. As a result, schoolchildren could learn about disaster prevention by an our educational curriculum. In addition, we revealed new two features of the schoolchildren. First, recognition of landmark is different from between schoolchildren and adults. In addition, schoolchildren frequently used landmarks that are familiar to them life such as related to the city and public facility. Second, schoolchildren can do operation of electronic map such as changing map scale and slide according to the purpose.

Keywords: Education for disaster prevention · Hazard map · Tablet-type device · Disaster and schoolchildren

1 Introduction

1.1 Current Situation of Education for Disaster Prevention

In Japan, large-scale seismic disasters occur frequently. In suffering from the disaster, it is important to ensure ourselves from the ricks, and to do so, the education for disaster prevention at elementary schools is considered significant. It is often said that creating the hazard map of the town they live in is one of the good ways to learn the disaster prevention for the schoolchildren. A hazard map is a map where the necessary information in the disaster are appeared, such as the place of the evacuation centers, what kinds of risks will happen at the place where now we are [1] (Fig. 1). Schoolchildren can know the necessary information of the town when a disaster occurs by creating a hazard map by themselves and can learn about the evacuation route and how to decrease the risks using it.

In Japan, we do not have a specific subject of "disaster prevention education" and the education has been done within the framework of the school curriculum guideline issued by the Ministry of Education. As the new subject of the "Period of Integrated Study" was

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established in 1998 and the education for disaster prevention is sometimes set as one of the themes in the "Period of Integrated Study" among a variety of fields such as financial education and law education and so on, the time to be able to assign for the education for the disaster prevention has been limited. Though The Central Council for Education is discussing to set the education for the disaster prevention as a new subject, the policy has not been completed yet at this moment.

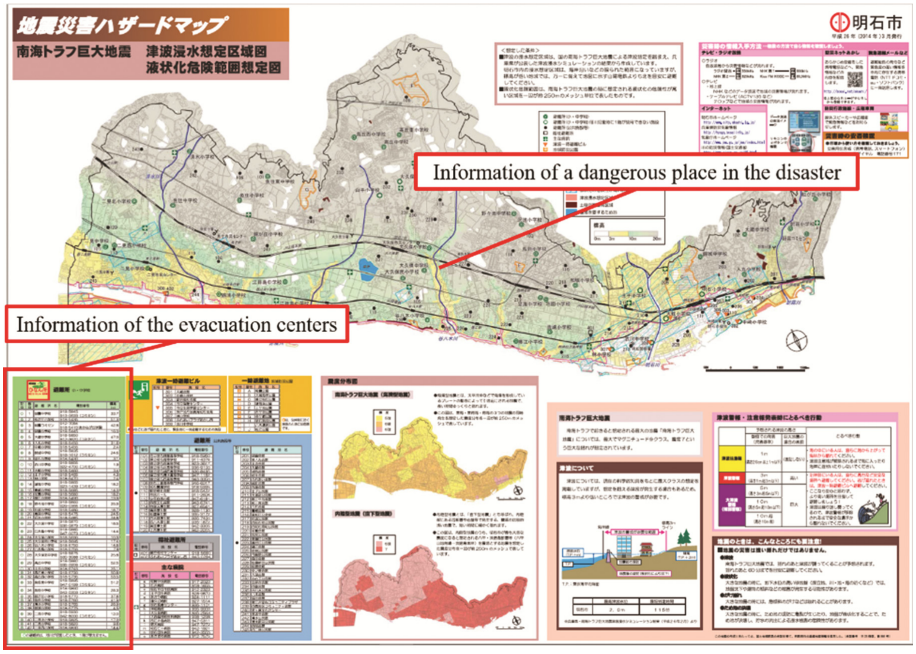

Fig. 1. The hazard map of seismic disaster in Akashi, Hyogo

1.2 Current Situation of Education Using ICT Device

The tablet-typed devices are widely been introduced to the educational field, and The Ministry of Education in Japan reported in "Survey results on actual situation of digitization of education" that the number of the tablet-type devices is 156,018 units in 2015 while 72,678 in 2014, and the use of tablet-type device in elementary school classes has been increased [3]. The advantages of applying ICT device in class are as follows:

- We can use the animations and sounds easily
- We can use various functions such as camera function
- It is easy to update and share the data.

However, the disparity are caused among schools because the capability of the teachers about the ICT and the financial condition of each school.

1.3 Effects by Utilizing ICT Device in Class

Previous researches showed effects of utilizing ICT devices in class. The report of The Ministry of Education in Japan showed that 98.0% of the teachers who carried out the classes utilizing ICT evaluated the effects of increasing interests of the students in learn by providing some fun. The survey on schoolchildren [4] also reported that the schoolchildren's activeness and motivation toward learning has increased by using ICT devices in class, and as the results, their scholastic abilities has been improved.

2 Related Work

Recently, some experimental studies using ICT device for regional disaster prevention have been conducted so far. Murakami, et al. [5] pointed out the issues that it takes much time and needs the great efforts to integrate the many local maps created in each local by paper into one, and showed the effects of the ICT devices of easiness in integration, sharing and updating in real time of map data. As these researches were done for the adults, especially for the elderly people, the effects the educational ways for the schoolchildren have not been known.

3 The Purpose of Study

In this paper, we propose a new educational curriculum of creating hazard map with tablet-type device for disaster prevention especially for schoolchildren and a application software as the educational tool. In addition, we carry out class as experiment in order to evaluate the educational curriculum and the application.

4 Educational Curriculum and Application as Educational Tool

Based on the interview with the elementary school teachers, we developed an educational curriculum and application.

4.1 Educational Curriculum

The classes proposed in this curriculum proceed in following order:

1. The schoolchildren learn how to use the tablet-type devices and our application,
2. The schoolchildren walk around the school for the fieldwork dividing several small groups,
3. The schoolchildren complete the hazard map and discuss about the dangerous place they found using the complete hazard map.

Class of Learning How to Use Tablet-Type Devices and the Application. The teachers stated that some schoolchildren inexperienced the operation of the tablet-type devices. Therefore, we teach schoolchildren how to use the tablet-type devices. It includes the basic operations of tablet-type device, such as how to turn on the tablet, and how to use our application.

The Fieldwork. In this class, the schoolchildren go outside of the school to find seemingly dangerous places in the disaster, and create the hazard map aiming to grasp how to prevent the risks of disaster.

Here, in Japan, public elementary schools are located close to schoolchildren's houses and they can go to school by walk every day. Therefore, the areas for the fieldworks were set about 20–30 min walking around elementary school.

In the fieldwork, the schoolchildren input the location information of objects on the electronic map. In addition, they input comment and type about the object, and take a picture of the object in order to keep memory.

The teachers stated that schoolchildren apt to become their sights narrow when they concentrate on one task. Therefore, if the elementary school student concentrates on the operation of the tablet-type device during the fieldworks, the risk of "walking while using the tablet-type device" increase. Therefore, we decided to instruct not to input information on the map outside but to do it in the classroom.

Class of Completing the Hazard Map and Consideration About the Dangerous Places in Their Town. In this class, schoolchildren complete the hazard map reviewing the fieldwork in each group. After that, each map is integrated into one map, and using it, they discuss with the other groups about where the dangerous places, why they are dangerous, and the useful items they found in their town when a disaster occurs.

4.2 Application as Educational Tool

We developed a creating hazard map application as the educational tool. We show the overview in section.

Basic Function. By turning on application, the map is appeared on screen of tablet. In addition, by operations that pinch in and pinch out, we can change map scale. In addition, by long tapping on map screen, we can put marker which represents the useful items or the dangerous place on the map (Fig. 2).

Fig. 2. Map screen and marker

After putting a marker, we can write the comment and select what the type of the object the marker is, and take picture of object (Figs. 3, 4, 5).

Fig. 3. Screen of inputting comment

Fig. 4. Screen of inputting type of object

By tapping marker, information it was inputted is showed (Fig. 5).
We can integrate maps which is created by each group to one map (Figs. 6, 7).

Fig. 5. Screen of taking picture object

Function for Schoolchildren. In Japan, the fourth grade children does not have learned the meanings of the map symbols. Instead of the map symbols, therefore, we adopted to display the landmarks, such as shop names, parks and so on in the form of character on the map as a store name or a building name. In applying this curriculum for the higher-grade children who have learned the map symbols, the landmarks can replace the map symbols in our application.

Fig. 6. Screen of marker’s information

Fig. 7. The map it was integrated

We walked around the elementary school in order to collect the landmarks such as the name and type of the building. As a result, we got information of about 400 buildings and we added information on buildings that seemed to be familiar to schoolchildren on the map.

5 The Experiment

The fourth grade children in the elementary school were involved in this experiment.

5.1 The Purpose of the Experiment

We experiment in order to evaluate the educational curriculum and the application, and reveal new features of schoolchildren in the fieldwork.

5.2 The Method of the Experiment

In this experiment, divided 43 children into 10 groups according to the areas they live in in order to find the dangerous places in their well-known areas. To maintain their safety, one experimenter joined each group. They made the round trip of the routes they always walk to go to school (Fig. 8).

As the searching objects, we set “a fire extinguisher”, “a fire hydrant”, “a fire cistern” and “others,” supposing fires after earthquakes.

The experimenter attached a wearable video camera in order to record the children’s behaviors.


Fig. 8. Scene of the fieldwork

6 Results and Consideration

We got the video about 90 min of the fieldwork. By analyzing these data, we investigated the new features of schoolchildren.

6.1 Distinctive Landmark of Schoolchildren

From the analysis of the video in the fieldworks, we found what landmarks children use. They frequent used landmarks are shown in Table 1.

Table 1. Landmarks and their grouping

Landmarks	Grouping
Okubo street	Group of city
Tyuo street	
crosswalk	
Minami city	
Saiku city	
Naka city	
Nakamati park	Group of public facility
Yamabushi park	
Ushigome police station	
Miyagi Michio's memorial house	
Aizitsu child institution	
Aizitsu elementary school	
Schoolchidren's house	Group of house
Grandmother's house	
Lawson (convenience store)	Group of shop
Butazanmai (beef barbecue restaurant)	
Yasaikeikaku (greengrocer)	
NTT Ushigome building	Group of high building

Table 1 indicates that the landmarks for the children are classified into five types: the names of the main streets and the towns, the public facility (such as the parks and the schools), their own and their relatives' houses, the name of the shops, and the high buildings. The former three results showed that children use the places deeply concerned with their lives as their landmarks, such as the schools, the parks and the friends' houses. This means that the recognition of the landmarks is different from the adults because their living areas and their lifestyle are different from adults. For example, while, from the observation of the adults, they tended to use the name of shops such as Starbucks as a landmark, the children grasp it simply the restaurant. Furthermore, the adults did not tend to use big buildings as landmarks.

This means that, even among the schoolchildren, the landmarks must be different as they develop. As, in our applications, we can easily change landmarks according to the users, we can apply it on the every class of every grades.

6.2 Operation of Electronic Map

Hearing the interviews before conducting the experiment, we had worried whether the fourth grade children would be able to understand maps and they would be able to connect the physical views of the town with the abstract representation of the maps.

However, they could understand the map due to the features of the electronic maps. The electronic maps allows the users to change the scales by zooming in and out. From the analysis of the video in the fieldworks, we observed that they changed the scales of the map according to situation. Schoolchildren used the following two types of map scales.

1. Overall scale where they can grasp the entire school district (Type i).
2. Detail scale where they can confirm just around landmarks (Type ii).

When schoolchildren are walking and putting the marker on the map, they used "Type ii" by zooming in. After putting the maker, they zoomed out the map of "Type i" and confirmed their current position on the map and, confirming it, they went back to "Type ii." In addition, when they can grasp their current position on map but current position was out of the map, they did not zoom our but just moved the displayed area in the same scale. These results means that the electronic map helps the children to comprehend the map and to connect the physical view of the town with the abstract representation of the map.

On the other hand, we could observed some difficulties in operating the tablet. From the video about search scenery, we discovered that when schoolchildren operate electronic map, often the operation result was different from the operation result he was imagining. For example, when schoolchildren slide a map screen, map screen was slid than they had imagined. And then, schoolchildren were confused. They also accidentally touched the screen of the tablet and eventually a displayed area or the scale of the map was changed and moved to the different area from their current position. In occurring such accident, they lost their position on the map. These results indicate that we need to improve the applications as to limit the scale-range of the map, in particular, we should

limit the scale range to the above two types. In addition, we should reduce the function of zooming by pinch in and the button for zoom in and out should be implemented.

7 Conclusion

We interviewed the elementary school teachers in order to find features of the schoolchildren. In addition, based on the found feature, we created and propose a new educational curriculum of creating hazard map with tablet-type device for disaster prevention especially for schoolchildren and an application software as the educational tool. Schoolchildren could learn about disaster prevention by our educational curriculum. In addition, we revealed new features of the schoolchildren in following:

- We revealed that recognition of landmark is different from between schoolchildren and adults. In addition, schoolchildren frequently used landmarks that are familiar to them life such as related to the city and public facility. By using tablet-type device, we can prepare landmarks that suitable for elementary school students and show these landmarks to map. In addition, we can do these works to easy.
- We revealed that elementary school students can do operation of electronic map such as changing map scale and slide according to the purpose. This result means that the electronic map helps the children to comprehend the map and to connect the physical view of the town with the abstract representation of the map, electronic map is suitable for a class of creating hazard map.
- In addition, we revealed that elementary school students are not used to operation of tablet-type device or they are difficult to operate tablet-type device accurately. Therefore, we need to improve development applications such as limit the range scale of the map and slide range to and make application operation easier.

8 Prospects for the Future

In experiment, we revealed that distinction of schoolchildren. By developing application based on revealed distinction, we can provide application that simple to use for schoolchildren to operate as an educational tool.

We revealed features of schoolchildren in a fieldwork. Next, we need to reveal features schoolchildren in a deskwork. It makes possible us to provide educational curriculum and application as the educational tool that more suitable for schoolchildren.

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