DEVELOPMENT OF SOFTWARE FOR EARTHQUAKE EDUCATION FOR SCHOOL TEACHERS USING A PERSONAL COMPUTER

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ABSTRACT

In 1987 and 1990, we distributed about 2000 questionnaires to schools to examine the state of earthquake preparedness in school. We found out from the surveys that many teachers felt necessity of disaster prevention education against an earthquake, but there is no good teaching material using audio-visual tools for it.

Therefore we developed a software for earthquake preparedness education using a personal computer. The software is for the use of teachers in elementary and junior high schools. We employed Macintosh II ci personal computer and its application software, Hyper Card, Canvas 3.0 and Color Magician III to develop the software because they are very easy to use and to develop the educational software. This paper describes the outline of the software.

1. INTRODUCTION

Japan is one of the earthquake-prone countries in the world. Many people have been killed and many important structures have been destroyed by strong earthquakes. Among casualties, some of them were killed or seriously injured due to lack of knowledge about what was an earthquake and/or what would happen during an earthquake.

The Tohoku area fronting the Japan Sea, for example, was struck by a strong earthquake ,i.e., the Nihonkai-chubu earthquake in 1983. One hundred and four people were killed by the earthquake, and one hundred people were killed by the tsunami cause by the earthquake. Thirteen schoolchildren who were on a picnic to the seashore of the Japan sea were included among them. Unfortunately not only the children but also the accompanying teachers and bus driver did not know the possibility of tsunami attack when an earthquake took place under the ocean, because they lived in a mountainous village and had no experience of tsunamis.

On the other hand, we have been collecting copies of notes written by people who had

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experienced earthquake disasters from libraries in many cities. From them, we learned that knowledge about what was an earthquake and what might happen during an earthquake played a critical role to survive the earthquake. At the same time, we realized the importance of earthquake preparedness education especially for schoolchildren.

From the above point of view, one of the authors distributed about 1900 questionnaires to examine the state of earthquake preparedness in school to elementary and junior high school teachers in Hokkaido, Tokyo, Kanagawa, Shizuoka, Aichi, Yamaguchi and Kumamoto prefectures in 1987. The result of the questionnaires revealed that most of teachers felt the importance and necessity of the education of earthquake disaster prevention, and they needed effective teaching materials for it such as audio-visual materials [1].

We, therefore, started to develop an educational program for earthquake disaster prevention using a personal computer. The main reason why we use a personal computer is that we can develop a interactive software with users, which can not be expected in videos or movies.

In 1990, we distributed additional questionnaires to elementary and junior high schools in Shizuoka and Yamaguchi prefectures to grasp what curricula should be included in the software. In the 1987 survey, teachers in Shizuoka prefecture were most highly aware of the danger of earthquake, but teachers in Yamaguchi prefecture were not. That is why these two prefectures were selected.

The software is developed for the usage in schools. The reasons why the software is intended for school usage are as follows;

(1) By early start of the learning, we can expect the effectiveness of the education. Therefore, to start from elementary school is desirable.
(2) Family members can learn what schoolchildren learned in school from them.
(3) Schools are in peculiar circumstances, i.e., a small member of teachers must take care of a large member of children even when disasters occur.

In this paper we first outline the result of the study of the questionnaires. Then describe the hardware and application software which are used to develop the earthquake education software and finally explain the contents of the earthquake education software. We named it "Quake-Busters", which stems from the theme of a film "Ghost-busters".

2. RESULT OF QUESTIONNAIRES

Main contents of the questionnaires in both 1987 and 1990 were to examine the consciousness of earthquake disaster prevention and measures taken in schools. Same parts of the results are shown in Fig.1, 2 and 3. Figure 1 shows the reply to the question whether the education for the disaster prevention is necessary or not. As can be seen in Fig.1, about 90% of the teachers feel the necessity of the education very much. It means that most of schools have a good grasp of its consciousness as an average. Figure 2 summarizes the desirable means or tools as a teaching material or method. It was found that they felt necessity

of audio-visual materials for the education and the percentage reaches almost 50%. Figure 3 lists the contents what teachers want to know relevant to the education and their rates. Very high percentage of teachers want to know examples of past disasters happened in schools and mental state of children during an earthquake. Then they want to know examples of plan of the earthquake drill. These results express teacher's sincere attitude to guard schoolchildren from earthquake disasters. These results, at the same time, mean the lack of attractive, effective and reasonable teaching materials for the purpose. In developing "Quake Busters", we reflected the result of the questionnaires in the contents.

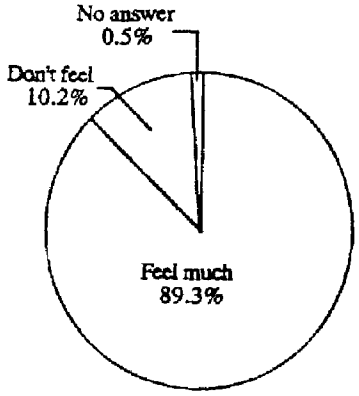


Fig.1 The ratio of teachers who feel the necessity of disaster prevention education against earthquakes.

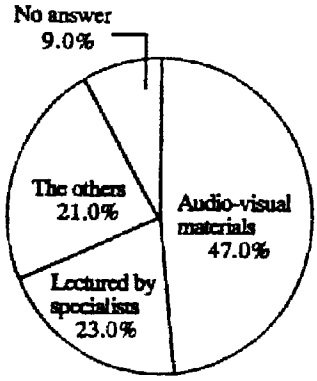
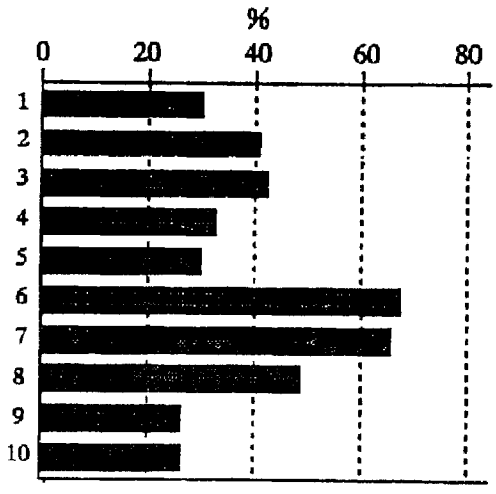


Fig.2 The ratio of teaching materials teachers feel necessity for the disaster prevention education.



1.Mechanism of an earthquake.
2.Property of an earthquake.
3.Prediction of an earthquake.
4.Reference books about the disaster prevention education.
5.Notes about past disasters.
6.Examples of past disasters in schools.
7.Mental state of children during an earthquake.
8.Examples of plan of the earthquake drill in schools.
9.Correspondence of fire departments and hospitals.
10.About life-line systems.

Fig.3 Itemes teachers want to know revelant to the disaster prevention education.

3. SUMMARY OF DEVELOPMENT OF THE SOFTWARE

We developed "Quake Busters" using a Macintosh II ci micro computer (Apple Computer, Inc.) with its application software, "Hyper Card". The application software, Hyper Card, can treat only two colors, i.e., black and white. Therefore, we employed the application software, Canvas 3.0, which enable us to use 256 color screen. In addition, to show photographs taken after earthquakes in "Quake Busters", we used the application software to scan pictures, Color Magician III. The following are reasons why we selected the system, i.e., the personal computer, Macintosh II ci and the application software.

(1) We can handle the personal computer by a mouse only.
(2) Hyper Card can be easily controlled by its associate programing language, Hyper Talk.
(3) The system has the function of recording and playing sound with aid of the application software, Mac Recorder.
(4) It is very easy to modify and improve Quake Busters, in other words, easy version up.

The hardware and software we employed are summarized in Table 1 and Fig.4.

As mentioned above, Hyper Card can express only black and white, (1bit, 2 colors), a sophisticated technique was needed to express 256 colors on the screen. The process is outlined in Fig.5. First, an open window is set up on a Hyper Card screen. On the other hand, we draw a color picture using the graphic software, Canvas 3.0, or scan a picture using the scanning software, Color Magician III, then save it in the picture library folder as a special type of file, i.e. PICT file. The PICT file is transmitted into the open window on the Hyper Card screen with aid of the control program written by Hyper Talk.

Table.1 Application software employed

SOFTWARE	FUNCTION
Hyper Card 2.0	Quake Busters is developed by this software.
Canvas 3.0	Color pictures are painted by this software.
Color Magician III	The application software for scanning pictures.
Mac Recorder	This is the software for recording and playing sounds.

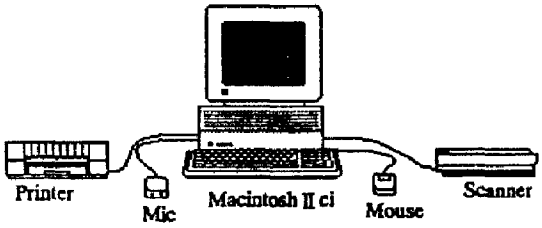


Fig. 4 The hardware system

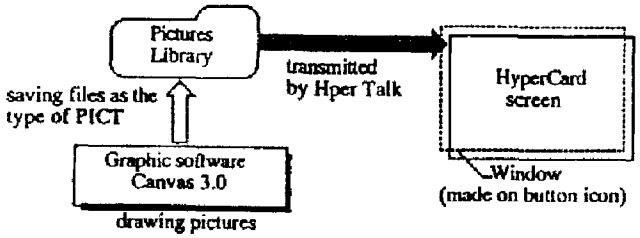


Fig. 5 The process to show color pictures on Hyper Card

4. CONTENTS OF "QUAKE BUSTERS"

4.1. INTRODUCTION TO "QUAKE BUSTERS"

"Quake Busters" consists of three curricula which are linked each other through "Menu Card" as shown in Fig.6. In learning earthquake preparedness, the knowledge of earth science, earthquake engineering, psychology in emergency situation and past disasters and so forth have to be integrated and well organized. Moreover, users should be provided with properly oriented guides on the basis of the wide range knowledge in order to cope with a sudden earthquake.

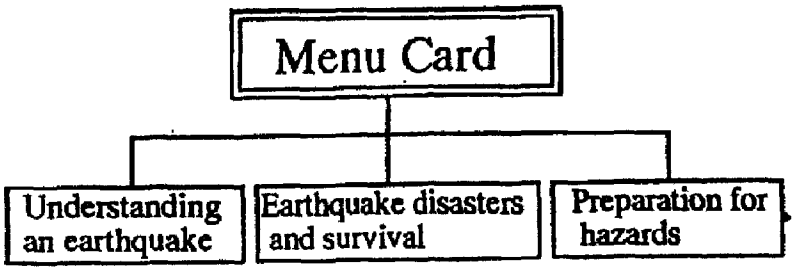


Fig. 6 The structure of "Quake Busters" which consists of three curricula

From these point of view, the authors divided the knowledge into three curricula under the headings of "Understanding an Earthquake", "Earthquake disasters and Survival" and "Preparation for Hazards". Each curriculum consists of about 50 cards which are drawn by using Hyper Card. We call the group of cards "stack". The contents of the curricula will be explained later. After opening animation with the theme music, "Menu Card" appears on the screen which is shown in Photo.1. It is the control card with five "buttons". By clicking one of the buttons, users can open a curriculum which they want to learn, learn how to use "Quake Busters", or quit "Quake Busters". Opening a curriculum, users will find small indigo-blue screen and five buttons in the lower position on the screen shown in Photo.2 . The indigo-blue rectangle screen which will call "Message screen" shows users guidance. Their buttons have five functions as follows;

① If users click the question mark, "help menu " appears.

② If the blue rectangle in the lower line is clicked, users can jump into another curriculum.

③ When the letter "Menu" in the yellow rectangle around in the lower line is selected, the Menu Card shown in Photo.1 will appear.

④ If the red letter "REW" in silver rectangle is clicked, users can go back to the previous card.

⑤ If the blue letter "FF" in silver rectangle is clicked, users can go forward to the next card.

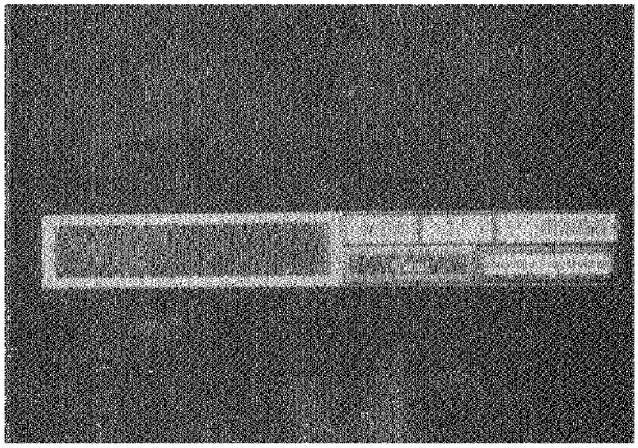


Photo.2 Navigation panel.

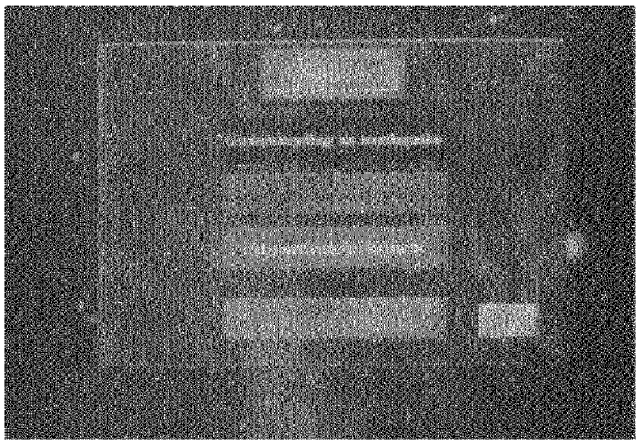


Photo.1 Menu card.

4.2. CONTENTS OF THE CURRICULA

4.2.1. Understanding an earthquake

"Understanding an earthquake" stack consists of six items. In this curriculum , users learn what is the earthquake, i.e., the mechanism, the characteristic and technical terms related to an earthquake. Users may be interested in and understand an earthquake instead of having the fear of it. We emphasize that users should never forget the dynamics of the earth including earthquakes that have formed the today's surface of the earth . The six items are as follows :

(1) Structure of the earth
(2) Continental drift
(3) Plate tectonics
(4) Mechanism of an earthquake
(5) Characteristics of earthquake motions
(6) Explanation of technical terms

The representative cards are shown in Photos.3 and 4. Photo.3 explains the inside of the earth. The structure of the earth is compared to a boiled egg for users to easily understand that the earth has layered structure. Photo.4 is a part of the motion picture which explains the mechanism of the occurrence of the inter-plate earthquakes.

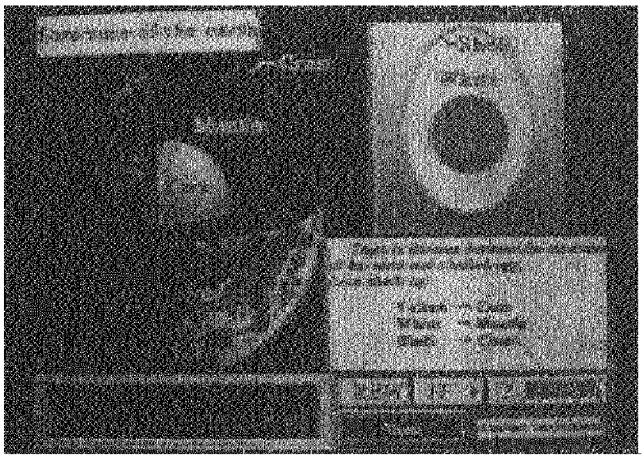


Photo. 3 Structure of the earth.

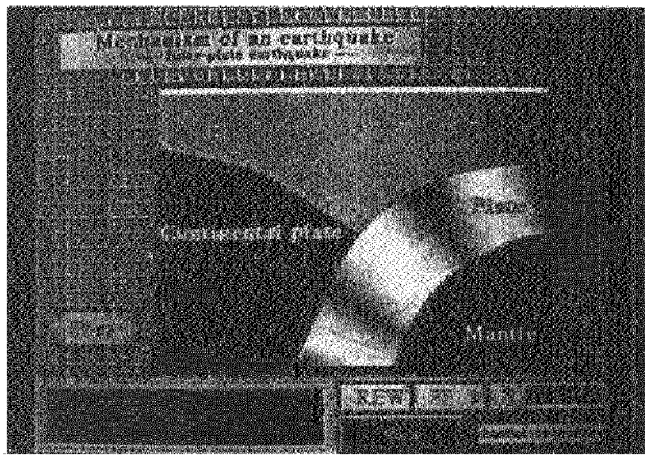


Photo. 4 Mechanism of an earthquake occurrence.