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Practice Class Using Spherical Panorama VR Learning Material for Peace Education

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Abstract: Although about 70 years have passed since World War II, peace education is still highly esteemed in Japan. On the other hand, basic knowledge in peace education was also reported to reflect low interest, particularly among the young generation; hence, we must consider peace education that enhances the young generation's interest. Therefore, this study investigated long-term knowledge retention about the war through a practice class using Spherical Panorama VR Learning Material. As a result, information about Nagasaki's damage was retained after the practice class used this material. Furthermore, results of subjective assessment demonstrated that this learning material was useful in increasing learners' interest and motivation; it also possibly encouraged learning in peace education.

Keywords: Virtual Reality, Tablet Device, Practice Class, Peace Education

1. Introduction

Even though about 70 years have passed since World War II, peace education is still highly esteemed in Japan. However, historical transmission of knowledge has become difficult because there are very few living persons who actually experienced the bombing. In addition, due to less people being familiar with it and mass media's lack of attention to it, children's knowledge about the atomic bombing has reduced (Ito 2012), thus revealing greater need for peace education. Furthermore, knowledge about war and peace has also decreased (Ito 2012), with low interest in basic knowledge being reported, particularly among the young generation. Therefore, we must consider peace education that enhances the young generation's interest.

On the other hand, learners' interest and understanding improve with virtual reality (VR) learning materials. Indeed, several methods exist for displaying spherical panorama images to provide virtual immersive learning, for example, CAVE (Ishikawa et al. 2010) and Dome Type Audio Visual MR Environment (Suzuki et al. 2012), in which interior spherical images can be shown. Moreover, one presentation method used Head Mounted Display (HMD) indicating the wide view's usefulness (Arthur 2000, Hassan et al. 2007).

Thus, archive content (Watanave et al. 2011) and VR content (Fujiki et al. 2014) regarding the bombing experience have been developed to solve this educational problem. However, since setting up the equipment is a heavy burden, implementation in various schools and at distant locations is difficult. Furthermore, it is difficult to provide the sensation of being in bombed areas for distance learners.

In contrast, tablet device usage is increasing, and its practical application in education is much anticipated (Savilla 2010). Additionally, spherical panorama cameras (Richo Theta) are available in the market, and spherical panorama images can easily be made (Shohara et al. 2014). Moreover, spherical panorama VR learning materials employing a tablet device can easily be developed, and these learning materials' usefulness is also predicted. Therefore, Setozaki et al. (2015) have developed Spherical Panorama VR Learning Material for Peace Education. However, before this study, its usefulness had not been tested.

Consequently, this study investigated knowledge retention about the damage to Nagasaki in a practice class using the Spherical Panorama VR Learning Material.

2. Outline for Spherical Panorama VR Learning Material

Figure 1 displays an outline of the Spherical Panorama VR Learning Material. This learning material has six content locations around the hypocenter area in Nagasaki city: Hypocenter, Urakami Cathedral, Shiroyama Elementary School, Yamazato Elementary school, the Former Urakami Branch of Nagasaki Prison, and the Nyokodo. These locations are displayed when the camera attached to the tablet device recognizes each augmented reality (AR) marker on the paper text. In this case, if the tablet device makes the image into an AR marker, then each spherical panorama image will be displayed. Therefore, learners can see spherical panorama content and images, which are synchronized with learner-operated movement of the tablet device.

Incidentally, photos taken just after the A-bombing, along with photos of present monuments and translators' films are overlaid on spherical panorama images (virtual environments). Moreover, when learners touch photos, the photos' sizes scale up and down. Additionally, learners can obtain audio and text descriptions of the photos.

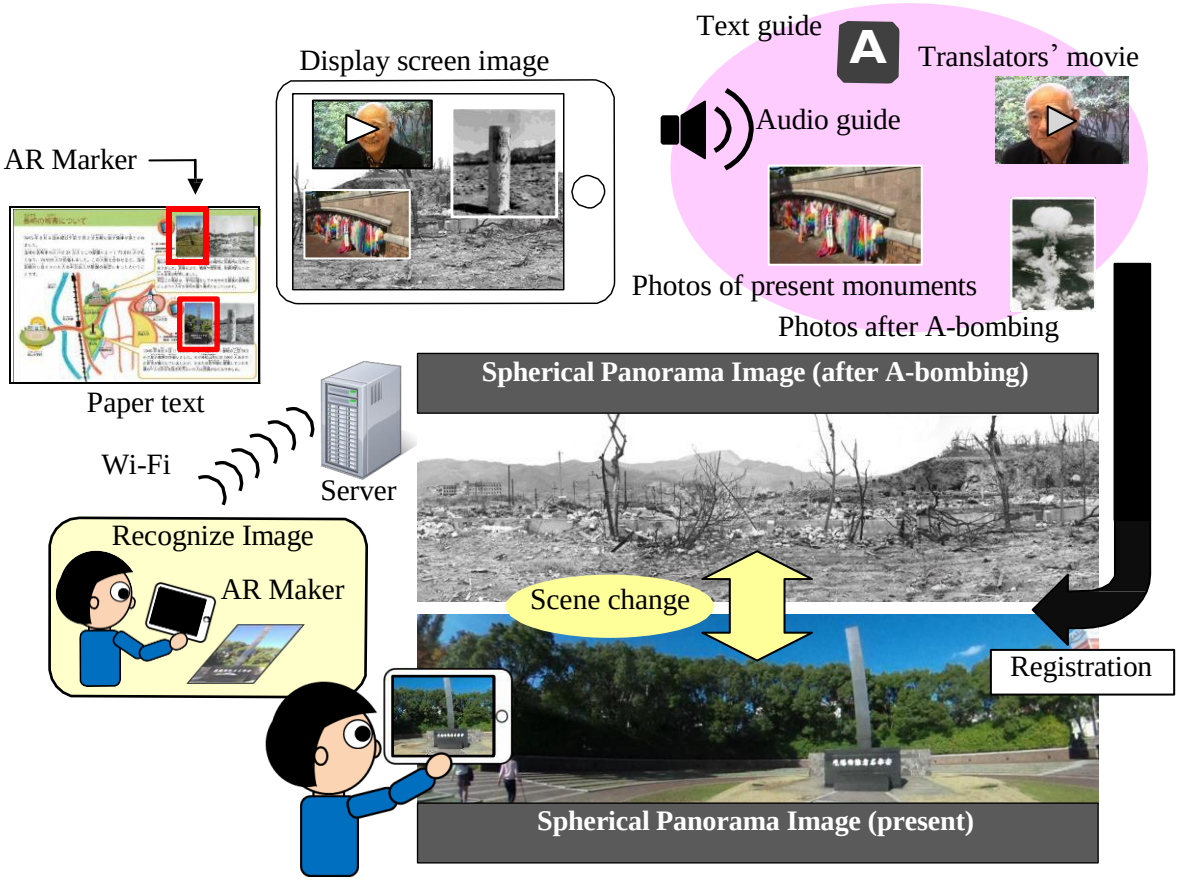

Figure 1. Outline of the Spherical Panorama VR Learning Material

3. Procedure

3.1 Practice Class

A practice class using the Spherical Panorama VR Learning Material was conducted for 29 elementary school (sixth-grade) students. Figure 2 shows a scene from the practice class. Previously, students had learned about World War II but not about the atomic bomb's damage to Nagasaki.

First, students reviewed World War II for about 15 minutes. Subsequently, they received an approximately 5-minute background overview of the atomic bombing of Nagasaki. Furthermore, after obtaining the Spherical Panorama VR Learning Material, the students learned about Nagasaki's damage by expending about 40 minutes on this task. Then, in groups of four to five, students learned about six content locations around the hypocenter area in Nagasaki city using the Spherical Panorama VR Learning Material. Incidentally, each group used two tablet devices.

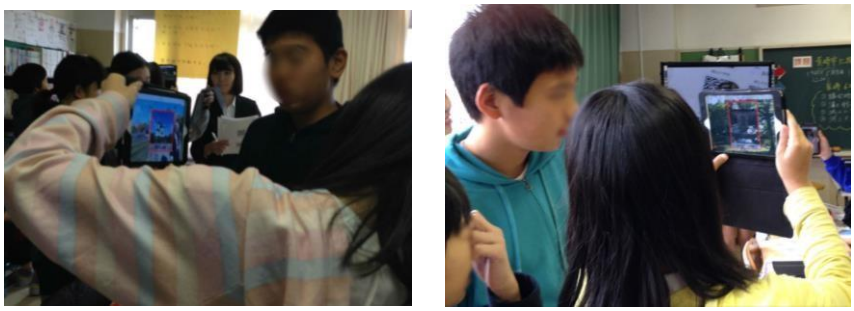

Figure 2. Scene of the practice class using SPVRLM for peace education

3.2 Assessment

To measure students' degree of understanding, we administered comprehension tests regarding World War II and the damage to Nagasaki. Additionally, to investigate students' levels of understanding, a pre-test and post-test were conducted before and after the class. Each test involved the same questions. In addition, a follow-up test was administered 1month after the class was held. Incidentally, the follow-up test also had the same questions as the pre-test and post-test. Furthermore, an analysis of variance was done with "test score" being the only factor.

Additionally, a questionnaire was administered as a subjective assessment. After the practice class, students responded to eight questions by selecting from the following four responses: Strongly Agree, Agree, Disagree, and Strongly Disagree. The positive (Strongly Agree and Agree) and negative (Disagree and Strongly Disagree) responses were totaled for each item and compared using Fisher's exact test.

4. Results and Discussion

4.1 Results of comprehension test

Figure 3 shows results of the comprehension test on the subject of World War II. In addition, an analysis of variance revealed significant difference in the test-score factor (F (2.83) = 11.86, $p < .01$). Moreover, results of multiple comparisons by Holm's method (MSe = 0.83, $p < .05$) showed a higher score on the post-test than the pre-test. As compared to the post-test, the follow-up test had low scores. Furthermore, the pre-test and follow-up test scores were shown to be similar.

Figure 4 shows results of the comprehension test regarding the damage to Nagasaki. In addition, an analysis of variance showed a significant difference in the test-score factor (F (2.83) = 28.52, $p < .01$). Moreover, results of multiple comparisons by Holm' s method (MSe = 1.86, $p < .05$) showed a higher score on the post-test than on the pre-test. Besides, post-test and follow-up test scores were shown to be similar. Furthermore, the follow-up test had a higher score when compared to the pre-test.

These results demonstrated that obtained knowledge regarding World War II was not retained after 1 month. On the other hand, knowledge about the damage to Nagasaki was retained after 1 month, suggesting that use of the Spherical Panorama VR Learning Material, in other words, learning experienced in the virtual environment, is useful for fixing knowledge.

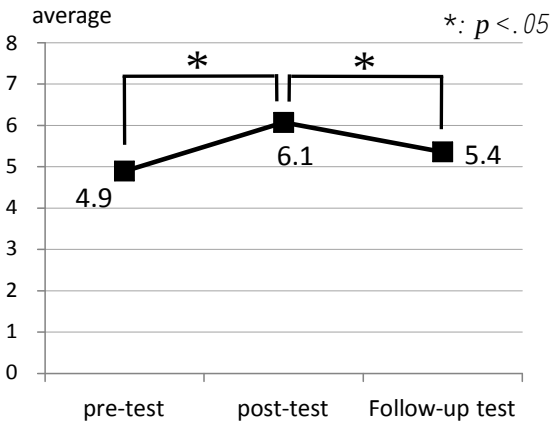

Figure 3. Results of the test about World War II

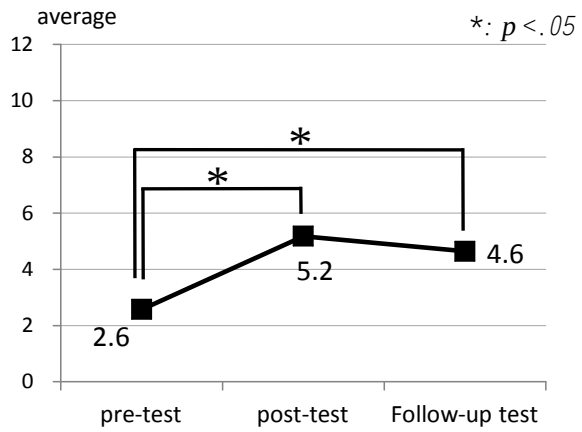

Figure 4. Results of the test about Nagasaki's damage

4.2 Results of subjective assessment

Table 1 shows Fisher's exact test results for subjective assessment, which confirmed numerous positive answers to all questions. This showed that the material is useful in increasing learners' interest and motivation and also possibly encouraging their learning in peace education. Furthermore, this learning material might be available for distance learners who are unable to visit Nagasaki in order to provide them with the feeling of being there. Overall, the subjective assessment demonstrated this learning material's usefulness.

Table 1: Subjective assessment results of VR Learning Material for Peace Education

Question Categories	Positive		Negative		Fisher's Exact Test
	Strongly Agree	Agree	Disagree	Strongly Disagree	
The learning material is interesting.	23	6	0	0	**
I learned dedicatedly.	12	17	0	0	**
I want to learn more about peace education.	10	18	1	0	**
It is easier to understand than textbooks.	24	5	0	0	**
It is easier to understand than the Internet.	22	6	1	0	**
Using this learning material provides a realistic feeling of damage caused by the A-bombing.	23	5	1	0	**
Using this learning material provides the sensation of being in Nagasaki.	15	12	2	0	**
Using this learning material spurred deep thinking about "What is peace?"	6	22	1	0	**

**: $p<.0.1$, *: $p<.05$, †: $p<.10$, *n. s.*: not significant.

5. Conclusion

This study investigated knowledge retention about the damage to Nagasaki through a practice class using the Spherical Panorama VR Learning Material.

As a result, knowledge about the damage to Nagasaki was retained after 1 month. Therefore, use of the Spherical Panorama VR Learning Material suggests that learning experienced through the virtual environment is useful for knowledge retention. Furthermore, results of subjective assessment proved that the material was useful in increasing learners' interest and motivation and also possibly encouraging their learning in peace education. Therefore, the study demonstrated the usefulness of this learning material.

A future study could be to design a class using this learning material and clarify its learning effect. Furthermore, research should not only reflect knowledge retention but also changes in learners' feelings.

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