Ogata, H. et al. (Eds.) (2015). Proceedings of the 23rd International Conference on Computers in Education. China: Asia-Pacific Society for Computers in Education

User Interface Evaluation in Spherical Panorama VR Learning Material for Peace Education

Norio SETOZAKI[a*], Ryo Yoshitomi[b] & Tsutomu Iwasaki[c]
[a]*Faculty of Education, Nagasaki University, Japan*
[b]*Faculty of Education, Nagasaki University, Japan*
[c]*Cybernet Systems Co., Ltd., Japan*
*setozaki@nagasaki-u.ac.jp

Abstract: Recently, it has become relatively easy to create spherical panorama content using augmented reality authoring software and spherical panorama cameras. Moreover, in Japan, 70 years have passed since World War II, but peace education is still esteemed. Thus, this study developed spherical panorama, virtual reality learning material for peace education, and evaluated the learning material's user interface. As a result, in terms of interest and motivation, the usefulness of this learning material was demonstrated. Furthermore, some of its improvements have been shown in this study.

Keywords: Virtual Reality, Augmented Reality, Tablet Device, Peace Education

1. Introduction

Assuredly, learners' interest and understanding improve with virtual reality (VR) learning tools. Indeed, there are several ways to display a spherical panorama image 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 HMD (Head Mounted Display), indicating the wide view's usefulness (Arthur 2000, Hassan et al. 2007). However, when the amount of equipment and the burden of installation are considered, using this technology at educational locations is not easy.

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 on the market and spherical panorama images can be made easily (Shohara et al. 2014). Therefore, spherical panorama VR learning materials employing a tablet device can easily be developed, and the usefulness of these learning materials is also much anticipated.

In Japan, 70 years have passed since World War II, and peace education is still highly esteemed. However, historical transmission becomes difficult because few persons who actually experienced the bombing are still living. 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 the equipment set-up burden is heavy, implementation in various schools and distance locations is difficult. Furthermore, the feeling of being in bombed areas is difficult to provide for distance learners.

Thus, this study aims to develop spherical panorama VR learning material for peace education and evaluate this learning material's user interface.

2. Outline for Spherical Panorama VR Learning Material

The outline for Spherical Panorama VR Learning Material is shown in Figure 1. This learning material has four content locations around the hypocenter area in Nagasaki city: Hypocenter, Urakami Cathedral, Shiroyama Elementary School, and the Former Urakami Branch of Nagasaki Prison. 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 a movement of the tablet device that learners operate.

Incidentally, photos taken just after the A-bombing and Translator's films are overlaid on spherical panorama images (virtual environments). Moreover, when learners touch photos taken just after the A-bombing, the photos' size scales up and down.

This learning material was developed using AR authoring software (Metaio Creator/metaio). Learners must install an AR browser application (junaio/metaio) in a tablet device, and learning content can be seen by installing junaio application via Wi-fi.

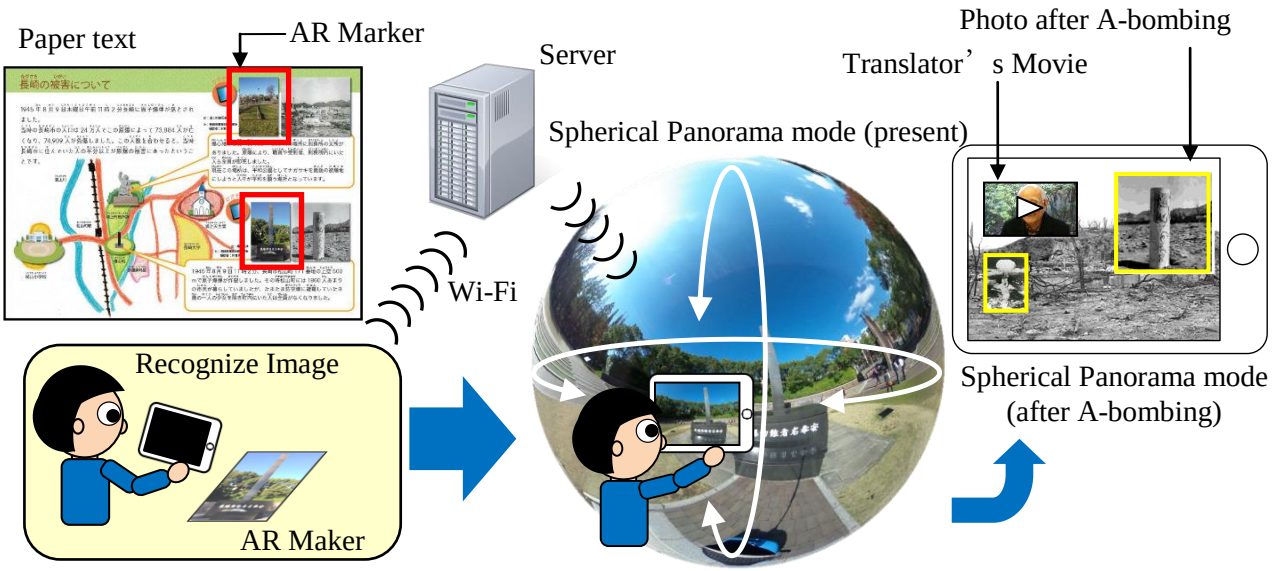

Figure 1. Outline of Spherical Panorama VR Learning Material

3. Subjective Assessment by Survey

A total of 41 undergraduate university students participated in the survey. After "operating" the learning material, students responded to 16 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

Table 1 displays the Fisher's exact test results, which proved the learning material useful in increasing learners' interest and motivation and also possibly encouraged active learning. Furthermore, the material might be available for distance learners unable to visit Nagasaki, to provide the feeling of being there. Additionally, the number of spherical panorama locations was increased as improvements to the material; and the trial usage revealed the need for added explanation by characters and film.

5. Conclusion

This study developed spherical panorama VR learning material for peace education. This learning material has four content locations around the hypocenter area in Nagasaki city. Furthermore, the user interface was evaluated. Finally, in terms of interest and motivation, this learning material's usefulness was demonstrated.

Future research will focus on further improving the learning material. It will also be necessary to examine the educational effect in practice classes.

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	
It is interesting learning material.	28	13	0	0	**
It is useful for peace education.	16	22	3	0	**
It raises learners' interest.	23	12	5	1	**
It raises learners' motivation.	24	11	6	0	**
It encourages active learning.	16	17	8	0	**
Using this learning material provides the feeling of being in the hypocenter area.	22	15	4	0	**
The photos overlaid on virtual environments are useful for knowing the scene after the A-bombing.	25	15	1	0	**
Changing the photos' size is easy.	21	15	4	1	**
The character's explanation is necessary in the virtual environment.	15	18	6	2	**
The film's explanation is necessary in the virtual environment.	18	13	10	0	**
Seeing the spherical panorama image synchronized with body motion gives a feeling of reality.	17	19	4	1	**
Locations of spherical panorama content should be increased.	13	20	8	0	**
Photos overlaid on the virtual environment should be increased.	6	13	22	0	*n.s.*
The film overlaid on the virtual environment should be increased	10	19	11	1	*
Information in the paper textbook should be increased.	2	11	25	3	*
Even if there are no explanations, the technology can be operated.	4	16	18	3	*n.s.*

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

References

Arthur, K, W. (2000) Effects of Field of View on Performance with Head-Mounted Displays, *The University of North Carolina at Chapel Hill, Doctoral Dissertation*.

Fujiki, T., Kawakami, H., Terashima, K. (2013) Development and Evaluation of VR Environment Assisted with Acquirement of Point of View Connecting Present and Backward by Learning of Atomic Bomb Ruins for Elementary and Middle School Children, *Japan Society for Educational Technology*, 37(Suppl.), 121–124.

Hassan, S, E., Hicks, H. Lei, H., Turano, K, A. (2007) What is the Minimum Field of View Required for Efficient Navigation?, *Vision Research*, 47(16), 2115–2123.

Ishikawa, T., Inoue, T. (2010) Head Tracking interface for CAVE−like VR Displays using the WiiRemote, IEICE Technical Report, 109(447), 119–124.

Savilla, B. (2010) Integrating the iPod Touch in K-12 Education: Visions and Vices. *Computers in the Schools*, 27(2), 121–131.

Shohara, M., Takeuchi, M. (2014) Development of "RICOH THETA": Spherical Image Camera, *Journal of the Society of Photographic Science and Imaging of Japan*, 77(3), 234–237.

Suzuki, S., Sugiyama, T., Miyai, T., Kimura, A., Shibata, F., Tamura, H. (2012) Dome Type Audio Visual MR Environment and Its Core Software Library, *IEICE Technical Report*, 111(499), 135–140.

Watanave, H., Sakata, K., Kitahara, K., Torisu, T., Osera, R., Akutsu, Y., Nakamaru, Y., Kusano, F. (2011) "Nagasaki Archive": Plural Digital Archives That Urges Multipronged, Overall Understanding about Archived Event, *Transactions of the Virtual Reality Society of Japan*, 16(3), 497–505.