Preliminary experiment about the evaluation of fixed-quantity classes that utilized VR-HMD

-Case study of VR Mines-

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1. Introduction

Japan's Ministry of Education, Culture, Sports, Science and Technology in 2012 suggested that in a bachelor's degree curriculum, the switch to active learning is necessary. However, when it comes to mining education in the country, problems like the lack of existing mines that allows hands-on field trips, lack of access to such mines, and the necessity to obtain permission to enter one makes the implementation of active learning into the syllabus considerably difficult. People now are coming up with ways to solve this problem by using the features in VR as one of the methods to assist the whole process of active learning. Even with that said, it is still unclear whether the practical use of VR can actually help with the student's improvement in comprehension and increase in willingness to learn. Therefore, in this study with the conduct of an experiment, we aim to quantitatively analyse the students' level of comprehension for lectures that utilizes VR mining contents to provide more insights for future lectures that desires to implement VR into their teaching method.

2. Method

2.1 Framework of experiment

In this study, the effectiveness of teaching conducted in lectures that uses the Virtual Reality-Head Mounted Device (VR-HMD) were verified using the Randomized Controlled Trial (RCT) method. RCT is one of the methods that aims to avoid biasness and objectively evaluate a curative effect. In this research, the RCT was applied for the inspection of the VR-HMD's effectiveness in teaching. The subjects of this research were first year students from the International Resource Sciences Department of Akita University. For this research, two lectures were conducted respectively to the students' group. One of the groups used VR-HMD and the other wasn't given any VR-HMD gears. At the end, students were given a test to have their comprehension of the lecture measured. First, subjects were divided into two groups randomly to avoid any selection biases. This process is called randomization. Later, a lecture about mining was conducted.

For this experiment, each group were tasked to their respective duties. After the lecture has been carried out, the subjects then were required to go through a test related to mining development. After the test is over, the average score from each group were obtained and compared with each other to see if there's a statistically significant difference between the groups. Also, after we had the subjects sit for the tests, we also had them answer a few questions from a questionnaire to evaluate the differences in the willingness to learn more about mining by comparing the results of each groups.

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The audio-visual materials used for this experiment were co-developed by Akita University and Toppan Co. Ltd, titled "Virtual Mine Training System". The Virtual Mine Training System is a system that re-projects mines in Japan using CG (computer graphics). The Virtual Mine Training System contains two types of videos as shown below.

Figure 1. Underground mining of a gold mine

Figure 2. Underground mining of a coal mine

2.2 Implementation of the lecture and data gathering

The study was conducted in June of 2018 and 2019. A class was performed using VR mine contents for 51 students. 25 students out of 51 students were formed into a group which were tasked with using the VR-HMD and the remaining 26 students were assigned to a group that studies using the normal 2D audio-visual material.

3. Results

After careful analysis, there was a significant difference found between the VR group and the 2D video group. It can be concluded that there was a better understanding towards the class' contents when using VR in a class compared to a class that uses a normal 2D video as a teaching material.

4. Conclusion

This study has provided new insights on how VR can be helpful for classes that desires to utilize them into their teaching method in the future. By analyzing quantitatively the comprehension of students that partake in a class that uses VR contents of a mine, we are able to come up with the conclusion that VR does contribute to the improvement of a student's understanding towards a class.

5. References

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