The effect of using data gloves in a VR learning support system

Zhao Ruoxi

School of Knowledge Science,
Japan Advanced Institute of Science and Technology
March 2019

Keywords: virtual reality, education, experience, emotion, data gloves, simulation chemistry laboratory

With the development of virtual reality (VR) technology, many learning and education applications have been realized through VR environment in recent years. The easy operation can give the user a superior experience and thus improve the using effect.

In this study, we constructed a virtual laboratory to support students' simulated chemistry experiments, and compared the performance of VR controller and data gloves in the virtual laboratory. This VR laboratory is to verify the effect of using data gloves in VR education system and confirm whether such method can stimulate students' learning desire. Eighteen participants were divided into two groups to take the education program in a VR laboratory with different operation ways: the laboratory operated by data gloves or by VR controllers. The laboratory employed the same teaching text and 3D model for all conditions.

Each participant was given a test to investigate acquired knowledge and was asked to go through an emotion self-rating by the before and after learning in the VR laboratory. After learning, the effect of using VR laboratory was evaluated through a Web-based learning tools (WBLT) evaluation scale. This evaluation measures the effect of using VR laboratory through students' self-evaluation on three aspects (including learning, design and engagement) of learning tools. Moreover, the questions about the interference of immersion regarding the use of data gloves and VR controller in the VR environment were also asked in the feedback section. Differences between groups can be reflected in the two groups' academic performance, emotional changes and evaluations on VR laboratory. The difference in terms of the efficiency in using data gloves or VR controller in the VR laboratory will also be determined according to whether the time required to complete the task is different between the two groups.

The emotion self-ratings of before and after learning showed an increase positively in the VR laboratory. The positive

emotions of the students under the condition where data gloves were employed were significantly improved compared with another case where the students using the VR controller. In the WBLT evaluation scale, students who used data gloves scored higher than students who used VR controllers as for both design and engagement. There was no significant difference in learning between the two groups. In the feedback section, it can be summarized that the interference of immersion in VR experience is lower in the process of using data gloves through the comparison of students' evaluation with the operation way. In addition, there was no significant difference as for the time to complete the learning and the efficiency of operations between the data gloves and the VR controller in this experiment.

VR laboratory can overall give students a superior learning experience. Students' active learning was Enhanced due to improved emotions after learning, engagement and immersive. Therefore, the purpose of stimulating students' interest in learning was also achieved. Data gloves perform better in VR laboratory than VR controllers.