3D Compound Virtual Field Trip system and its comparisons with an actual field trip

Chun-Yen Chang*, Ming-Chao Lin, Chien-Hua Hsiao
Department of Earth Sciences, National Taiwan Normal University, Taipei, Taiwan
changcy@ntnu.edu.tw*

Abstract

This article delineates an online 3D Compound Virtual Field Trip (3D-CVFT) system developed by us and compares the 3D-CVFT with an actual field trip. Some possible educational implications in terms of the use of virtual reality technology as an alternative to the geological field trip are also discussed.

1. Introduction

Field trip plays an important role in learning and research in earth science. However, due to issues in time and budget as well as safety concerns, field trips have not been fully employed as an instructional activity (Tuthill & Klemm, 2002). The use of virtual reality technologies for rich multi-media presentations of the field sites thus becomes a practical alternative.

2. The online 3D-CVFT

The major technologies used in this study include graphic-based (Fig. 1) and image-based virtual realities (Figures 2 & 3). Graphic-based virtual reality provides a highly interactive and free-control condition without any scale and time limits. Image-based virtual reality, on the other hand, is the easier way to build scenes and objects by means of series of pictures. The online 3D Compound Virtual Field Trip (3D-CVFT) was built by using the graphic-based VR as the main design framework and incorporating the image-based VR in our system.

The 3D-CVFT developed by us was built by integrating four parts into the system, including the streaming video server, the instant message server, the auto-grading and the feedback system as well as the related websites as illustrated in Figure 3.

Fig. 1. A screenshot of the 3D-CVFT System

Fig. 2. Two types of image-based VR in the 3D-CVFT system

Fig. 3. The online 3D-CVFT System
3. The comparison between an actual field trip and the online 3D-CVFT system

An actual field trip plays the most important and irreplaceable role at allowing learners to apply their personal senses and have real life interactions with the learning objects. However, due to the many restrictions of an actual field trip such as conditions of weather, distance, physical strength and safety, the online 3D-CVFT system, on the other hand, can function as a complementary tool to facilitate students’ learning. We attempt to compare them in Fig. 4 in terms of their respective advantages and disadvantages before, during and after the field trip. The longer arrow lengths shown in Figure 4 indicate one is more advantageous than the other.

Fig. 4. The comparison between an actual field trip and the online 3D-CVFT system

4. Pilot studies and implications

Several pilot studies have been conducted using the 3D-CVFT system either as teaching materials to supplement lecture teachings or as the preparations before the actual field trips. The results revealed that the system indeed functioned well as an effective tool to assist students’ learning and the learners in general responded positively toward the system (Lin & Chang, 2007, 2008). A recent study conducted with 20 undergraduate Earth science students at National Taiwan Normal University indicated that the integrated 3D-CVFT system resulted in better learning outcomes, $t = 8.5$, $p < 0.00$, $d = 1.9$ (large effect size), as shown in Table 1. A majority of participating students (77%) thought that the 3D-CVFT system was beneficial to their learning of geological concepts with respect to the field sites. They also ‘felt’ like having visited the real field site after finishing the online virtual learning.

Our future work will try to incorporate more streaming films of the environmental and geological features of the Hsiaoyukeng field site into the streaming video server and broadly implement this system to more schools. We will also try to conduct various evaluation studies in exploring how the online 3D-CVFT system can best serve different students’ learning needs and better facilitate students’ field-trip learning, which are currently under investigations in Taiwan.

5. References

