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The Effects of Applying Virtual-Reality Implementation for Reflection after Contextual Mobile Learning

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Abstract: This study integrated Chinese, Geography, and computer science courses, with teachers from those disciplines collaborating to prepare their courses. The study employed mobile devices in the learning activities, used the situated learning strategy, and involved the students in real-life investigation in the interdisciplinary literacy curriculum. The students observed, learning in the real-life environment, and utilized mobile technologies to support their data collection and information searching. The students made connections between the knowledge in the textbook and the real-life situation in the literacy-based learning activities. After they came back to the classroom, they used the data and photos they had collected to design the virtual reality of the environment they had visited in order to recall and reflect on the activity. This study primarily explored the learning effectiveness of Chinese, and found that the students made significant progress. However, from the investigation of motivation, it was found that the students did not prefer to practicing writing based on the virtual reality situation in comparison with the real-life situation.

Keywords: interdisciplinary curriculum; mobile learning; virtual reality; literacy

1. Introduction

Students should have the appropriate knowledge, skills, and attitudes to solve complex situations in real life. Interdisciplinary integration courses can not only teach students knowledge, but can also help them to use the subject knowledge in their lives. Therefore, many teachers are attempting to link the relevance of the knowledge content of various disciplines to guide students to cultivate their cognition, affect, and skills in their life. This study combined the 10th-grade Chinese language, geography, and information courses to help students learn the knowledge of volcanic terrain and affect. The interdisciplinary curriculum is based on volcanic topography. We linked the Yuwen River history of sulphur mining in the Chinese language poems and the knowledge of volcanic topography to guide students to discover the relevance of the subject knowledge. We also asked the students to survey and collect data about Taiwan's Beitou Volcano. They could take photos, notes, and voice recordings using mobile devices, and were then asked to create personal virtual reality (VR) to improve their learning performance and motivation.

2. Literature Review

2.1 Interdisciplinary Learning

Interdisciplinary learning can constitute unique knowledge of more than two different disciplines (such as theory and research) to find or innovate more knowledge (Nissan, 1997). In addition, Jantsch (1947) proposed that we have no way to solve problems with only a single aspect of professional knowledge in a rapidly changing environment, while Balsiger (2005) indicated that interdisciplinary integration includes expertise in various fields, and we should thus observe and integrate knowledge from multiple perspectives to further design various research methods.

However, interdisciplinary integration has a considerable degree of difficulty, such as the integration of disciplines in the humanities and natural sciences (Tress, Tress, Décamps, & d'Hauteserre, 2001).

2.2 Mobile Learning

With the rapid progress of technology, most people have their own cell phone in this era of global digitalization. Many scholars have attempted to apply different learning activities in education through the convenience of mobile learning (Sharples, 2000). Therefore, the convenience of mobile learning can be used to design student learning situations and allow students to share content without the limitations of time and environment (Cochrane, 2014). Moreover, past studies have pointed out that mobile learning can not only attract students to engage in the learning activities, but can also allow students to switch from passive learning to becoming active learners (Wang, Shen, Novak, & Pan, 2009). Chiu, Pu, Kao, Wu, and Huang (2018) combined the advantages of mobile learning and augmented reality (AR) to conduct environmental visits in a real environment. Therefore, it can be seen that the application of mobile learning combined with AR or VR in education is becoming a trend.

2.3 Virtual Reality

In VR environments, students have an immersive virtual environment that can enhance their interactions with the learning environment. Moreover, experimental results have found that it is possible to further develop students' imagination and possibility of learning (Lorenzo, Lledó, Pomares, & Roig, 2016). In addition to the actual operation of the VR system, we also hope that students can use it to construct VR content based on their knowledge. In this learning approach, it is expected that students who learn with practice will perform better than those who learn with passive learning methods. VR should not only be used as an exercise and a skilled tool, but should have a greater variety of applications in education (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014).

3. Experimental design

3.1 Participants

A total of 59 students participated in this activity in a senior high school in Taipei City, all of whom were in the experimental group. All of the students were taught by experienced Chinese, geography, and information teachers. The learning unit of Chinese was literature landscape - Beitou sulfur, and the learning unit of Geography was volcanic terrain. The information course teacher was responsible for teaching the students to make the VR project. None of the students had used the VR system before.

3.2 Experiment process

Before the learning activity, the Chinese and Geography teachers planned the interdisciplinary curriculum content, and designed the activity plan and learning site investigation. At the beginning, all the students were asked to take a pre-test of Chinese and Geography. The combined Chinese language and Geography teachers then taught the basic pre-class knowledge to help the students enter the learning situation and have the concept of outdoor data collection. The students conducted 50 minutes of VR production teaching and 100 minutes of VR production time. After the course discussion and feedback time, the students were asked to take the Chinese and geography post-tests and to complete the Writing motivation questionnaire.

3.3 Measuring tools

The Chinese language pre- and post-tests were designed by two experienced teachers. The pre-test included 20 multiple choice items, with a perfect score of 100. The post-test included 20 multiple

choice items (80%) and 8 matching items (20%). The writing motivation questionnaire was modified from Wang (2017) to measure the students' perceptions of the learning activity, and included a total of 11 items. We used a Likert 5-point scale. The Cronbach's alpha value was .88, indicating that the scale has good reliability.

4. Results

4.1 The performance of Chinese Language

From the analysis results, the means of the pre-test and post-test were 64.57 and 78.57, respectively. Moreover, the VR combined with the interdisciplinary integration was significant for Chinese Language learning performance (t=-11.15, p<0.001). That is, the students improved their learning performance of Chinese Language after completing the VR learning activity.

Table 1.

The paired sample t-test results of Chinese language performance

Variable	Groups	N	Mean	SD	t
Chinese language	Pre-test	59	64.57	9.05	*-11.15****
	Post-test	59	78.57	10.24	

$^{***}p<.001$

4.2 Results of the Writing motivation questionnaire

As shown in Table 1, most students maintained a certain degree of learning motivation for the VR project design activities, and they also believed that this learning activity could improve their willingness to write. Among them, the highest score is for the item: "I prefer to use the VR system for outdoor writing compared to indoor writing."

Table 2.

Descriptive statistics results of the Writing motivation questionnaire

	Title	5	4	3	2	1	N	Mean	SD
Writing Motivation Questionnaire	1. I am very happy to use VR system to help me write.	17	19	19	3	1	59	3.81	0.97
	2. I can easily use the VR system.	12	16	21	10	10	59	3.51	1.01
	3. The VR system is helpful for my writing.	16	21	16	4	2	19	3.79	1.04
	4. I like to use the VR system for outdoor exploration and to help me write.	12	28	12	6	1	19	3.75	0.96
	5. Compared to indoor writing, I prefer to use the VR system for outdoor writing.	21	20	11	5	2	19	3.90	1.09
	6. The use of the VR system helps me to start writing more easily.	14	14	23	7	1	19	3.56	1.04
	7. The VR system enriches my writing ideas.	13	15	24	5	2	19	3.54	1.04
	8. The VR system can enhance my writing motivation.	10	16	25	5	3	19	3.42	1.04
	9. The VR system can enhance my creative writing.	13	15	25	4	2	19	3.56	1.02
	10. I usually like to use the VR system to help my writing.	7	10	20	15	7	19	2.81	1.18
	11. I think using the VR system can help my writing.	16	17	17	7	2	19	3.64	1.11

5. Results

This study attempted to introduce interdisciplinary integration VR project design learning activities to help students improve their learning outcomes for Chinese language, Geography, and writing motivation. From the research results, the students not only improved their Chinese language learning achievements, but also their writing motivation. However, they were focused on the collection of VR material, resulting in the fact that they ignored the observation of the geographical environment. As a result, they did not perform as well as expected in Geography. Hwang, Shi, and Chu (2011) indicated that appropriate learning strategies should be introduced in learning activities to guide students to improve their learning effectiveness and motivation. Simultaneously, future studies need to consider the students' cognitive load when they are unfamiliar with the VR system. Researchers can also include a control group for more in-depth statistical analysis.

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