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Assessing young learners' situational interest in an immersive virtual reality learning environment: the role of epistemic curiosity

Kun-Hung CHENG[a*]
[a]*Graduate Institute of Library and Information Science, Research Center for Humanities and Social Sciences, National Chung Hsing University, Taiwan*
* khcheng@dragon.nchu.edu.tw

Abstract: This study aimed to assess young learners' epistemic curiosity and its role in the learners' situational interest aroused in an immersive virtual reality (IVR) learning environment. There were 30 elementary school students invited to use an IVR system, namely "Find The ROOT," for science learning in this study. The results showed that the students' situational interest could be generally aroused, particularly for the males. Compared with the D-type epistemic curiosity, the students' I-type epistemic curiosity likely played a more crucial role in their perceptions of situational interest. Moreover, this study supposed that the gender variable might interfere with the relationships between epistemic curiosity and situational interest when young learners were involved in IVR learning activities. Future work was suggested to enlarge the research sample to verify the relationships between epistemic curiosity and situational interest with the consideration of gender issues.

Keywords: epistemic curiosity, situational interest, virtual reality, elementary school

1. Introduction

Interest, a psychological state, was conceptualized as personal interest and situational interest (Krapp et al., 1992). While personal interest refers to a person's traits in preference of an activity based on past experiences, situational interest is a person's affective perceptions occurring when he/she interacts with an activity or an environment (Krapp et al., 1992). According to Chen et al. (1999), situational interest consists of six dimensions: *total interest, novelty, challenge, attention demand, instant enjoyment,* and *exploration intention.* A recent study reported that a library guide by spherical video-based virtual reality (VR) could enhance university students' situational interest, particularly for the senses of novelty and challenge (Lin et al., 2019). The affordance of 3D virtual worlds such as *Second life* for arousing teachers' situational interest was also addressed by previous studies (i.e., Cho et al., 2015). However, limited work was made for exploring young learners' situational interest when engaging in fully immersive virtual reality (IVR) environments with head-mounted display (HMD).

Epistemic curiosity is another psychological state that an individual is eager to obtain intellectual knowledge for inherent interest (*I-type*) or eliminating feelings of informational deprivation (*D-type*) (Litman, 2008). The role of learners' epistemic curiosity in their learning behaviors such as information seeking has been addressed by previous studies (e.g., Litman et al., 2005). Since the expedition in IVR learning environments involves behaviors of exploring virtual information, there is a need to examine what role of learners' traits of epistemic curiosity play in their learning by IVR with considering the possible stimulation of situational interest. In addition, gender differences in users' perceived presence in VR environments were documented in the literature (e.g., Narciso et al., 2019); hence, the gender issue was also explored in this study.

2. Method

2.1 IVR system

To explore students' situational interest when engaging in science learning with the aid of IVR technology, this study adopted an IVR system developed by Cheng et al. (2019), namely "Find The

ROOT," for plants learning. The learning system was developed based on Oculus platform. Users have to wear an HMD (Gear VR headset was used in this study) along with holding a controller to observe the virtual world and interact with the virtual plants. Students can learn the appearance of plants, the propagation of plants, and the reproduction of plants in the three virtual scenes of the IVR system. For example, when users selected a flower by clicking the trigger button on the controller, a 3D animation for presenting how pollination is achieved by bees would exhibit in front of the users (see Figure 1).

Figure 1. The screenshots of the IVR learning system (left: selecting a flower, right: 3D animation for pollination).

2.2 Participants and research procedure

This study invited 30 elementary school students in 6th grade to participate in the research trial for learning science by IVR. Among these participants, 17 students were male (57%), and 13 students were female (43%). There were 80% of the students reported that they have seen VR application previously, indicating that the effects of technology novelty may not interfere the results of this study.

Before the research trial began, the students were required to responded to a pre-test questionnaire (describe later) for understanding their epistemic curiosity. Besides, each student was individually guided for the usage of the IVR devices (i.e., how to wear the HMD and how to use the controller) by a research assistant. When the student was familiar with the operation of the IVR learning system, the research trial began. The students were informed to freely explore the first two scenes in the virtual plant world. If they felt uncomfortable during the virtual navigation, they were allowed to request for terminating the research trial. As the learning activity finished, the students were required to responded to a post-test questionnaire (describe later) for evaluating their situational interest.

2.3 Questionnaires

There were two questionnaires exploited in this study. The epistemic curiosity inventory developed by Litman (2008) was adopted for the pre-test for assessing the students' psychological traits of epistemic curiosity. The Cronbach's α values for the two scales were 0.82 (*I-type*, 5 items) and 0.75 (*D-type*, 5 items), and overall α value was 0.82. For the post-test, this study adapted the situational interest questionnaire developed by Chen et al. (1999) to fit the context of IVR learning. The Cronbach's α values for the six scales were 0.93 (*total interest*, 3 items), 0.70 (*novelty*, 3 items), 0.80 (*challenge*, 3 items), 0.89 (*attention demand*, 3 items), 0.98 (*instant enjoyment*, 3 items), 0.67 (*exploration intention*, 3 items), respectively, and the overall α value was 0.74. All the items of the two questionnaires in this study were scored in a 5-point Likert scale, with "1" representing "strongly disagree" and "5" representing "strongly agree."

3. Results

3.1 Perceptions of situational interest

This study firstly conducted repeated ANOVA to compare the students' scores on the scales of the situational interest. The results presented that there were significant differences among the students' perceptions of situational interest (F=93.06, p<.001). Specifically, in the IVR learning activity, the students exhibited strong perceptions of *total interest* (M=4.88, SD=0.31), *novelty* (M=4.87, SD=0.30), and *instant enjoyment* (M=4.84, SD=0.42). Further analyses of gender differences showed that the

males also expressed stronger interest in the three scales than the females did. Although their perceptions of *exploration intention* (*M*=4.74, *SD*=0.40) and *attention demand* (*M*=4.59, *SD*=0.60) were slight weaker than the above three perceptions, the IVR learning system could still engage the students to explore the virtual world and concentrate on the learning tasks. Notably, these students expressed less perceptions of *challenge* (*M*=2.37, *SD*=1.11) than the other perceptions of situational interest, indicating that the IVR learning activity in this study was not a demanding task for the students.

3.2 Relations between epistemic curiosity and situational interest

In this study, the young learners exhibited higher epistemic curiosity regarding I-type (*M*=4.46, *SD*=0.51) than D-type (*M*=3.80, *SD*=0.65). The relationships between the students' epistemic curiosity and their perceptions of situational interest in the IVR learning activity were further analyzed. As shown Table 1, the psychological trait of I-type epistemic curiosity was significantly related to the perceptions of *exploration intention* (*r*=0.64, *p*<.001)*, novelty* (*r*=0.42, *p*<.05), and *total interest* (*r*=0.44, *p*<.05), indicating that the learners with strong intentions to discover something new for inherent delight (I-type) tended to possessed more situational interest, particularly for the behaviors of exploration, sense of novelty, and perceptions of general interest in the IVR learning environment of this study. On the other hand, the D-type epistemic curiosity was not significantly associated with situational interest. Interestingly, when further examining the gender differences in the relations between epistemic curiosity and situational interest, it was found that the females with stronger D-type epistemic curiosity tended to pay more attention to the IVR learning materials (*r*=0.56, *p*<.05), implying the gender variable might interfere with the relationships between epistemic curiosity and situational interest.

Table 1

The relationships between the students' epistemic curiosity and situational interest

	Exploration Intention	Instant Enjoyment	Novelty	Attention Demand	Challenge	Total interest
I-type EC	**0.64*****	0.33	**0.42***	0.35	-0.33	**0.44***
D-type EC	0.29	0.19	0.26	0.02	-0.06	0.26

EC: epistemic curiosity, *p<.05, ***p<.001

References

Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology, 45*, 180-191.

Chen, A., Darst, P. W., & Pangrazi, R. P. (1999). What constitutes situational interest? Validating a construct in physical education. *Measurement in Physical Education and Exercise Science, 3*(3), 157-180.

Cheng, K. H., Wang, Y. C., Chang, C. W., & Tsai, C. C. (2019). Learning plants by immersive virtual reality: a pilot exploration of elementary school students' flow experience and attitudes. Paper presented at the 23th Global Chinese Conference on Computers in Education (GCCCE 2019), Wuhan, China, May 23- May 27.

Cho, Y. H., Yim, S. Y., & Paik, S. (2015). Physical and social presence in 3D virtual role-play for pre-service teachers. *The Internet and Higher Education, 25*, 70-77.

Krapp, A., Hidi, S., & Renninger, K. A, (1992). Interest, learning, and development. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), *The role of interest in learning and development* (pp. 1-26). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Lin, C. S., Yu, S. J., Sun, C. Y., & Jong, S. Y. (2019). Engaging university students in a library guide through wearable spherical video-based virtual reality: Effects on situational interest and cognitive load. *Interactive Learning Environments*. Advanced online publication.

Litman, J. A. (2008). Interest and deprivation dimensions of epistemic curiosity. *Personality and Individual Differences, 44*, 1585-1595.

Litman, J. A., Hutchins, T. L., & Russon, R. K. (2005). Epistemic curiosity, feeling-of-knowing, and exploratory behaviour. *Cognition and Emotion, 19*, 559-582.

Narciso, D., Bessa, M., Melo, M., Coelho, A., & Vasconcelos-Raposo, J. (2019). Immersive 360 degrees video user experience: impact of different variables in the sense of presence and cybersickness. *Universal Access in the Information Society, 18*(1), 77-87.