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An innovative approach to improving university students' situational interest using the wearable spherical video-based virtual reality guide in the library

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Abstract: The purpose of this study was to investigate the difference in situational interest (Exploration Intention, Instant Enjoyment, Novelty, Attention Demand, Challenge, and Total Interest) between a virtual reality (VR) guide and a map guide. The VR guide group and the map guide group consisted of 43 and 45 university students. The VR guide group used a wearable VR guide device which consisted of the EduVenture VR application and Google Cardboard, while the map guide group used tablet PCs to learn the functions of the library. Both groups had to complete a prior knowledge test, field tasks and the situational interest scale. The study found that the spherical video-based virtual reality application EduVenture VR with Google Cardboard used in the library guide had a positive impact on the university students. The use of the wearable VR guide device to learn the functions of the library raised the situational interest dimensions of Novelty and Challenge more than the use of the map guide. In the future, it is expected to introduce spherical video-based virtual reality into education to change the students' way of learning and to achieve more effective learning outcomes and motivation by improving situational interest in the learning process.

Keywords: learning motivation, spherical video-based virtual reality, situational interest, library guide

1. Introduction

Due to the rapid advancements in science and technology, applying technology to improve learning motivation has become an important part of innovative instructional design. Incorporating technology into the learning process has become our primary aim. The researcher chose EduVenture VR because it not only allows learners to use mobile devices for distance learning but also presents the virtual scene to the learner with a combination of a 360-degree real environment and simple system functions. Merchant, Goetz, Cifuentes, Keeney-Kennicutt, and Davis (2014) also believe that Virtual Reality is effective in formal and informal learning in higher education. Moreover, Ray and Deb (2016) compared the results of wearable device learning and traditional learning and found that using the wearable device VR technology can not only improve the effectiveness of the learning process but can also increase students' interest.

We chose a university library for our study because a library is an important place for knowledge exchange and research assistance (Abel & Newlin, 2002). Therefore, each university has its own library. With the rapid changes in educational environments and emerging technologies, university libraries face the need for change and adjustment (Jubb, 2010). This research focused on improving the library guide functions. A guide indicates a process of interpreting things or places that make such things or places easier to understand (Edson & Dean, 1996). The guide to the library is also one of the important functions that can help users understand the library. The situational simulations of EduVenture VR have the potential to construct new functions and activities in the library. EduVenture VR can be implemented with a wearable device such as Google Cardboard.

This device can maximize the functional benefits of the mobile device, and users can operate it without their hands.

This study focused on learners' situational interest when they used the VR guide to learn the library's functions. Situational interest can help provide an understanding of learners' direct experience of the environment. We examined the difference in their situational interest by comparing the spherical video-based VR guide with the map guide. To effectively explore the research objectives listed above, this study addresses the following research question: What is the difference in the situational interest of the learners in the VR guide group and map guide group in the library?

2. Literature Review

2.1 Virtual Reality – EduVenture VR

EduVenture VR is an online platform launched by the Centre for Learning Science and Technology of the Chinese University of Hong Kong in 2016 (Jong, Luk, Leung, & Poon, 2018). Using the EduVenture VR editor would enable the production of a low-cost and interactive 360-degree panoramic VR learning video. With EduVenture VR's built-in object combinations, the system environment can be brought closer to the real world for learners to learn or to be guided. To date, few studies have been performed on guiding with the EduVenture VR. This study represents a breakthrough and is also consistent with the original purpose of developing EduVenture VR, which is intended to be applied to campus learning and to improve student engagement and motivation (Jong et al., 2018).

2.2 Wearable devices for learning

In 2014, Google Cardboard was announced at Google I/O (Google, 2014). Google Cardboard is a VR tool. It is a wearable device made of thick cardboard, and is simply worn like glasses. Users must place a mobile device in front of the lens and open the specialized application with an appropriate focus adjustment. With this simple piece of hardware, they will be able to experience 360-degree panorama VR. Google Cardboard has recently become a popular learning aid. Gutierrez, Vexo, and Thalmann (2008) also noted that using wearable devices provides an optimal immersive experience that is more conducive to learning than are projection screens or desktop-based VR. The study hoped to enhance interest in learning through appropriate learning applications and wearable VR guide devices, such as Google Cardboard combined with informal courses. Google Cardboard with a mobile device is shown in Figure 1.

Figure 1. Google Cardboard with a mobile device

2.3 Situational interest

Situational interest refers to interest activated by the environment (Hidi, 2006; Schraw & Lehman, 2001; Sun & Rueda, 2012), that is, an individual's attraction to an activity environment or a learning

task that is automatically generated in a short time, rather than a personal preference for the activity (Hidi & Anderson, 1992; Krapp, Hidi, & Renninger, 1992). It focuses on the interaction between an individual and an activity, so the critical factor in developing a student's situational interest is the learning environment (Chen, Darst, & Pangrazi, 2001; Linnenbrink-Garcia et al., 2010). Educators can change the learning environment by adjusting their teaching methods, assignments and materials, which can in turn enhance the learners' situational interest (Hidi, 2001). Many studies have proved that situational interest can notably improve student engagement (Alexander, Jetton, & Kulikowich, 1995), performance (Harp & Mayer, 1997) and effort (Rotgans & Schmidt, 2014). Chen, Darst, and Pangrazi (1999) used a series of empirical studies to develop the scale of situational interest. This scale also integrates many studies from the past (Harter, 1978; Hidi & Anderson, 1992; Krapp et al., 1992) and summarizes six sub-dimensions, namely Exploration Intention, Instant Enjoyment, Novelty, Attention Demand, Challenge and Total Interest.

3. Methods

3.1 Participants and Procedures

This was a quasi-experimental research study, and 100 university students volunteered to participate. The effective sample size was 88 people (88%), and all the participants were university students. These participants were randomly separated into the VR guide group and the map guide group consisting of 43 (48.86%) and 45 (51.14%) participants, respectively. There were 23 male (26.14%) and 65 female participants (73.86%), 63 undergraduate (71.59%) and 25 graduate students (28.41%). The average age of the participants was 21.85 years old (SD = 2.12).

The experiment included four stages. The participants completed all the questionnaires online. In stage I the detailed research process was explained to the participants and they signed the consent form. They also needed to complete a basic information form, and to take a prior knowledge test which was to determine their understanding of the library. In stage II, the content of the two groups was different. The VR guide group used the wearable VR guide device, created by EduVenture VR, and Google Cardboard with a mobile device inserted. Then, the researchers provided an explanation regarding how to use the device, and the tag and teleport functions would help them understand this system. The researchers also helped the participants adjust the focal distance and solve any image problems until they could operate the device. The map guide group used the tablet PC to see the public floor layout of the library, one floor per page. The two groups had the same tasks and there were four tasks on different floors of the library. The VR guide group could find yellow marks through the 360-degree panoramic view of the library in thee wearable VR guide devices and the map guide group could also find it in the public floor layout of the library on the tablet PC. When the two groups had confirmed the four task locations in the VR system or floor layout, they then looked for the task location in the actual library and answered the questions in each of the tasks, which was stage III. Clues to the answers were provided around the task location and the pathway. The participants completed the answer sheet and then entered the final stage in which they had to complete the post-test questionnaire of the situational interest scale. A flowchart describing the experiment is shown in Figure 2.

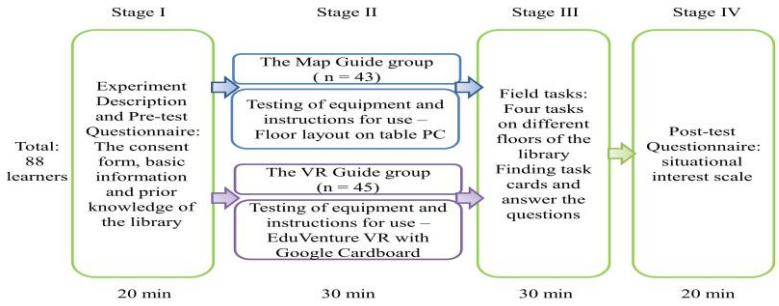

Figure 2. Experimental flowchart

3.2 Prior knowledge test & Situational interest scale

The prior knowledge test, which consisted of six questions, was conducted to determine whether the members in the different groups had a consistent understanding of the library before the experiment. The results showed no significant difference (t (86) = -1.54, p > .05) between the VR guide group and the map guide group. This result means that the two groups had the same prior knowledge.

This study adapted the situational interest scale developed by Chen et al. (1999). The scale is divided into six sub-dimensions, comprising 24 items, with four items in each dimension. The six sub-dimensions are "Exploration Intention," "Instant Enjoyment," "Novelty," "Attention Demand," "Challenge," and "Total Interest." Exploration Intention refers to the tendency for a learner to explore and discover during learning ("I like to find out more about how to do it"); Instant Enjoyment refers to a learner's satisfaction during the learning process ("This activity is exciting"); Novelty refers to the differences between a learner's known and unknown information, which is also called information deficiency ("This activity is fresh"); Attention Demand refers to the required concentration and mentality in a learning activity ("I was focused"); Challenge refers to the feeling that reflects one's ability ("It is hard for me to do this activity"); the last item is Total Interest, which represents the degree of entire situational interest ("The activity looks fun to me"). The questionnaire used a 5-point Likert scale, with 1 representing *strongly disagree* and 5 representing *strongly agree*. The Cronbach's α value of the situational interest scale was .92, and for each dimension it was .88, .91, .90, .95, .84 and .89, respectively.

4. Results

Table 1 shows the results for the situational interest and sub-dimensions of situational interest. The Levene's test for situational interest and all sub-dimensions was not significant (p > .05), except for Total Interest (p < .05). Based on the t-test results, situational interest (t (86) = 1.85, p = .07), Exploration Intention (t (86) = 1.03, p = .31), Instant Enjoyment (t (86) = 1.43, p = .16), Attention Demand (t (86) = .20, p = .84) and Total Interest (t (80.63) = .38, p = .71) were not significant. Novelty (t (86) = 2.40, p < .05) and Challenge (t (86) = 2.06, p < .05) were significant between the two groups. The mean Novelty value was 16.47 (SD = 2.28) for the VR guide group and 15.13 (SD = 2.88) for the map guide group, and the mean Challenge value was 9.72 (SD = 2.62) for the VR guide group and 8.58 (SD = 2.59) for the map guide group. These results indicate that using a wearable VR guide device to learn the functions of the library, which is helpful for learners' Novelty and Challenge, does not affect other sub-dimensions or situational interest.

Table 1

Results for situational interest and the sub-dimensions of situational interest

Variables	VR guide group (n = 43)		Map guide group (n = 45)		t	df	p
	M	*SD*	*M*	*SD*			
Situational interest	89.65	8.30	85.64	11.69	1.85	86	.07
Exploration Intention	15.44	2.12	14.98	2.11	1.03	86	.31
Instant Enjoyment	16.35	2.24	15.60	2.66	1.43	86	.16
Novelty	16.47	2.28	15.13	2.88	2.40	86	< .05
Attention Demand	15.70	2.77	15.58	2.84	.20	86	.84
Challenge	9.72	2.62	8.58	2.59	2.06	86	< .05
Total Interest	15.98	2.08	15.78	2.84	.38	80.63	.71

5. Discussion & Conclusion

The research question aims to understand whether using a wearable VR guide device in combination with EduVenture VR with Google Cardboard for university library guide learning can enable

learners to develop situational interest compared to using a map guide. The result shows that wearable VR guide devices can improve the situational interest dimensions of only Novelty and Challenge. In other words, wearable VR guide devices are more novel and challenging than map guides to learners. EduVenture VR is a newly developed platform (Jong et al., 2018). The overall content and operation are not the same as general applications without wearable devices in the past, so it is more novel and challenging to users. In addition, the novelty means that the learners were very interested in such emerging technology. The VR guide with the wearable device is used to experience virtual space through one's own eyes, which is not a common experience (Carrozzino & Bergamasco, 2010) and it thus brings novelty. On the other hand Challenge is the feeling that reflects one's ability and is one of the motivations for attracting students to participate in activities (Harter, 1978). The VR guide with the wearable device is not very common, nor is it easily accessible to the general public, which is the reason for the challenge. Many learners in the experiment even used it for the first time, but the map guide in the study is similar to the existing guide method, such as physical floor layout, so the learners do not need to spend more time to learn to use it. The EduVenture VR has been successfully applied in the library guide field in this study.

The results of this study support that applying wearable VR guide device technology in library education is a feasible trend worth promoting in the future. It can improve the use of the library and the value of field education. When the library releases or promotes new functions, the situation can be simulated, and the effect can be anticipated; even the overall environment could be improved through the use of the wearable VR guide device. Not only can the cost of developing new functions be significantly reduced, but also because of the high degree of familiarity, students can reduce the time of learning and increase the breadth of applications in the future. In addition, learners could use their mobile device to view VR anytime without spending time onsite asking or searching.

This study focused on the learners' situational interest. Much data and information can be analyzed and integrated in the future, including the feelings of the users, the content of the tasks, the acceptance of new technologies, the time taken to complete tasks and the effectiveness of the performance after being guided. However, the learning content can be combined with EduVenture VR to create a more complete learning environment through dynamic teaching methods and the integration of technology into the value of field education through the expansion of field tasks. Not only will it enrich the learning content but it will also give learners a different learning choice. At the same time, the situational interest is increased to enhance the learning motivation. The wearable VR guide device combining the EduVenture VR application has provided new opportunities related to learning with technology.

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