CS6460 Research Proposal

Analysis Factors affecting learning behaviors in a VR environment

Changrui Zhang

1. Introduction

1.1 background

Many innovations have been experienced in technology today. These innovations progressively take their places in education environments. Technology is as influential factor in education as it has ever been. Academic institutions are challenged by these new technological requirements and must adopt appropriate strategies to meet the innovative educational demand. The advancement in interactive and immersive technologies can have a noticeable impact on various styles of teaching and learning. Virtual reality is a technology that is attractive to student community. Virtual reality due to its 3Is (Immersive, Interaction and Imagination) features is among activity area that have been frequently discussed and used in education environments in the recent years. Research in virtual reality and education is novel and has potential for expansion in the coming years.

Virtual reality (VR) was first promoted by the United States Virtual Programming Language Research Center (VPL Research) in 1989 and attracted public attention immediately. VR can be defined as implementations by which individuals find themselves in a virtually created environment using various tools and interact with the environment (Carrozzino and Bergamasco, 2010). As also Rheingold (1991) stated, VR could be defined as experiences which individuals could walk around in three dimensional environments, developed with computer technologies, and the environment could be observed from all angles. Generally, according to VR implementation definitions, the feelings that individuals directly interact with the environment and feel themselves in the related environment are emphasized.

VR implementations have continued their presence in many areas from tourism to education. VR implementations could be possibly encountered in a touristic destination advertising, historical elements presentation or in entertainment sector. Besides this wide range of use areas, developing and spreading of the current technology enable the increase use of VR implementations in education environments. A summary of education application of VR is in Figure 1.

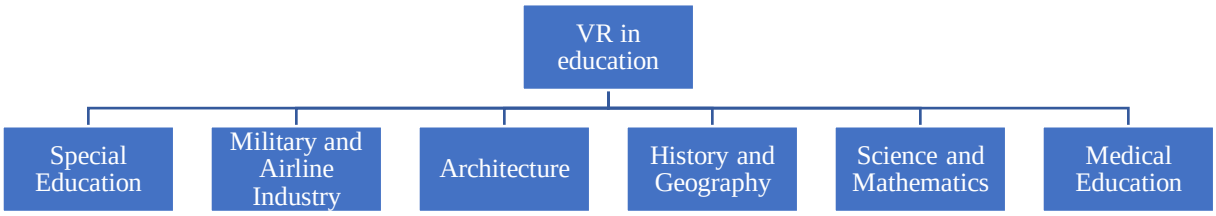

Figure 1. VR Application in Education

Many studies have been conducted on the applications and effectiveness of virtual reality in education and training since the 1980s. McLellan (1996) provides comprehensive and in-depth reviews of the literature related to the research and use of virtual reality for education and training in editions of The Handbook of Research for Educational Communications and Technology. Youngblut (1998) conducted an extensive survey of research and educational uses of virtual reality during the 1990's. The survey attempted to answer questions about the use and effectiveness of virtual reality in kindergarten through grade 12 education. He found that there are unique capabilities of virtual reality, and the majority of uses included aspects of constructivist learning Studies showed potential educational effectiveness for special needs students. Salzman, Dede, Loftin, and Chen (1999) describes how virtual reality aids complex conceptual learning, and how virtual reality's features and other factors shape the learning process and learning outcomes. The model resulted from a study to identify, use, and evaluate immersive virtual reality's affordances as a means to facilitate the mastery of complex, abstract concepts. Chee (2001) argues for the need to root learning in experience, using physics as an example. He states that physics students have little "feel" and "understanding of the qualitative dimensions of the phenomena they study". Chee believes that virtual reality can be used to achieve this goal, "providing a foundation for students' conceptual and higher-order learning". Dalgarno, Hedberg, and Harper (2002) believe that the most important potential contribution of 3D learning environments (3DLEs) to conceptual understanding is through facilitation of spatial knowledge development. They have identified aspects of a research agenda to test this, including "exploration of the characteristics of 3DLEs that are most important for spatial learning along with issues in designing appropriate learning tasks".

Also, there are many quantitative studies show VR is really effective in some domains of education. A study was made to evaluate the use of 3D models to improve the learning process of human anatomy students, and it was shown that using such technology has a positive impact on the students (Nicholson, D.T., Chalk, C., Funnell, W.R.J. and Daniel, S.J., 2006.). The effectiveness of traditional clinical education toward skill acquisition goals versus simulation-based medical education (SBME) with deliberate practice (DP) was also studied (McGaghie, W.C., Issenberg, S.B., Cohen, M.E.R., Barsuk, J.H. and Wayne, D.B., 2011.). These results show that SBME with DP is superior to traditional clinical medical education in achieving specific clinical skill acquisition goals. Besides medical education, VR also benefits skill training. Another study is investigating how novice drivers with autism spectrum disorder (ASD) differ from experienced drivers. The study shows that virtual reality driving simulation training (VRDST) improves ASD driving performance significantly (Cox, D.J., Brown, T., Ross, V., Moncrief, M., Schmitt, R.,

Gaffney, G. and Reeve, R., 2017.) Studies also show that VR can improve learning outcomes in K-12 and higher education (Merchant, Z., Goetz, E.T., Cifuentes, L., Keeney-Kennicutt, W. and Davis, T.J., 2014.).

Virtual reality technologies have been developed for a wide range of applications in education, but how does each learner think about it and what are the factors that affect learners' attitude? Further research is needed to answer these questions. Such research will help establish appropriate and effective learning techniques and practices to motivate meaningful learning.

1.2 Method

How to best assess learner attitudes toward virtual reality learning environments is a critical issue that requires a theory-based approach. The acceptance of information technology by users is the key to the success of information technology applications. To this end, Davis (1989) proposed the Technology Acceptance Model (TAM) to study the influencing factors of information technology acceptance behavior. In the TAM, learner behavioral intention to use a system reflects system acceptance (Lee & Lehto, 2013). Technology Acceptance Model enables to explain the determinants that encourage system use.

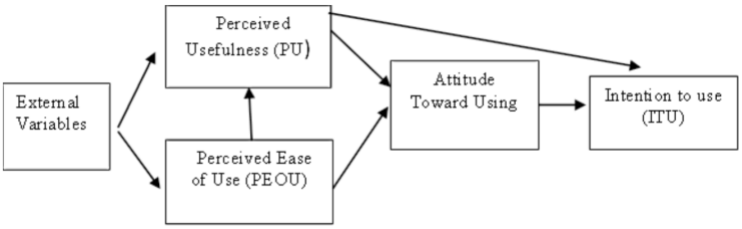

Figure 2. TAM model

In the model, it is assumed that *Use Behavior* is determined by *Behavioral Intention*, while *behavioral intention* is related to *Perceived Usefulness* and *Attitude toward Using*. The two core variables of the TAM model: *perceived usefulness* and *Perceived Ease of Use* have influences on the attitude of use, and at the same time, the *Perceived Ease of Use* also affects *perceived usefulness*.

External variables include system characteristics, user intervention, and other factors that indirectly affect the two core variables in the model. Subsequently, many scholars have revised and improved it by adding external factor variables and subjective modulating variables and form rich TAM expansions in different empirical studies (Venkatesh & Bala, 2008). At present, the TAM model and its extended model have a strong influence in the research of information technology, and the number of papers used to study it exceeds other theoretical models. Similar application is that Rafal Wojciechowski and Wojciech Cellary in 2013 used TAM to evaluate learners' attitude toward learning in ARIES augmented reality environments.

1.3 Research Plan

The research will use ***King Tut VR*** app as a tool to teach students history of king tut. The King Tut VR was Created as part of a museum exhibit. It will let student experience the Tomb of King Tutankhamun on mobile phone in Virtual Reality. The full 360-degree virtual environment enable student get a personal view of these impressive historical artifacts without having to go to Egypt or worry about the curse of the Pharaohs. The data will be collected via a survey after the student using the app.

Based on technology acceptance approaches, the research will evaluate learner perceptions of virtual reality learning technologies and examines learners' behavioral intention to use such a virtual reality learning environment Also, the research will find which factors can affect the will of use and learning behaviors by adopting the extended technology acceptance model.

2. Task and Schedule

2.1 Schedule

My current estimate is that the project will take 130 hours to complete and have broken down each week's tasks into maximum of 22 hours weekly workload. Following is the complete schedule.

Week 5	1. Research for the app to use as a tool for education. (6 hours)
	2. Summary the research background.(6 hours)
	3. Wirte up the research Proposal & Peer Review (5 hours)
Week 6	1. Review the technology acceptence model (5 hours)
	2. Design a techonology acceptence model for the research(10 hours)
	3.Write up Weekly Status Check & Peer Review (3 hours)

Week 7	1.Research on Questionare design methodology (3 hours)
	2.Design Questionare for research.(11 hours)
	3.Write up Intermediate Milestones I & Weekly Status Check & Peer Review. (6 hours)
Week 8	1. Revise the Questionares (3 hours)
	2.Use King Tut VR to teach students history in a college (12 hours)
	3. Write up Weekly Status Check & Peer Review (3 hours)
Week 9	1. Collect data by survey using questionare design before and check the data quality. (8 hours)
	2. Conduct preliminary analysis and reach early observations and conclusions. (8 hours)
	3. Write up Intermediate Milestones I & Weekly Status Check & Peer Review. (6 hours)
Week 10	1. Apply data to technology accpetence model design before. (5 hours)
	2. Conduct Regression anlysis and reach a conclusion of each facotors that affect user's attitude. (10 hours)
	3. Write up Weekly Status Check & Peer Review (3 hours)
Week 11	1. Complete Final Paper. (8 hours)
	2. Complete Final Presentation. (4 hours)
	3. Complete all project diliverables. (5 hours)

2.2. Intermediate Milestones

Intermediate Milestones I

In the first intermediate milestones, I plan to show my 1. technology acceptance model including all variables revised for this specific topic and 2. questionnaire designed for technology acceptance model. Later I will modify my questionnaire according the feedbacks of classmates if needed.

Intermediate Milestones II

In the second intermediate milestones, I plan to share my 1. preliminary data collected by the questionnaire and 2. early conclusions and observations based on the survey 3. plans for later analysis leading up to the final deliverable.

Reference

[1] Carrozzino, Marcello, and Massimo Bergamasco. "Beyond virtual museums: Experiencing immersive virtual reality in real museums." Journal of Cultural Heritage 11, no. 4 (2010): 452-458.

[2] Rheingold, Howard. Virtual Reality: Exploring the Brave New Technologies of Artificial Experience and Interactive Worlds-From Cyberspace to Teledildonics. Secker & Warburg, 1991.

[3] McLellan, H., 1996. Virtual realities. *Handbook of research for educational communications and technology*, pp.457-487.

[4] Youngblut, C., 1997. Educational uses of virtual reality technology. Executive report. Reprinted from Educational uses of virtual reality technology (IDA Document Report Number D-2128). Alexandria, VA: Institute for Defense Analyses, 1998. VR in the Schools, 3 (1). Retrieved July 16, 2009.

[5] Salzman, M.C., Dede, C., Loftin, R.B. and Chen, J., 1999. A model for understanding how virtual reality aids complex conceptual learning. *Presence: Teleoperators & Virtual Environments*, *8*(3), pp.293-316.

[6] San Chee, Y., 2001. Virtual reality in education: Rooting learning in experience. In International Symposium on Virtual Education (pp. 43-54).

[7] Dalgarno, B., Hedberg, J. and Harper, B., 2002. The contribution of 3D environments to conceptual understanding.

[8] Nicholson, D.T., Chalk, C., Funnell, W.R.J. and Daniel, S.J., 2006. Can virtual reality improve anatomy education? A randomised controlled study of a computer-generated three-dimensional anatomical ear model. *Medical education*, *40*(11), pp.1081-1087.

[9] McGaghie, W.C., Issenberg, S.B., Cohen, M.E.R., Barsuk, J.H. and Wayne, D.B., 2011. Does simulation-based medical education with deliberate practice yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. *Academic medicine: journal of the Association of American Medical Colleges*, *86*(6), p.706.

[10] Seymour, N.E., Gallagher, A.G., Roman, S.A., O'brien, M.K., Bansal, V.K., Andersen, D.K. and Satava, R.M., 2002. Virtual reality training improves operating room performance: results of a randomized, double-blinded study. *Annals of surgery*, *236*(4), p.458.

[11] Cox, D.J., Brown, T., Ross, V., Moncrief, M., Schmitt, R., Gaffney, G. and Reeve, R., 2017. Can youth with autism spectrum disorder use virtual reality driving simulation training to evaluate and improve driving performance? An exploratory study. *Journal of autism and developmental disorders*, *47*(8), pp.2544-2555.

[12] Merchant, Z., Goetz, E.T., Cifuentes, L., Keeney-Kennicutt, W. and Davis, T.J., 2014. Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education*, *70*, pp.29-40.

[13] Davis, Fred D. "Perceived usefulness, perceived ease of use, and user acceptance of information technology." MIS quarterly (1989): 319-340.

[14] Lee, Doo Young, and Mark R. Lehto. "User acceptance of YouTube for procedural learning: An extension of the Technology Acceptance Model." Computers & Education 61 (2013): 193-208.

[15] Venkatesh, Viswanath, and Hillol Bala. "Technology acceptance model 3 and a research agenda on interventions." Decision sciences 39, no. 2 (2008): 273-315.

[16] Wojciechowski, Rafał, and Wojciech Cellary. "Evaluation of learners' attitude toward learning in ARIES augmented reality environments." Computers & Education 68 (2013): 570-585.

[17] King Tut VR https://www.eonreality.com/portfolio-items/king-tut/