Learning Effects of Desktop Virtual Reality (VR) Environments in College and Career Technical Training

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Abstract

The paper explains how we conducted research on desktop virtual reality (VR) in a college and technical education environment. It also describes what the research team discovered to be important factors in its successful implementation. The research project was conducted with a college and the Occupational Education Virtual Reality Research Team at Oklahoma State University with the purpose of determining the learning effects of desktop virtual reality (VR) in college and technical training. Participants were students from a two-year surgical technicians program and students from a career tech center.

Introduction and Background

The research is a group of students in the Ph.D. Occupational Education Studies program, at Oklahoma State (OSU)who investigated the design and performance effects of desktop virtual reality and virtual environments (VR/VEs) through small-scale mixed-method studies. The studies combined theory-based quasi-experiments consisting of qualitative interviews with learners exposed to desktop VEs for surgical operating rooms [1].

Specifically, the research conducted by the team compared the learning effects of two different types of desktop virtual reality (VR) in presenting scenes and equipment in surgical operating rooms. This technology was used in a way that supports the instruction, where adult learners can use technology to obtain information and meet their learning needs.

The use of technology for adult literacy and education has grown from computer-assisted instruction to the information highway to the use of personal computers in management and information systems [2].

Virtual Reality technologies allow users to occupy, navigate, manipulate, and control realistic computer-generated environments. These VEs can immerse users/learners in a bounded graphical space and give them a strong feeling that they have actually *been* in a particular environment (Di Blas & Poggi, 2007; Mikropoulos, 2006). Desktop Virtual Reality creates and delivers VEs in the form of on-screen "movies" that users can "enter" and explore

ISBN 978-1-60643-379-9

interactively by moving a mouse or other navigation device. The user determines what movements to make and when to make them; the user explores the imagery on the computer screen in real time as if actually moving within a place in the physical world. Movement can include panning and rotating the scene to simulate physical movements of the head and body, zooming in and out to simulate movements toward and away from objects or parts of the scene, and clicking on “hot spots” to navigate to additional embedded scenes and objects [3].

Administering the Research Test

The VR group from OSU went to a hospital’s operating room to create the images for the VR scenes. The desktop operating room VR “movies” were created by taking a series of digital still photographic images and then using special VR software (VR WORKS, PANO WEAVER, TOUR WEAVER) to “stitch and blend” the images into a single panoramic scene that the user can “enter” and explore individually and interactively. The user would employ a mouse to move and explore within an on-screen virtual environment as if he or she were actually moving within a space in the real world. Movements could include rotating the panoramic image to simulate physical movements of the body and head, and zooming in and out to simulate movements toward and away from objects or parts of the scene. Embedded individual virtual objects can be “picked up,” rotated, and examined as the user chooses, and clickable “hot spots” can also be used to navigate at will [4]. An example is shown in Figure 1 below:

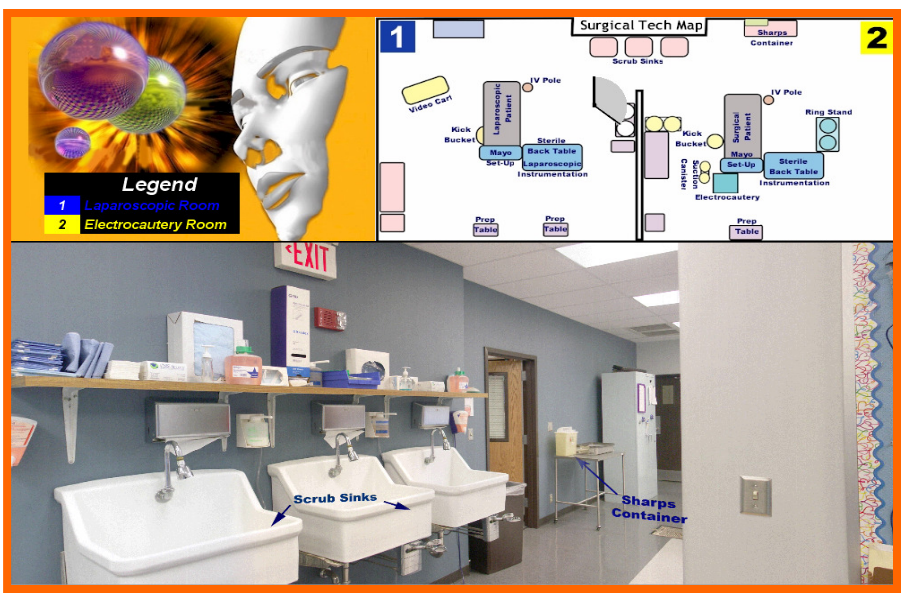

Figure 1: Desktop Operating Room VR

Each subject was given a demographic survey to complete and a copy of the *SPT1* answer sheet, which is a level of visualizing skill assessment using the Successive Perception Test 1

(SPT1), which is a video-based test that requires subjects to recall and select the screen picture [5].

The Successive Perception Test1 (SPT1) instrument was used to measure Lowenfeld's visual/haptic typology. Lowenfeld discovered that individuals with visual learning abilities had a higher chance of discriminating details that were visual. Furthermore, their reaction was also noted to be more impersonal. On the other hand, haptic learners (those with learning abilities based in the sense of touch) were not in a position to discriminate details that were visual and had a higher chance of reacting to situations with more emotions. Lowenfeld revealed that a number of individuals that were partially blind had the ability to make use of the little sight that they possessed to either view an object or apply their other senses as a way of expressing themselves. However, other individuals that were also partially blind were not in a position to utilize their eyes. These individuals found it more useful to apply touch senses [6].

The participant was then trained on how to operate the type of VR treatment he/she would be using during the activity. Each subject was assigned to either navigated or non-navigated VR treatments, so the VR group only needed to train each subject on how to operate one kind of presentation. It was explained to the subject that the researcher would show him/her a computer presentation that would demonstrate how to work the VR program.

Conducting the Qualitative Interviews with Selected Subjects

The researcher asked the subject numerous questions, such as, “I would like to find out more about your experiences with the Virtual Reality (VR) program. Have you had any previous experiences with virtual reality? Have you ever experienced virtual reality before?”

Using the completed data forms, the researchers coded all data and created an SPSS data file. Quantitative analysis was done with SPSS. Qualitative data was analyzed through thematic analysis and coded for statistical analysis. Learning performance variables included: tests of spatial orientation within a visual environment (measured by multiple-choice responses to questions requiring location of items in the environment relative to specified locations of the user), perceived performance confidence (measured on defined Likert-type scales), and perceived task difficulty (measured on defined Likert-type scales).

Theoretical and Empirical Foundations for the Studies

The experimental VR studies developed by the VR research team have been guided by predictive research hypotheses situated in a collection of theoretical bases and supporting empirical research literature. These have included the following:

LOWENFELD'S VISUAL/HAPTIC TYPOLOGY: Lowenfeld and Brittain describe haptic and visual styles of learning as being on opposite ends of the continuum. It has been noted that a majority of people usually fall between the two extremes. Persons that are visually oriented are not able to adapt to a given situation via means of kinesthetic and touch functions with ease. Lowenfeld has noted that as individuals advance in age, their haptic and visual perception also tends to diminish in importance [7].

This may be regarded as more of a developmental effect as an increasing number of individuals turns more visual as they advance in age. Compared with other forms of perceptual styles, haptic perceptual style has a lot more significance amongst adults. Lowenfeld and Brittan state "that for some children, not only those who might be termed extreme haptics, school may be frustrating because of the emphasis on visual learning." Lowenfeld and Brittain go on to say, "the person with haptic tendencies, on the other hand, is concerned primarily with body sensations and subjective experiences, which are felt emotionally" [7].

AGE AND TECHNOLOGY: Well-known research on age and "generational" differences in technology experience and self-efficacy (e.g., Howe & Strauss, 2000, 2003; Prensky, 2001; Tapscott, 1998) has presented evidence that these differences may relate to perceptions and performance with technology-based learning. A recent study of older adult computer users (Karavidas, Lim and Katsikas, 2005) suggests there is a gender difference in anxiety levels in older adult computer users, with women displaying more anxiety and reporting less computer knowledge, despite the fact that males and females reported similar levels of computer usage.

AGE, COMPUTER SKILLS, AND PRIOR GAMING EXPERIENCE*:* While these variables were included, the VR studies at the university found one of the limitations of the study may be the small sample size and limited range of these variables. These findings indicated that in the study between the college and OSU there were no differences in age and technology, and what was found were deficiencies in learner preparation and training for VR.

Conclusions

The main question was whether age affects the levels of technophobia. However, the college and OSU study showed there were no differences in the use of technology between the different age levels observed at the two schools during the five years of research. It was observed that in the study between the college and OSU there were no differences in age and technology; what was found were deficiencies in learner preparation and training for VR.

References

[1] Ausburn, L., Ausburn, F.B., Steele, D., Kroutter, P., Dotterer, G., "et al". "Critical Elements for Successful Performance in Desktop Virtual Reality Environments". The Hawaii International Conference on Education 1-7 January 2010.

[2] Hopey, C. (1999) Technology and Adult Education: rising expectations. *Journal of Adult Learning*, 10(2).

[3] Hogan, M. , (2006). Technophobia Amongst Older Adults in Ireland, *Irish Journal of Management*. 27(1), 21.

[4] Ausburn, L.J. Martens, J., Washington, A., Steele, D., & Washburn, E. Spring 2010 "A Cross-Case Analysis of Gender Issues In Desktop Virtual Reality Learning Environments". *Journal of Industrial Teacher Education*, Vol. 46, pp. 1-34.

[5] Lowenfeld, V. (1954). *Your child and his art: A guide for parents*. New York: Macmillan.

[6] Lowenfeld, V. (1970). *Creative and mental growth*. New York: Macmillan.
[7] Lowenfeld, V., and Brittain, W. L. (1987). *Creative and mental growth*. New York: Macmillan Publishing Company.

Biography

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