THE IMPACT OF THE DEGREE OF IMMERSION UPON LEARNING PERFORMANCE IN VIRTUAL REALITY SIMULATIONS FOR MEDICAL EDUCATION

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Background: Simulations are being used in education to enhance understanding, improve performance, and assess competence. Validated virtual reality (VR) simulations provide a means of making experiential learning reproducible and reusable. This study compared knowledge acquisition using a knowledge structure design of 1st-year medical students at The University of New Mexico. One group (13 students) used a fully immersed VR environment with a head mounted display (HMD); another group (12 students) used a partially immersed VR environment. The study aims were to determine whether there were significant differences between the two groups as measured by changes in knowledge structure before and after VR simulation experience.

Tools and Methods: Students participating in the VR were exposed to a scenario where they are 1st responders in an accident involving head trauma. The impact of the simulation on learning was examined by comparing participant results on pre- and post-relatedness ratings of key concepts that were demonstrated in the simulation. Pathfinder was used to derive two knowledge structures from each student’s relatedness ratings – one from the pre-training ratings, one from the post-training ratings. Knowledge structures were compared to expert knowledge structures resulting in a similarity coefficient reflecting the student’s level of domain knowledge. Those similarity coefficients were compared before and after VR experience in each group and between groups. If learning is occurring, knowledge structure should correlate more strongly with expert knowledge structure after VR simulation.

Results: A 2x2 repeated measures analysis of variance was performed on similarity coefficients with pre vs. post as a within-subjects variable and fully vs. partially immersed as a between-subjects variable. Overall pre/post difference was significant, F (1,23)=30.734, p<.001, but the overall group difference (fully vs. partially immersed) was not significant F (1,23)=0.05. Matched pairs t-tests were performed comparing pre and post similarity scores for each group. The difference was highly significant t (12)=5.115, p<.001 for fully immersed and significant t (11)=2.625, p=.024 for partially immersed.

Conclusions: Both groups benefited from VR simulation training, but the immersed group showed a significantly higher gain than the partially immersed group. This demonstrates a positive effect of VR simulation on learning but an enhanced effect of full-immersion using a HMD vs. a screen-based VR system.