EPICSAVE – A multi-user Virtual Reality-Simulation for paramedic education

Th. Luiz, D. Lerner, J. Pranghofer, A. Franke, M. Herkersdorf, K. Wegner, J. Schild, S. Misztal, B. Roth, L. Flock

Introduction: Rare exposure to critical, complex, highly dynamic emergencies, such as severe anaphylaxis, is a major challenge during vocational training. Widespread training methods using low- or high-fidelity simulators or even standardized simulation patients show considerable limitations in representing the dynamically fluctuating symptoms (e.g. cyanosis, rash, level of consciousness, postural change) and vital signs. Immersive VR environments are learn-effective and cost-efficient solutions for creating simulations in a vast set of areas, especially in emergency medicine. Furthermore, multi-user VR-environments enable social interaction through several multisensory channels; they also support coordinated and cooperated actions and improve collaborative learning and team training.

Methods: EPICSAVE (www.epicsave.de) is a project funded by the German Ministry of Education and Research and the European Union Social Funds (support file: 01PD15004). It involves an interdisciplinary consortium that incorporates expertise from all relevant disciplines, i.e., emergency medicine, paramedic-training academies, media education, media design, and VR-technology.

Project aims were:

1. Development of a Virtual Reality-(VR)-Simulation environment and

2. Implementation and evaluation of the training system within two paramedic vocational training institutions.

In an iterative process, we developed an immersive, navigable, multi-user 3D VR emergency scenario with an integrated virtual patient (VP). The VP represents all common clinical symptoms of anaphylaxis - and many other cardiovascular and pulmonary emergencies. The VR environment allows the training of task-work skills, such as clinical and procedural reasoning, and of teamwork skills, which are necessary for effective crisis resource management. The VR environment, in which the trainees interact via a head-mounted display and hand-controllers, offers many interaction tools, such as the use of diagnostic (penlight, stethoscope, ECG, pulse oxymetry, measurement of blood pressure, temperature, and blood glucose) and therapeutic equipment (e.g. oxygen insufflation, airway management, defibrillation, i.v. and i.m. injection, pharmacotherapy). The system allows spatial navigation through the emergency scenario and verbal communication with trainees and trainer. A tutoring system records all actions within the VR and supports trainers in the debriefing phase.

Results: In a formative evaluation of the prototype by 24 paramedic trainees, we could demonstrate a positive and sustained learning experience that depends on a high presence experience, which in turn depends on an acceptable usability.

Discussion: Usability in VR is an important issue as there are no standards, yet. We identified and solved several aspects in our VR-prototype that caused “breaks in presence” and cognitive load (e.g., communication and navigation problems). Further studies should focus on long-term learning effects.

References: Schild J, Misztal S, Roth B, et al. (2018): Applying Multi-user Virtual Reality to Collaborative Medical Training. In: IEEE VR 2018. [In press]

Schild J, Lerner D, Misztal S, Luiz T (2018): EPICSAVE – Enhancing Vocational Training for Paramedics with Multi-user Virtual Reality. In: IEEE SeGAH. [In press]