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Comparison of Cognitive Load in Virtual Reality and Conventional Simulation-Based Training: A Randomized Controlled Trial

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Abstract : Background: Cardiopulmonary resuscitations are stressful situations in which vital decisions must be made within seconds. Lack of routine due to the infrequency of pediatric emergencies can lead to serious medical and communication errors. Virtual reality can fundamentally change the way simulation training is conducted in the future. It appears to be a useful learning tool for technical and non-technical skills. It is important to investigate the use of VR in providing a strong sense of presence within simulations. Methods: In this randomized study, we will enroll doctors and medical students from the Medical University of Vienna, who will receive learning material regarding the resuscitation of a one-year-old child. The study will be conducted in three phases. In the first phase, 20 physicians and 20 medical students from the Medical University of Vienna will be included. They will perform simulation-based training with a standardized scenario of a critically ill child with a hypovolemic shock. The main goal of this phase is to establish a baseline for the following two phases to generate comparative values regarding cognitive load and stress. In phase 2 and 3, the same participants will perform the same scenario in a VR setting. In both settings, on three set points of progression, one of three predefined events is triggered. For each event, three different stress levels (easy, medium, difficult) will be defined. Stress and cognitive load will be analyzed using the NASA Task Load Index, eye-tracking parameters, and heart rate. Subsequently, these values will be compared between VR training and traditional simulation-based training. Hypothesis: We hypothesize that the VR training and the traditional training groups will not differ in physiological response (cognitive load, heart rate, and heart rate variability). We further assume that virtual reality training can be used as cost-efficient additional training. Objectives: The aim of this study is to measure cognitive load and stress level during a real-life simulation training and compare it with VR training in order to show that VR training evokes the same physiological response and cognitive load as real-life simulation training.

Keywords : virtual reality, cognitive load, simulation, adaptive virtual reality training
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