Adapting virtual trainings of applied skills to cognitive processes in medical and health care education within the DiViFaG project

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Abstract: The use of virtual reality technology in education rises in popularity, especially in professions that include the training of practical skills. By offering the possibility to repeatedly practice and apply skills in controllable environments, VR training can help to improve the education process. The training simulations that are going to be developed within this project will make use of the high controllability by evaluating behavioral data as well as gaze-based data during the training process. This analysis can reveal insights in the user's mental states and offers the opportunity of autonomous training adaption.

Keywords: virtual reality; training simulation; medicine; health care; cognitive load; eye-tracking

1 Research Context

Since virtual reality (VR) became more affordable over the last years, awareness of its potential for educational purposes has risen. It has been shown that the use of VR techniques can help to promote skill acquisition during training. Additionally, the VR training environment is highly controllable and can be adjusted to the learner's skill levels [CER19]. By making use of those benefits, VR training simulations can improve education as in the context of medicine and health care, since those educations include the training of practical skills. During their education students often state lacking the possibility of training practical skills sufficiently [Fe04]. To further enhance the training, it is important to reduce the amount of extraneous cognitive load while keeping the level of difficulty of the training context cognitively demanding [Sw11].

2 Research Question

During the project multiple VR training scenarios will be developed by all project partners to make use of the mentioned benefits of VR training for medical and health care education. By integrating the scenarios into existing learning management systems, students can easily access them and teachers can adjust them to their personal needs.

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To enable an even more autonomous and individual training, the scenarios will be extended by online user data evaluation, including behavioral data as well as gaze-based data. This enables the measurement of mental states such as cognitive load by, for example, analyzing pupil oscillation [Du20] or the task-dependent pupil size [HP17]. The training environment then adapts to those measurements by offering more hints or guidance for more insecure or novice users or changing the task design from a recall to a recognition task to prevent cognitive overload (Fig.1). The additional feedback, as well as changing the task for more advanced learners to a design that builds on prior knowledge, are based on the cognitivist learning theory [BW77]. The training adaptions will be evaluated to analyze the impact of the considered changes regarding improved learning outcome, higher motivation and impact on the long-term memory.

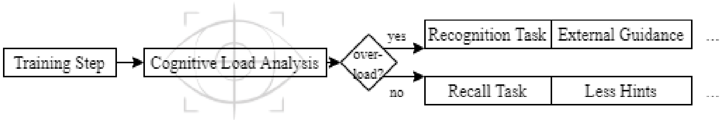

Fig. 1: Possible decision process of the application based on user data analysis

The project has started in January 2020. Until September we will have implemented three scenarios that cover interaction techniques such has eye- and hand-tracking as well as speech recognition. We look forward to demonstrating examples at the conference. DiViFaG is sponsored by the Bundesministerium für Bildung und Forschung.

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