

**STUDY ON TRANSFER OF BASIC SKILLS ACQUIRED ON THE
LAPSIM VIRTUAL REALITY TRAINER TO A CLINICAL
SETTING**

Cecilie Våpenstad (MSc)¹, Magdalena Karolina Chmarra (PhD)², Erlend Fagertun Hofstad (MSc)¹, Lars Eirik Bø (MSc)¹, Esther Kuhry (MD, PhD)^{2,3,4}, Thomas Langø (PhD)¹, Ronald Mårvik (MD, PhD)^{2,3,4}

¹SINTEF Technology and Society, Dept. of Medical Technology, Trondheim, Norway, ²Norwegian University of Science and Technology (NTNU), Medical Faculty, Trondheim, Norway, ³Trondheim University Hospital, Dept. of Gastrointestinal Surgery, Trondheim, Norway, ⁴Trondheim University Hospital, National Center for Advanced Laparoscopic Surgery, Trondheim, Norway.

AIMS: In surgical training, teaching of psychomotor skills is often done using virtual reality (VR) simulators. The VR simulators propose abstract basic skills tasks that each are meant to train different parts of complex laparoscopic psychomotor skills. As the simulator decomposes complex surgical tasks into abstract basic skills tasks, it is important that the training experience, both in touch and sight, can be transferred to the clinical setting. In addition, the VR simulators can objectively assess performance, permitting criterion-based training taking into account different learning curves. In this study, we set up a criterion-based training program and tested it by comparing clinical skills of two groups: experimental and control.

METHODS: Medical students with no experience in laparoscopy attained a criterion-based training program on the LapSim® (Surgical Science AB, Sweden) VR simulator with handles with haptic feedback: Xitact™ IHP (Mentice AB, Sweden). After the training, the students performed a cholecystectomy on a box model. In addition, a control group of medical students without training also performed the cholecystectomy in the box model. The performances were video rated by two surgeons blinded to subject training status.

RESULTS: In total, 30 students performed the cholecystectomy. 16 students completed the criterion-based training program with an average of 90 trials to pass the test (SD 35.6). There was a negative correlation (spearman's $\rho = -0.67$, $p = 0.01$) between the number of trials needed to pass the test and the video rating. There was a negative trend towards VR training, where the control group performed the cholecystectomy better than the experimental group ($p < 0.05$). There was a good correlation between the video rating of the two surgeons (spearman's $\rho = 0.49$, $p = 0.01$).

CONCLUSIONS: Criterion-based training is important, because it takes into account the variety of individuals' learning curves. Nevertheless, caution must be taken that the skills needed to reach the criterion-based level are sufficient and transferrable to clinical settings. The use of VR simulators can and should be used to train specific psychomotor skills outside the operating room. It is, however, important to ensure that the

simulator reflects the psychomotor challenges, touch and sight that the surgeon perceives during laparoscopy.