Case study

VR Ultrasound

The aim of this project was to develop and validate a tool that could teach medical students basic point-of-care ultrasound, in a cost-efficient manner.

A VR learning tool teaching ultrasound theory, knobology, and allowing for simulated hands-on procedural training, was developed by VitaSim in close cooperation with the University of Southern Denmark (SDU) and Odense University Hospital (OUH).

The efficacy of the tool was compared to traditional e-learning in a double-blinded, randomized controlled trial (RCT).
20 medical students participated in a voluntary, short ultrasound course and received 60 minutes of education through either VR (intervention) or e-learning (control), followed by 15 minutes of non-supervised hands-on training (both).

Primary outcome was an OSAUS[1] based score obtained in an OSCE[2] setting. Secondary outcomes were attainment of individual groups of learning goals and subjective measures from a questionnaire.

Conclusion: A clear trend of VR outperforming e-learning was observed (figure 1).

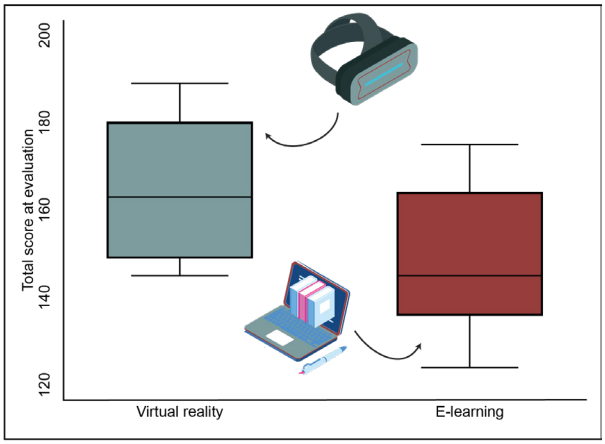


Figure 1: Comparison of VR with e-learning for teaching ultrasound.

Two-sample t-test with unequal variances for total score

Groups	n	Score (mean)	95% conf. Interval	
VR	11	164.82	153.55	176.09
E-learning	9	148.00	133.77	162.23
Combined	20	157.25	148.29	166.20
Difference		16.82	-0.057	33.69
t = 2.1083		H_a: Difference > 0	pr(T > t) = 0.0253	

The total score represents the archievement of all learning goals and was the primary outcome of this study.

A one-sided t-test showed a significant difference ($p<0.05$), confirming our alternative hypothesis that the VR would score higher than e-learning.

"How would you describe your experience of preparing for hands-on training using Virtual Reality?"

"Good, it gave a good sense of what moving the probe around did, and which image you can expect to get."

"It was a good tool for learning. You feel very immersed in the examination and loose track of time and place."

A questionaire involving scale-based (LIKERT) and short text answers was given to all students to evaluate perceived learning, self-efficacy, presence, usability and technological quality.

[1] Objective Structured Assessment of Ultrasound Skills

[2] Objective Structured Clinical Examination

Case study

VR USGIVA

The aim of this project was to create and validate a tool that would allow students to practice Ultrasound Guided Intravenous Access (USGIVA).

The project was done in collaboration with SDU, OUH, SimC and a group of medialogy students from Aalborg University (AAU). The software was produced as a spin-off on VR Ultrasound, reusing many features.

An iterative approach including usertests, group- and expert interviews was used. Development, data collection, analysis and write-up was completed in less than 3 months.

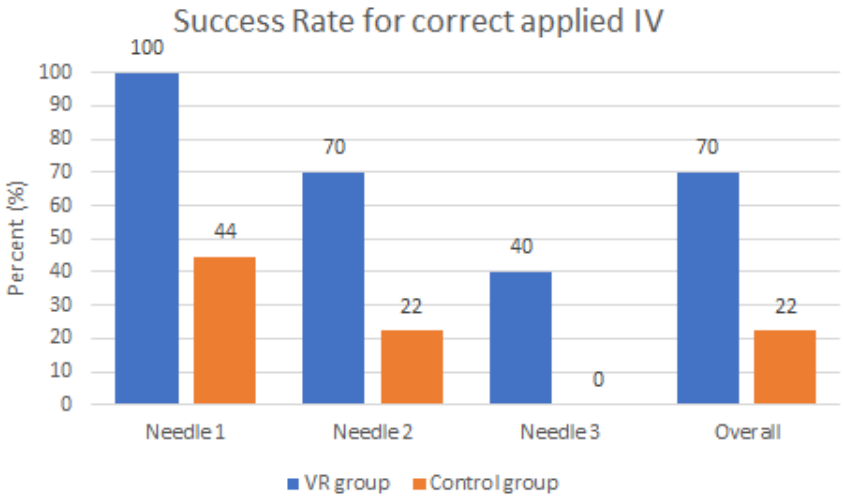
Tool efficacy was evaluated in a double blinded RCT. 19 medical students received a short session (< 60 minutes) of either e-learning (control group) or e-learning+VR practice (intervention, figure 2).

Primary outcome was no. of succesful USGIV's (maxium 3) archived on a realistic phantom in 15 minutes (figure 3). Secondary outcomes included objective measures (i.e. no. of venous punctures) as well as subjective (i.e. expert opinion on student USGIVA skill, self-efficacy).

Conclusion: A positive and significant effect of the VR tool was observed.

Figure 2: Practice. A medical student from the intervention group is practicing USGIVA in virtual reality.

Figure 3: Evaluation. A medical student is trying to insert the first intravenous cannula during the OSCE based evaluation.



The graph shows the success rate of both groups over the three needles. The increase in difficulty is evident as the success rate decreases for both groups.

However, the VR group scored better across all three needles and had an overall success rate of 70% compared to 22% in the control group.

To establish if the differences in success rates were significant a Two Proportion Z-Test was used.

Statistical significance was observed individually for all three needles and total success rate.

	Needle 1		Needle 2		Needle 3		Total	
Sample size	10	9	10	9	10	9	30	27
Success	10	4	7	2	4	0	21	6
Fail	0	5	3	7	6	9	9	21
p - value (Fischer's exact)	0.0108		0.0698		0.0867		0.033	
Alpha (α)	0.05		0.05		0.05		0.05	
Significance (p < α)	Yes		No		No		Yes	

VR Control