

Basic point-of-care ultrasound skills training with a novel serious video game

Josef M. Lintschinger^{1,2}, Lena Reischmann^{1,2}, Lorenz Kapral^{1,2}, Daniel A. Klaus¹, Wolfgang Schaubmayr¹, Christina Hafner^{1,2}

¹ Medical University of Vienna, Department of Anaesthesia, Intensive Care Medicine and Pain Medicine, Division of General Anaesthesia and Intensive Care Medicine, Vienna, Austria

² Ludwig Boltzmann Institute Digital Health and Patient Safety, Vienna, Austria

Objectives

Point-of-care ultrasound (POCUS) is increasingly used in medical practice. However, effective training remains a challenge. Novel digital tools like serious video games offer a promising solution for accessible, cost-effective education. This study evaluates the non-inferiority of the serious video game *Underwater* for basic echocardiography skills compared to traditional simulator-based training (Figure 1).^{1,2}

Methods

This prospective, single-blind, randomized controlled non-inferiority trial was conducted at the Medical University of Vienna. The participants were medical students ≥ 18 years, all of whom had a foundation in anatomy but no prior experience in POCUS. Their performance in echocardiography examinations was evaluated using the modified Objective Structured Assessment of Ultrasound Skills (OSAUS) score (4 to 20 points) and its subcategories (1 to 5 points)³. Following a baseline assessment, the students participated in a two-hour workshop and four training sessions over a two-week period. A final assessment was conducted afterward.

Results

From October 3rd to May 5th, 2024, 97 out of 103 participants were analyzed, resulting in a dropout rate of 5.8%. The mean difference in OSAUS scores was -0.6 ± 3.5 for the video game and -1.2 ± 3.7 for the simulator group, demonstrating non-inferiority as hypothesized ($p < 0.001$). No significant differences in image optimization due to hand-eye coordination were observed between the two groups (-0.2 ± 1.8 for video vs. -0.16 ± 1.4 for simulator, $p = 0.782$). 63.8% of the video group and 78.0% of the simulator group found the randomized learning method to be helpful or very helpful.

Discussion/conclusion

Our findings suggest that the serious video game *Underwater* is a non-inferior training method for training hand-eye coordination in basic echocardiography skills. However, since performance declined similarly in both groups from baseline to final assessment, combining digital hands-on training with additional instruction may be essential for better learning outcomes.

Figure 1. Point-of-care ultrasound training methods



a) Serious video game *Underwater* (<https://ultrasound-game.com/>)

b) Ultrasound simulator. Basic hand-eye coordination task. U/S MENTORM (3D Systems, Symbionix, Israel). (<https://surgicalscience.com/medical-specialities/sonography>)

References

- [1] Sfinx Games. <https://www.ultrasound-game.com/>
- [2] Surgical Science Sweden AB. <https://surgicalscience.com/medical-specialities/sonography/>
- [3] Tolsgaard MG, Todsen T, Sorensen JL, Ringsted C, Lorentzen T, Ottesen B, et al. International multispeciality consensus on how to evaluate ultrasound competence: a Delphi consensus survey. *PLoS ONE* 2013;8:e57687.

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the Medical University of Vienna (1289/2023).

Conflict of interest: The authors declare that they have no competing interests.

Funding: This work was supported by the Austrian Society of Anaesthesiology, Resuscitation and Intensive Care (ÖGARI) with the *Förderpreis der ÖGARI*.