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Virtual reality training to improve complex skills – concerns and remarks: A Letter to the Editor.

Lukas P.E. Verweij
PhD Candidate
Department of Orthopedic Surgery, Amsterdam University Medical Centers, University of Amsterdam, Amsterdam Movement Sciences (AMS), Academic Center for Evidence-Based Sports Medicine (ACES), Amsterdam Collaboration for Health and Safety in Sports (ACHSS), Amsterdam, the Netherlands

Other Contributors:

Michel P.J. van den Bekerom
Orthopedic Surgeon
Department of Orthopedic Surgery, Onze Lieve Vrouwe Gasthuis, Amsterdam, The Netherlands

Gabriëlle J.M. Tuijthof
Program Leader & Senior Researcher
Department IDEE, Faculty of Health, Medical and Life Sciences, Maastricht University, Maastricht, The Netherlands

Leendert Blankevoort
Associate Professor
Department of Orthopedic Surgery, Amsterdam University Medical Centers, University of Amsterdam, Amsterdam Movement Sciences (AMS), Academic Center for Evidence-Based Sports Medicine (ACES), Amsterdam Collaboration for Health and Safety in Sports (ACHSS), Amsterdam, the Netherlands

Kaj S. Emanuel
Postdoctoral Researcher
1. Department of Orthopedic Surgery, Amsterdam University Medical Centers, University of Amsterdam, Amsterdam Movement Sciences (AMS), Academic Center for Evidence-Based Sports Medicine (ACES), Amsterdam Collaboration for Health and Safety in Sports (ACHSS), Amsterdam, the Netherlands
2.Department of Orthopedic Surgery, Maastricht University Medical Center+, Maastricht, The Netherlands

Dear editor:

We have read with great interest the study by Lohre et al “Improved Complex Skill Acquisition by

Immersive Virtual Reality Training: A Randomized Controlled Trial" reporting the evaluation of a training module developed by PrecisionOS Technologies (1). Virtual reality (VR) training is in potential a great addition to the residency training of surgeons (2). We highly encourage this research field with a special focus on validation (at all levels) to ensure that VR training allows correct training of skills (3, 4). In short, the authors claim to have conducted an adequately powered randomized controlled trial between traditional learning methods and immersive VR training. They conclude that with 570% reduced learning time, significantly better improvements of technical and nontechnical skill acquisition were achieved (1). Considering the importance of this subject, we would like to argue that this paper would benefit from a thorough discussion of the severe limitations in relation to the strong claims drawn.

First, the authors highlight that the study is adequately powered. Any trial should be statistically powered on the primary outcome variable to determine the sample size. The primary outcome is the variable that tests the hypothesis, which is formulated in the current study as "immersive VR is superior in teaching a multistep orthopedic surgical procedure to senior orthopedic residents compared with traditional learning methods" (1). However, the study is powered on an estimated difference in knowledge score between resident and expert groups. We did not expect a power calculation on the participants of different skills levels, but on the expected difference between learning groups, which is contained in the hypothesis of this study. Furthermore, a knowledge score is not the correct measure to evaluate a skills acquisition nor a means to validate the VR module. For this reason, the study may not be adequately powered to draw the strong conclusions on differences between VR and traditional learning methods. Also, it is unclear to us how the participants were selected to create a random sample.

Furthermore, the authors state that VR-training efficacy and validity is compared against traditional learning methods (5). Although we are aware that there is an ongoing debate whether this is the optimal learning method, surgical skills are traditionally learned by the master-apprentice model of "see one, do one, teach one" (6, 7, 8). Therefore, we severely question that studying a journal paper (9) is an adequate example of this traditional learning model to train skills. The authors failed to discuss the validity of the selected traditional learning method.

Finally, in the discussion it was stated that "With the tasks examined, we have demonstrated significant improvements of technical and nontechnical skill acquisition at a mean reduction of 570% in learning time" (1). While we find it difficult to imagine a reduction that exceeds 100%, we are equally puzzled how this was calculated. The learning task time was reduced from 20 ± 4 minutes in the control group to 11 ± 3 minutes in the VR group, which seems to represent a reduction of 45%. Throughout the abstract, relevance, results, and discussion, this is however presented as a 570% reduction, which needs explanation. Furthermore, the technical skills were assessed by the validated OSATS score, which showed

no statistically significant difference between the groups with p = 0.70. It is an interesting side-finding that the OSATS subscore “instrument handling” is significantly different between the immersive VR group and the control group. However, this does not allow such a strong conclusion on overall skill improvement, particularly if the statistical tests are not corrected for multiple comparisons.

In conclusion, this study would benefit from thorough discussion of the questionable mode of traditional learning. Furthermore, it is important to appreciate that the study is powered on an arbitrary secondary variable. Finally, we feel that the firm positive conclusion of the study is based on a strange interpretation of the reduction of the learning time, and on a secondary finding of skills improvement.

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Conflict of Interest: None Declared