

Implementation of a Virtual Reality Neuraxial Masterclass In Medical Education For Trainees

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Background

- ❖ Neuraxial anesthesia is an advanced skill that many trainees find difficult to master
- ❖ Traditional teaching modalities (e.g. lectures, models) have limitations, prompting investigation into virtual reality (VR) as an educational tool¹
- ❖ Previously, educators within our department created a “VR Neuraxial Masterclass” - a curriculum for neuraxial procedural training using a software program specialized for spatial medical imaging designed for VR environments²
- ❖ **Hypothesis:** Participation in the VR neuraxial masterclass improves knowledge and confidence for neuraxial procedures among trainees

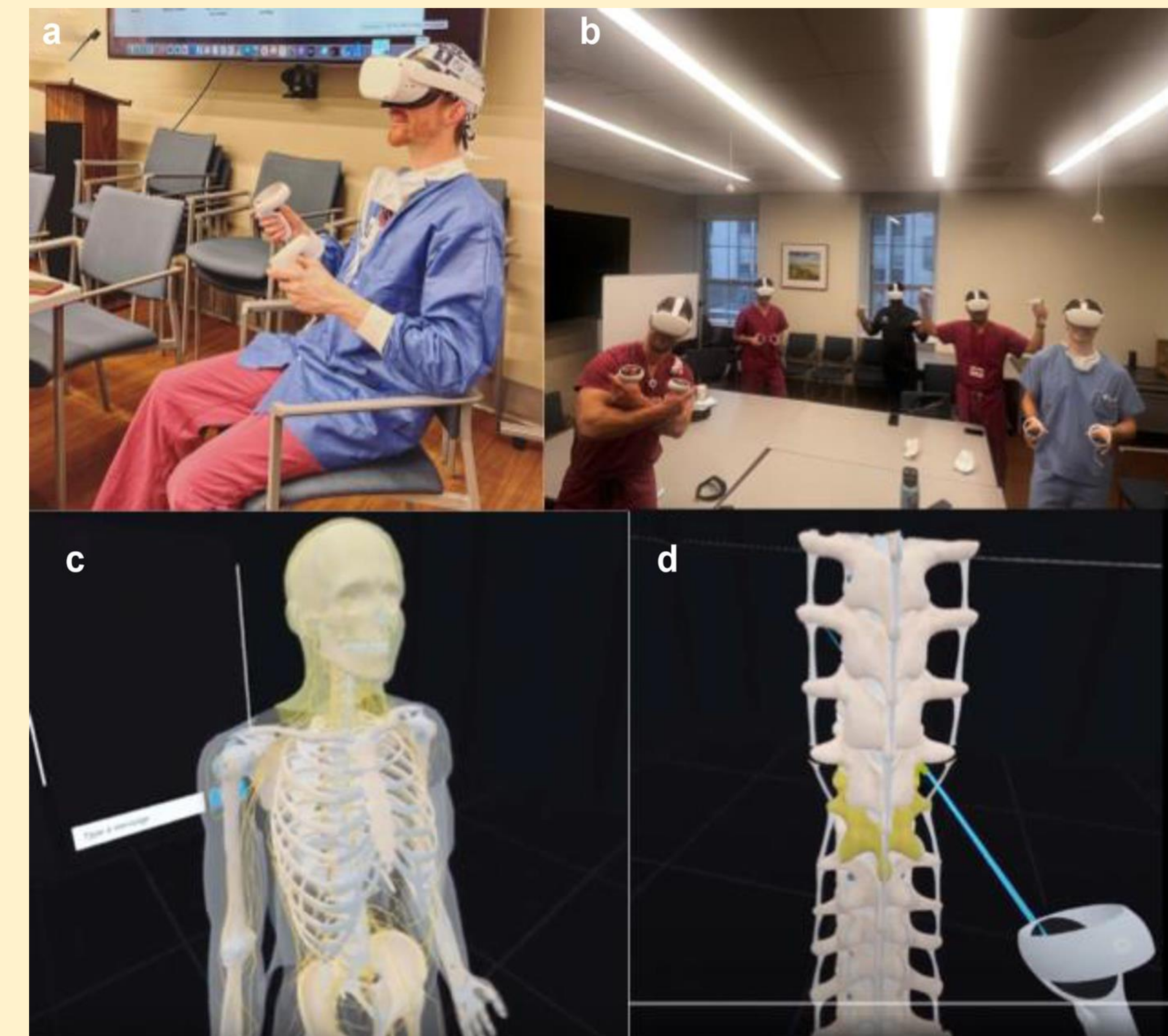


Figure 1 from [2]
Images of trainees using VR headsets
Images within VR environment

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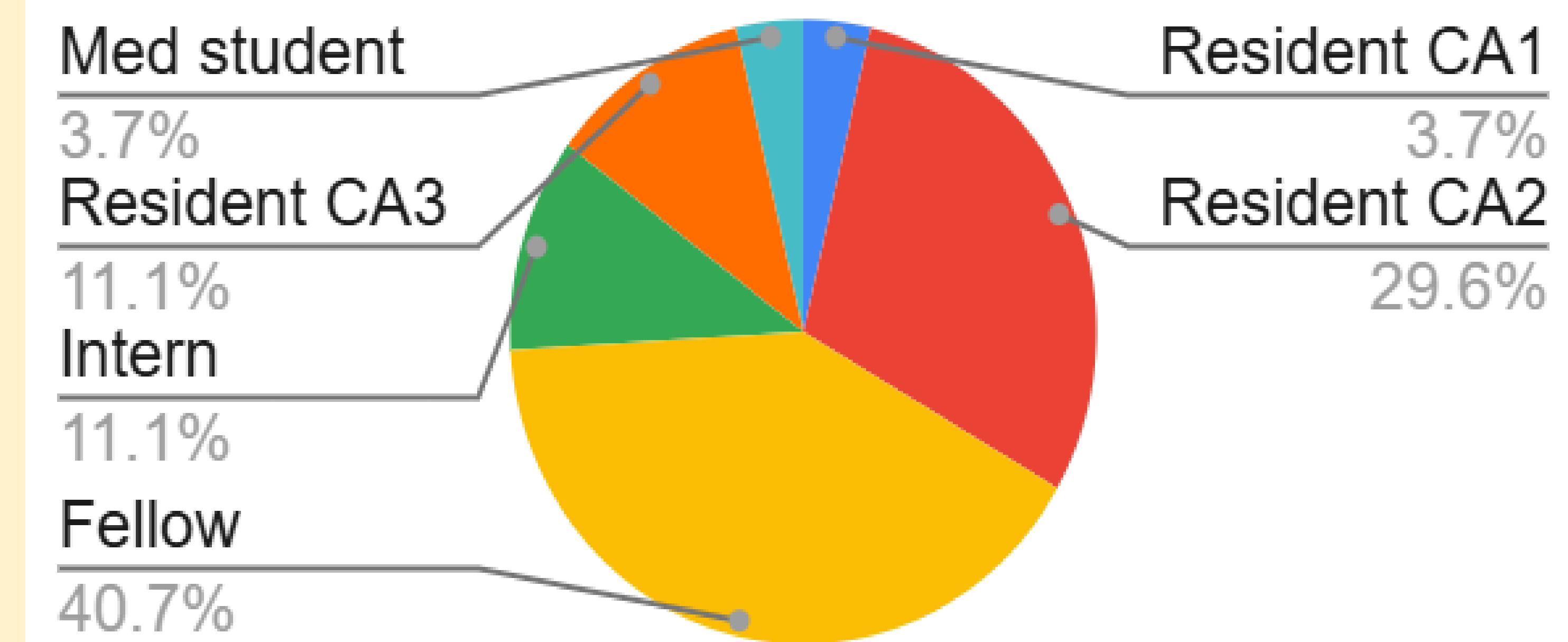
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Study Design & Methods

- ❖ Pre-post intervention pilot study
- ❖ Multi-center collaboration with N = 27 participants
- ❖ **“VR Neuraxial Masterclass”**: six, 5-10min instructor-led, recorded lessons covering spinal anatomy, exploration of the epidural space, and approaches to neuraxial placement
 - ❖ Instructor audio, hand gestures, annotations, and drawings using 3D models viewable in real time
 - ❖ Uploaded onto VR headset made available to trainees
- ❖ **Primary outcome**:
 - Improvement in anatomic and procedural knowledge assessed by identical pre- and post-intervention tests
- ❖ **Secondary outcome**:
 - Learner satisfaction and perceived educational value assessed by post-intervention satisfaction survey



Assessments:

- Knowledge: 15 multiple-choice questions (pre- and post-tests)
- Satisfaction Survey: Likert-scale items and open-ended questions on ease of use, realism, understanding, confidence, recommendation likelihood

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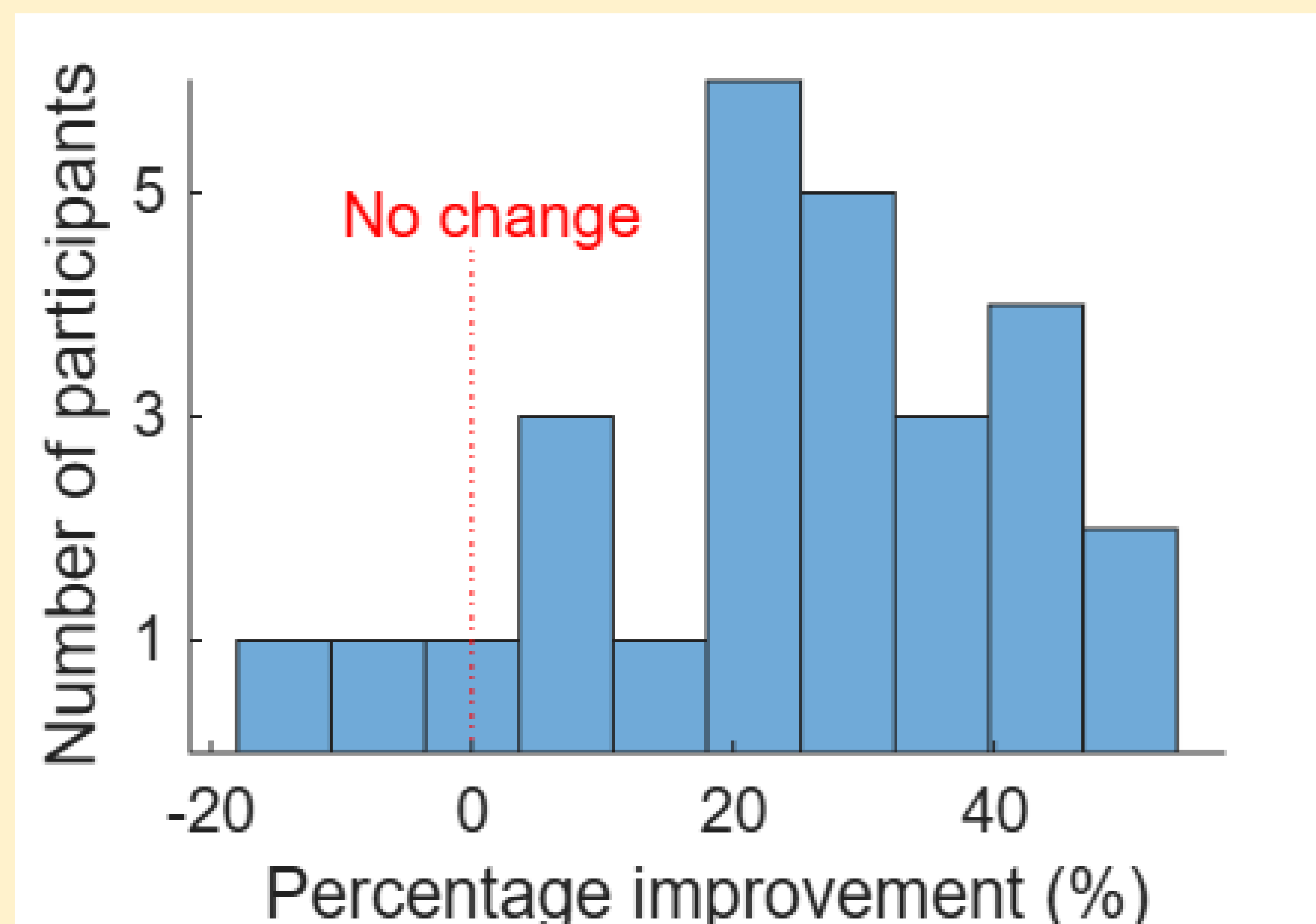
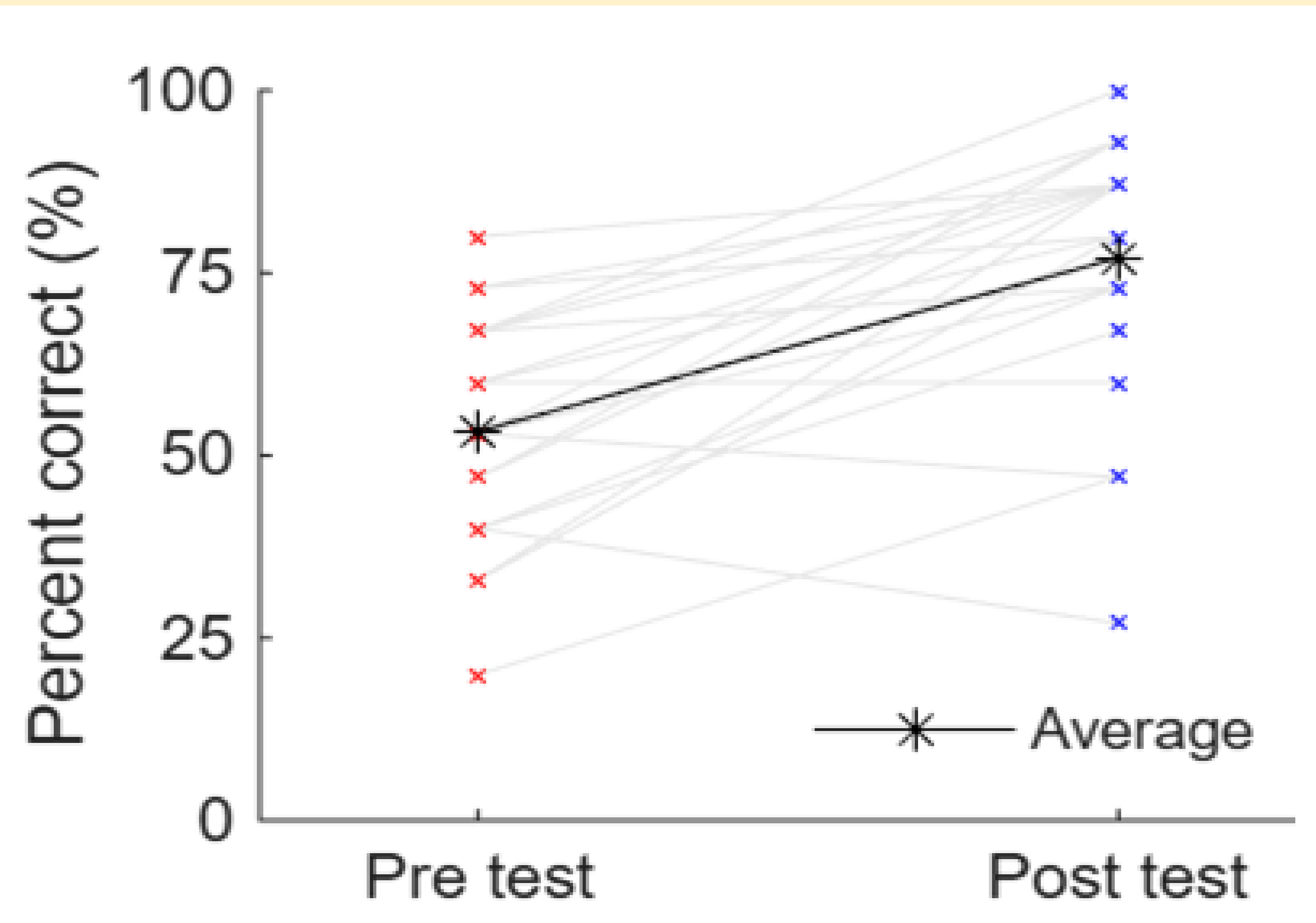
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Results

Knowledge assessment



Satisfaction Survey

- 100% of users reported that they enjoyed the experience, gained new knowledge, and would recommend to a co-resident/co-fellow
- High usability (90%), visual clarity (94%)
- High physical comfort, negligible cybersickness
- Enhanced anatomic and spatial understanding
- Improved procedural confidence compared to traditional methods alone
- High interest in future VR education
- Qualitative feedback suggested minor technical refinements and pacing adjustments

Mean pre-test score:

53% ± 14%

Mean post-test score:

77% ± 17%

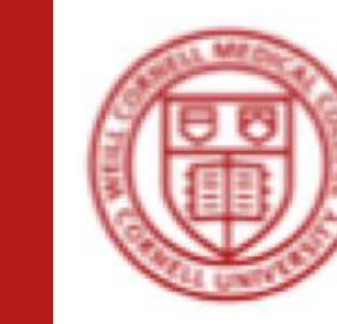
Average absolute gain:

24% (p < 0.0001)

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Conclusions

- ❖ Participation in the VR masterclass led to improved scores on knowledge assessment, with consistent benefits across trainee levels and institutions
- ❖ Participation was associated with high rates of user satisfaction and interest in future VR education

Future Directions

- **Long-Term Outcomes:** Assess knowledge retention and transfer to clinical practice (e.g. incidence of inadvertent dural puncture)
- **Larger-Scale Trials:** Expand participation; assess efficacy, cost-effectiveness, and efficiency
- **Curriculum Integration:** Combine VR with hands-on workshops or post-training reinforcement
- **Haptic Technology:** Integrate force-feedback devices for realistic tactile sensations
- **Expand VR Curricula:** Develop modules for specific pathologies (e.g. scoliosis)

References

1. Rubin JE, White RS, Boyer RB, Jotwani R. Obstetric anesthesiology and extended reality: an introduction to future uses of spatial computing in obstetric anesthesiology. *Int J Obstet Anesth*. 2024;57:103959.
2. Rubin JE, Jotwani R. Curriculum for neuraxial procedural training using medical extended reality. *Br J Anaesth*. 2025;134(6):1797-1800.