A PILOT STUDY COMPARING A 3D MODELING WEBSITE WITH VIRTUAL REALITY FOR TEACHING CARDIAC ANATOMY TO PEDIATRIC ELECTROPHYSIOLOGY TRAINEES

Objectives: Developing an accurate and detailed 3D mental model of cardiac anatomy is critical for new electrophysiology (EP) trainees. Due to its immersive and interactive nature, virtual reality (VR) may provide a more effective and efficient learning environment for assimilating 3D cardiac anatomy than current teaching methods. We sought to determine the feasibility of teaching cardiac anatomy to EP trainees using a VR-based educational platform and perform a pilot study comparing it to a traditional slideshow format combined with Sketchfab - a 3D modeling platform website.

Methods: VR Environment: In collaboration with the Visible Heart® Lab at the University of Minnesota and Telerobotics, LLC – a Seattle-based start-up company, we created a shared, remote, immersive virtual reality environment for learning cardiac anatomy. The system allows the shared viewing, manipulation, and virtual dissection of high-resolution 3D human cardiac models in a VR environment by participant avatars. Participants viewed the environment using Oculus Quest and Quest2 head-mounted displays (Meta, Menlow Park, CA, USA). Heart Models: High-resolution 3D models of wax-infiltrated congenital heart (membranous and AV septal) defect specimens were provided by Boston Children's Hospital, USA & Mie University, Japan. Participants: Seven pre- (US categorical pediatric cardiology fellows accepted into EP fellowships) and early-stage pediatric EP fellows were recruited for the study (Table 1). Study Activities: We performed a prospective crossover pilot study. All participants underwent a traditional slideshow lecture over video-chat, followed by an instructor-guided viewing of the 3D heart models on Sketchfab (3D model collections by heartmodels - Sketchfab). The following week the same instructor (SPS) taught the participants in the VR training environment using 3D renderings of the same heart models. Participants were then asked to complete a demographic questionnaire and a Likert satisfaction survey adapted from previously validated usability instruments.

Results: Participants consistently rated the VR learning environment more favorably than the slide show/Sketchfab experience and expressed a strong interest in adopting VR in their EP training curriculum (Figure 1).

Conclusions: We demonstrate the feasibility of using a remote, shared, VR-based education platform for teaching cardiac anatomy, and this training environment was favorably received by novice pediatric EP trainees. Further efforts are needed to improve VR usability and to develop objective assessment tools that measure learning of spatial anatomic relationships.

Presenting author's contact details:

Email address: stephen.seslar@seattlechildrens.org

Full postal address: 4800 Sand Point Way, NE, M/S RC.2.820, Seattle, WA 98105

Daytime and evening phone number: (858) 761-4571

Author and co-authors' details

Stephen P. Seslar[1], Susana Arango[2], David Buyck[2], Ryan james[3], Paul A. Iaizzo[4], Wayne Monsky[5], Tjörvi Perry[2]

Affiliations:

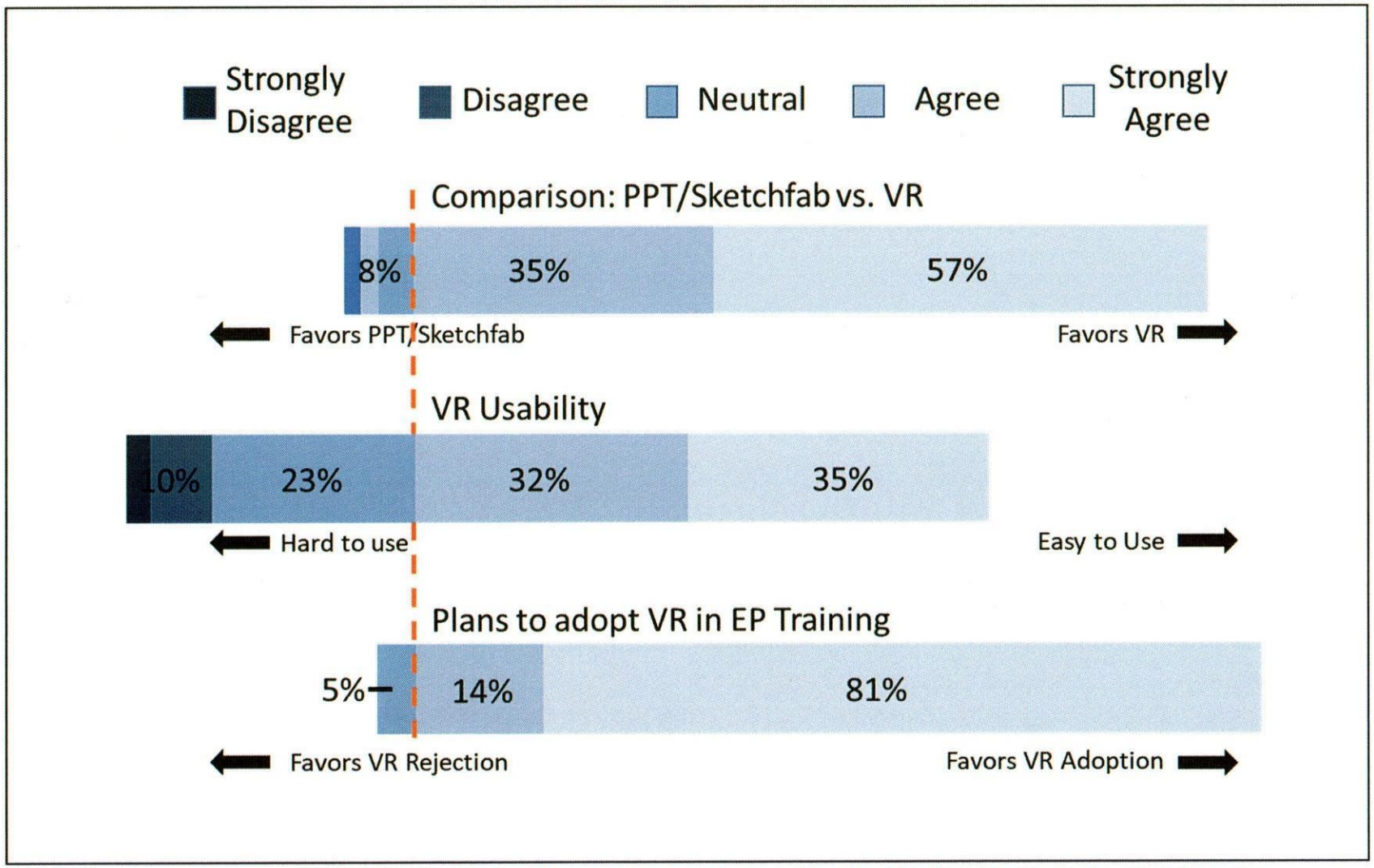
1. Department of Pediatrics, University of Washington, Seattle, WA, United States.
2. Department of Anesthesiology, University of Minnesota, Minneapolis, MN, United States.
3. Telerobotics, LLC, Bothell, WA, United States.
4. Univ of Minnesota, Dept of Surgery, Minneapolis, MN, United States.
5. Department of Radiology, University of Washington, Seattle, WA, United States.

Conflicts of Interest: Dr. James serves as President and CEO of Telerobotics, LLC, a for profit start-up company building technology related to this research. None of the other authors have any disclosures.

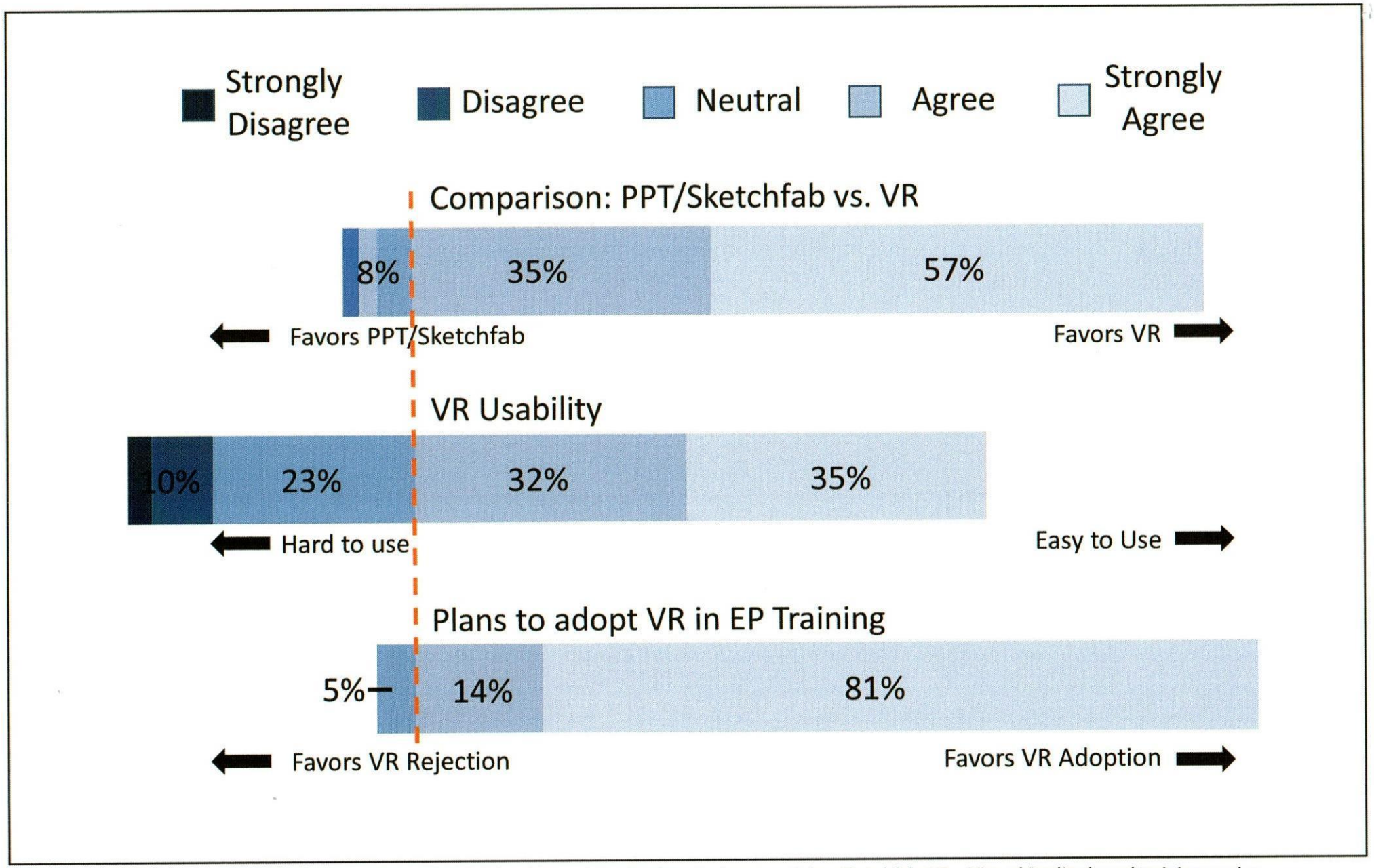
Table 1 – Participant demographics

Age [mean (SD)]	33 (0.9)
Sex [%]	F 25%
PGY [mean (SD)]	5.9 (0.7)
Current Position [n (%)]	
2nd Yr Cardiology Fellow	2 (29)
3rd Yr Cardiology Fellow	4 (57)
1st Yr EP Fellow	1 (14)
Mapping – # simulation hours in past year [n (%)]	
None	4 (57)
<3	3 (43)
3 to 25	0 (0)
26-50	0 (0)
>50	0 (0)
Mapping – # clinical procedures in past year [n (%)]	
None	1 (13)
<3	2 (29)
3 to 25	2 (29)
26-50	0 (0)
>50	2 (29)
Virtual reality - # VR hours in Healthcare Training in past year [n (%)]	
None	5 (74)
<3	1 (13)
3 to 25	1 (13)
26-50	0 (0)
>50	0 (0)
Virtual reality - # VR hours in Recreational Activities in past year [n (%)]	
None	4 (57)
<3	0 (0)
3 to 25	3 (43)
26-50	0 (0)
>50	0 (0)

Figure 1: Aggregated satisfaction survey results



PPT = Microsoft PowerPoint-based training session; SketchFab = 3D model collections by heartmodels – Sketchfab; VR = Virtual Reality-based training session



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