Alexander Brenner, Yannik Warnecke, Michael Fujarski and Julian Varghese
Institute of Medical Informatics, University of Münster, Germany

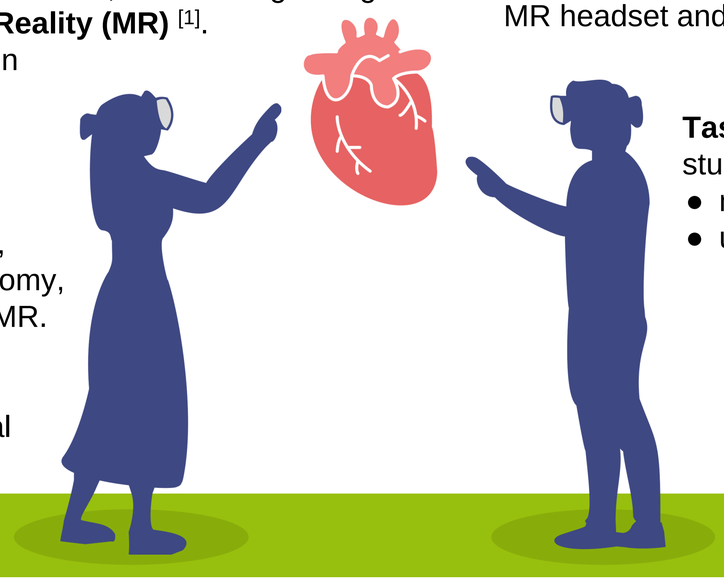
Mixed Reality in Medical Education - Introduction of a Practical Course Module

Introduction

With increasing digitalization in healthcare, there is growing potential for the application of **Mixed Reality (MR)** [1]. We present a **new course** using MR in medical education.

We integrated the **HoloLens 2**, an advanced MR headset, to
- demonstrate the capabilities of MR,
- enhance the understanding of anatomy,
- provide hands-on experience with MR.

We evaluated a test run of the course that included ten participants - medical students from advanced semesters.



Methods

After an introduction, practical tasks were performed in groups of three students and the lecturer, all wearing an MR headset and viewing the same object. For this purpose, we implemented a **custom application** with Unity. Via a web-application, the remaining persons looked at the same 3D models on 2D screens.

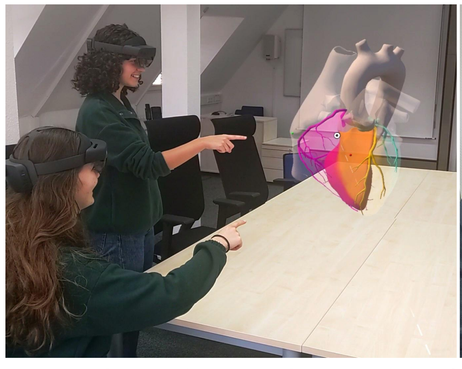
Task 1 introduced the hand-tracking to the students and involved practicing
- moving and scaling with hand-gestures,
- using the index finger as a virtual pointer.

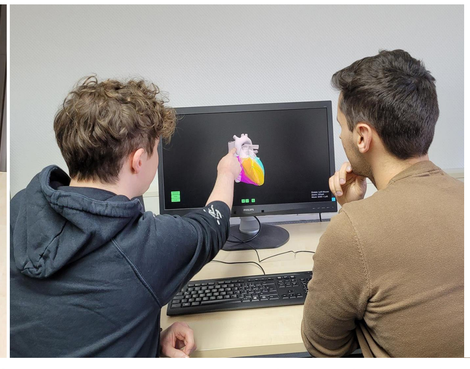
Task 2 let the students explain the anatomy and medical conditions of the heart, including
- the **atrial septal defect (ASD)**,
- the v**entricular septal defect (VSD)**,
- the **coronary arteries**.

More information

Discussion and Conclusion

Most participants regarded the technology as a useful addition to traditional learning methods. Our evaluation is limited to a small number of people that were already interested in the topic. Moving forward, more refinement is planned based on further evaluation.

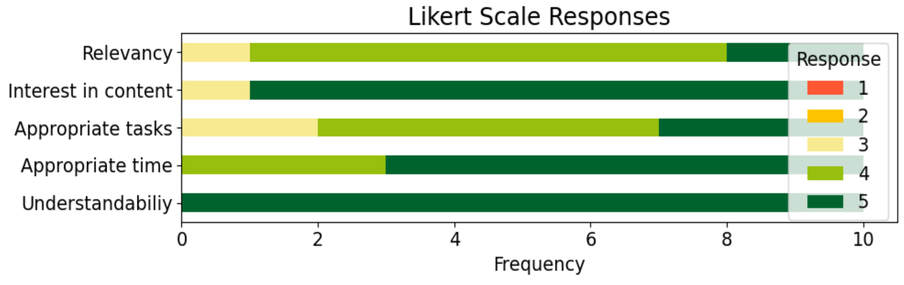


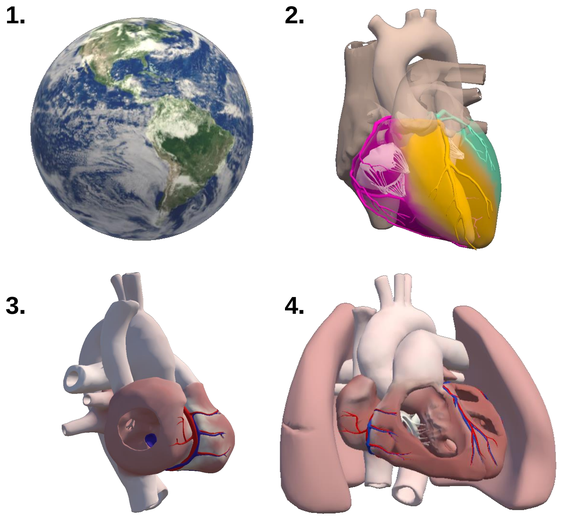


Comparison of MR and 2D. Left: HoloLens screen capture shows the user's perspective. Colored spheres indicate the pointers. **Right**: The web-viewer is used to discuss the model.

Results

The feedback was predominantly positive. Based on the Likert scale (1=worst, 5=best), best feedback was given on understandability (mean of 5), interest in the content (mean of 4.8) and appropriate time schedule (mean of 4.7). Lower ranked points were relevancy (mean of 4.1), selection of tasks (mean of 4.1).





Overview of the 3D models used. 1: Earth core. **2**: Coronary arteries. **3**: Atrial septal defect. **4**: Ventricular septal defect [2].

References
[1] Palumbo A, Microsoft HoloLens 2 in Medical and Healthcare Context: State of the Art and Future Prospects, Sensors. 22 (2022) 7709. doi:10.3390/s22207709.
[2] Gsaxner C, Li J, Pepe A, Jin Y, Kleesiek J, Schmalstieg D, et al. The HoloLens in medicine: A systematic review and taxonomy. Medical Image Analysis. 2023;85:102757.
[3] Sieben A, de Goeje L, Jongloed MRM, Schaafsma B, Wisse BJ, de Ruiter MC, Verlinden JC, Coster JE, Nieuwland W, UMCG, 2019. https://sketchfab.com/eLearningUMCG