Evaluating two interactive 3D tools for the teaching of heart anatomy

Laura Pérez[1], Robin Sloan[2], Paul Robertson[2], Alan Denison[1], Flora Gröning[1]

[1] School of Medicine, Medical Sciences and Nutrition, University of Aberdeen
[2] School of Arts, Media and Computer Games, Abertay University

Introduction

Virtual learning environments (VLEs) provide remote access to 3D material, allow interaction with 3D models and can be adapted to different learning outcomes (Fig. 1). In contrast to VLEs, 3D PDFs allow easy storing and sharing of 3D models, but do not provide feedback on performance (Fig. 2). Current Anatomy VLEs lack self-assessment exercises to learn how to orientate a heart correctly, although this task is vital for understanding the anatomy of the heart. In this study, we developed two learning tools for heart anatomy, a VLE and 3D PDF, and asked staff and students to evaluate the usefulness of these tools.

Fig 1. VLE to learn how to orientate the heart correctly

'Photos of cadaveric material have been removed for online publication'

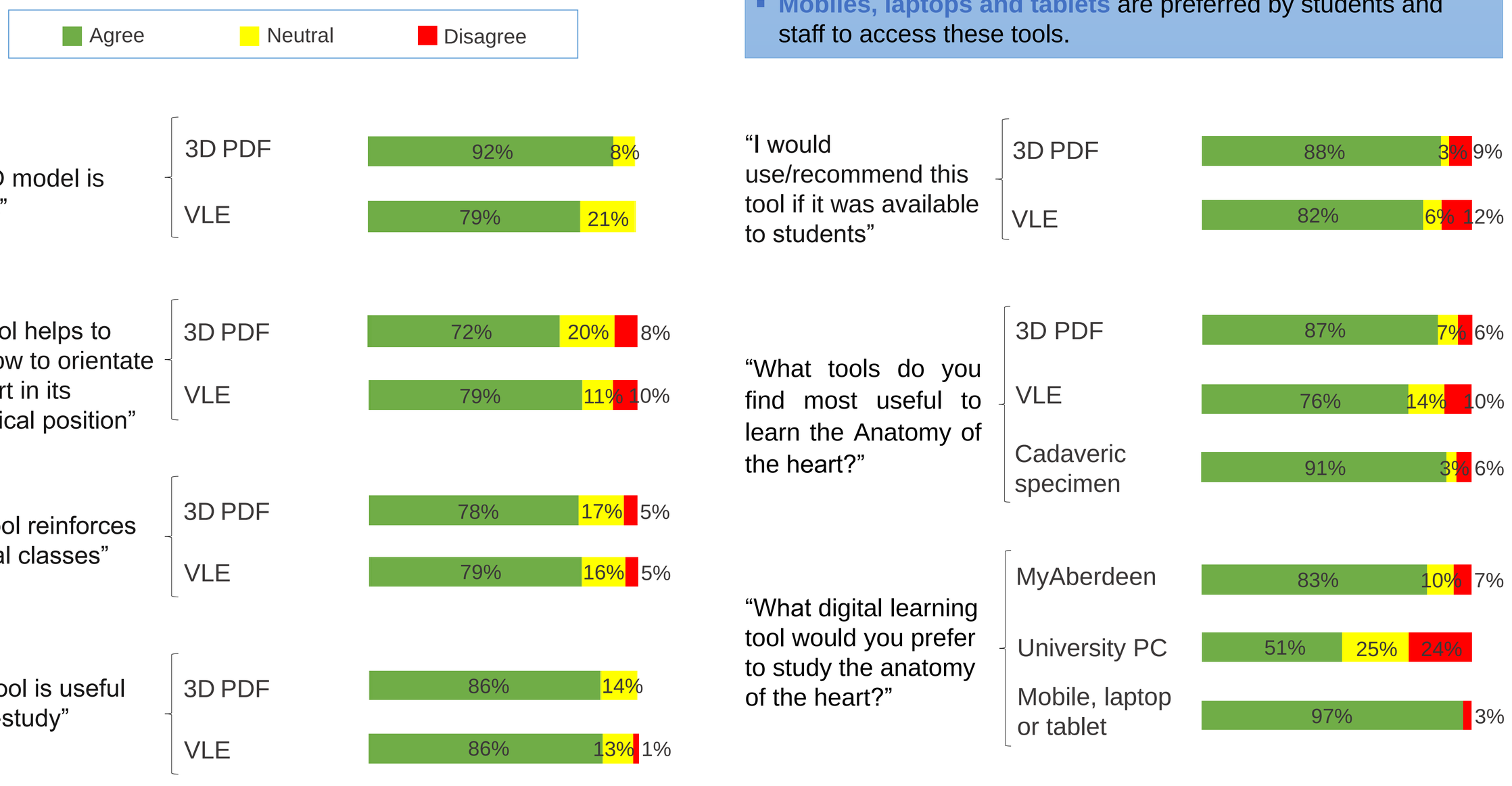
Fig 2. Interactive 3D PDF

Materials & Methods

We created a 3D model of a cadaveric heart using photogrammetry, i.e. by taking photos from different angles around the specimen and using a software for 3D reconstruction. The same software allowed the generation of a 3D PDF. We used a game-engine to develop a VLE in which users have to orientate the heart model correctly. To evaluate these learning tools, we handed out questionnaires to 61 undergraduate Anatomy students (year 1) and 5 staff members.

Results

The answers provided by the students are shown below. Answers from staff members were very similar to students', with only slight variations in the percentages.



Conclusions

- Photo-based models are seen as **realistic and with high level of anatomical detail**.
- Students and staff would **recommend** using these tools, particularly **before or after practical classes**, as a **reinforcement** and for **self-study**.
- **Cadaveric specimens are considered the most useful tool** to learn how to orientate the heart in its anatomical position; our VLE and 3D PDF cannot be used as a replacement. The 3D PDF was considered slightly more useful than the VLE to learn this task. This might be explained by the high precision level needed to orientate the heart correctly in the VLE (a range of 30° only). The VLE must be adjusted to the students' anatomical expertise in order to make it more useful as a learning tool.
- **Mobiles, laptops and tablets** are preferred by students and staff to access these tools.

References

[1] Prensky, M (2001). *Digital Game-based Learning.* 1st ed. McGraw-Hill.
[2] Patieas, P. (2002). *J Photogramm Remote Sens* 56 (5-6), 295-310.
[3] Olague, G. and Mohr, R. (2002). *Pattern Recognition* 35, 927-944.

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