3D-Printed Specimens as a Valuable Tool in Anatomy Education: A Pilot Study

Presented by MAC STUDENT

Introduction

Traditional methods of studying anatomy involve primarily lecture materials, cadaveric materials and digital imaging resources. The knowledge of anatomy is primarily gained by studying cadavers and once mastered, surgical training and proper execution of surgical procedures are practiced on real life patients.

Problems associated with these ancient methods are costs, maintenance, ethical, legal and religious views and limitations of viable cadavers. By comparison, 3D-printed specimens are a valuable tool that have no maintenance, ethical, legal and religious views and limitations.

The purpose of this study was to assess the usefulness of 3D-printed models as a suitable anatomy educational tool and investigate the effectiveness of the different types of specimens (wet, plastinated, 3D-printed model) as learning tools in anatomy education and to investigate student's personal preferences as learning tools in anatomy education.

Materials & Methods

23 Health Science Student Participants from Curtin University

- 11 1st Year & 12 3rd Year students

Both groups were exposed to plastinated, wet, and 3D printed models of the

- External Heart, shoulder, thigh : each with fully labelled diagram

Station 1: Plastinated specimens of the external heart, shoulder, thigh
Station 2: 3D printed models of the external heart, shoulder, thigh
Station 3: Wet specimens of the external heart, shoulder, thigh

- Each specimen within each station had one question proposed
- At the end, the students were to rate each station's questions via the Likert Scale

Results

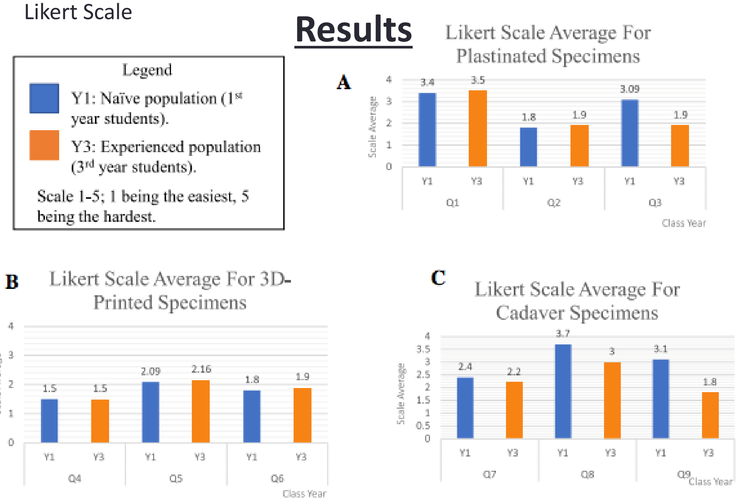

Figure 1. (A) Likert scale average. Questions 1–3 of the test paper associated with plastinated specimens (P-value = 0.1097). **(B) Likert scale average.** Questions 4–6 of the test paper associated with 3D-printed specimens (P-value = 0.8652). **(C) Likert scale average**. Questions 7–9 of the test paper associated with cadaver specimens (P-value = 0.0211). The 3D differed significantly from plastinated and wet (p=0.0002 and P=0.0007).

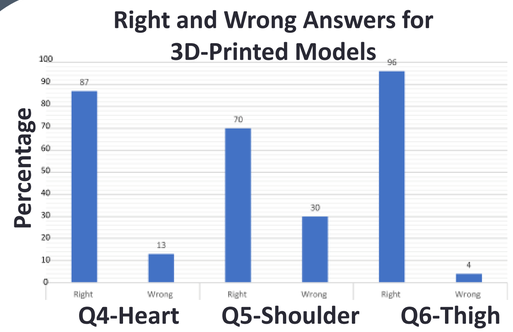

Fig. 2. Proportion of right and wrong answers for 3D-printed models (questions 4–6 in test paper) (P-value = <0.0001). Combination of both year 1 and 3 students.

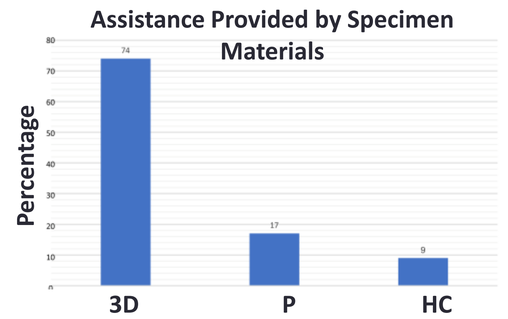

Fig. 3. Proportion of different specimen materials that assisted participants the most with the identification of pinned structures for Q4. 3D: 3D printed specimen; HC: human cadaveric specimen; P: plastinated specimen (P-value <0.0001).

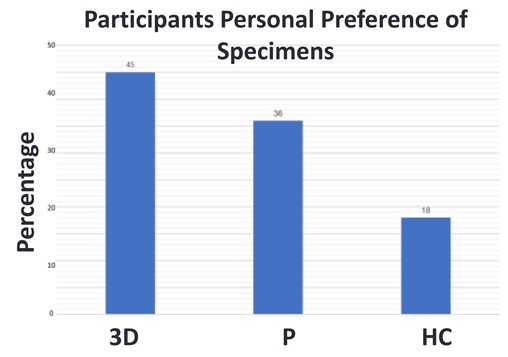

Fig. 4. Proportion of specimen materials based on personal preferences of participants for Q5 (P-value <0.0001).

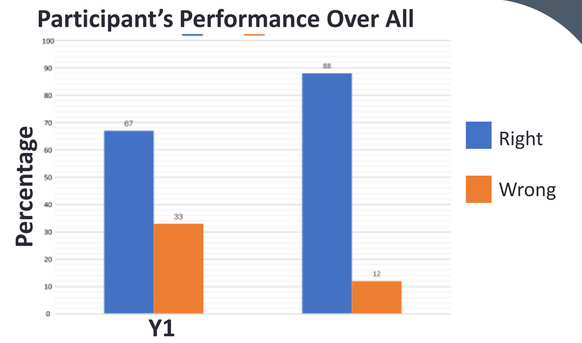

Fig. 5. Participant's performance. Proportion of right and wrong responses from the test paper. 1st year scored 67%, 3rd year scored 88% correctly. (P=0.0002).

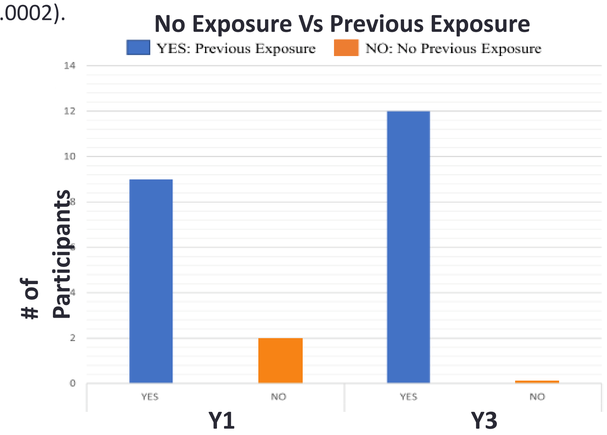

Fig. 6. Number of participants previously exposed to human tissues or not. No correlation between previous exposure and overall performance.

Discussion & Conclusion

The study showed that 3D-printed models could be an effective tool for anatomical learning. It has the capability to be used adjacent to human cadaver materials and integrated with existing tools.

Limitations: For ease of use and effectiveness of 3D models in comparison to wet/plastinated models, the 3D-printed models were in color and the 2D images provided for each specimen were also in color. Biased opinions towards 3D models could be due students not wanting to bother with being careful and cautious while handling wet and plastinated specimens. There is a lack of demographic details such as age and sex. This study was made of entirely all volunteer students during a busy 2nd semester.

3D models are easier to handle, take care of, and can be personalized. In addition, 3D-specimens as a high quality teaching tool and can alleviate the ethical, cultural, logistical and financial difficulties that cadaver-based curriculum has.

References

Garas, M., Vaccarezzo, M., Newland, G., McVay-Doorbusch, K., Hasani, J., 2017. 3D-Printed specimens as a valuable tool in anatomy education: A pilot study, *Annals of Anatomy 219*, 57-64. doi https://doi.org/10.1016/j.aanat.2018.05.006