

A PERSPECTIVE OF MEDICAL STUDENTS ON 3D PRINTING FOR ANATOMY EDUCATION

A.M. Sanchez-Perez¹, J. Fuentes-Ballesteros², J. Andres-Esperanza², M.C. Mora-Aguilar²

¹Universidad Jaume I, Unidad Predepartamental de Medicina (SPAIN)

²Universidad Jaume I, Departamento de Ingeniería Mecánica y Construcción (SPAIN)

For centuries, the dissection of full-body corpses has been the gold standard in Anatomy education, promoting deep anatomical comprehension. In the last years, with the growth of medical training on several fronts, the hours devoted to Anatomy practice have been reduced. This reduction has led to dissection giving way to prosection: students do not dissect human bodies but study the morphology of corpses already dissected by another person.

These pedagogical changes are also influenced by the maintenance costs, bureaucracy, ethical implications, and expenses in the prevention of occupational risks resulting from the cadaver preservation with volatile fixatives (with more severe legislation on fixation agents). Teachers and technical staff are exposed to greater occupational risks because of the hours of preparation prior to the class. Given the relatively short useful lifespan (two or three years) for a corpse, this preparation is a big-time investment. Moreover, the provision of human bodies may be challenging. In most countries, Spain included, the legislation only allows voluntary donations to universities.

To overcome some of these challenges, innovation in teaching Anatomy has been advocated by many medical schools with the use of 3D printed models based on data from computed tomography (CT) and magnetic resonance imaging (MRI). These 3D models have a long useful lifespan and are free of maintenance costs, thus being amortized in the long term. Moreover, their level of detail can be equal or higher than a corpse fixed and dissected in a reasonable time in terms of cost-benefit. In addition, 3D models can be handled without gloves, masks, nor extractor hoods, reducing costs and wastes. Furthermore, given the fidelity to human bodies, these models are increasingly used in surgical practice as a preoperative model.

In the medical degree at Universitat Jaume I (UJI, Spain) we evaluated the appraisal of 49 second-year medical students, with a voluntary and anonymous questionnaire, of a pilot lecture using 3D printed pieces of thorax and heart. The survey revealed that 44.9% felt that 3D printed parts were safer to handle than preserved bodies. The 63.3% found that the fact of using 3D impressions from real data was of great or high relevance. A great majority, the 83.7%, evaluated the anatomical detail of the 3D impressions as excellent or very good. In terms of ease of handling, a great majority

(>90%) considered 3D printing more comfortable than preserved cadavers. Interestingly, 34.7% said that anatomical knowledge can be acquired equally or similarly with a 3D-printed corpse. Nobody thought that it was not useful at all, and only 8.2% considered 3D models of little use. Regarding the characteristics where the students found that the 3D printed model was superior to the fixed corpse, security stands out (44.9%), followed by anatomical detail (32.7%). Finally, the 85.8% of the students considered important to increase the number of different 3D printed parts.

We propose 3D printed parts to support teaching anatomy for 1st and 2nd-year students as a safe and highly valuable pedagogical tool. Understandably, forensic and surgery branches of medicine will need, in addition, dissecting skills.

Acknowledgement:

Work supported by: Aid Program for Educational Innovation (2018-19) from the Unitat de Suport Educatiu (USE); Medicine Department; Faculty of Health Science; and Vice-chancellor of Infrastructure of the Universitat Jaume I.

keywords: 3d printing, anatomy, medicine.