ARanatomy, an augmented reality application dedicated to anatomy and histology teaching. An educational innovation with high potential in different educational strategies.

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Anatomy and histology are cornerstones of preclinical education for health professionals. However, students may not fully perceive the importance of these disciplines and therefore may not develop a sufficient level of competence. To facilitate learning and increase efficiency, 3D environments using augmented reality (AR) recently emerge as educational strategies. They seem to improve knowledge and create an environment conducive to learning. Therefore, we have developed an AR application that integrate anatomy and histology, based on anatomical reality, able to scalable and usable in hybrid teaching.

Reference patient DICOM data were transformed into .obj formats using the 3D slicer software and imported into the blender, while zbrush, autodesk maya and substance software were used to optimize the skeleton, urinary cavities, and vascular structures. Bone images obtained by photogrammetry were superimposed on this reconstruction. To this basic structure, relevant anatomical and histological structures with a high degree of scientific fidelity have been integrated.

A feasibility study was carried out to assess the technical aspects, the ways to introduce the app to the students and the potential for its implementation in educational strategies.

First, a technical test was performed with 500 first-year medical students. From 202 respondents, 31% of them encountered technical difficulties mostly related to functionalities. We are nevertheless optimistic about the tool potential because almost half of the students (47% of respondents) have found it very useful to better visualize the 3D aspects and the relationships between organs.

A second feasibility study investigated the tool handling. 41 second-year medical students were randomly assigned to three protocols: one totally autonomous, one autonomous after watching an explanatory video and another supervised by a teacher. The handling was evaluated by questions requiring the use of all the app functionalities. The most successful group is the one that used the explanatory video, followed by the accompanied group and then the working independently group. The survey showed that the students experienced technical difficulties to display the model (20%) and the observation levels (11%), to perform rotations (40%) and zooms (17%). The tool potential was underlined as 91% find the app useful. Aspects relating to anatomy and histology integration (34%), 3D visualization (28%) and topography (17%) are mentioned in the free answers. Several anatomical visualizations in the same tool, displaying areas of interest and superimposing histological images are estimated useful by all of the involved students (100%). Finally, 97% of students have a general positive opinion qualifying the app as promising, useful, fun, integrative, congruent with morphology courses. This view is tempered by difficulties related to technical stability.

In conclusion, the difficulties encountered are explained by the fact that the tool is still in the optimization phase. The app potential was undeniably highlighted. The integration of anatomy and histology in the same learning tool is a real opportunity. Indeed, while most students approach anatomy as a compartmentalized memorization task, those who combine it with understanding, integration with other disciplines and visualization at different levels seems to have a better acquisition of knowledge. This aspect will be investigated in the future.

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