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Anatomy & Physiology: Current Research

Perspective

Innovations in Anatomical Dissection and Digital Learning Technologies

Melissa Brown*

Department of Anatomy and Physiology, Southern Health Sciences College, Adelaide, South Australia, Australia

DESCRIPTION

Anatomy has long been regarded as the cornerstone of medical and health sciences education. For centuries, cadaveric dissection has served as the gold standard for understanding the structural organization of the human body, allowing students to develop spatial awareness, manual skills and an appreciation for anatomical variation. However, rapid technological advancements are reshaping anatomy education by integrating digital learning technologies with traditional dissection practices. Cadaver based dissection continues to offer irreplaceable educational value. It provides students with direct exposure to authentic human anatomy, enabling them to appreciate the complexity of tissues, organs, neurovascular structures and anatomical relationships that cannot be fully replicated through textbooks or digital illustrations. Dissection also cultivates professionalism, ethical responsibility, teamwork and respect for human donors. One of the most significant innovations is the widespread adoption of three Dimensional (3D) anatomical visualization. High resolution digital anatomical models allow learners to manipulate organs, rotate structures, perform virtual dissections and explore complex anatomical relationships from multiple perspectives. Unlike static diagrams, interactive 3D platforms enable repeated practice without damaging specimens, supporting self directed learning and improving long term knowledge retention. These systems have become particularly valuable for understanding regions with intricate anatomical organization, such as the brain, pelvis, cranial nerves and cardiovascular system.

Virtual Reality (VR) and Augmented Reality (AR) have further transformed anatomy education by creating immersive learning environments. VR enables students to enter fully interactive anatomical spaces where they can examine organs at life size or magnified scales, while AR overlays digital anatomical structures onto physical models or living subjects. These technologies enhance spatial understanding by allowing learners to visualize anatomy dynamically rather than memorizing isolated structures. In clinical education, AR assisted visualization is increasingly being applied during surgical training and procedural simulation, helping bridge the gap between classroom learning and patient care. Another important advancement involves the development of virtual dissection tables and digital cadaver platforms. These technologies utilize high resolution medical imaging datasets derived from Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and cryosectional anatomy to generate realistic virtual human bodies. Students can perform layer by layer dissections, isolate individual anatomical systems, simulate pathological conditions, and reconstruct anatomical structures repeatedly without the limitations associated with physical specimens. Such flexibility supports individualized learning while accommodating diverse educational settings. Artificial intelligence (AI) is also beginning to influence anatomy education. Machine learning algorithms can personalize educational content based on individual learning patterns, automatically assess student performance and identify areas requiring additional instruction. AI-powered image recognition systems facilitate rapid identification of anatomical structures in radiological images, histological slides and digital specimens. These intelligent educational platforms provide immediate feedback, enabling students to strengthen anatomical knowledge more efficiently while supporting instructors through automated assessment and curriculum management.

Digital technologies have also expanded opportunities for remote and collaborative learning. Cloud based anatomy platforms, online simulation laboratories, interactive atlases and virtual classrooms allow students worldwide to access high quality educational resources regardless of geographical location. This capability became especially important during the COVID 19 pandemic, demonstrating that digital anatomy education can maintain learning continuity during periods when access to traditional laboratories is limited. Hybrid educational models now combine face to face dissection with online learning modules to maximize flexibility and educational effectiveness. Despite these advances, digital technologies should complement rather than replace cadaveric dissection. Physical dissection provides tactile feedback, appreciation of natural anatomical variation and opportunities to develop surgical skills that remain difficult to replicate fully through virtual simulations.

Correspondence to: Melissa Brown, Department of Anatomy and Physiology, Southern Health Sciences College, Adelaide, South Australia, Australia, E-mail: melissa.brown@shsc.edu.au

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