

Anatomy Education in Transition: A Review of Cadaveric Dissection and Alternative Learning Approaches

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ABSTRACT

Background: The foundation of anatomy teaching has long been thought to be cadaveric dissection, which gives students practical experience and a genuine understanding of three-dimensional human anatomy. However, the use of alternate teaching methods has increased recently due to curriculum compression, scarce resources, and quick technological advancements.

Objective: This review focuses on learning results, student perceptions, and curriculum relevance while methodically contrasting cadaveric dissection with other anatomy teaching approaches.

Methods: For research published between January 2000 and December 2025, a thorough search of Scopus, PubMed, MEDLINE, and Google Scholar was conducted. Cadaveric dissection, anatomy education, prosection, plastination, 3D anatomy, virtual reality, and augmented reality were among the keywords. Included were published studies that reported academic results or learner perceptions and involved undergraduate medicine or health science students.

Results: Advantages in geographic comprehension, tactile learning, awareness of anatomical range, and professional identity building were consistently shown by cadaveric dissection. Other methods provided improved sustainability, accessibility, and visualization, frequently yielding similar test results. The highest levels of student satisfaction and reinforced cognitive learning were attained by blended learning approaches that combined dissection with digital tools.

Conclusion: An essential part of teaching anatomy is still cadaveric dissection. In integrated, technology-enhanced courses, alternative approaches work best as supplementary tools. Research backs up the preservation of cadaveric dissection while carefully integrating digital tools to enhance student learning.

Keywords: Anatomy education, cadaveric dissection, virtual anatomy, prosection, medical education, 3D anatomy, augmented reality, virtual reality, plastination.

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Introduction

The conceptual and structural basis of medical and health-science education is human anatomy. Clinical reasoning, procedural abilities, and safe patient care all depend on a solid grasp of anatomy. Cadaveric dissection has historically been the main technique used to help students develop their tactile familiarity, spatial awareness, and three-dimensional comprehension of human structures (1,2). Dissection promotes empathy, ethical consciousness, cooperation, and respect for body donors in addition to knowledge acquisition (3,4).

Cadaveric dissection has long been valuable for teaching, but it is becoming more difficult. The amount of time allotted to anatomy has decreased due to curriculum compression, and the investigation of

alternate teaching techniques has been further prompted by growing student numbers, budget limitations, legal restrictions, ethical issues, and a lack of body donors (5–7). As a result, prosection-based instruction, plastinated specimens, 3D-printed models, digital platforms, and virtual or augmented reality (VR/AR) technologies have all been incorporated into anatomy education (8–10).

Benefits including better visualization, standardized training, learner autonomy, and scalability are highlighted by proponents of technology-enhanced learning (11,12). According to some research, dissection and other techniques perform similarly in short-term assessments (13, 14). However, critics point out that these methods frequently lack the professional identity formation, exposure to

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anatomical variety, and multisensory engagement that come with cadaver-based learning (15,16).

The current discussion in anatomy education has moved from the question of whether dissection should be replaced to the question of how to combine conventional and modern methods to enhance student learning (17). While previous reviews have looked at individual modalities, there are still few thorough analyses that compare various techniques in the cognitive, psychomotor, and affective domains. By comparing cadaveric dissection to other approaches in terms of learning results, student perspectives, and curricular relevance, this review seeks to close that gap.

Methods

Search Strategy: For research published between January 2000 and December 2024, a thorough search of Scopus, PubMed, MEDLINE, and Google Scholar was carried out. "Cadaveric dissection," "anatomy education," "virtual anatomy," "prosection," "plastination," "3D learning," and "VR/AR anatomy" were among the keywords.

Inclusion Criteria:

- Publications that undergo peer review
- Anatomy instruction at the undergraduate level in medicine or health sciences
- Studies that are observational, comparative, or interventional
- Reporting student perspectives, skill progress, spatial comprehension, or learning outcomes

Exclusion Criteria:

- Veterinary anatomy studies
- Case reports without outcome measures
- Conference abstracts without full text
- Non-English publications

Data Extraction and Synthesis: The study design, teaching mode, assessment techniques, and major findings were the main topics of the narrative synthesis of the data. A qualitative synthesis was carried out rather than a meta-analysis because of the diversity among the studies.

Results

Deeper anatomical comprehension, improved spatial reasoning, and kinesthetic learning were all consistently supported by cadaveric dissection (1,3,15). Students who participated in dissection showed improved integration of anatomy with therapeutic concepts and a deeper understanding of anatomical variety (7,16). Additionally, a number of studies found that students who engaged in dissection had better professional attitudes, ethical awareness, and cooperation skills (4,12).

Prosection and plastinated specimens are examples of alternative methods that enhance instructional effectiveness and structural clarity, especially in large cohorts (9,18). Exam results were frequently similar to those obtained by dissection thanks to the repeated practice and independent learning made possible by three-dimensional models and digital platforms (10,14,19). Though they did not consistently outperform conventional techniques in information gathering, VR/AR technologies improved visualization and engagement (13, 20).

The best results in terms of student satisfaction, cognitive load reduction, and laboratory session readiness were obtained from blended techniques that combined cadaveric dissection with digital resources (2,11,21).

Discussion

The ongoing benefits of cadaveric dissection in anatomy instruction are reaffirmed by this review. It is a fundamental element due to its distinct advantages in spatial orientation, tactile learning, and exposure to anatomical variety. Dissection promotes professional growth, ethical consciousness, and emotional fortitude in addition to its cognitive advantages (4,12,22).

In terms of sustainability, accessibility, and visualization, other approaches clearly have advantages. While digital and VR-based platforms facilitate self-directed learning and curriculum flexibility, sectioning and plastination cut down on laboratory time and logistical difficulties (8,10,20). However, they cannot completely replace cadaveric learning due to their low tactile involvement and restricted professional interaction chances.

In order to preserve learning continuity, the COVID-19 epidemic hastened the implementation of online and mixed anatomy instruction (24). According to post-pandemic data, students favor hybrid models that combine scheduled cadaver sessions with digital

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preparation to increase participation and perceived learning efficiency (25).

The most compelling evidence is in favor of blended and integrated curricula, in which dissection is strategically supplemented rather than replaced by alternate modalities (6,17,23). Virtual pre-dissection exposure combined with practical cadaver work improves understanding and maximizes lab productivity.

The expanding importance of technology-enhanced anatomy teaching is further supported by recent research published in 2025. Although there is conflicting evidence for better knowledge learning, systematic reviews have shown that virtual reality and immersive learning environments increase student engagement, visual understanding, and learning satisfaction (26,29). Improved collaborative learning experiences and better visualization of intricate anatomical linkages were observed in studies comparing immersive virtual reality with three-dimensional anatomical models (28). Additionally, recent evaluations of mixed-reality platforms and virtual dissection tables indicate that these technologies work best when combined with cadaver-based training rather than as stand-alone substitutes (27). According to student perception surveys, students continue to view cadaveric dissection as a crucial part of anatomy teaching, but they also appreciate digital tools (30). These results support the idea that the most balanced and instructionally successful method for contemporary medical teaching is to use mixed anatomy curriculum that combine regular dissection with digital technologies (26–30).

The balance between technological innovation and educational effectiveness is a crucial factor in modern anatomy education. Although digital tools offer accessibility and flexibility, research indicates that they are most useful when used in conjunction with conventional techniques rather than in their place. Particularly for complex anatomical regions, virtual reality applications, online learning platforms, and three-dimensional visualization tools can improve student engagement and support autonomous learning. Additionally, self-paced study and repeated practice are made possible by technology-enhanced resources, which ease some of the drawbacks of limited laboratory access and growing class sizes (31, 34, 35, 42, 43).

The necessity of anatomy courses that complement clinical practice and competency-based medical education is another developing subject. Research has

shown how crucial it is to define fundamental anatomical information and make sure that instructional strategies promote long-term memory and practical application. Students' capacity to use anatomical knowledge in healthcare settings may be enhanced by integrating anatomy with clinical scenarios, radiological imaging, and problem-based learning. The most complete approach to anatomy education in the contemporary era seems to be provided by educational frameworks that integrate cadaveric experience, digital technologies, and clinically focused instruction (32,33,38,39,40).

Future research should assess competency-based outcomes, clinical performance, and long-term knowledge retention. Curriculum development must be guided by multicenter research and standardized measurements.

Conclusion

Cadaveric dissection continues to be an exceptionally valuable and pedagogically indispensable component of anatomy education, offering unparalleled anatomical realism and professional growth. Instead of being used as stand-ins, alternative teaching modalities should be included into a blended, technology-enhanced curriculum since they offer significant complimentary benefits. Curriculum strategies that combine cadaveric dissection with contemporary digital resources to satisfy changing educational needs and maximize student learning results are supported by current research.

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Conflict of Interest

The authors declare that they have no conflicts of interest with regard to this manuscript's publication.

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