



CHALLENGES AND DISTINCTIONS IN ONLINE ANATOMY EDUCATION FOR MEDICAL STUDENTS: A SHORT REVIEW

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ABSTRACT

The COVID-19 pandemic catalyzed a paradigm shift in education, with online learning becoming the primary mode of instruction across disciplines, including medical education. Anatomy, traditionally taught through hands-on dissection, cadaveric demonstrations, and interactive classroom sessions, faced significant challenges in transitioning to the online realm. This paper explores the difficulties encountered in delivering anatomy education online, compares the efficacy of online versus traditional methods, and discusses the long-term implications of this shift on medical training. Through a review of existing literature and empirical findings, we aim to highlight key challenges such as reduced tactile learning, limited student engagement, technical barriers, and alterations in assessment strategies. Furthermore, we examine pedagogical adaptations, the role of digital tools like virtual dissections, and the importance of blended learning models in addressing these gaps.

KEYWORDS : Online anatomy education, COVID-19 pandemic, cadaveric dissection, tactile learning, 3D models, virtual dissection, student engagement, blended learning, VR/AR, active learning.

INTRODUCTION

Anatomy is a cornerstone of medical education, providing the foundational understanding of human body structures necessary for clinical practice. Traditionally, anatomy has been taught through cadaveric dissections, in-person lectures, and hands-on laboratory experiences (Bhattarai et al.;2022). The abrupt shift to online education during the COVID-19 pandemic forced educators to explore alternative methods of teaching, including virtual dissections, 3D anatomical models, and online discussion forums. While online teaching offers flexibility and a wider range of resources, it presents unique challenges for subjects like anatomy, which require experiential and tactile learning. This paper examines the specific challenges of teaching anatomy in an online format, the differences between online and traditional in-person approaches, and potential strategies for improvement in the future.

Challenges in Online Anatomy Education

1. Loss of Tactile Learning

One of the primary challenges in online anatomy education is the absence of tactile learning, which has historically been a crucial component of anatomy training. Cadaveric dissection provides students with the invaluable opportunity to engage directly with human tissues and understand the three-dimensional complexity of anatomical structures. Research suggests that hands-on dissection significantly enhances the comprehension of spatial relationships, a critical aspect that is difficult to reproduce through virtual tools (Estai & Bunt, 2016). While virtual dissection software, such as Visible Body and 3D Anatomy Atlas, offers a visual and interactive alternative, these platforms fall short in replicating the feel, texture, and subtle variations encountered in cadavers, limiting the depth of students' learning experiences.

2. Limited Student Engagement

In a traditional classroom, students benefit from real-time interactions, where they can ask questions, clarify doubts, and engage with peers, fostering a deeper understanding of complex topics. Online platforms, however, often struggle to replicate this level of interactivity. Choi-Lundberg et al. (2016) found that students learning anatomy online reported feelings of isolation and disengagement compared to their in-person counterparts. While tools like Zoom and Microsoft Teams enable some interaction, they lack the spontaneity and fluidity of face-to-face discussions. This reduced engagement can impede the development of critical thinking skills, which are crucial for medical professionals, as it limits the opportunity for immediate feedback and collaborative problem-solving.

3. Technical Barriers and Digital Literacy

Not all students have equal access to the technological tools and reliable internet connections necessary for effective online learning, creating a digital divide that disproportionately impacts students from underprivileged backgrounds, further exacerbating educational inequalities (Dhawan, 2020). Additionally, digital literacy is a crucial factor in determining how successfully students can engage with online platforms. Many students, especially those early in their medical training, may find it challenging to navigate the intricacies of digital tools, which can hinder their ability to fully participate and benefit from virtual anatomy lessons.

4. Altered Assessment Strategies

Traditionally, anatomy knowledge has been assessed through practical exams, such as cadaveric spot tests, structure identification, and viva voce. However, with the shift to online education, alternative assessment methods like multiple-choice questions (MCQs) and online quizzes have become more common. While these formats offer efficiency, they often fall short in evaluating the depth of understanding needed for clinical practice. Relying on MCQs can encourage surface-level learning, where students focus on memorization rather than developing a comprehensive grasp of anatomical structures (Gupta et al., 2021). Additionally, the use of online proctoring raises concerns regarding academic integrity and the fairness of these assessments.

Distinctions Between Online and In-Person Anatomy Education

1. Resource Availability

Online education offers an unprecedented range of digital resources, including 3D anatomical models, virtual dissections, and augmented reality (AR) tools. These resources provide students with a more diverse array of learning materials than traditional anatomy education, which often relies on physical textbooks and cadaveric dissections (Singh et al., 2021). However, while these tools can enhance theoretical understanding, they cannot fully substitute the practical experience of working with real human tissues.

2. Flexibility and Accessibility

Online learning offers flexibility in both time and location, enabling students to engage with course materials at their convenience. This flexibility is especially advantageous for students with other commitments or those living in remote areas. However, the lack of structured schedules in online learning can lead to decreased motivation and poor time management for some students. In contrast, traditional in-

person classes provide a more structured environment, helping students maintain focus and stay on track with their studies (Longhurst et al., 2020).

3. Collaboration and Peer Learning

In medical education, collaborative learning and peer interaction are vital components that enhance students' understanding of complex subjects, particularly in anatomy. Traditionally, dissection labs and study groups foster active peer-to-peer learning, where students clarify doubts, share insights, and engage in hands-on problem-solving. This environment encourages the development of teamwork and communication skills, which are essential in clinical practice. However, online learning can impede these collaborative experiences. Without the physical presence of peers and instructors, students may feel isolated, leading to decreased engagement in group discussions or reluctance to participate in collaborative projects. The lack of shared spaces for informal learning—such as study groups formed during in-person classes or casual exchanges during lab work—limits opportunities for deeper engagement with the material. Furthermore, the absence of immediate feedback from peers during collaborative dissection sessions can prevent students from developing the critical thinking and spatial reasoning skills required in anatomy. Studies suggest that virtual environments, while useful for delivering content, often fail to replicate the spontaneous, interactive nature of group learning in physical settings. For example, Cheng et al. (2022) highlight that the absence of collaborative lab work diminishes students' ability to internalize anatomical relationships in a meaningful way. These findings emphasize the need for innovative online platforms that encourage more effective peer interaction, potentially through small group assignments or virtual lab simulations designed to mimic the collaborative elements of in-person anatomy education. Promoting synchronous sessions and using breakout rooms for smaller group discussions may help mitigate some of these limitations, but a complete replication of the hands-on, peer-driven learning experience remains a challenge in online formats.

Adaptations and Solutions

1. Blended Learning Models

A hybrid or blended learning approach, integrating both online and in-person components, offers a potential solution to the challenges of online anatomy education. In this model, students benefit from the flexibility of online platforms for theoretical understanding and self-paced study while still gaining essential hands-on experience through in-person labs. This combination allows students to engage with digital resources, such as virtual dissections, 3D anatomy models, and quizzes, to reinforce their foundational knowledge remotely, as noted by Yoo et al. (2021). At the same time, in-person lab sessions provide the tactile experience and direct interaction with anatomical specimens that are crucial for deep comprehension and the development of spatial awareness. By participating in dissections and guided labs, students enhance their practical skills, which are critical in medical practice. The hybrid model also encourages the use of digital tools to supplement and enhance traditional learning methods, leading to improved flexibility without sacrificing the depth of learning achieved through hands-on experiences. This balanced approach also addresses the issues of collaboration and peer interaction. While students can engage in virtual study groups or collaborative assignments online, in-person labs allow for the kind of real-time feedback and peer discussions that are difficult to replicate in a fully virtual environment.

This hybrid method provides the best of both worlds, combining the accessibility and convenience of online learning with the essential physical and interactive elements of traditional anatomy education

2. Enhanced Use of Technology

Advances in technology, particularly AR and virtual reality (VR), hold promise for improving the online anatomy learning experience. AR tools can overlay anatomical structures onto real-world objects, providing a more immersive and interactive learning environment (Tang et al., 2020). VR simulations offer a 3D, spatial understanding of anatomy, allowing students to "dissect" virtual cadavers. While these technologies are still in their infancy, they represent a potential solution to the loss of tactile learning in online education.

3. Active Learning Strategies

To address the issue of student engagement, educators can incorporate more active learning strategies into their online teaching. Techniques such as problem-based learning, case studies, and online breakout rooms can encourage students to engage more deeply with the material (Singh et al., 2019). Additionally, regular live sessions with opportunities for real-time interaction can help replicate the dynamic, interactive environment of in-person classes.

CONCLUSION

The shift to online anatomy education has highlighted significant challenges, particularly in the areas of tactile learning, student engagement, and assessment. While online tools offer valuable resources for theoretical learning, they cannot fully replace the experiential learning that is central to anatomy education. Blended learning models, technological innovations, and active learning strategies offer promising solutions to these challenges. As medical education continues to evolve, it is essential to find a balance between online and in-person teaching methods to ensure that future medical professionals receive comprehensive and effective training in anatomy.

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