# ROLE OF ARTIFICIAL INTELLIGENCE IN ANATOMY: A BOON OR BANE?

## Abstract

When it comes to implementing cutting-edge technologies for education, such as artificial intelligence (AI), anatomy educators are frequently at the vanguard. Technology advancements have provided educational institutions with a virtual reality-capable teaching, interactive, and diagnostic tool. For safe clinical treatments, competent clinicians, especially surgeons, need a thorough understanding of anatomy. There is a concern that medical students will not be adequately prepared for clerkships and residency program. Therefore, creating efficient teaching techniques for anatomy is crucial for secure medical practice. There are varying opinions on whether complete cadaver dissection is still appropriate for a modern undergraduate program, despite the fact that cadaver-based instruction has continued to be the primary instructional method for hundreds of years. There are conflicts between the benefits and risks of incorporating AI into anatomy teaching, according to the perspectives of a public health researcher, a medical ethicist, and an educational technology specialist. These conflicts show how AI is presently unprepared to take into account the uncertainties inherent to anatomy instruction in the domains of human variation, healthcare practice, diversity and social justice, student assistance, and student learning.

**Keywords:** Artificial Intelligence, Anatomy, Cadaver, Technology

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## I. INTRODUCTION

Anatomy and cadaveric dissection go hand in hand since time immemorial. The fundamentals of learning medical science and clinical courses is anatomy. Anatomy gives the basic knowledge related to physical examination and medical investigations. It helps in learning about the various diseases and clinical conditions affecting the human body [1]. Technologies have now been incorporated into the classrooms to make the use of curriculum more efficient. Alternative methods of teaching anatomy are being employed by the anatomy educators, which are more clinically oriented and relevant [2]. Till the late twentieth century anatomy was untouched by technological tools. Printed books, use of chalk and board, photographic projections in the classrooms and cadaveric dissections were used for the purpose of teaching and learning anatomy.

In this era of artificial intelligence, new technologies have taken over the entire world. Not only has the Artificial intelligence improved the quality of work, it has also made human life much more effective and time saving. In the world of medical education artificial intelligence has proven to be of utmost importance. It has taken anatomy and its teaching methods under its umbrella. Anatomy educators are embracing the new technologies by incorporating different AI tools like virtual dissection tables, Three dimensional printers and three dimensional application software. The development of artificial intelligence (AI) has important potential effects on the teaching of clinical anatomy in various situations and cultures.

The advancements in Radiology have directly influenced the anatomy education. Radiology is now integrated into anatomy courses. Medical students are now expected to have a basic understanding of imaging modalities. Radiology being a technology driven speciality, now helps in incorporating three dimensional images of a patient. This makes the understanding of Anatomy much simpler. Computed tomography (CT), which acquires volumetric pictures that encode the anatomy by density, is the most effective radiological imaging modality. Doctors regularly view CT scans in 2D and 3D for the benefit of their patients. Anatomy classes are increasingly using 3D reconstructions of CT scans, especially in light of the emerging interest in 3D printing as a teaching tool [3].

Digital imaging and communications in medicine (DICOM) data from MRI and CT images can be utilized to visualize in three planes so that any cuts or mistakes that could be harmful while working directly on a corpse can be dissected or corrected [4].

## II. ROLE OF CADAVERIC DISSECTION IN ANATOMY

Since ancient times, cadaveric dissection has been the primary teaching method in anatomy instruction. Herophilus of Chalcedon and Erasistratus of Chios performed the first human cadaveric dissections in Greece in the third century BC in order to comprehend the entire body from the perspective of anatomy and physiology. However, attitudes and taboos associated with religion and morality that were held against doctors and medical schools also had a negative impact on the scientific usefulness of cadaver-based education [5]. Below are some advantages and disadvantages of using cadavers in anatomy.

1.  The fact that dissection is frequently students' first exposure to mortality and serves to remind pupils of the reality of sickness is a special benefit of using cadavers.
2.  Students can learn from cadavers how to appreciate their patients even after they have passed away. When performing dissection on a cadaver, depth perception can also be best understood.
3.  One frequently mentioned benefit of cadaveric dissection is the relative position and observation of relations between structures.
4.  Through tactile information on tissue texture and 3D vision of anatomical structures, dissection aids in the identification of structures by pupils. This is crucial in the training of healthcare workers who will interact with patients since it requires a thorough understanding of human anatomy.
5.  The fact that a structure cannot be rebuilt after being cut or damaged during cadaveric dissection is a major drawback.
6.  Cadavers are frequently heavy and challenging to maneuver.
7.  With a cadaver, the dissection order is also comparatively predetermined. This makes it difficult to revisit finished cadaver dissections.
8.  It takes two to four times as long for students to finish cadaveric dissections than it does for other methods of studying human anatomy.
9.  Cadavers are preserved in formalin. This exposes the people dealing first hand with it to health problems.
10. Cadavers require more storage area.
11. The ongoing costs of collecting cadavers, keeping a conducive environment for dissection, and caring for cadaver remains are not negligible.

Modern anatomy education has changed recently, and numerous cutting-edge methods are now employed to teach anatomy. Traditional methods in anatomy education include cadaveric dissection and didactic lessons using atlases; new approaches include 3D simulation technologies, virtual/augmented reality, 3D printed materials, simulation/training models, and radiology-based comparative illustrations [6].

## III. ADVANTAGES OF USING ARTIFICIAL INTELLIGENCE IN ANATOMY

Artificial intelligence can be used to teach anatomy in conjunction with cadavers or even as a stand-alone technology. It provides an opportunity to understand anatomy and demonstrates the specifics of various anatomical structures. To pique the curiosity of the students, different layers of the cadavers might be cut away or removed. By removing the associated components, students can also separate a single organ. Virtual dissectors can also be used for conducting practicals and discussion as well [7].

Medical pupils can modify and learn about a detailed, interactive, 3D digital depiction of the human anatomy using a high-tech tool called a virtual dissection table, which incorporates modern imaging technology. Due to their many advantages over conventional approaches, virtual dissection tables have become an essential part of contemporary medical education. In contrast to conventional dissection techniques, it has a number of advantages.

**The Benefits of Using Various AI Modalities are:**

1. The key benefit is that it does away with the necessity for actual cadavers, which may be expensive, challenging to obtain, and dangerous for students' health.
2. Students can use a computer and specialized software to alter and dissect virtual 3D representations of the human body.
3. The ability for these technologies to operate at levels and pace that are not ordinarily feasible by human instructors is one of the alluring prospects and advantages of artificial intelligence-infused anatomical education.
4. Additionally, it provides chances for improved reliability and accuracy in the delivery of anatomy instruction and evaluations, along with the ability to identify problems and trends that could otherwise go unnoticed by humans [8].
5. This technology gives students a learning experience that closely resembles the actual dissection procedure while being realistic, engaging, and dynamic. Students have the option to see various bodily layers, spin and focus in on particular components, and even do simulated dissections.
6. It encourages students to learn anatomy at their own rate, go over difficult ideas several times, and practice skills without worrying about harming the specimen being studied.
7. The Artificial intelligence provides virtual anatomy for both men and women, with accurate representations of the muscles, bones, nerves, and internal organs.
8. Students can utilize the labelled structures and remarks for self-evaluation or self-review.
9. Virtual dissecting tables increases the understanding of volumetric anatomy and makes studying more entertaining [9].

## IV. DISADVANTAGES OF USING ARTIFICIAL INTELLIGENCE IN ANATOMY

It's crucial that anatomy educators gain a critical knowledge of the larger implications of using artificial intelligence in addition to developing a clear understanding of what could be accomplished practically with AI technologies.

1. Virtual dissection inhibits the tactile form of learning by preventing students from enjoying the feel and texture of specific organ of the human body, such as muscles, tendons, bones, hearts, and lungs, without interacting with human tissues.
2. It can be difficult to integrate technology into the classroom in an efficient and effective way.
3. If faculty are not given this training, they will not be able to use the technology to its maximum potential. Faculty must receive proper training linked to using the technology and integrating it into teaching.
4. The setting up of virtual dissector table and system is expensive so every institute cannot afford it.

There is a risk that too prescriptive AI diagnostics would reduce students' ability to tolerate uncertainty, dulling their perception of the inherent nuances and uncertainties in human anatomy. The design of anatomy education curricula that challenges students to understand the human form as individually variable and the clinical implications of anatomy as complicated is a recent trend, thus it is crucial that AI-driven teaching tools reflect this model.

## V. CONCLUSION

Modern clinical anatomy education progressively emphasizes, values, and emphasizes the inherent diversity and variability of the human form. The same factors that make it difficult for anatomy educators to emphasize and convey this anatomic "uncertainty" to their healthcare students are also responsible for the opportunities that AI offers in terms of scaling, speed, consistency, and precision. Cadaveric dissection has always been an integral part of anatomy. Availability of cadavers however is a serious issue. Certain countries face the problem of inadequate number of cadavers for medical education which hinders the learning process and practical knowledge of anatomy. Artificial intelligence has been a boon to such institutes. Data of different patients from CT scans is compiled and used in virtual dissectors. Students can get a plethora of knowledge just by a single touch.

Few could have predicted the devastating effects COVID-19 would have on education when the World Health Organization designated it a pandemic on March 11, 2020. The COVID-19-related closing of schools and colleges had been a crucial global incident that had forced us to re-evaluate how education is carried out in all of our nations. This problem led to a number of adjustments, one of which was that all teaching was now mediated by digital tools. Additionally, in order to achieve the goals of this study, it was necessary to reconsider the teaching methods used in the new virtual classrooms. Artificial intelligence came in as a saviour of the educational system. With the help of a virtual dissector students sitting across different rooms can be taught the same topic. Bones, muscles , nervous system as well as cardiovascular system along with their clinical implications become much easy to explain with the help of artificial intelligence. Because cadaver CT scans do not depict living anatomy, which is crucial for clinicians to comprehend, they may be inferior for teaching anatomy.

To diagnosis specific disorders, such as a bowel obstruction, it is crucial to be able to spot a typical bowel gas pattern on radiological examinations. Due to the fact that a cadaver CT image is of a deceased person, students would not be able to learn the normal intestinal gas pattern. One benefit of using patient CT scans for virtual dissection is that the images record living anatomy and physiology, such as the usually aerated aerodigestive tract [10].

When in comparison with non-virtual teaching methods, 3D visualization technologies demonstrate stronger factual understanding, greater proficiency in spatial knowledge, improved student happiness, and learners' sense of teaching effectiveness. Utilizing artificial intelligence's features can help doctors and surgeons better understand radiological anatomy, plan procedures, and open up new research opportunities.

This signals a paradigm shift away from the enthusiastic, uncritical adoption of novel technologies into anatomy teaching and toward a coordinated effort by anatomy educators to carefully examine the hidden and unintended effects of AI on learning. It also serves as a call to action for anatomy educators to participate in the creation of AI that is fit for purpose.

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