

## Impact of Artificial Intelligence in Anatomy

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**Abstract:** Artificial intelligence is being used and integrate positively in anatomy, in which programs are available at all times, enhancing efficiency and decision-making, however, it also offers significant challenges by reducing human jobs, ethical concerns and high costs. This review provides an overview of artificial intelligence and the significant technology in the anatomy education.

**Keywords:** Anatomy, Artificial intelligence, Anatomage table.

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### INTRODUCTION

Artificial intelligence is a field of computer science that focuses on constructing algorithms and software that are capable of performing human tasks and decision-making (Narayanan *et al.*, 2023).

Making awareness of artificial intelligence is vital amongst students and medical educators to develop and implement artificial intelligence based- tools in medical education (Ahmed *et al.*, 2022). Medical education involves a lifelong learning field ranging from undergraduate to postgraduate and it is also relevant to several health care specialists, from doctors to nurses and other associated health care workers (Chan and Zary, 2019). Significantly, participating artificial intelligence tools in learning can improve student knowledge, skill progress, and understanding of difficult medical conceptions (Narayanan *et al.*, 2023).

Artificial intelligence uses machine learning models to collect, compute, evaluate and even supplement enormous data to be reclaimed when required. Several advantages of artificial intelligence have been reported in education, such as packing of a huge electronic data, teaching from remote places, few teachers and fast feedback from users. Artificial tools may not replace human communications but can change learning and teaching anatomy, verify, provide deep learning and a three-dimensional virtual reality. Artificial intelligence can alter anatomy

education and provide personalized learning experiences by analyzing students or users' data (Mahajan, 2024). Administrative tasks such as schedules, attendance and assignments can be supported by artificial intelligence systems and can offer teachers with data-driven perceptions into student emotions, performance, and engagement levels, allowing them to tailor their teaching procedures and approaches support or intervention (Lin *et al.*, 2023). Moreover, students and educators must gain important skills in directing and understanding the artificial intelligence technologies.

### Chatbots

Chatbots called conversational agents, employ dialogue systems to permit natural language conversations with users by means of text, speech, or both. Chatbots are artificial intelligence systems programmed to understand, and reply to human inquiries on exact input data by repossessing information from internet databases and creating human language using their progressive natural language processing model (Ghorashi *et al.*, 2023). Artificial intelligence chatbots have been developed in a variety of health care domains such as medical consultations, diagnosis of disease, mental health support and for COVID-19 pandemic (Miner *et al.*, 2020).

Chatbots use machine learning and natural language processing algorithms and might be programmed to respond to new information from user interactions. Crucially, chatbots supports students to

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receive personalized assistance outside the classroom that acting as an interactive search engine to answer questions that arise from the learner, guiding students through challenging concepts and offering real-time feedback (Ghorashi *et al.*, 2023). The advantage of the existing chatbots can automate repetitive, time-consuming tasks such as converting lecture material into question and rapidly answer-based flashcards, also enabling active recall and retention of data. However, chatbots can possibly generate false references, so, students should use chatbots as assistive tools (Narayanan *et al.*, 2023). Google Bard and ChatGPT were evaluated in anatomy education, in which the two large language models were questioned to answer questions, create multiple-choice questions, and write articles on anatomy subjects. The findings suggested that the models were able to achieve these tasks with variable degrees of accuracy (Ilgaz and Çelik, 2023). ChatGPT-4 cannot substitute the vital role of educators and should be used as a complementary tool (Totlis *et al.*, 2023). Further study is necessary for the optimal use and to improve the precision of the models and to better understand using successfully in educational settings (Mogali, 2024).

### DIGITAL ANATOMY PLATFORM

Anatomy learning platforms used for teaching and learning of human anatomy such as 3D Organon, Visible Body®, BioDigital, Zygote Body®, Primal Pictures and Complete Anatomy have been reported. Complete Anatomy has been developed and considered one of the best educational three-dimensional (3D) anatomy platform formed by 3D4Medical since 2009. The complete anatomy platform used by institutions, students, educators, and medical specialists. Complete anatomy has growing users due to its collaborative anatomy models, clinical video animations, and the virtual dissection tools. Medical educators allowed to use specific dissections in lectures and online materials such as videos animation and audio recordings. A Dashboard feature is involved that highlights student activity such as attendance, quiz results, and progression through shared materials. Complete Anatomy platform is a way to stay in touch with learning in the anatomy laboratory for students by making the cadaver portable on mobile devices. Also, educators can help them in building and designing curricula (Motsinger, 2020; Lee *et al.*, 2024).

### ANATOMAGE TABLE

Cadaver dissection is the traditional method of teaching anatomy permitted students to know clearly the organization of human body and experience the texture of the human tissues (Dissabandara *et al.*, 2015; Youssef, 2021) Dissections can be useful for younger surgeons on human cadavers to improve surgical techniques or build new procedures (Youssef, 2022). Importantly, digital dissection, a new generation of products has been developed. The students can achieve virtual dissection by removing layers or exact structures of the body in order

similar to real time dissection sittings. One of best example of innovative anatomy teaching methods is the Anatomage table. Virtual dissection tables allowed the students the chance to virtually dissect human cadaver on a touchscreen (Martín *et al.*, 2018; Kavvadia *et al.*, 2023; Abdellatif *et al.*, 2022). The advantage of the Anatomage table includes absence of chemicals used in traditional dissecting rooms, safe and controlled learning environment for medical students. Students can virtually dissect a human by moving through layers of body and can be easily used to zoom in, manipulate and rotate and allowed for frequent practice without the limitations and ethical concerns associated with traditional dissection procedures. Virtual dissection includes radiological imaging such as MRI and CT will help incorporation of radiology and anatomy in the curricula. The future plans of the Anatomage table in the field of anesthesiology is the integration of the Anatomage table with advanced imaging modalities such as MRI or CT scans. This would enable exact preoperative planning for complex surgical processes, permitting anesthesiologists to visualize patient-specific anatomy and adjust anesthesia administration. So, Anesthesiologists can practice several airway management methods, such as intubation and this offers an opportunity to improve and upgrade their skills in a safe environment before applying them to actual patients (Gupta, *et al.*, 2023; Said Ahmed, 2023). However, the table can be expensive with probable ongoing maintenance and software updates, might cause financial challenges for some healthcare institutions or individuals. The Anatomage table technical malfunctions such as software difficulties, or system failures could possibly disrupt teaching sessions and required timely technical support to resolve any problems. This table may not fully imitate the unpredictable nature of real patients during anesthesia processes, including patient responses, and decision-making skills required in operation theatres.

### CONCLUSION

Artificial intelligence offers an amazing future methods to facilitate anatomy education by introducing new technical developments. However, uses of artificial intelligence in anatomy faces several challenges. Artificial intelligence tools must be developed and installed ethically. Bias and errors of the data lead to inaccurate educational outcomes. So, it should update the artificial intelligence system to decrease errors and confirm fairness. The significant of privacy issues in artificial intelligence system in anatomy teaching or learning such as images and probably students' personal information, presentation and behavior are vital to ensure the security for educational institutions and students. Further research is required to better understand how the artificial intelligence can be used successfully in anatomy.

### REFERENCES

- Narayanan, S., Ramakrishnan, R., Durairaj, E., & Das, A. (2023). Artificial Intelligence

- revolutionizing the field of Medical Education. *Cureus*, 15(11), e49604. DOI 10.7759/cureus.4960
- Ahmed, Z., Bhinder, K. K., Tariq, A., Tahir, M. J., Mehmood, Q., Tabassum, M. S., ... & Yousaf, Z. (2022). Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan: A cross-sectional online survey. *Annals of Medicine and Surgery*, 76, 103493.
  - Chan, K. S., & Zary, N. (2019). Applications and Challenges of Implementing Artificial Intelligence in Medical Education: Integrative Review. *JMIR Med Educ*, 5(1), e13930. doi: 10.2196/13930. PMID: 31199295; PMCID: PMC6598417.
  - Mahajan, A. (2024). Ethical considerations of artificial intelligence (AI) in teaching and learning anatomy. *Indian J Clin Anat Physiol*, 11(2), 66-67.
  - Lin, C. C., Huang, A. Y. Q., & Lu, O. H. T. (2023). Artificial intelligence in intelligent tutoring systems toward sustainable education: a systematic review. *Smart Learn Environ*, 10, 41. <https://doi.org/10.1186/s40561-023-00260-y>
  - Ghorashi, N., Ismail, A., Ghosh, P., Sidawy, A., & Javan, R. (2023). AI-powered chatbots in medical education: potential applications and implications. *Cureus*, 15(8), e43271. doi: 10.7759/cureus.43271. PMID: 37692629; PMCID: PMC10492519
  - Miner, A. S., Laranjo, L., & Kocaballi, A. B. (2020). Chatbots in the fight against the COVID-19 pandemic. *NPJ Digit Med*, 3(1), 1-4.
  - Ilgaz, H. B., & Çelik, Z. (2023). The significance of artificial intelligence platforms in anatomy education: an experience with ChatGPT and Google Bard. *Cureus*, 15(9), e45301. doi: 10.7759/cureus.45301. PMID: 37846274; PMCID: PMC10576957.
  - Totlis, T., Natsis, K., Filos, D., Ediaroglou, V., Mantzou, N., Duparc, F., & Piagkou, M. (2023). The potential role of ChatGPT and artificial intelligence in anatomy education: a conversation with ChatGPT. *Surgical and Radiologic Anatomy*, 45(10), 1321-1329. <https://doi.org/10.1007/s00276-023-03229-1>
  - Mogali, S. R. (2024). Initial impressions of ChatGPT for anatomy education. *Anat Sci Educ*, 17(2), 444-447. doi: 10.1002/ase.2261.
  - Motsinger, S. K. (2020). Complete Anatomy. *J Med Libr Assoc*, 108(1), 155-157. doi: 10.5195/jmla.2019.853.
  - Lee, J. W. Y., Susanto, J., Lai, S. H., Cheow, P. C., Low, L. X. T., & Bello, F. (2024). What Faculty and Students Value When Evaluating Human Digital Anatomy Platforms: A Mixed-Methods Study. *Journal of Medical Education and Curricular Development*, 11. <https://doi.org/10.1177/23821205241256043>
  - Dissabandara, L. O., Nirthanana, S. N., Khoo, T. K., & Tedman, R. (2015). Role of cadaveric dissections in modern medical curricula: a study on student perceptions. *Anatomy & cell biology*, 48(3), 205-12. doi:10.5115/acb.2015.48.3.205
  - Youssef, S. (2021). Different approaches for teaching and learning anatomy and future directions. *Indian J Clin Anat Physiol*, 8(1), 1-6.
  - Youssef, S. (2022). Importance of anatomical variations for surgery and clinical practice. *wjpls*, 8(12), 157-160.
  - Martín, J. G., Mora, C. D., & Henche, S. A. (2018). Possibilities for the use of anatomage (the anatomical real body-size table) for teaching and learning anatomy with the students. *Biomed. J. Sci. Tech. Res.* 4, 4080-4083.
  - Kavvadia, E. M., Katsoula, I., Angelis, S., & Filippou, D. (2023). The Anatomage Table: A Promising Alternative in Anatomy Education. *Cureus*, 15(8), e43047. doi: 10.7759/cureus.43047. PMID: 37692592; PMCID: PMC10484354.
  - Abdellatif, H., Al Mushaiqri, M., Albalushi, H., Al-Zaabi, A. A., Roychoudhury, S., & Das, S. (2022). Teaching, learning and assessing anatomy with artificial intelligence: the road to a better future. *International journal of environmental research and public health*, 19(21), 14209. <https://doi.org/10.3390/ijerph192114209>
  - Gupta, B., Tripathy, D. K., Talawar, P., & Gupta, A. (2023). Role of 3D anatomy and virtual dissection platform in anesthesiology: a narrative review. *Bali Journal of Anesthesiology*, 7(4), 191-196. DOI: 10.4103/bjoa.bjoa\_210\_23
  - Ahmed, M. A. A. S. (2023). Use of the Anatomage virtual table in medical education and as a diagnostic tool: an integrative review. *Cureus*, 15(3), e35981.