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Comparative Study of Traditional and Virtual Methods in Teaching Anatomy to Students

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Abstract

Background: *Human anatomy is a fundamental course in medical sciences education, and mastering it is crucial. Traditionally, anatomy is taught using cadavers, models, and lectures. Anatomical knowledge is vital for accurate disease diagnosis; therefore, employing modern technologies to enhance teaching and learning can be highly beneficial.*

Methods: *This developmental study used census sampling among first-semester General Anatomy students. Posterior forearm muscles were taught using both a virtual dissection table and anatomical models, while anterior muscles were taught using models only. Theoretical knowledge was assessed with a written test, and practical skills through an objective structured practical examination (OSPE). Outcomes from each teaching method were then compared.*

Results: *The study demonstrated that combining the virtual dissection table with anatomical models significantly improved student scores. Most students preferred using 3D anatomy tools in addition to traditional models for learning anatomy, as they enhance active learning.*

Conclusion: *The use of a virtual dissection table can help students understand anatomy more effectively, resulting in improved exam performance. Moreover, this tool can make the curriculum more engaging and valuable. It also contributes to improving radiological knowledge and deepening the learning experience.*

Keywords: Virtual dissection table, Educational model, Anatomical model.
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Introduction

Human anatomy is one of the oldest subjects in medical education, and various methods are used worldwide for its teaching and learning[1]. A deep understanding of human anatomy is crucial to foundational medical sciences. This knowledge is essential for accurate diagnosis and effective treatment of numerous medical conditions.

The use of cadavers is considered essential for learning anatomy and has traditionally been taught through cadaver dissection and instructional lectures[2]. However, an important concern regarding cadaver-based dissection is the range of limitations associated with it, including high costs, ethical considerations, scarcity of cadavers, and the logistical challenges of managing dissection labs. Moreover, visualizing anatomical structures in various positions and cross-sections can be difficult using cadavers alone. To address these limitations and enhance anatomy education, modern technological tools, such as the virtual dissection table, have been developed and increasingly adopted[3].

The integration of advanced technological resources into medical education has been shown to enhance learning outcomes and improve the quality of training in both medical education and healthcare delivery[4]. Supplementary educational tools serve as effective adjuncts to traditional teaching methods, facilitating deeper understanding, promoting knowledge retention, and supporting long-term memory consolidation of acquired content[5, 6].

The virtual dissection table features life-sized, three-dimensional images of all parts of the human body, offering a comprehensive and interactive anatomical learning experience[7]. This table provides a highly realistic simulation of human dissection, making it a valuable educational tool[8]. It enhances students' understanding of anatomical knowledge and improves their grasp of human anatomy, leading to deeper and more effective learning. Consequently, this improved comprehension contributes to better long-term retention of knowledge[9].

The three-dimensional virtual anatomy table is a technology that can teach students various dissection methods and enhance their level of anatomical knowledge. Additionally, the virtual dissection table allows for the creation of sectional views of different parts of the body, which greatly aids in the understanding and diagnosis of sectional anatomy. This device also provides the capability to review and repeat previous steps during instruction, offering students the opportunity for repeated practice[10, 11].

Devices known as virtual dissection tables have significant potential to enhance anatomy education. These tools can provide students with an extensive collection of medical images and fully digitized cadaveric specimens, effectively complementing traditional cadaver-based teaching[12]. New educational technologies, by offering diverse, engaging, and innovative software, serve as learner-centered approaches that create valuable opportunities to improve learning outcomes and increase student motivation[12].

Therefore, a blended approach to anatomy education that combines traditional methods, such as cadaver dissection and anatomical models, with advanced tools like 3D model presentations and radiological imaging can significantly enhance the quality of instruction. Furthermore, the integration of new technologies can help overcome the limitations

associated with conventional teaching methods and improve learning outcomes[10].

Research shows that the use of educational tools and technologies, especially in teaching subjects perceived by students as difficult or monotonous, makes instruction more effective and engaging. Incorporating videos, images, and animations alongside textual materials creates a balance between auditory and visual learning, thereby increasing learners' interest and motivation to learn[13, 14].

Moreover, advances in technology and its widespread use in all aspects of students' lives have influenced educational methods. The use of various educational technologies and applications is rapidly increasing, and their accessibility is straightforward. When combined with traditional methods, these technologies can boost students' motivation and learning outcomes.

Given the importance and difficulty of anatomy learning for radiology students, this study aims to investigate the use of educational technologies such as the virtual dissection table alongside traditional methods like cadaver dissection and anatomical models, to evaluate their impact on student learning and educational performance.

Materials and Methods

This research was conducted using a total population sampling approach, involving all first-semester undergraduate students in Radiology, Operating Room Technology, and Anesthesia Technology at Shahroud University of Medical Sciences during the 2024–2025 academic year (IR.SHMU.REC.1403.186). The study population consisted of 60 students enrolled in the first semester. The duration of the study was six months, aligning with the academic semester.

As part of the practical anatomy curriculum, students were taught the topic of posterior muscles using both anatomical models and a 3D virtual dissection table. In contrast, the topic of anterior forearm muscles was delivered exclusively through anatomical models without the use of the dissection table.

Theoretical knowledge was assessed via a paper-based multiple-choice examination, while practical knowledge was evaluated using the Objective Structured Practical Examination (OSPE). The OSPE included stations requiring the identification of anterior and posterior forearm muscles, with assessments conducted both with and without the 3D dissection table.

Results

Participants were divided into three groups based on their academic programs (Group A: Radiology, n=23; Group B: Operating Room Technology, n=22; Group C: Anesthesia Technology, n=15) (Table 1).

Before analysis, assumptions of normality and homogeneity of variance were tested and satisfied. The mean scores obtained in the posterior forearm test using the virtual anatomical table were compared with those from the anterior arm test conducted without the virtual anatomical table.

Independent samples *t*-tests were conducted to evaluate differences within each group. A statistically significant improvement in mean scores was observed in Group A with the use of the virtual anatomical table (P-value<0.05). In Group B and Group C, although mean scores were higher with the virtual anatomical table, the differences did not reach statistical significance (P-value>0.05) (Figure 1).

Table 1. Descriptive statistics for marks obtained in each test (*P-value<0.05)

Test	Group	Number of students	Mean
Anterior arm muscles	A	23	3.6±0.44*
	B	22	6.7±0.44
	C	15	4.73±0.53
Posterior arm muscles	A	23	4.6±0.47
	B	22	7.2±0.47
	C	15	6.2±0.37

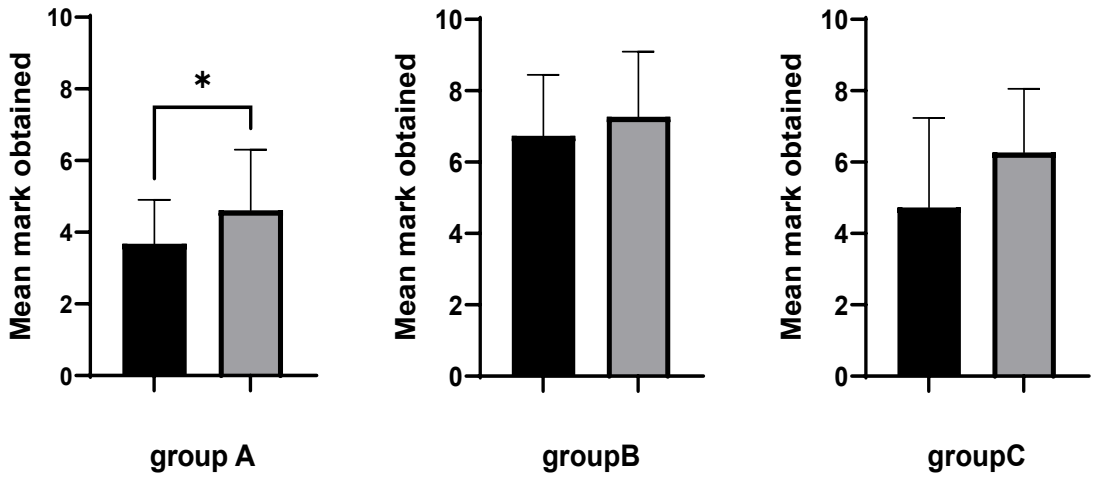

Figure 1. The mean marks obtained in the posterior forearm test using a virtual anatomical table, compared with the anterior forearm muscles test without the virtual anatomical table. Data are expressed as mean±SD. * indicates a statistically significant difference between the two conditions within Group A (Radiology) (P-value<0.05). No significant differences were observed in Group B (Operating Room Technology) and Group C (Anesthesia Technology).

Discussion

The use of advanced technologies in anatomy education has introduced more modern and efficient learning methods. One notable innovation is the virtual dissection table, which offers several clear advantages over traditional cadaver dissection. These include significantly lower costs, unlimited access, and the elimination of time-consuming tasks such as specimen preservation, physical dissection, and disposal. In addition, the platform allows for detailed visualization of different anatomical regions and the ability to generate customized longitudinal, sagittal, and transverse sections. This enables students to develop a deeper and more accurate understanding of human anatomy.

The results revealed that students preferred using the virtual dissection table as a supplementary tool alongside anatomical models to better understand human anatomy. The majority reported benefiting from the integration of this innovative learning resource into their anatomy education. Similarly, the results of a study showed that imaging science students appreciated the use of the virtual dissection table, as it had a positive impact on their anatomy learning experience. Furthermore, Custer and colleagues found that the interactive nature of the virtual dissection table increased student engagement in the learning process[14].

Our findings indicated that this teaching method enabled students to answer questions more effectively, participate actively in discussions, and articulate their understanding of specific anatomical concepts. The use of the virtual dissection table fostered active learning by encouraging engagement and interaction. Consequently, this approach supports the development of scientific reasoning, independent learning skills, teamwork, and interpersonal communication.

Additionally, the findings of this study revealed a statistically significant difference in the average test scores between the student groups. Specifically, the group taught exclusively using the virtual dissection table scored higher on average compared to the group instructed with traditional anatomical models. However, a significant difference in learning outcomes was observed between instruction methods incorporating and excluding the virtual dissection table. These results suggest that the combined use of the virtual dissection table alongside traditional anatomical models positively influences students' comprehension of muscle anatomy.

Afsharpoor et al. reported a significant improvement in practical examination scores among students utilizing the virtual dissection table, although no notable changes were observed in their theoretical exam performance[15]. Similarly, Brown et al. showed that the use of the virtual dissection table fostered greater student engagement in the learning process[16]. In another study, the virtual dissection table was perceived to offer educational value comparable to that of traditional cadaver dissection[17]. Furthermore, Brown's research indicated that the majority of students endorsed the virtual table as an effective learning tool[16]. Alasmari reported that the majority of medical students believed the virtual dissection table enhanced their ability to study and learn various anatomical structures. He also noted that most students found the visualization of the digital human body to be more accessible due to the table's ability to rotate images across multiple planes[18, 19].

Our findings are consistent with previous studies, which reported that students found the sectional views provided by the virtual dissection table helpful in enhancing their ability to identify the relative positions of internal body structures. Moreover, most participants indicated that the virtual dissection table improved their ability to visualize body systems by enabling them to rotate the digital body, thereby fostering a

more comprehensive understanding of anatomical relationships. Students using the virtual table demonstrated a stronger grasp of spatial relationships compared to those relying solely on traditional anatomical models. In addition, many students highlighted the value of integrated radiological imaging, which helped them connect anatomical knowledge to clinical practice[20].

Students in this study also reported that combining the virtual dissection table with traditional anatomical models enhanced their overall learning experience. Similarly, Kažoka et al. showed that the virtual dissection table improved students' ability to visualize and retain anatomical structures[21].

Further research is needed to evaluate its effectiveness more comprehensively, particularly by comparing student performance in anatomy across two groups: one using only moulage and another combining moulage with the virtual dissection table. Our findings suggest that incorporating modern educational technologies can enhance student engagement and make anatomy classes more dynamic and appealing. This makes virtual dissection tables a valuable tool for learning human anatomy.

Conclusion: The use of the virtual dissection table has a positive impact on the learning of radiology students. This tool, by offering features such as unlimited access and eliminating the time-consuming processes involved in cadaver preservation and dissection, helps students learn anatomy more effectively and engagingly. Furthermore, incorporating the virtual dissection table as a supplementary learning resource alongside cadavers and anatomical models can enhance the understanding of anatomical concepts. It is therefore recommended that this technology be integrated into educational curricula.

Ethical Considerations

Ethical approval was obtained from the Ethics Committee of Shahroud University of Medical Sciences (IR.SHMU.REC.1403.186) before the study. Participation was voluntary, and written informed consent was obtained from all students. Participants were assured that their academic evaluation would not be affected by their involvement in the study. Confidentiality and anonymity of data were maintained throughout the research process, and all procedures were conducted in accordance with institutional ethical guidelines.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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References

1. Azer SA, Azer S. 3D anatomy models and impact on learning: a review of the quality of the literature. Health Professions Education 2016;2(2):80-98. doi: 10.1016/j.hpe.2016.05.002

2. Johnson JH. Importance of dissection in learning anatomy: personal dissection versus peer teaching. Clinical Anatomy 2002;15(1):38-44. doi: 10.1002/ca.1090

3. Ahmed MAAS. Use of the Anatomage virtual table in medical education and as a diagnostic tool: an integrative review. Cureus 2023;15(3).

4. Resta P, Laferrière T. Technology in support of collaborative learning. Educational Psychology Review 2007;19:65-83. doi: 10.1007/s10648-007-9042-7

5. Azizi A, Alaei A, Valaei N, Bagheri M. Comparison of theory-practical teaching method with practical-theory method on learning and student satisfaction in oral medicine. Research in Medicine 2014;38(3):145-147.

6. Khaghanizade M, Shokrollahi F. Using educational media and coeducational instruments in teaching. Education Strategies in Medical Sciences 2009;2(3):127-130.

7. Kazoka D, Pilmane M. 3D dissection tools in Anatomage supported interactive human anatomy teaching and learning. EDP Sciences; 2019:02015. doi: 10.1051/shsconf/20196802015

8. McLachlan JC, Patten D. Anatomy teaching: ghosts of the past, present and future. Medical Education 2006;40(3):243-253. doi: 10.1111/j.1365-2929.2006.02401.x

9. Triepels C, Koppes D, Van Kuijk S, et al. Medical students' perspective on training in anatomy. Annals of Anatomy-Anatomischer Anzeiger 2018;217:60-65. doi: 10.1016/j.aanat.2018.01.006

10. Zilverschoon M, Vincken KL, Bleys RL. The virtual dissecting room: Creating highly detailed anatomy models for educational purposes. Journal of Biomedical Informatics 2017;65:58-75. doi: 10.1016/j.jbi.2016.11.005

11. Hoyek N, Collet C, Di Rienzo F, De Almeida M, Guillot A. Effectiveness of three-dimensional digital animation in teaching human anatomy in an authentic classroom context. Anatomical Sciences Education 2014;7(6):430-437. doi: 10.1002/ase.1446

12. Chytas D, Salmas M, Noussios G, et al. Do virtual dissection tables add benefit to cadaver-based anatomy education? An evaluation. Morphologie 2023;107(356):1-5. doi: 10.1016/j.morpho.2022.01.002

13. Lewis T, Burnett B, Tunstall R, Abrahams P. Complementing anatomy education using three-dimensional anatomy mobile software applications on tablet computers. Clinical Anatomy 2014;27(3):313-320. doi: 10.1002/ca.22256

14. Berney S, Bétrancourt M, Molinari G, Hoyek N. How spatial abilities and dynamic visualizations interplay when learning functional anatomy with 3D anatomical models. Anatomical Sciences Education 2015;8(5):452-462. doi: 10.1002/ase.1524

15. Custer TM, Michael K. The utilization of the anatomage virtual dissection table in the education of imaging science students. Journal of Tomography & Simulation 2015;1.

16. Anand MK, Singel T. A comparative study of learning with "anatomage" virtual dissection table versus traditional dissection method in neuroanatomy. Indian Journal of Clinical Anatomy and Physiology 2017;4(2):177-80.

17. Afsharpour S. Analysis of immediate student outcomes following a change in gross anatomy laboratory teaching methodology Reply. Journal of Chiropractic Education 2018;32(2):159-159. doi: 10.7899/JCE-17-7

18. Bork F, Stratmann L, Enssle S, et al. The benefits of an augmented reality magic mirror system for integrated radiology teaching in gross anatomy. Anatomical Sciences Education 2019;12(6):585-598. doi: 10.1002/ase.1864

19. Alasmari WA. Medical students' feedback of applying the virtual dissection table (anatomage) in learning anatomy: a cross-sectional descriptive study. Advances in Medical Education and Practice 2021:1303-1307. doi: 10.2147/AMEP.S324520

20. Brown J, Stonelake S, Anderson W, et al. Medical Student Perception of Anatomage-A 3D Interactive Anatomy Dissection Table: 0938. International Journal of Surgery 2015;23:S17-S18. doi: 10.1016/j.ijsu.2015.07.053

21. Fyfe G, Fyfe S, Dye D. Use of Anatomage tables in a large first year core unit. Australasian Society for Computers in Learning in Tertiary Education; 2013:298-302. doi: 10.14742/apubs.2013.1501