Original Article

Student Feedback on CADAVIZ: Evidence of Effective Anatomy Learning

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Abstract

Background: Anatomy has been a cornerstone of medical education, traditionally taught through cadaveric dissection. However, challenges such as limited cadaver availability, high costs, and ethical considerations have prompted the need for alternative teaching methods. **Objectives**: This study aims to evaluate the effectiveness of CADAVIZ, a 3D virtual dissection table, as a supplementary tool in anatomy education at Ashok Rao Mane Ayurvedic College, Kolhapur, India. **Materials and Methods**: A survey-based methodology was employed, involving 30 first-year medical students who were exposed to both traditional cadaver-based teaching and the CADAVIZ virtual dissection table. The feedback was collected through a structured questionnaire using a Likert scale to assess the tool's usability, effectiveness, and impact on learning. **Results**: Students provided overwhelmingly positive feedback on CADAVIZ's user-friendly interface, 3D visualization features, and its ability to enhance the understanding, confidence, and practical skills. The detail and accuracy of the anatomical representations were highly appreciated. However, minor concerns regarding the tool's speed were noted. **Conclusion**: CADAVIZ proves to be an effective supplementary tool for anatomy education, addressing logistical and ethical challenges associated with cadaveric dissection. Its integration of audio-visual elements fosters immersive learning and complements traditional methods. Future research should focus on its long-term impact on academic performance and skill development.

Keywords: Active learning, anatomy education, cadaver dissection, CADAVIZ, 3D virtual dissection table, innovative teaching methods, medical education, spatial understanding, student engagement, technology integration in education

Introduction

Anatomy has been central to medical education, traditionally taught through cadaver dissection, which offers hands-on learning and spatial understanding.[1,2] However, high costs, maintenance, and limited availability have led educators to explore alternatives like three-dimensional visualization technology (3DVDT).[3,4] While 3DVDT enhances spatial learning, its effectiveness compared to cadaveric dissection remains debated.[3] Ethical and logistical challenges further limit cadaver use.[5,6] At a reputed Ayurvedic College, CADAVIZ, a 3D dissection tool, supplements traditional methods. This study examines students perspectives on CADAVIZ's role in enhancing anatomy education and its impact on the comprehension and engagement.

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Materials and Methods

This study was conducted at an Ayurvedic Medical College to evaluate the application of the virtual dissection table, CADAVIZ, as an additional resource for anatomy and Ayurveda education. A descriptive, survey-based methodology was employed.

An electronic questionnaire was designed, comprising six questions to assess students' perceptions of CADAVIZ

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as a supplementary tool to traditional learning methods. The questionnaire included queries about ease of use, effectiveness, engagement, and comparison with conventional dissection methods. The responses were recorded using a Likert scale. The questionnaire included open-ended questions [Table 1]. The study participants were 30 first-year medical students who were exposed to both CADAVIZ and traditional learning methods during their anatomy and Ayurveda courses. The survey was administered at the conclusion of the study period, ensuring that students had sufficient exposure to CADAVIZ [Figure 1].

The collected responses were subjected to quantitative analysis. Frequencies and percentages were calculated to summarize students perceptions, providing insights into the effectiveness and acceptability of the virtual dissection table.

Table 1: Study questionnaire

Sr. no.	Questions
A.	Does CADAVIZ has a user-friendly interface?
B.	Do you think CADAVIZ is effective in enhancing your understanding of anatomical structures?
C.	Did the 3D visualization features of CADAVIZ aid in your learning process?
D.	Did CADAVIZ impact your confidence in understanding and recalling anatomical information?
E.	Did CADAVIZ help in improving your practical skills?
F.	Are you satisfied with the level of detail and accuracy of the anatomical representations in CADAVIZ?

The data for comparing students' responses were collected using a Likert scale [Figure 2] with three levels: Strongly Agree, Agree, and Neutral.

The study was approved by the Institutional Ethics Committee (IEC). It was conducted in accordance with the guidelines set by the Ministry of AYUSH, Government of India, and adhered to established ethical principles. Informed consent was obtained from all participants prior to their involvement in the study, in compliance with the ethical standards outlined in the Declaration of Helsinki.

Results

The feedback on CADAVIZ as a tool for anatomy education demonstrated overwhelmingly positive responses. A majority of students found the interface user-friendly [Figure 1A–F] with 53.1% agreeing and 46.9% strongly agreeing. Its effectiveness in enhancing the understanding of anatomical structures was endorsed by 71.9% strongly agreeing and 25% agreeing, while its 3D visualization features aided learning for 59.4% who strongly agreed and 37.5% who agreed. CADAVIZ also boosted students' confidence in understanding and recalling anatomical information, with 56.3% strongly agreeing and 40.6% agreeing. Additionally, it significantly improved practical skills, as reported by 65.6% who strongly agreed and 28.1% who agreed. Lastly, the detail and accuracy of anatomical representations were appreciated, with 48.3% strongly agreeing and 53.1% agreeing. These results underscore the role of CADAVIZ as an effective and engaging educational tool in anatomy learning.

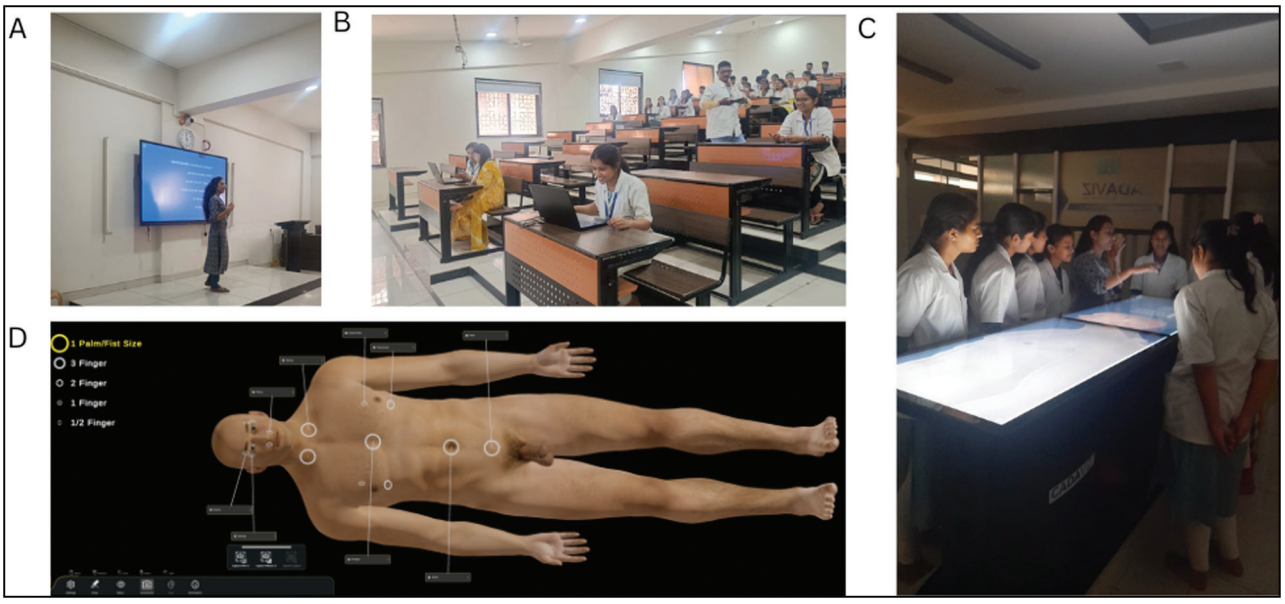

Figure 1: Illustration of the learning process with Cadaviz. A: Depiction of the traditional method of learning B: Students providing feedback on Cadaviz. C: Interactive session with students using Cadaviz, showcasing its engagement. D: demonstration of a lecture on Cadaviz.

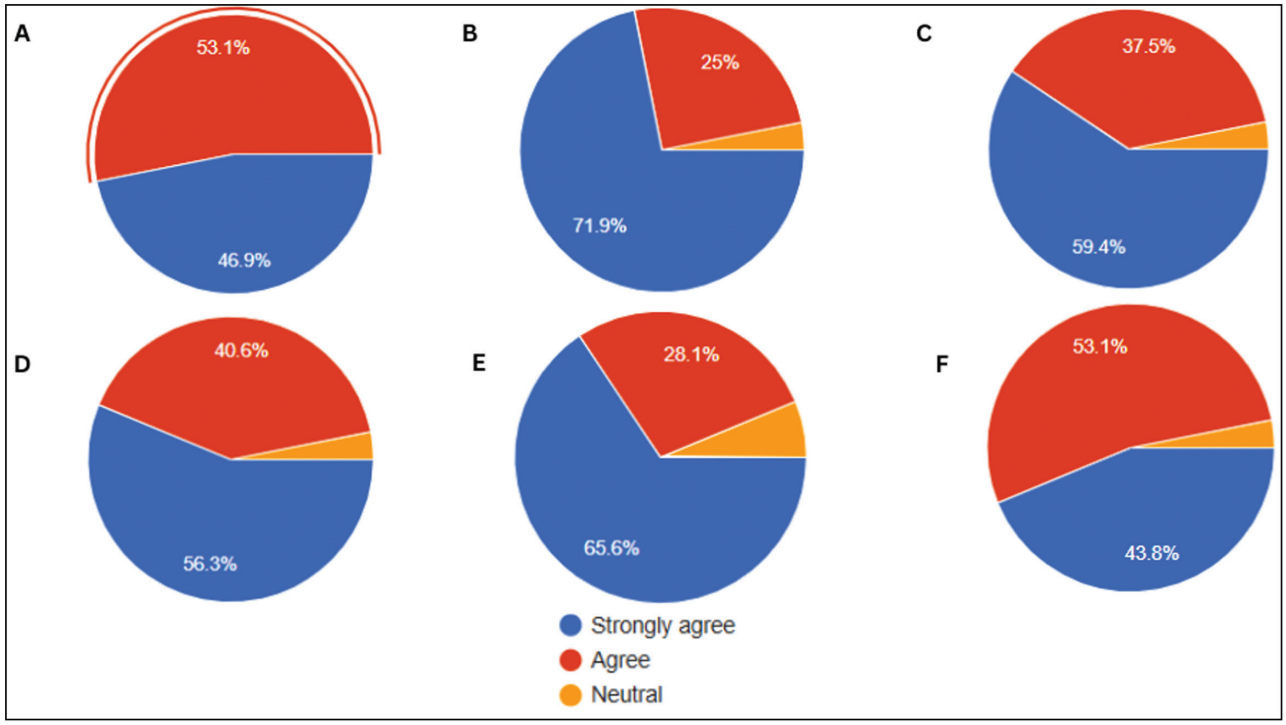

Figure 2: The data for comparing students responses collected using a Likert scale

The open-ended section of the questionnaire invited students to provide additional feedback, and one student emphasized the exceptional visual quality of the CADAVIZ table as its most advantageous feature. They noted that the clarity in visualizing organs significantly enhanced their understanding. The integration of audio-visual elements was highlighted as particularly useful for both studying and practical applications, enabling clear visualization of anatomical structures alongside access to relevant information. This combination was seen as instrumental in improving practical knowledge. However, the student pointed out that the tool's working speed was somewhat slow but still regarded it as an overall valuable learning resource.

Discussion

Traditional teaching methods, particularly classroom lectures, have been criticized for their one-way communication, lack of interactivity, minimal feedback, and promotion of passive learning strategies.[6] The findings of this study highlight the potential of CADAVIZ as a valuable supplementary tool in anatomy education, particularly in institutions like Ashok Rao Mane Ayurvedic College that integrate both traditional and technological teaching methods. The overwhelmingly positive student feedback suggests that CADAVIZ enhances the learning experience by addressing key challenges associated with traditional cadaver dissection, such as limited availability, high costs, and ethical concerns related to the handling of human remains.

The user-friendly interface of digital tools facilitates seamless navigation and interaction, enhancing their effectiveness in onsite interactive class settings by providing easy accessibility for both students and educators.[7] Similarly, the study highlighted that a significant proportion of students highly appreciated the accessibility and ease of use of CADAVIZ, with nearly half strongly agreeing that its user-friendly design contributed to an enhanced learning experience. This indicates that the tool is well-designed for educational purposes, enabling seamless navigation and engagement. Additionally, the effectiveness of CADAVIZ in improving students' understanding of anatomical structures was strongly endorsed by 71.9% of students, which underscores its ability to provide clarity and depth in anatomical education.

3D technology greatly enhances learner satisfaction and enriches the overall educational experience. As a cutting-edge teaching aid, 3D visualization excels in fostering engagement and deepening comprehension.[8] Notably, the 3D visualization features of CADAVIZ received strong praise, with 59.4% of students strongly agreeing that these tools significantly improved their understanding and learning outcomes. This supports previous findings that three-dimensional visualization tools enhance spatial understanding and help students grasp the relationships between anatomical structures more effectively than traditional two-dimensional resources. Furthermore, CADAVIZ's ability to boost confidence in understanding and recalling anatomical information was acknowledged by a significant proportion of participants, which suggests

that it fosters a deeper and more lasting comprehension of complex anatomical concepts.

The integration of technology into the curriculum and its ability to bridge the gap between theoretical knowledge and practical applications play a vital role in determining the effectiveness of modern teaching tools. One of the most discussed topics in anatomy education is the role of cadaveric dissection, which, despite its importance, faces challenges such as high costs, ethical considerations, a shortage of cadavers, and the complexities of managing dissection lab facilities. With increasing student enrollment in anatomy classes, the availability of cadavers often falls short of meeting the educational demands of all learners.

Health education institutions encounter significant obstacles in acquiring cadavers for teaching purposes, including legal, administrative, cultural, religious, social, and economic constraints.[9] These challenges underscore the need for alternative teaching aids like CADAVIZ, which have shown substantial potential in enhancing anatomy education. Importantly, CADAVIZ had a considerable impact on students' practical skills, with 65.6% strongly agreeing that it contributed positively to their skill development. This highlights the tool's effectiveness in addressing key challenges while offering an innovative and engaging learning experience. This aligns with the growing emphasis on experiential and simulation-based learning in medical education, where tools like CADAVIZ allow students to practice and refine their skills in a risk-free environment. The level of detail and accuracy of anatomical representations was also highly praised, demonstrating that CADAVIZ successfully replicates the intricacies of human anatomy, which are essential for accurate learning.

One student specifically emphasized the exceptional visual quality and audio-visual integration of CADAVIZ, highlighting its utility for both studying and practical applications. While the student expressed minor concerns about the tool's working speed, this did not diminish its perceived value as a resource for improving practical knowledge.

CADAVIZ not only addresses the logistical and ethical challenges of cadaver dissection but also enhances student engagement by promoting active learning and higher-order thinking. Its ability to provide detailed, interactive, and immersive experiences makes it a compelling alternative or supplement to traditional methods.

However, while the results of this study are promising, it is important to acknowledge certain limitations. The study was conducted with a relatively small sample size of 30 first-year medical students, which may limit the generalizability of the findings. Additionally, the study focused primarily on student perceptions and did not include objective assessments of learning outcomes or retention. Future research could benefit from a larger and more diverse sample size, as well as a longitudinal design to evaluate the long-term impact of CADAVIZ on academic performance and skill development.

Conclusion

In conclusion, the study demonstrates that CADAVIZ is a highly effective and engaging tool for anatomy education. By combining the strengths of traditional teaching methods with modern technological innovations, CADAVIZ offers a comprehensive learning experience that enhances understanding, confidence, and practical skills. Its integration into medical education curricula can address the challenges of traditional dissection while fostering deeper learning and knowledge retention among students.

Patient declaration of consent statement

Not applicable.

Acknowledgment

Nil.

Ethical policy and Institutional Review Board statement

The study was approved by the Institutional Ethics Committee (IEC) under the reference number AMAMCH/1063-1/2024 (IEC). It was conducted in accordance with the guidelines set by the Ministry of AYUSH, Government of India, and adhered to established ethical principles. Informed consent was obtained from all participants prior to their involvement in the study, in compliance with the ethical standards outlined in the Declaration of Helsinki.

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Nil.

Conflicts of interest

There are no conflicts of interest.

List of Abbreviations

3D	Three-dimensional
3DVDT	Three-dimensional virtual dissection table

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