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Anatomical approach of learning Anatomy - perspective of medical students on Traditional versus Virtual methods

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ABSTRACT

Introduction: Anatomy education is essential in medical training, traditionally relying on cadaveric dissection for comprehensive learning. Cadaveric dissection not only enhances students' anatomical knowledge but also promotes teamwork, professional skills, and ethical understanding. With advancements in technology, virtual dissection methods such as VR, AR, and 3D modeling are emerging as supplementary tools, potentially enhancing accessibility and reducing psychological strain.

Aims and Objectives: This study aims to examine medical students' perceptions of various anatomy education methods, including cadaveric dissection versus virtual dissection, in understanding the complexities of human anatomy. It also seeks to evaluate their confidence levels and skill development associated with each method. Additionally, the study assesses the effectiveness of these approaches and explores the potential integration of a hybrid model in contemporary anatomy education.

Materials and Methods: This study surveyed 262 undergraduate medical students at 8 medical colleges in Delhi National Capital Region (NCR), examining their preferences and perceptions regarding cadaveric learning and virtual learning. A structured questionnaire assessed students' experiences and confidence in anatomy learning through these methods. A cross-sectional study design was used, gathering data through a validated, anonymous Google Forms questionnaire. The questionnaire included Likert scale questions—used to measure levels of agreement or confidence—and additional multiple-choice and open-ended questions, analyzing demographic factors, educational preferences, and perceived confidence levels with each method.

Results: Most students (57.6%) regarded cadaveric dissection as essential in the curriculum and 30.9% supported hybrid approaches combining traditional and virtual methods. Students preferred cadaveric dissection for skill-building and confidence in clinical practice but virtual tools were valued highly for review and accessibility. Only 11.5% favored prosection exclusively.

Conclusion: Cadaveric dissection remains indispensable for developing practical skills, though hybrid approach utilizing both traditional and virtual methods is widely preferred and it offers a balanced, comprehensive anatomy education model. Institutions should integrate these methods to optimize clinical preparedness and professional competence in medical students.

Keywords: *Anatomy education, cadaveric dissection, virtual dissection, confidence level, skill, face to face learning.*

1. INTRODUCTION

Anatomy is far more than *landmarks*. Human anatomy education is a cornerstone of medical profession teaching and training, crucial for developing a solid foundation in clinical knowledge, since anatomical knowledge is a requisite for safe and competent medical practice and it is indispensable in medical curricula[1]. A comprehensive understanding of normal anatomy is essential, as it enhances a student's ability to recognize pathological changes caused by disease or injury. Historically, cadaveric dissection has been central to anatomy education, providing students with hands-on exposure to the human body. Not only does cadaveric dissection help medical students to learn human structure and function, but the dissection experience can also promote the development of teamwork, self-reflection, interprofessional and communication skills, and ethical qualities[2]. The human body is a typical example of organism diversity and variation, but 2D textbooks are no longer sufficient to provide a full picture that can guide clinical management and regimes.

However, the evolution of digital and simulated resources has introduced alternative methods such as virtual dissection and prosections. Digital anatomy, or what is often defined as computer-based 3D modeling of the human body, is an area of growing importance and significance. Today, most medical schools are venturing into the domain of digital anatomy, where the technologies of the Internet of Things, including mobile and platforms, virtual reality (VR), mixed reality (MR) and augmented reality (AR), 3D printing, analytics, and sensors are used to recreate human structures to support the study of the human body[3]. Cross-sectional and three-dimensional visualization of anatomical structures (i.e. virtual dissection) may prove to be effective for the retaining of anatomical details and the understanding of their neighbourhood relationships[4]. Understanding the students' perceptions on the usefulness of the dissection module is crucial, as it can inform curriculum design, ensuring that the adoption of new technologies enhances rather than detracts from educational experience, this understanding can help educators strike a balance between traditional methods and innovative approaches, ultimately improving the efficacy of anatomy education.

2. AIMS AND OBJECTIVES

This study aims to explore medical students' perceptions of different anatomy education methods (cadaveric dissection, virtual dissection, and prosections) to understand the intricacies of human anatomy and to evaluate their confidence levels and skills when using these methods. The study investigates the effectiveness of each approach and the potential for a hybrid model in modern anatomy education.

3. REVIEW OF LITERATURE

Research on anatomy education reflects a growing interest in alternative methods to traditional cadaveric dissection. Various studies highlight both the benefits and limitations of these methods, with a focus on student engagement, practical skills, and educational outcomes.

Keerti Singh's (2019)[5] study published in *BMC Medical Education* emphasizes the importance of active learning in anatomy education and how various teaching methods, including cadaveric dissection and virtual tools, can enhance student understanding. Singh's findings suggest that while cadaveric dissection provides an immersive experience essential for developing tactile skills, the integration of virtual resources can supplement learning by offering interactive, repeatable experiences that reinforce anatomical knowledge.

Shinde Amol's (2022)[6] investigation into virtual online teaching during the COVID-19 pandemic highlights the adaptability of online methods for anatomy education. Amol's study observed that although virtual anatomy platforms provide accessibility and ease, they may lack the kinesthetic learning that cadaveric dissection offers. Amol's work supports the notion that virtual tools can act as valuable adjuncts to traditional learning, especially when in-person dissection is not feasible.

Sneha Guruprasad (2022)[7] explored the benefits and pitfalls of learning anatomy through various modalities. Her research indicates that while virtual and prosection methods offer significant benefits, such as reducing emotional strain and providing consistent anatomical views, they may limit hands-on skill development and the depth perception that cadaveric dissection uniquely provides. Guruprasad's findings suggest that a well-rounded anatomy curriculum should balance virtual and physical dissection to maximize educational impact.

Anasuya Ghosh's (2022)[8] research comparing face-to-face versus virtual assessment in anatomy education reveals that face-to-face interactions provide an irreplaceable component of practical learning, helping students to develop skills in a more engaging and interactive setting. Ghosh's study supports the idea that virtual assessments, while valuable for review and standardized learning, cannot fully replicate the depth of learning achieved through physical dissection and in-person interactions.

Anuja Sinha's (2024)[9] questionnaire-based study on perceptions and attitudes towards cadaveric dissection provides insight into student experiences and preferences. Sinha found that a majority of students value cadaveric dissection for its ability to build professional skills and prepare them for clinical practice. However, Sinha's research also indicates that some students

face emotional challenges and discomfort, highlighting a potential benefit of incorporating prosections and virtual resources to reduce psychological strain.

Heera Islam's (2024)[10] study on perceptions and attitudes towards online clinical modules reflects the increasing acceptance of online learning in anatomy education. Islam's findings suggest that while students recognize the convenience and adaptability of virtual modules, they still express a need for direct interaction with human tissues to gain a realistic understanding of anatomical structures. This study underscores the potential of online modules as supplements rather than replacements for hands-on experiences.

Finally, Young Hyun Hun (2024)[11] conducted a study on the effectiveness and satisfaction of virtual dissection among medical students, examining how virtual dissection affects learning outcomes and student satisfaction. Hun's research found that students appreciated the flexibility and safety of virtual platforms, particularly in terms of reducing exposure to chemicals and managing ethical concerns. However, Hun's study also revealed that some students felt a lack of tactile engagement, underscoring the need for a hybrid approach that includes hands-on experience.

4. MATERIALS AND METHODS

The present cross-sectional study recruited 262 undergraduate medical students from eight medical colleges across Delhi NCR. These students were engaged in cadaveric dissection during their MBBS tenure. The study received approval from the Institutional Ethical Committee, and all participants were provided the option to either participate or decline without any consequences. Informed consent was obtained from students who agreed to participate, with complete anonymity maintained in accordance with ethical guidelines.

Data collection was conducted using a structured questionnaire (Table 1), distributed via Google Forms, which was pre-validated by subject experts to ensure reliability and relevance. The questionnaire assessed students' perceptions, experiences, and confidence levels regarding cadaveric dissection and virtual anatomy tools.

Table 1.

1.	Year of study 1st year, 2nd year, 3rd year, 4th year, internship		
2.	Gender	Male	
		female	
3.	Have you previously participated in cadaveric dissections	Yes	No
4.	Have you used 3D models or virtual online presentations for Anatomy learning?	Yes	No
Perception of learning with cadavers			
5.	On a scale of 1-5, how useful do you find cadaver dissections for understanding human Anatomy? (1= not useful, 5= extremely useful)		

6.	What do you believe are the main advantages of using cadavers for anatomy learning? (Select all that apply) - Realistic texture and structure - Practical understanding of spatial relationships - Development of surgical skills - Psychological preparation for clinical work - Other (please specify)		
7.	What challenges do you face when learning with cadavers? - Ethical concerns - Availability of cadavers - Time constraints - Preservation issues (e.g., smell, tissue degradation) - Other (please specify)		
Perception of Learning with Virtual Models and 3D Presentations:			
8.	On a scale of 1-5, how useful do you find 3D models and virtual presentations for understanding human anatomy? (1 = Not useful, 5 = Extremely useful)		
9.	What do you believe are the main advantages of using 3D models or virtual presentations for anatomy learning? (Select all that apply) - Ease of access - Clear visualization of structures - Ability to revisit content multiple times - No ethical concerns - Cost-effectiveness - Other (please specify)		
10.	What challenges do you face when learning with virtual models or online presentations? - Lack of tactile feedback - Over-simplification of structures - Limited spatial understanding - Technical difficulties (e.g., software or device issues)		

	- Other (please specify)		
Comparison Between Cadavers and Virtual Models:			
11.	Which method do you find more effective for learning anatomy: cadaveric dissection or virtual 3D models? - Cadaveric dissection - Virtual 3D models - Both equally effective - Neither		
12.	Do you think cadaveric dissection should remain a mandatory part of anatomy training? - Yes - No - Undecided		
13.	In your opinion, can virtual models and 3D presentations completely replace cadaveric dissections in medical education? - Yes - No - Maybe (please elaborate)		
14.	How do you rate the emotional or psychological impact of dissecting a cadaver on your learning experience? (1 = No impact, 5 = Significant impact)		
15.	Do you feel that virtual models can provide the same depth of understanding of anatomical relationships as cadaver dissections? - Yes - No - Partially		
Application to Clinical Practice:			
16.	Which method do you feel better prepares you for real-life clinical and surgical settings?		

	- Cadaveric dissection - Virtual models and presentations - Both equally - Neither		
17.	Do you think learning anatomy through cadaveric dissection helps you build confidence for performing procedures on live patients? - Strongly agree - Agree - Neutral - Disagree - Strongly disagree		
18.	Do you think the absence of tactile feedback in virtual models is a significant limitation for learning anatomy? - Yes - No - Not sure		
General feedback			
19.	What improvements would you suggest for the current anatomy learning practices at your institution? (Open-ended question)		

5. RESULTS

The questionnaire included Likert scale questions—used to measure levels of agreement or confidence—and additional multiple-choice and open-ended questions, analyzing demographic factors, educational preferences, and perceived confidence levels with each method.

The Likert scale was employed to gauge responses ranging from Strongly Disagree, disagree, neutral, agree, and strongly agree in each section. These were coded in numerical values (i.e., 1,2,3,4,and5 respectively). The results were expressed in terms of frequency and percentages, and the data were systematically recorded and analyzed.

For open-ended questions, students' responses were carefully reviewed to identify meaningful units reflecting their perceptions of virtual anatomy dissection. These units were condensed, interpreted through abductive reasoning, and organized into themes by two subject experts. Thematic analysis was then performed to examine key areas of student perceptions, including confidence levels, skill acquisition, technical usability, and comparative insights.

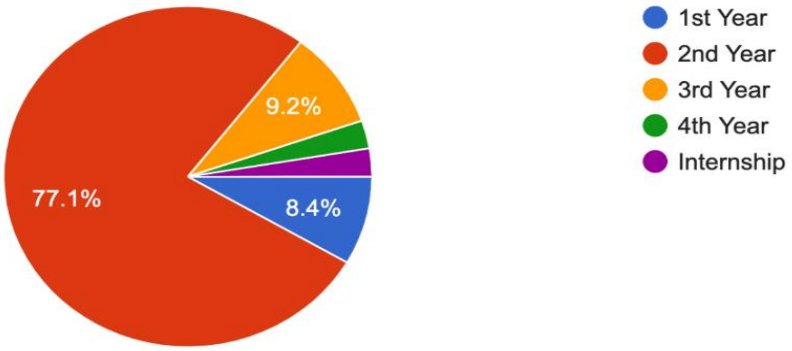

Figure1: Respondents' professional year

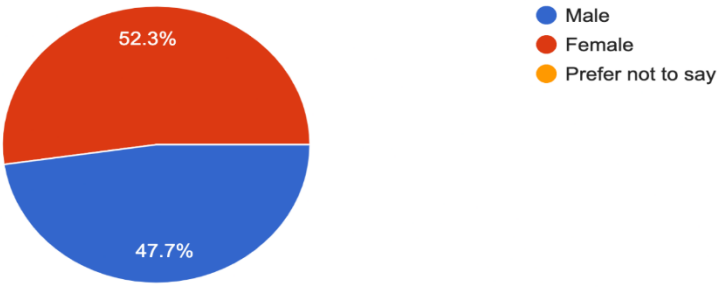

Figure 2: Gender distribution

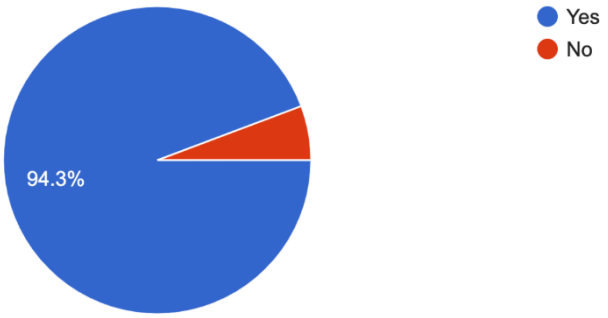

Figure 3: Participation in Cadaveric dissection

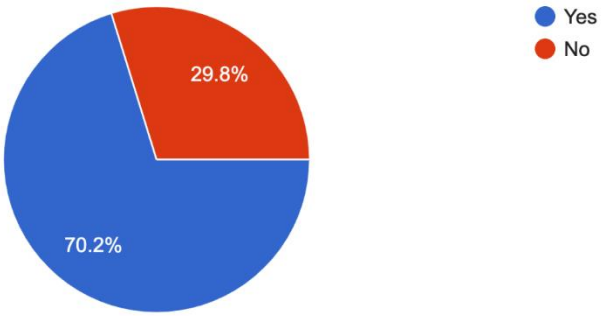

Figure 4: Use of 3D Models and Virtual Presentations

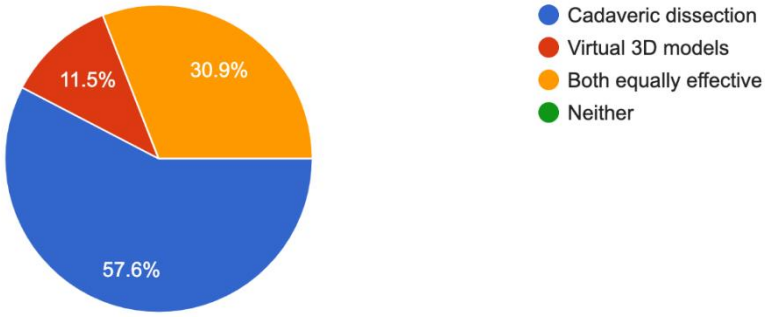

Figure 5: Preferred Learning Method: cadaveric dissection or virtual 3d models

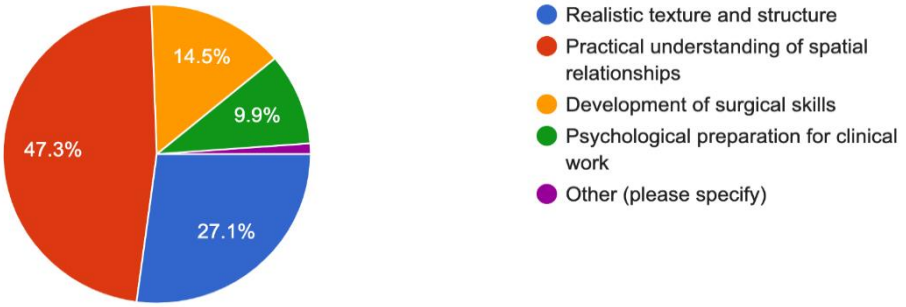

Figure 6: Main advantages of using cadavers for anatomy learning

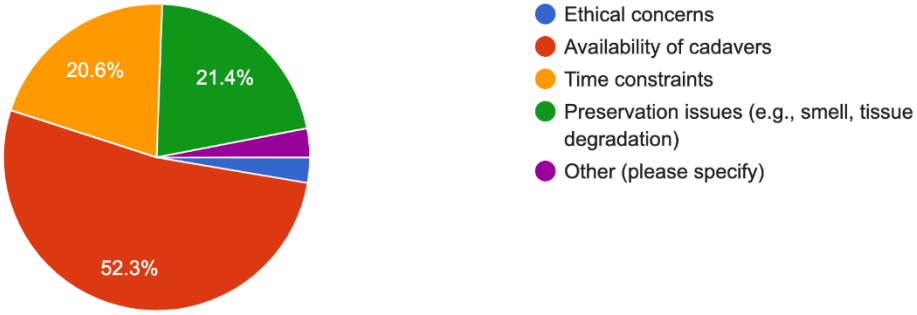

Figure 7: Challenges when learning with cadavers

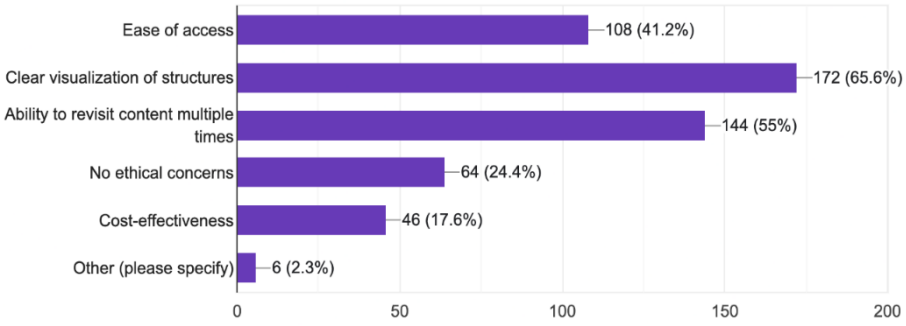

Figure 8: Main advantages of using 3D models or virtual presentations for learning anatomy

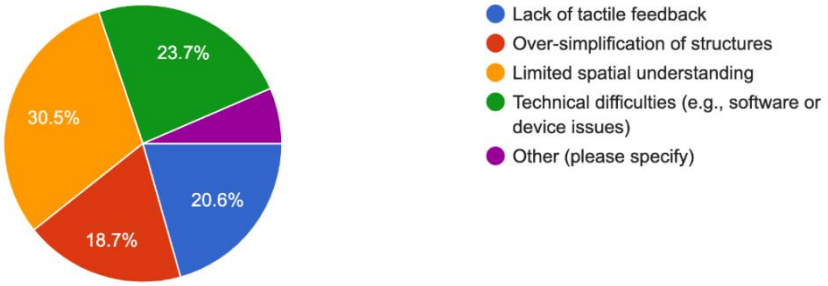

Figure 9: Challenges when learning with virtual models

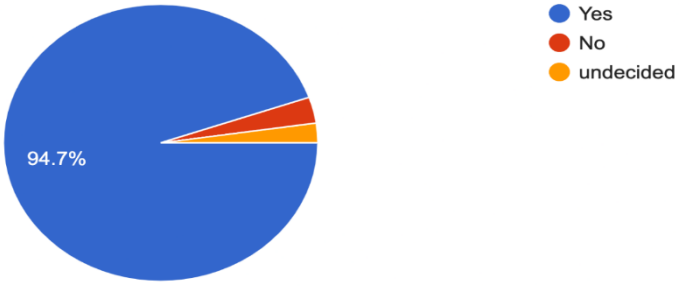

Figure 10: Support for Mandatory Cadaveric Dissection

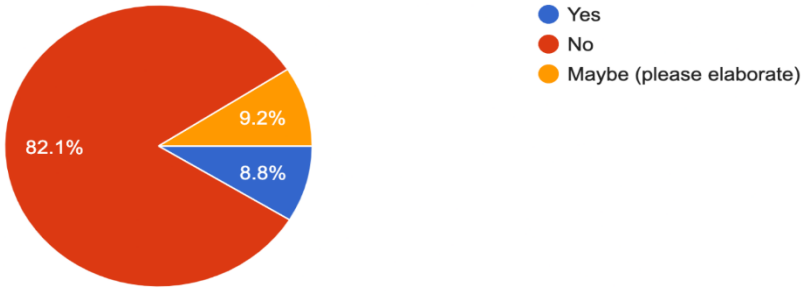

Figure 11: Replacement Potential of Virtual Models:

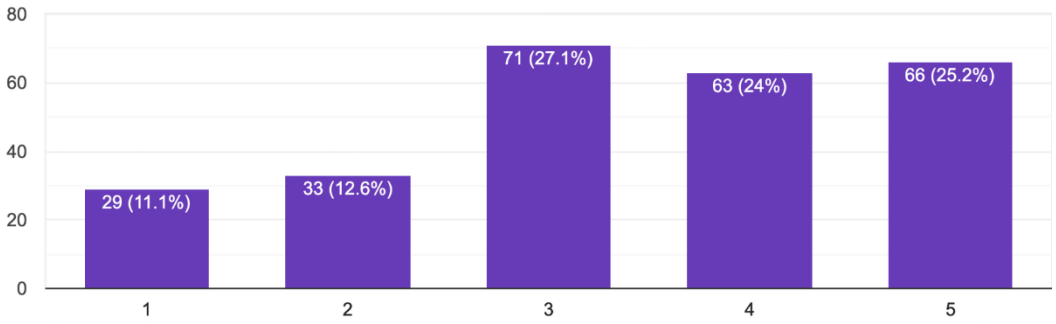

Figure 12: Emotional/Psychological Impact of dissecting a cadaver on learning experience

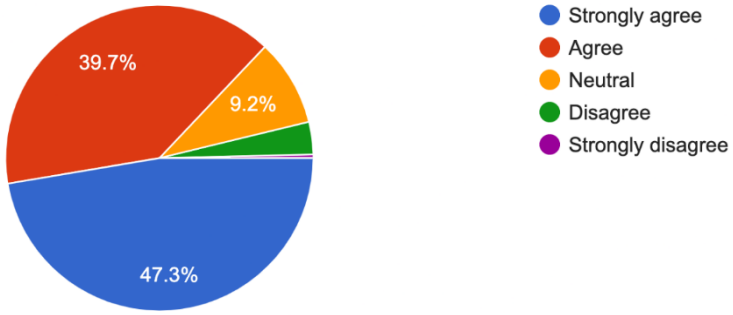

Figure 13: Learning Anatomy through cadaveric dissection helps in building confidence for performing procedures on live patients

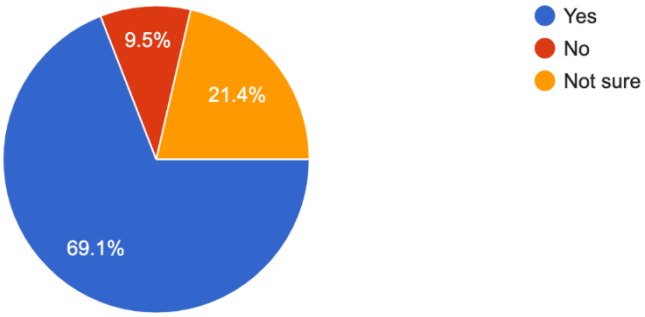

Figure 14: Importance of Tactile Feedback in virtual models is a significant limitation

The survey on anatomy education preferences provides insights into students' experiences and perceptions regarding cadaveric dissections, virtual 3D models, and related learning methods. Below are the summarized findings:

1. **Demographics (Figure 1 and 2):**
   - **Year of Study**: Most respondents (77.1%) were in their 2nd year (202 students), followed by 3rd year (9.2%, 24 students), and 1st year (8.4%, 22 students).
   - **Gender**: The survey included 137 female (52.3%) and 125 male (47.7%) respondents.
2. **Participation in Cadaveric Dissections (Figure 3):**
   - **Experience**: A majority (94.3%, 247 students) have participated in cadaveric dissections, with only (5.7%, 15 students) having no such experience.
3. **Use of 3D Models and Virtual Presentations (Figure 4):**
   - **Usage**: 184 (70.2%) students reported using 3D models or virtual anatomy presentations, while 78 (29.8%) had not engaged with these resources.
4. **Preferred Learning Method (figure 5):**
   - **Cadaveric vs. Virtual**: 151 (57.6%) students preferred cadaveric dissection for anatomy learning, while 30 (11.5%) found virtual models more effective. A significant portion (30.9%, 81 students) felt both methods were equally effective.
5. **Main advantages of using cadaveric dissection (Figure 6):**
   - **Practical Understanding of Spatial Relationships (47.3%)** - The most cited advantage, emphasizing how cadavers provide a three-dimensional view and help learners comprehend the physical relationships between different anatomical structures.
   - **Realistic Texture and Structure (27.1%)** - Cadavers allow students to experience the authentic feel and

appearance of human tissues, which is vital for realistic anatomical education.

- **Development of Surgical Skills (14.5%)** - Cadavers serve as a practical platform for students to practice and refine surgical techniques in a risk-free environment.
- **Psychological Preparation for Clinical Work (9.9%)** - Exposure to cadavers helps students adapt emotionally and mentally to working with human bodies in real-life clinical settings.
- **Other (1.2%)** - A minimal percentage of responses cited additional or unspecified advantages.

6. **The challenges faced when learning with cadavers are (Figure 7):**
   - **Availability of Cadavers (52.3%)** - The most significant challenge reported is the limited availability of cadavers, highlighting the difficulty in accessing this critical resource for anatomy education.
   - **Preservation Issues (21.4%)** - Problems such as unpleasant odors, tissue degradation, and the maintenance of cadavers were frequently mentioned as major hindrances.
   - **Time Constraints (20.6%)** - Many respondents noted that time limitations, likely due to scheduling or curriculum pressures, affect the ability to maximize learning opportunities with cadavers.
   - **Other Concerns (3.1%)** - A small number of participants cited additional or unspecified challenges, indicating the presence of individual-specific difficulties.
   - **Ethical Concerns (2.7%)** - Some individuals raised ethical issues, such as the moral implications of using human bodies for educational purposes, as a challenge.
7. **The main advantages of using 3D models or virtual presentations for anatomy learning, are as follows (Figure 8):**
   - **Clear Visualization of Structures (65.6%)** - A highly cited advantage, virtual presentations provide precise and enhanced visual clarity, making it easier to understand anatomical relationships.
   - **Ability to Revisit Content Multiple Times (55%)** - Students can revisit the material repeatedly, facilitating deeper learning and reinforcing knowledge at their own pace.
   - **Ease of Access (41.2%)** - 3D models and virtual tools are often readily available, reducing logistical challenges associated with physical resources like cadavers.
   - **No Ethical Concerns (24.4%)** - Unlike cadavers, virtual tools eliminate ethical dilemmas related to the use of human bodies in education.
   - **Cost-Effectiveness (17.6%)** - Many virtual platforms are more affordable in the long run compared to the maintenance and procurement costs of cadavers.
8. **The challenges faced when learning with virtual models or online presentations can be summarized as (Figure 9):**
   - **Lack of Tactile Feedback (20.6%)** - A predominant concern, many learners highlighted the absence of physical interaction with structures, which limits the hands-on experience critical for understanding anatomy.
   - **Limited Spatial Understanding (18.7%)** - Virtual models often fail to convey a clear three-dimensional spatial relationship between anatomical structures, which is essential for a comprehensive understanding.
   - **Technical Difficulties (23.7%)** - Issues such as software glitches, hardware limitations, or general technology-related problems were frequently reported, posing significant barriers to effective learning.
   - **Over-Simplification of Structures (18.7%)** - Some respondents noted that virtual presentations can oversimplify complex anatomical features, leading to a reduction in detail and depth of understanding.
   - **Other Concerns(6.5%)** - A small percentage of respondents cited other challenges, including personal preferences or platform-specific limitations.
9. **Support for Mandatory Cadaveric Dissection (Figure 10):**
   - **Mandatory Status**: A strong majority (94.7%, 248) believed cadaveric dissection should remain a mandatory part of anatomy education, with only 8 (3.1%) opposed and 6 (2.3%) undecided.
10. **Replacement Potential of Virtual Models (Figure 11):**
    - **Virtual Replacement**: 215 (82.1%) students felt that virtual models cannot completely replace cadaveric dissections, while 23 (8.8%) thought they could. Another 24 (9.2%) were open to the possibility but with

reservations.

11. **Emotional/Psychological Impact (Figure 12):**
    - **Impact Rating**: Responses varied, with most (27.1%, 71) students rating the psychological impact of cadaver dissection as moderate [3], while 66 (25.2%) rated it as high [5] and 63 (24%) as moderately high [4].
12. **Confidence in Clinical Preparation (Figure 13):**
    - **Confidence Building**: 124 (47.3%) students strongly agreed that cadaveric dissection builds confidence for clinical procedures, with 104 (39.7%) in agreement and smaller groups being neutral (9.2%, 24 students) or disagreeing (3.4%, 9 students).
13. **Importance of Tactile Feedback (Figure 14):**
    - **Feedback Limitations**: A notable 181 students (69.1%) viewed the lack of tactile feedback in virtual models as a significant limitation, while 21.4% (56 students) were uncertain, and 25 (9.5%) did not see it as a major issue.

These results highlight that while students value the benefits of virtual anatomy tools, the tangible experience and tactile learning from cadaveric dissection are seen as essential, both for skill development and confidence in clinical practice. The strong support for maintaining cadaveric dissection as a core part of anatomy training underscores its perceived irreplaceability in developing practical and emotional preparedness for healthcare settings.

6. DISCUSSION

Traditional Cadaveric Dissection in Anatomy Education

Cadaveric dissection has been a central practice in medical education ever since Andreas Vesalius started dissecting the cadavers in 1514[12]. By working directly with human cadavers, students gain tactile experience and confront the reality of human mortality, a rite of passage that fosters respect and empathy.

Advantages of Cadaveric Dissection[13]

Cadaveric dissection offers several unique benefits:

- **Realistic, Hands-On Experience**: Working with human cadavers provides students with firsthand exposure to human anatomy, enhancing their understanding of spatial relationships and tissue characteristics.
- **Professional Skill Development**: Cadaver labs allow students to develop teamwork, communication, and professionalism, as they work collaboratively and learn to treat the cadaver with respect.
- **Exposure to Anatomical Variability**: Each human body is unique, and cadaver dissection exposes students to individual anatomical differences, preparing them for the variability encountered in clinical practice.

Limitations of Cadaveric Dissection[14]

Despite its many advantages, cadaveric dissection also presents certain challenges:

- **Time and Resource Intensive**: Cadaveric dissection requires significant time investment and financial resources for cadaver acquisition, lab maintenance, and chemical preservation.
- **Health and Safety Risks**: Students and instructors face risks associated with exposure to formaldehyde and other chemicals used in preservation.
- **Fixed Sequence and Irreversibility**: Once a structure is dissected, it cannot be reconstructed, limiting opportunities for review and potentially constraining learning.

Virtual Dissection: Technological Advancements in Anatomy Education

Recent advancements in technology have led to the development of virtual dissection tools, offering digital representations of human anatomy that can be explored interactively. Virtual platforms provide customizable 3D models, allowing students to manipulate, isolate, and reconstruct anatomical structures repeatedly.

Advantages of Virtual Dissection[15]

Virtual dissection offers a range of benefits:

- **Repeatability and Customization**: Unlike physical cadavers, virtual models allow students to revisit structures, customize dissection views, and explore specific areas of interest without the risk of damage.
- **Accessibility and Flexibility**: Digital platforms are accessible from any location, enabling remote learning and supplementing in-person instruction.

- Ability to learn at their own pace
- **Reduced Ethical and Safety Concerns**: Virtual dissections eliminate the ethical and health risks associated with handling human remains and chemical exposure.
- **Time Efficiency**: online videos allow students to study a wide range of anatomical structures in less time than cadaveric dissection, supporting a packed curriculum.
- **Reduced Emotional and Ethical Burden**: As students do not perform dissections, they experience less emotional distress, which can facilitate a more comfortable learning environment.

Limitations of Virtual Dissection

While beneficial, virtual dissection has some limitations:

- **Lack of Tactile Experience**: Virtual models cannot replicate the physical sensation of handling tissues, which is crucial for developing tactile and procedural skills.
- **Technological Integration Challenges**: Effective use of virtual dissection requires trained faculty and updated equipment, which may pose challenges for some institutions.
- **Limited Exploration**: Students may only observe predetermined structures, limiting their opportunity to investigate anatomy independently.
- Limited realism, cognitive overload.

The limitations of each method suggest that a hybrid approach, combining cadaveric, virtual, and prosection techniques, may be most beneficial for anatomy education.

In this study, 57.6% of participants regarded cadaveric dissection as an essential component of the undergraduate medical curriculum. This figure is somewhat lower than findings from prior research. Agnihotri and Sagoo et al.[16], Mishra P et al.[17] and Khan AN et al.[18] reported that approximately 80% of students advocated for cadaveric dissection as integral to the curriculum. Dubhashi et al.[19] found that 67% of students supported dissection as a curriculum mainstay. These discrepancies may reflect variations in institutional resources, exposure levels, and evolving attitudes toward digital tools.

A smaller proportion, 11.5% of students in this study, expressed a preference for prosected specimens over cadaveric dissection, viewing them as more beneficial for anatomy learning. This perspective highlights a subset of students who may appreciate the time efficiency and structured guidance offered by expertly prepared specimens, yet this approach may lack the interactive depth that some students find valuable in traditional dissections.

Approximately 30.9% of participants believed cadaveric dissection and virtual learning methods to be equally effective, suggesting a growing openness to a hybrid approach. This finding aligns with trends in modern medical education, where virtual tools are increasingly used alongside traditional methods to create a comprehensive learning environment.

Notably, 87% of students in this study felt that cadaveric dissection significantly enhanced their confidence and skill-building abilities. This high level of confidence aligns with previous findings that physical dissection offers irreplaceable benefits for hands-on learning, particularly in developing tactile skills and preparing students for clinical practice.

The results highlight the value that Generation Z students place on cadaveric dissection for developing clinical confidence, tactile skills, and a realistic understanding of anatomy. Although students appreciate the accessibility and ethical ease of virtual models, they believe cadaveric dissection remains essential for acquiring practical skills and psychological resilience. The support for a hybrid approach, integrating cadaveric dissection with virtual resources, suggests that combining the strengths of each method can provide a comprehensive and flexible anatomy education model. This approach may allow students to review anatomical structures repeatedly through virtual models while still benefiting from the irreplaceable hands-on experience of dissection. Such a comprehensive approach would provide the practical skills, theoretical knowledge, and professional awareness needed for clinical practice. Wickramasinghe N (2022) also found that to teach the same structures, VR, AR, and tablet anatomy apps may increase learner immersion and engagement, and learners develop a deeper understanding of surface anatomy and internal structures relative to their surroundings, the latter of which is a desired anatomy learning outcome [3].

By thoughtfully blending virtual dissection with traditional methods, medical educators can enhance and create a more flexible, accessible, and engaging learning experience. Selecting the right software and tools, ensuring device compatibility, and establishing a robust support system for troubleshooting software issues can make this integration more successful.

7. CONCLUSION

Anatomy education is evolving, with cadaveric dissection, virtual dissection, and prosections each playing a valuable role. The findings confirm that while virtual methods offer useful adjuncts, they cannot fully replace cadaveric dissection's hands-on experience, critical for clinical preparation. Institutions should consider a balanced blend of these methods to ensure

students gain comprehensive, practical, and confidence-building anatomy education suitable for real-world patient care.

Effective digital anatomy education necessitates a comprehensive curriculum redesign. It should not be treated as a straightforward technical shift from cadaver-based to digital methodologies. When developing a digital anatomy curriculum, it is essential to ensure that content delivery is closely integrated with the selected digital tools. A well-coordinated alignment between learning activities and performance assessments using these tools is critical. Since various digital anatomy tools offer unique supplementary features, their selection should be guided by the specific attributes and competencies required of graduates.

8. LIMITATIONS

Most survey studies on cadaveric dissection in the Indian context have primarily focused on student perceptions, with little to no consideration of faculty perspectives. The current study is limited to a small sample of students from institutions in the Delhi NCR region, which may affect the generalizability of the findings. Additionally, variations in learning styles, as well as cultural, educational, and curriculum differences, could influence perceptions.

Being a questionnaire-based study, the responses reflect subjective, immediate perceptions of the students, and self-reported bias cannot be entirely ruled out. As an online survey, it also carries potential limitations such as self-selection bias, non-response bias, survey fatigue, distractions, misinterpretations, anonymity-related issues, and the possibility of random responses.

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