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Anatomy

An Assessment of Student's Perception of Learning Anatomy and Virtual Tools among Bangladeshi Medical Undergraduates

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Abstract	Original Research Article

Introduction: The rapid advancement of virtual tools in medical education has led to a debate on the most effective methods for teaching anatomy to medical students. This study aimed to assess the perceptions of first-year medical students in Bangladesh regarding traditional cadaveric and modern virtual methods in anatomy education. ***Methods:*** This cross-sectional descriptive and analytical study was conducted among 110 first-year medical students from two medical colleges in Dhaka, Bangladesh. A pre-tested, open-ended questionnaire was administered to collect data on demographic characteristics, student preferences in anatomy learning, and their level of agreement on the use of traditional and virtual methods. Non-parametric statistical tests were performed to evaluate score differences between teaching methods. ***Result:*** The study revealed a strong preference for a blended approach, integrating both cadaveric and virtual methods. Cadaveric methods were predominantly favored for tasks requiring a deep understanding of anatomical structures (76.36%), while virtual methods were preferred for understanding the anatomical basis of functional consequences (60.91%). A significant number of students strongly agreed that cadaveric dissection is vital in anatomy learning (29.09%). ***Conclusion:*** The study suggests that both traditional cadaveric and modern virtual methods have unique strengths and weaknesses in anatomy education. A blended approach, integrating both methods, could offer the most comprehensive learning experience for students. The findings have implications for curriculum designers, educators, and policymakers in medical education.
Keywords: Anatomy, Education, Cadaveric, Dissection, Virtual Learning, Student Perception.

INTRODUCTION

Anatomy serves as the bedrock of medical education, offering essential insights into the human body that are critical for clinical practice [1, 2]. Traditionally, the teaching of anatomy has been rooted in cadaveric dissection, a method that has stood the test of time [3]. However, the landscape of anatomy education is undergoing a seismic shift, particularly with the advent of digital technologies such as virtual reality (VR), 3D models, and augmented reality (AR) [4, 5]. In Bangladesh, a country with burgeoning medical colleges but limited resources, the student-to-cadaver ratio is often less than ideal [6]. This makes the integration of virtual tools not just an innovative approach but a necessity. The COVID-19 pandemic has further accelerated this need, pushing educational institutions worldwide to adopt digital tools for remote learning [7,

8]. The importance of anatomy in medical education is universally acknowledged. It serves as the foundation for understanding pathophysiology, diagnosis, and treatment in medicine [9]. However, the traditional method of cadaveric dissection is increasingly being questioned due to ethical concerns such as the sourcing of cadavers and logistical issues like preservation and storage [10]. Moreover, the time and resources required for dissection courses are considerable, leading to debates about the cost-effectiveness of this approach. Virtual tools offer a compelling alternative. They are not only cost-effective but also provide an interactive learning environment that can be tailored to individual needs [11]. Studies have shown that these digital methods can be as effective as traditional ones, depending on their implementation and the learning strategies employed [12]. For instance, virtual stereoscopic visualizations have been found to offer both

benefits and challenges in anatomy education [13]. Despite the potential advantages, the integration of virtual tools into anatomy education has been met with mixed reactions. One significant concern is the lack of tactile feedback, which is considered crucial for understanding the spatial relationships between anatomical structures [14]. Additionally, the effectiveness of these tools in the context of Bangladesh, where the study is set, has not been extensively researched. This study aims to fill this gap by assessing the perceptions of medical undergraduates in Bangladesh towards different methods of anatomy teaching, with a focus on virtual tools. The research will be conducted in two medical colleges in Dhaka, Bangladesh: Bangladesh Medical College and Holy Family Red Crescent Medical College. The study is timely, given the accelerated adoption of digital tools in medical education due to the COVID-19 pandemic [15]. Understanding students' perceptions is vital for several reasons. First, it provides insights into the learning preferences of the target population, which can inform curriculum development [16]. Second, it helps identify potential barriers to the adoption of new teaching methods [17]. Finally, it contributes to the broader discourse on the future of medical education, particularly in resource-limited settings like Bangladesh. The present study ultimately aims to provide empirical evidence on the comparative value of traditional and virtual methods in anatomy education in Bangladesh. The findings could have significant implications for medical education policy and practice, both nationally and globally.

METHODS

This cross-sectional descriptive was conducted to assess the perceptions of first-year medical undergraduates towards different methods of anatomy teaching. The research was conducted in two medical colleges in Dhaka, Bangladesh: Bangladesh Medical College and Holy Family Red Crescent Medical College. A total sample size of 110 first-year medical students was included in the study. Ethical approval was obtained from the institutional ethics committees of both colleges. Participants were recruited through convenience sampling, and informed consent was obtained prior to data collection. The primary data collection tool was a pre-tested, open-ended questionnaire designed to capture information on demography and student perceptions. The questionnaire included a section where participants were required to indicate their preferred method of anatomy teaching based on its ability to help them achieve learning objectives. Additionally, the questionnaire featured a 5-point Likert-type scale to record the level of agreement or disagreement of the learners towards the instructional practices in anatomy teaching. Data were analyzed using non-parametric statistical tests to evaluate score differences between traditional and virtual teaching methods. The study aimed to provide empirical evidence that could inform curriculum development and teaching strategies in anatomy education, particularly in the context of Bangladesh.

RESULTS

Table 1: Demographic Characteristics of the participants (n=110)

Variable	Frequency	Percentage
Gender		
Male	46	41.82%
Female	64	58.18%
Age		
≤18	17	15.45%
19-20	92	83.64%
21	1	0.91%
Religion		
Islam	79	71.82%
Hindu	21	19.09%
Christian	4	3.64%
Buddhist	6	5.45%

The demographic characteristics of the 110 first-year medical students who participated in the study are summarized in Table 1. The sample was predominantly female, comprising 58.18% (n=64) of the participants, while males accounted for 41.82% (n=46). The majority of the students were aged between 19 and 20 years, making up 83.64% (n=92) of the sample. Only a small fraction of the participants were aged 21 (0.91%, n=1) or below 18 (15.45%, n=17). In terms of religious affiliation, the majority of the students were Muslim (71.82%, n=79), followed by Hindu (19.09%, n=21), Buddhist (5.45%, n=6), and Christian (3.64%, n=4).

Table 2: Student Preference in terms of understanding basic anatomy (n=110)

Variable	Cadaveric		Virtual	
	n	**%**	**n**	**%**
Recognition of Anatomical Structure	84	76.36%	26	23.64%
Concept of Anatomical Position	56	50.91%	54	49.09%
Outline the Planes of Body in Anatomical Position	51	46.36%	59	53.64%
Use anatomical knowledge to predict functional Consequence	43	39.09%	67	60.91%
Gross description of an organ	67	60.91%	43	39.09%
Deviation of Normal Anatomy	61	55.45%	49	44.55%
Defining the body cavities	48	43.64%	62	56.36%
Muscular attachments and Bony relations	64	58.18%	46	41.82%
Vascular Network; branches and tributaries	46	41.82%	64	58.18%
Nerve Plexus: Formation, brances and tributaries	35	31.82%	75	68.18%
Different ways of describing and Visualizing human body	66	60.00%	44	40.00%
Interrelationships between anatomical systems of the human body	69	62.73%	41	37.27%

Table 2 presents the students' preferences in terms of understanding basic anatomy through either cadaveric or virtual methods. A majority of students (76.36%, n=84) preferred cadaveric methods for the recognition of anatomical structures, while only 23.64% (n=26) favored virtual methods for the same. When it came to understanding the concept of anatomical position, the student preference was almost evenly split between cadaveric (50.91%, n=56) and virtual methods (49.09%, n=54). Interestingly, for outlining the planes of the body in anatomical position, a slight majority (53.64%, n=59) preferred virtual methods over cadaveric (46.36%, n=51). The use of anatomical knowledge to predict functional consequences was better understood through virtual methods for 60.91% (n=67) of the students, as opposed to 39.09% (n=43) who preferred cadaveric methods. For the gross description of an organ, 60.91% (n=67) of students favored cadaveric methods, while 39.09% (n=43) opted for virtual methods. In terms of understanding deviations from normal anatomy, 55.45% (n=61) preferred cadaveric methods and 44.55% (n=49) preferred virtual methods. When defining body cavities, a majority (56.36%, n=62) preferred virtual methods, contrasting with 43.64% (n=48) who favored cadaveric methods. For understanding muscular attachments and bony relations, 58.18% (n=64) preferred cadaveric methods, while 41.82% (n=46) opted for virtual methods. In the context of understanding vascular networks, branches, and tributaries, 58.18% (n=64) favored virtual methods over 41.82% (n=46) who preferred cadaveric methods. A significant majority (68.18%, n=75) preferred virtual methods for understanding nerve plexus formation, branches, and tributaries, compared to 31.82% (n=35) who favored cadaveric methods. For different ways of describing and visualizing the human body, 60.00% (n=66) preferred cadaveric methods, while 40.00% (n=44) opted for virtual methods. Lastly, for understanding the interrelationships between anatomical systems of the human body, 62.73% (n=69) preferred cadaveric methods, and 37.27% (n=41) preferred virtual methods.

Table 3: Student preference in terms of describing clinical aspects

Variable	Cadaveric		Virtual	
	n	**%**	**n**	**%**
Relate the gross anatomy to common medical illness	67	60.91%	43	39.09%
Understand the anatomical basis of physical diagnosis	54	49.09%	56	50.91%
Understand the anatomical basis of radiological images	38	34.55%	72	65.45%
Understand the anatomical basis of signs and symptoms of common to severe injuries, diseases and conditions	58	52.73%	52	47.27%

Table 3 outlines the students' preferences in terms of describing clinical aspects through either cadaveric or virtual methods. For relating the gross anatomy to common medical illnesses, a majority of students (60.91%, n=67) preferred cadaveric methods, while 39.09% (n=43) favored virtual methods. When it came to understanding the anatomical basis of physical diagnosis, the student preference was almost evenly divided between cadaveric (49.09%, n=54) and virtual methods (50.91%, n=56). Interestingly, a significant majority of students (65.45%, n=72) preferred virtual methods for understanding the anatomical basis of radiological images, as opposed to 34.55% (n=38) who favored cadaveric methods. In terms of understanding the anatomical basis of signs and symptoms of common to severe injuries, diseases, and conditions, the preference was fairly balanced, with 52.73% (n=58) opting for cadaveric methods and 47.27% (n=52) for virtual methods.

Table 4: Student preference in terms of evaluation of learning environment

Variable	Cadaveric		Virtual	
	n	%	n	%
Clarify meanings	56	50.91%	54	49.09%
Enhances the Skill of thinking	54	49.09%	56	50.91%
Activating prior knowledge	55	50.00%	55	50.00%
Answering the assessment	50	45.45%	60	54.55%

Table 4 delves into the students' preferences in terms of evaluating the learning environment, comparing cadaveric and virtual methods. For clarifying meanings, the student preference was almost evenly split between cadaveric (50.91%, n=56) and virtual methods (49.09%, n=54). A similar trend was observed in enhancing the skill of thinking, with 49.09% (n=54) preferring cadaveric methods and 50.91% (n=56) favoring virtual methods. Interestingly, when it came to activating prior knowledge, the student preference was exactly balanced between cadaveric and virtual methods, each accounting for 50.00% (n=55) of the sample. For answering assessments, a slight majority of students (54.55%, n=60) preferred virtual methods, compared to 45.45% (n=50) who favored cadaveric methods.

Table 5: Students' level of agreement on the use of traditional and virtual methods in anatomy education

Criteria	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
Do you agree with the total shifting of dissection hall to multimedia labs	21 (19.09%)	21 (19.09%)	26 (23.64%)	24 (21.82%)	18 (16.36%)
Do you think that cadaver dissection is still vital and obligatory in anatomy learning?	3 (2.73%)	13 (11.82%)	18 (16.36%)	44 (40.00%)	32 (29.09%)
To what extent do you agree that integration of cadaveric & virtual is the best practice in learning anatomy?	5 (4.55%)	2 (1.82%)	26 (23.64%)	33 (30.00%)	44 (40.00%)

Table 5 illustrates the students' level of agreement on the use of traditional versus virtual methods in anatomy education. When asked about the total shifting of dissection halls to multimedia labs, the responses were fairly distributed across the scale. A total of 19.09% (n=21) strongly disagreed and another 19.09% (n=21) disagreed, while 23.64% (n=26) remained neutral. On the other hand, 21.82% (n=24) agreed and 16.36% (n=18) strongly agreed with the shift. Regarding the necessity of cadaver dissection in anatomy learning, a significant majority of the students either agreed (40.00%, n=44) or strongly agreed (29.09%, n=32). Only a small fraction of the students disagreed (11.82%, n=13) or strongly disagreed (2.73%, n=3), and 16.36% (n=18) remained neutral. As for the integration of cadaveric and virtual methods, a substantial portion of the students either agreed (30.00%, n=33) or strongly agreed (40.00%, n=44) that it is the best practice in learning anatomy. A minority of students disagreed (1.82%, n=2) or strongly disagreed (4.55%, n=5), while 23.64% (n=26) were neutral on the matter.

Table 6: Overall student opinion on best way of learning anatomy

Method of learning	Frequency	Percentage
Dissection	58	52.73%
Prosected Specimen	6	5.45%
Plastic models	11	10.00%
Virtual	25	22.73%
Lecture/Demonstration	11	10.00%

Table 6 provides an overview of the students' opinions on the best method for learning anatomy. Dissection was the most favored method, with 52.73% (n=58) of the students choosing it as the best way to learn anatomy. Virtual methods were the second most popular, preferred by 22.73% (n=25) of the students. Lecture and demonstration methods, as well as plastic models, were each chosen by 10.00% (n=11) of the students. Prosected specimens were the least favored, with only 5.45% (n=6) of the students considering it the best method for learning anatomy.

DISCUSSION

The study aimed to assess the perceptions of first-year medical students in Bangladesh regarding various methods of anatomy teaching, including traditional cadaveric and modern virtual methods. The

demographic profile of the study population was predominantly female (58.18%), aged between 19-20 years (83.64%), and mostly followed Islam (71.82%). These demographic variables are in line with the general demographics of Bangladesh. These findings could have implications on learning preferences, as suggested by existing literature [18]. Statistically, cadaveric methods were more favored for tasks like recognition of anatomical structures (76.36%) and gross description of an organ (60.91%). This aligns with a pilot study by Darras *et al*., which found that integrating virtual dissection with cadaveric methods enhanced students' understanding of anatomy [19]. Another study by Darras *et al*., also emphasized the limitations of cadaveric dissection and how virtual dissection can overcome these limitations [20]. In terms of clinical aspects, the data revealed a balanced preference between cadaveric and virtual methods. For instance, understanding the anatomical basis of physical diagnosis was almost evenly split between cadaveric (49.09%) and virtual methods (50.91%). This is consistent with a study by Nakai *et al*., which found that virtual reality workspaces could be beneficial for anatomy education, especially during the COVID-19 pandemic when traditional methods were less accessible [18]. When evaluating the learning environment, both cadaveric and virtual methods were found to be equally effective in criteria like clarifying meanings and enhancing the skill of thinking. This supports the notion of a blended learning approach, as advocated by existing research [21]. The level of agreement on the use of traditional and virtual methods revealed that a significant number of students strongly agreed that cadaveric dissection is vital in anatomy learning (29.09%). This sentiment is supported by a study by Abrams *et al*., which found that cadaveric dissection could have a positive impact on the learning of anatomy, humanism, empathy, well-being, and professional identity formation in medical students [22]. In terms of the overall best method for learning anatomy, dissection was the most preferred (52.73%), followed by virtual methods (22.73%). This finding corroborates existing literature that suggests that while technology can supplement traditional methods, it cannot entirely replace them [23]. In conclusion, the study's findings suggest a strong inclination among students towards a blended approach, integrating both cadaveric and virtual methods for a comprehensive learning experience in anatomy. Further research is warranted to explore how these methods can be optimally integrated into the anatomy curriculum.

Limitations of the Study
The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION
In summary, this study provides valuable insights into the perceptions of first-year medical students in Bangladesh regarding anatomy education, specifically focusing on traditional cadaveric and modern virtual methods. The findings suggest a strong preference for a blended approach that integrates both cadaveric and virtual methods for a comprehensive learning experience. Cadaveric methods were predominantly favored for tasks requiring a deep understanding of anatomical structures, while virtual methods showed promise in understanding the clinical aspects and evaluation of the learning environment. The level of agreement among students also indicated the irreplaceable value of cadaveric dissection in anatomy learning. The study's outcomes align with existing literature, advocating for the integration of both cadaveric and virtual methods to enhance the anatomy curriculum. This blended approach not only capitalizes on the strengths of each method but also compensates for their individual limitations. Further research is warranted to explore the optimal ways of integrating these methods into the anatomy curriculum for medical education in Bangladesh and beyond. The study has implications for curriculum designers, educators, and policymakers in medical education, as it emphasizes the need for a balanced, student-centered approach that leverages the benefits of both traditional and modern teaching methods.

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