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Research Article

Online studying Human Anatomy

Perception and Attitude of First-Year Medical Students on Studying Human Anatomy Through Cadaver Dissection (Online Streaming) – A Survey Investigation

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Abstract: In medical colleges, cadaveric dissection is an effective anatomy teaching method. Cadaveric dissections put students at the center of learning and show structures in their natural environment. However, most students dislike autopsy dissection since it's tedious and time-consuming. Thus, our study examined first-year medical students' attitudes toward dissection to learn anatomy. After the semester, students received a 3-domain questionnaire on preparedness, attitude, and restrictions. All information was gathered and recorded anonymously using Google forms. Each domain has many questions that add up to a score that shows how well they are prepared and how far online learning can go. One hundred MBBS first-year students participated in online anatomy lessons. After online courses, consenting students completed Google feedback forms regarding their experiences, which were examined and quantified. One hundred students completed the questionnaire and provided comments. Online courses were the most fantastic method to study human anatomy in medical school, according to 97.2%. Only 32.8% of students were uneasy, utilizing visuals to illustrate the softer aspects. Students' emotions and attitudes during corpse dissection varied by gender. Online was more appealing to males than women. Students prefer online courses over image-based ones because of the flexibility of time management and seating configuration. The statistical analysis revealed significant gender-related inequalities in student opinions. Other medical students showed similar variances at various phases of the research. The online anatomy classes for AVMC&H medical students were easy and enjoyable and utilized the "steeplechase" method. Our study shows the pros and cons of online education. Trainers/instructors should examine using online live forms as an instructional tool in anatomy training and generate new anatomy-related films for formal live teaching in the medical curriculum to accomplish this goal. However, additional study is needed to determine how much online education affects student learning and training.

Keywords: Alternative learning, E-platforms, Pandemic, Anatomy, First-year medical students, COVID -19, Feedback, online learning.

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1. INTRODUCTION

Human anatomy is the first, most basic, and most important part of the core education required for undergraduate and further understanding of medical science. Learning gross anatomy provides an emotional and intellectual approach to medical education.[1] Cadaver dissection also plays an important role and acts as a building block that provides essential knowledge required for the future study period of MBBS curriculum students.[2] The rapid spread of the COVID-19 pandemic has resulted in extraordinary economic, social, and educational changes. Medical education has undergone rapid modifications with the introduction of specialized online education.[3] Innovative online teaching and assessment methods are now needed. The Ministry of Health and Family Welfare, Government of India, has advised all educational institutions in India to suspend communication courses as a preventive step to reduce the overcrowding of students in closed spaces.[4] The dissection of the human body during an anatomy course poses problems for a first-year medical student with respect to confidentiality, autopsy sources, death, and invasion of death.[5] The emotional and psychological components of human dissection are important factors in professional training and professional behaviour among first-year students.[6,7] Medical first-year students typically have different emotional reactions and confused thoughts and have different experiences when they see human corpses for the first time. All Indian medical institutions have started using online meeting platforms like Zoom, Cisco, Google Meets, and YouTube etc.[4] In this scenario, teaching anatomy has gone entirely virtual, with academics taking students through videoconferencing. Practical anatomy teaching, particularly, has many difficulties since the topic requires a three-dimensional knowledge of structural relationships. Traditionally, cadaveric dissection has been a significant part of gross anatomy education in Indian medical colleges.[8] As far as we are aware, there has yet to be a previously published study on medical students' perception of learning anatomy dissection through a live online platform in medical colleges in Puducherry. Due to the current situation, a face-to-face assessment was not possible. Therefore, we evaluated using an online approach. Various research described a comparison of traditional and computer-assessed anatomy practical exams.[9] In these unique times, new ways and means of imparting education were discovered, which helped in the continuity and transmission of learning. According to reports, e-learning has proved to be an effective tool for bridging the learning gap.[10] Medical colleges, including Harvard and Yale, saw e-learning as a viable option during the pandemic. [11] In a quantitative assessment, 65.21% of medical professionals believed that e-learning significantly reduced the pandemic's negative effects on medical education.[12] The Dost S et al. study, which included 2721 medical students from 39 UK medical schools, found that using technology could improve teaching and learning while also providing time and space flexibility.[13] During the COVID-19 shutdown, Ba Chek M et al. [14] did research with Polish medical students and found the same benefits of e-learning. Most of the research on e-learning during the pandemic has come from Western countries[15] The findings of this research may not be relevant to Indian contexts due to differences in infrastructure facilities, accessibility, understanding, and awareness of certain instructional styles. As this form of assessment is relatively new in the Indian medical context, there is a paucity of literature on student responses to assessment in this unpredictable and unfamiliar manner. Consequently, this study was conducted on AVMC& H medical students to analyze psychological and emotional reactions and feelings among first-year medical students exposed to human cadavers in a dissection hall.

2. MATERIALS AND METHODS

2.1. Inclusion Criteria

All first-year students at the Faculty of Anatomy in Aarupadai Veedu medical college and hospital were eligible to respond to the survey. Written consent was taken from the first-year medical students for participating in the study.

2.2. Exclusion Criteria

Students in the second and third years of MBBS were excluded as they had experience with online classes. Students who refused to participate were also excluded. Moreover, survey forms with incomplete information should have been included in the analysis.

2.3. Rationale

The authors underline that this is an examination of a remote online learning experience designed and conducted in a crisis and risk management mode to mitigate the negative consequences of the COVID-19 pandemic. 14 Although it seems subjective to look at students' attitudes and impressions, it is important to evaluate the experience in these situations, which is shared by many institutions and programmes worldwide. This method gives a more in-depth look at how students and staff learn online from a distance. All classes and exams use Backboard and Backboard Collaboration. Interactive sessions were conducted using Zoom and Youtube Live. The delivery of instructional materials occurred both synchronously and asynchronously. The information used in this research was drawn from students' experiences when enrolled in a distance learning programme provided by the College of Anatomy at Aarupadai Veedu Medical College and Hospital in Puducherry, India. The shift to distance learning over the Internet resulted from the general COVID-19 lockdown imposed locally and globally. At that time, lectures, seminars, and examinations were given remotely using internet tools and virtual platforms. The duration of these teaching activities was intended to be shorter than the normal semester. All students were informed of any modifications, including scheduling, evaluation, grade distribution, and the addition or removal of educational activities. To expedite the delivery process and improve the effectiveness of data collection, participating students were invited to complete an online self-reporting questionnaire. Individual emails were sent to each participant with links to the survey and a disclaimer stating that participation was necessary to protect participants' privacy but was entirely anonymous to the study team and provided all the information was to be kept completely secret. The first page of the survey had an informed consent form attached to it. This form fully explained the study's goals, risks, and benefits.

2.4. Sample design and setting

Participants in the research were first-year preclinical medical students exposed to cadaver dissection for a week. Around

100 MBBS first-year students of both genders will be enrolled in online anatomy lectures and practical courses from December 2020 to March 2021. The questionnaire was sent to the eligible students via an online link using SurveyMonkey®. The data were collected during the pandemic period. After the end of the semester, students were given sufficient time to respond, and the survey questionnaire was emailed to them.

2.5. Questionnaire design

The study included demographics, preparedness, and attitudes toward online education, experience, and barriers to using online education technologies. The researchers created the survey because the questions were created after an in-depth analysis of the literature and scales that had already been validated. In addition, some items were made using qualitative data collected during the pilot testing phase. The questionnaire form was divided into four parts.

1) First to elicit demographics and Personal information details
2) Questions designed for informational, medical and anatomy-related instructional uses were designed to assess the use of live streaming.
3) Questionnaires ask about their first response to attending the online dissection room classes like emotional trauma, feelings, anxiety, stress during the first exposure to the autopsy, average mental preparation before dissection, empathy and respect for the cadaver, prior experience with a cadaver before dissection, and its effect on coping mechanisms.
4) The final section consisted of four yes/no questions that focused on evaluating the value of the Zoom platform in learning the anatomy experienced by the participants.
5) Finally, students were asked whether their instructors advised them to use this platform to learn anatomy and whether they were willing to continue with online anatomy dissection classes.

The principal investigator will explain the method and purpose of the study to all participants and, after obtaining verbal consent, ask them to complete the questionnaire. The personal information of the participants will be kept confidential. Figure 1 describes the standard operating procedure for online classroom assessment that we followed in our medical college Students' perceptions concerning new environmental settings, virtual communication, and remote interaction were assessed. Questionnaires were distributed and verified through peer review during online anatomy lectures/practical laboratory sessions. The validity and dependability of the final survey were not checked. The final questionnaire covered three key domains: barriers to online learning, attitudes toward education, and student preparedness. All of the questions were based on the Likert scale. There were 9 questions to test the readiness domain, 21 questions to test the attitude domain, and 15 questions to test the constraints domain. Except for some negative questions, where the scores are reversed, each response received one point (strongly disagree = 1, disagree = 2, neutral = 3, agree = 4, strongly agree = 5). For the preparation, approach, and handicap categories, this results in perfect scores of 45, 105, and 75. A recent question was added to two questions on their approach to making all their degree coursework available online without hindrances, including motivation to sign up for and complete online courses already in place. Some of the questions assessed the student's attitude towards collaboration, the development of communication skills, and the effective exchange of ideas. Last but not least, a question was designed to measure students' perceptions of how appropriate the online learning experience was. Table 1 lists the domains and queries for each domain. Fifteen questions within the scope of constraints addressed potential barriers that students could develop to experience during this novel. These constraints stem from prior technical knowledge or knowledge acquired during the pandemic. Motivating the students to engage with the event and adjust to unexpected changes took a lot of work. Content delivery methods (online vs face-to-face), instruction, communication, and the new assessment method and schedule were some of the topics of the questions. Additional anticipated constraints in cost, time, quality, and support systems were also assessed. The questionnaire also included personal characteristics of students such as gender and current first-year MBBS medical students at AVMC&H. In addition, the questionnaire included questions on prior experience with online learning (e.g., attending webinars, receiving and giving online courses, online workshops, etc.) and areas of development that students may have to engage in online learning. Think necessary for this (3 questions). Finally, they were asked whether there is any need for training on computer skill literacy, skill training in using computers and the Internet, and online course delivery.

2.6. Statistical analysis

The Statistical Package for the Social Sciences (SPSS) Inc., Chicago, Windows version 22.0, was used to collect and analyze data systematically. Descriptive and descriptive statistical approaches were used to analyze the data. A P value of 0.05 or less was considered statistically significant.

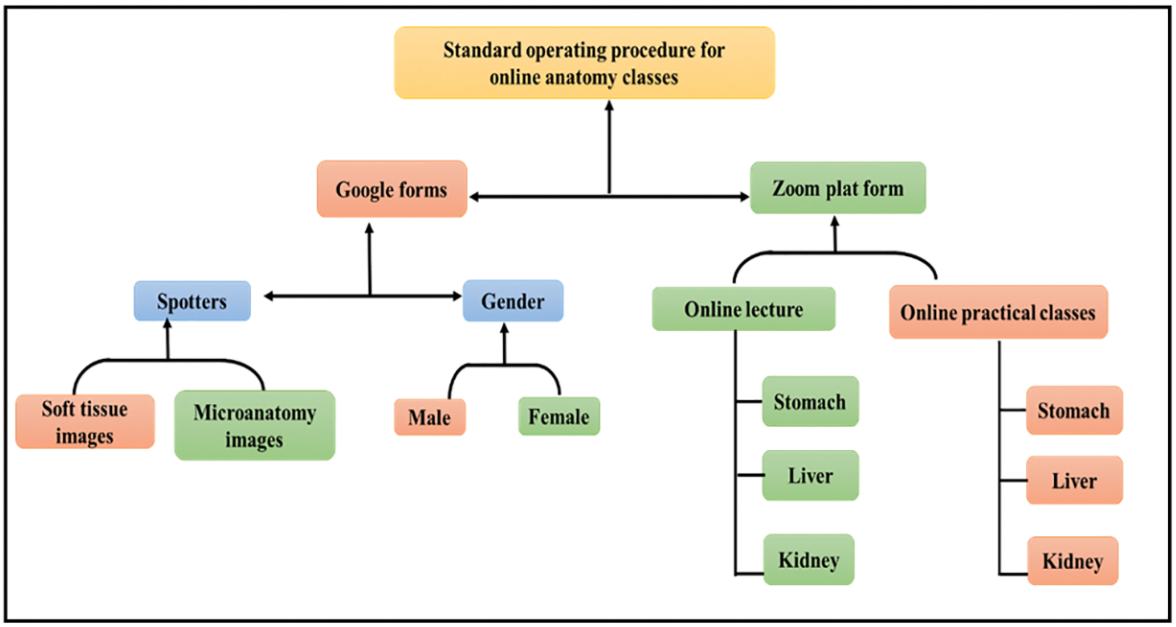

Fig 1. Flowchart demonstrating the standard operating procedure used for conducting online anatomy lectures/practical classes

Table 1: Lists the domains and queries for each domain.

Domain	Stem and response statements
Preparedness	How do you feel about your preparation for e-learning?
	I was ready to start the online course.
	Before the emergence of covid-19, the institution promoted online learning.
	After the development of covid-19, the institution started adopting online learning.
	Online education enables students to continue their education like traditional technology.
	Teachers will effectively tackle the challenges of online learning.
	I am comfortable taking online lessons.
	My experience and background will make it easier for me to participate in online learning.
	Because of my computer skills, I can complete online courses and assignments.
	My university has the necessary hardware and technical support for online education.
Attitude:	What do you think about your online learning strategy?
	My future goals are unaffected by this pandemic access to online learning
	My university provides an excellent online learning environment
	In my opinion, online learning should become the standard rather than conventional learning.
	To meet my academic demands, I can easily access the Internet.
	I feel comfortable having lively online discussions with both of my classmates. And my teacher.
	Taking lessons online will help me remember and understand the material better.
	Compared to on-campus education, I am more adept at reading in online courses and scheduling time for tasks.
	I can complete the assignment on time.
	Since it allows for more interaction, I opt for individual learning between students and professors.

	I feel more comfortable sharing my thoughts online than in the classroom.
	I can ask my teacher questions online and get quick answers.
Barriers:	Which of the following hinders e-learning?
	Little familiar with technology
	Lack of prior online tool usage experience
	A lack of enthusiasm
	Too difficult e-learning resources
	Inadequate guidance
	Teachers refraining from using popular websites like Facebook and YouTube
	Residing far from a place of learning
	Inability to network with subject-matter experts
	The e-learning tools are very difficult.
Areas of development	Please specify your requirement for the following areas of development of e-learning.
	Introduction to computer literacy
	Computer and internet skills instruction
	Training to help you get your online course

3. RESULTS

Findings from the analysis of qualitative and quantitative data gathered from the present study are presented below.

3.1. The characteristics of the participants

Feedback was collected from students regarding online lectures and practical assessments. More than 100 students were involved in the online Anatomy course and practical examination. 100% of students filled out the feedback form and returned it. Of these, 45 students were women, while the rest were men. The age of the participants ranged from 17 to 19 years. Table 2 lists the participant characteristics. Male participants in the first medical year made up the highest percentage (50.8%) of participants. In comparison, female participants made up the lowest percentage (49.8%), corresponding to the total number of students enrolled in each of these years. Almost half of the students (48.5%) said they had used online learning before, such as attending webinars, courses, and workshops. Before dissection, 78% were excited. Only 4% of those who had amputations feared it.

3.2. Attitudes of First-year medical students toward online learning

The students' reactions and attitudes changed as the contact duration increased. Student interest and enthusiasm toward autopsy increased while fear and depression decreased from 93% to 15% and 35% to 07%, shown in table 2, respectively. It was observed that the main symptoms experienced by the students were formalin smell and watery eyes; some students also reported symptoms like nausea, vomiting, skin irritation, and redness of the eyes. Figure 2 demonstrates the student's symptoms on attending the online streaming classes. 56% of people reported feeling sick, and 93% reported burning eyes. The main reason for all the above symptoms was the smell of formalin. More than 50% of the students said they were determined to study anatomy through cadaver dissection, which helped them deal with the symptoms the first time they entered the dissection hall. Some students reported that living in groups, resting, and taking advice from teachers and superiors helped them deal with the above symptoms. Most students were ready, eager, and willing to learn anatomy through cadaveric dissection. The students pointed out that the UG curriculum should include a dissection method to teach anatomy to the students. All students expressed gratitude towards people and relatives who donated their bodies. It was observed that most students got information about skeletons through school laboratories, textbooks, school visits to medical exhibitions, models, etc. Students were aware of personal protective measures such as wearing gloves, cutting nails, using disinfectant soaps after amputation, and wearing a mask while handling the dead/dissected specimens.

Table 2: Attitude of the students towards dissection

Students' reactions	Questionnaire (1) before dissection	Questionnaire (2) after starting dissection
Fear	93%	15%
Excitement	68%	91%
Interest	64%	89%
Depression	35%	07%

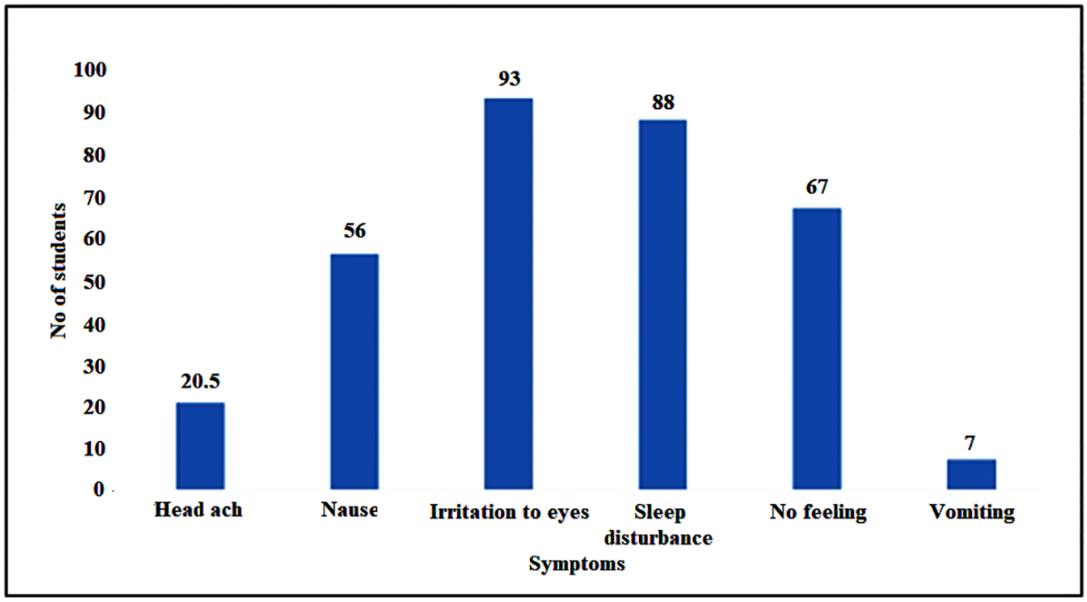

Fig 2: Shows the Student's symptoms on attending the online streaming classes

3.3. Demographic details and Survey questions analysis

Demographic variables included age, gender, degree, and place of residence. The mean age of the respondents was 17–19 years. In our present study, there were 50 (50.8%) more male respondents than 49 (49.8%) female respondents. Most of the respondents were from rural backgrounds, 35 per cent, 55 per cent were from urban areas, and only 10 per cent were from peri-urban areas. The number of students who answered each question in the google form survey was assessed, and the percentage of students who answered "agree or strongly agree" and "disagree or strongly disagree" questions are shown in Table 3. Individual student variables such as gender and body composition in the year of study were also included in the questionnaire. Figure 3 reveals the opinion of medical students towards cadaveric dissection. It displays positive responses, with 83% of medical students expressing interest in discontinuation and 78% expressing curiosity, although 51% also expressed depression and other adverse feelings. 14% of participants wanted to leave the dissection room. 45% of people were interested in donating for future dissections Additionally, the questionnaire asked about previous online learning experiences such as attendance at webinars, receiving and/or providing online courses, visiting online seminars, etc., as well as areas of development that students have been able to learn online. Participation in questions was considered important. They were asked whether there was a need for training in computer literacy, Internet and computer skills, and online course delivery. The results indicated that nearly 80% of students agreed that the College of Anatomy was well prepared and ready to learn online during the complete transition to online education due to the COVID-19 pandemic. However, only 19.9% disagreed with the notion of a lack of preparedness due to vegetarianism. During the COVID-19 pandemic, the results also showed that more than 80.2% of the students were happy with the online education their college professors gave them.

3.4. Factors affecting the success of online classes of dissection

According to a qualitative analysis of responses to open-ended questions, most participants understood the importance of the following elements for running effective online dissection classes: subject matter, technical setup, teacher skills, student preparation, follow-up, and many other sub-components well as included. Most respondents stated that the format and content of the online dissection lessons were important factors in their success (see Table 4). Classes of Dissection must be recordable for the material to be accessible whenever it is convenient for the student. Students who cannot attend live stream lessons due to poor internet access will benefit from having tapes on hand. The only way for online dissection lessons to be effective is to have internet access for every student. For the best learning experience, it is necessary to meet minimum technical requirements like software, hardware, and Internet access

3.5. Factors affecting the failure of online classes of dissection

Several participants in this study claimed that barriers to online learning included technical limitations, distractions, an ineffective teacher, ineffective learners, and health problems. The participants cited technological limitations as a major problem. Concerns about technology limitations were expressed in all comments (see Table 5). Some students need internet connectivity to attend online courses. Accessing the course platform and content can lead to slow connectivity. Online courses can only be effective if all have internet access fairly and reasonably available. Respondents were also concerned about the need for more community. Creating a welcoming environment for learning or a sense of community in an online setting takes work. It will be important to consider strategies for fostering communication and relationships between instructors and students. Most participants agreed that online courses are efficient as they are participatory, well-structured, and offer a flexible curriculum. They also agreed that excellent trainers and reliable internet access are essential.

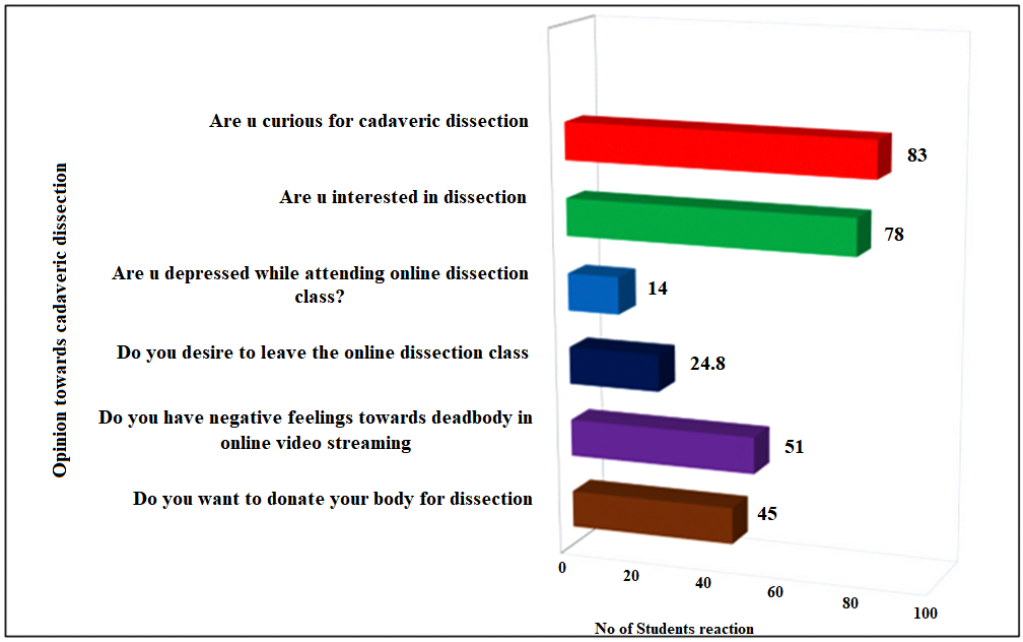

Fig 3: Reveals the opinion of medical students towards online cadaveric dissection

Table 3: Shows the feedback questionnaire administered to the first-year preclinical medical students through a Google form

1. The demographic characteristics		
Age		
Gender:		Male □ or Female □
Class:		First year – Medical student
Place of residence:		
Please respond to the following questions.		
	Question asked	**Strongly agree (1) Strongly disagree (5)**
2. Knowledge about e-learning, personal computer, and internet service availability		
a)	I'm familiar with live online learning.	1 2 3 4 5
b)	I attend all the online live classes scheduled at my college.	1 2 3 4 5
c)	I don't find any difficulties to login in class	1 2 3 4 5
d)	I have adequate facilities to attend online live classes.	1 2 3 4 5
3. Attitude towards the effectiveness of an online live class of anatomy dissection		
a)	Able to visualize the structure clearly	1 2 3 4 5
b)	Able to get the orientation of the structure properly	1 2 3 4 5
c)	Able to clear your doubts	1 2 3 4 5
d)	Able to concentrate constructively during the demonstration	1 2 3 4 5
e)	This platform provides more interaction than regular demonstration.	1 2 3 4 5
f)	Able to achieve the learning outcome	1 2 3 4 5
g)	What do you find better in this mode of teaching	1 2 3 4 5
h)	What do you find worst in this mode of teaching	1 2 3 4 5
i)	The study of gross anatomy by dissecting cadavers is better in this method of learning.	1 2 3 4 5
4. Views about the continuing live online anatomy dissection classes in future		

a)	Do you feel this mode of learning will compensate for the regular demonstration?	1 2 3 4 5
b)	Recommend teaching of anatomy dissection by online method	1 2 3 4 5
c)	Recommend teaching of anatomy dissection by an online method as supplementation to regular demonstration	1 2 3 4 5
d)	I do not recommend the teaching of anatomy dissection by online method	1 2 3 4 5

Table 4: Shows the factors influencing the performance of online courses

Themes	Subthemes	Criteria	Example
Nature of content	Structure	Bringing course goals and objectives into a well-thought-out and effective course design	Instead of merely copying from other materials, producing powerpoint presentations, and reading them to students, staff should take their time to prepare the information.
	Accessible Interactive	"Universal design for learning," which takes into account all possible students and assures active learner engagement, as well as interactive movies that help viewers internalize the concept	The platform should promote in-person interactions and make use of animated films to increase involvement.
	Comprehensive Flexibility	Simple to comprehend, learn anywhere, anytime	Clear, straightforward, and exact instruction is required. "The timeline should be set up to suit the learner's convenience."
	Relevancy	The learner's assessment of the material's appropriateness for the course	"Lectures should be useful and include real knowledge."
Infrastructure	Connectivity	Students may use the Internet without being interrupted.	"Removal of network problems"
	Data pack	Having a sufficient data pack available to use the internet facility	When taking online courses, a complimentary data pack is provided.
	Data speed	The speedy and continuous flow of information	""Uninterruptible high-speed Internet
	Devices	Possession of the necessary equipment to participate in the courses	"We need to be permitted to use our phones to attend the courses."
	Video/audio	The high-quality production of video and audio during class	"Audio and video clarity"
	User friendly	Learning software and hardware	"Using a user-friendly interface for students."
Competency	Technical skills	For instructors, a working understanding of computers and the Internet is necessary.	Our professor should possess solid technical expertise.
	Communication skills	Effectiveness of the instructor's idea communication	"Using his communication talents, the lecturer creates a classroom-like setting."
Readiness	Motivation	The behaviour of the learner that is focused on goals	"Students should be interested in learning for themselves"
	Discipline	Keeping a schedule and being accountable	More discipline is needed among students.
	Focus	Student's capacity to remain focused and avoid distractions during learning	The effectiveness of online lessons depends on the student's ability to stay focused.
Follow up	Query Question	A question-and-answer session designed to clear up any confusion.	"Pre-recorded movies and top-notch study guides with a forum for questions will be more efficient."
	Evaluation	Classes with frequent online assessments" include keeping an eye on the students to ensure they are there, collecting comments on previous lessons, giving them tasks, and administering online tests to evaluate performance.	Classes with frequent online exams."

Table 5: Shows factors affecting the failure of online classes of dissection

Themes	Subthemes	Criteria	Example
Technological constraint	Digital divide	What difference between students who have quick access to the Internet and computers and those who don't	"Not all students in remote areas can access a laptop and the internet."
	Data limit	Inadequate data pack to get the information or attend the class	Online education requires a lot of data, which is expensive.
	Poor connectivity	Learning is made more difficult for students due to intermittent internet access.	Owing to a network issue, lessons are being dragged.
	Issues with the device	Lacking a device or having a device that is incompatible with the software needed for online courses	"Some of the students don't have access to technology."
	Non - recordable videos	Online courses which cannot be saved or stored for later study	"Learning is hampered by videos that can't be recorded or replayed later."
	Technical issues	Inadequate audio or video quality; limited bandwidth	Signal strength is weak, and the voice quality is terrible.
	Virtual presence only	There is no face-to-face contact between the students and the instructor.	Merely one-way communication and no opportunity for engagement
Distractions	Poor learning environment	Unfriendly learning environment	The home environment is not conducive to studying since it causes many disruptions for kids and family members.
	Noise	Distractions that keep students from learning	Two-way communication is disgusting because voices are being raised on both sides
Instructor's incompetency	Technophobia	Fear of managing it among instructors	Lack of technical expertise of the teacher."
	Poor teaching skills	Instructor's inability to effectively teach the material	Lengthy, tedious talks with inadequate justifications
	Unstructured content	Having a poorly planned curriculum and unclear course objectives	Seminars that are conducted for name sake with poorly planned content
Health issues	Strain	Attention issues brought on by the hazardous radiation from the computer used for online courses.	Headache due to harmful rays is caused by continuous use of a cell phone for lessons.
	Worsening of existing health issues	The deterioration of previously existing health conditions as a result of lengthy online courses	Back and migraine pain are exacerbated by ongoing courses.

Online versus Face-to-Face Examination

Compared to face-to-face exams, most participants agreed or strongly agreed with every statement made in favour of the online exam, with the one exception that the exam was challenging due to staff absenteeism and inability to address new issues. To perform additional analysis, we recorded this statement so that strongly disagree represented by five and strongly agree by 1, as it was stated differently from other claims in this domain. After this recording, it was found that the mean score of the new statement was 3.3 (1.4). The average score of the five statements in this domain varied from 2.6 to 3.8 (maximum: 5) (Table 6)

Table 6. Shows the Relative frequency distribution of students' responses to Online versus Face-to-Face Examination

Statement	Strongly Disagree %	% Disagree	Neutral %	Agree %	Strongly Agree %	Mean (SD)
Online test reduces exam stress and anxiety.	8.1	8.2	14.5	22.2	45.5	3.8
Students can focus on the questions and concentrate better while taking the online exam.	11.4	12.2	10.5	21.8	43.4	3.6
Tests taken online are easier to complete than in-person exams.	10.0	11.5	18.5	21.0	38.5	3.6
Exams taken online are more equitable than in-person exams in grading and student equity.	15.6	10.0	15.1	19.0	40.5	3.7
Online tests are challenging as no staff member is available to handle the new issues.	24.0	23.6	21.3	17.0	14.2	2.6

Table 7 summarizes a comparative analysis of the literature from comparable studies conducted on medical students during the COVID-19 pandemic.

References	Place of study	Study design	Sample size	Advantages/ Merits of EL	Challenges/ Barriers to EL	The overall attitude towards EL/Recommendations
Gupta S et al., 2021 [20]	New Delhi, India	C/S OS	Medical students (248) Faculty (23)	88.3% found online classes useful	Poor internet connectivity Lack of human interface	Positive 54.4% preferred BL for the cognitive domain
Dost S et al., 2020 [35]	Sudan, Africa	C/S OS	UG medical students (358)	Saves time on travelling Flexibility	Family distractions Poor internet connection	Positive Preference TL > EL.
Olum R et al., 2020 [21]	Uganda	C/S OS	MBChB (172)	Useful for sharing learning material	Internet costs Poor internet connectivity	Negative BL (75%)
Ba˛czek M et al., 2021 [19]	Poland	C/S OS	Medical students (804)	Ability to stay home Continuous access to study material	Lack of interaction with patients Technical problems with IT equipment	Positive Preference EL=TL
Abbasi MS et al., 2020 [31]	Data from 11 countries	C/S OS	Healthcare students (1255)	EL is satisfactory in acquiring knowledge.	Ineffective in acquiring clinical and technical skills	Positive Satisfaction with the use of EL is better in developed countries than in developing countries
Alsoufi A et al., 2020 [38]	Libya	C/S OS	Medical students (3348) across 13 medical schools	47.5% preferred electronic systems	Poor internet services Financial costs	The majority felt that EL could not replace TL
Abbasi S et al., 2020 [30]	Pakistan	C/S	MBBS and BDS (382)	Popular medium	Lack of stu-T interaction Practical	Negative 77% had negative perceptions towards EL

					training compromised	
Gismalla MDA et al., 2021 [37]	Sudan, Africa	C/S OS	UG medical students (358)	EL was best solution during COVID-19 lockdown	Internet costs Infrastructure issues	Positive
Alsaywid B et al., 2021 [28]	Saudi Arabia	C/S OS	Medical students (300)	The role of EL as an alternative mode of learning during the pandemic was satisfactory.	Infrastructure issues	Positive 77.67% felt EL should be a mandatory education tool
The present study, 2022	Puducherry	C/S OS	MBBS – First year (100)	Easy and quick sharing of educational material Flexibility in time and space	Suboptimal practical training Poor internet signal Lack of face-to-face interactions	Positive TL (45.9%) BL (41.2%).

BDS: Bachelor of dental surgery; BL: Blended learning; C/S: Cross-sectional; EL: Electronic learning; MBBS: Bachelor of medicine and Bachelor of surgery; MBChB: Bachelor of medicine and surgery; OS: Observational survey; Stu-T: Student teacher; TL: Traditional learning, UG: Under graduation

4. DISCUSSION

In response to the crisis caused by the coronavirus pandemic, we pushed for the quick implementation of two major changes to the medical higher education system: digitization and switching to an e-learning process centred on the student. The main objective of this study was to examine first-year medical students' preferences and perceptions toward online classes. Computer-aided education has been an important part of medical education for over five decades. [16] Physical methods of university learning were no longer an option after the COVID-19 pandemic. The effectiveness of distance learning through the Internet depends on several variables, including the speed and quality of the Internet, the accessibility of online resources, the availability of appropriate infrastructure in educational institutions, and the readiness of both teachers and students to adopt this technology. [17,18] We examined the methods used by professors from two Romanian higher education institutions to disseminate information during the coronavirus pandemic, considering these factors. Also, we looked at how students felt about their experiences with online learning and how that affected their ability to learn and remember things. In our present study, the students strongly believed that dissection makes learning more interesting. It makes them recall what they learned and provides the 3-dimensional perspective of structures we conducted completely online, reflecting this. First-year medical students typically experience a variety of emotional reactions and mixed feelings when they first encounter human cadavers in the online dissection room.[19] During the lockdown, institutional e-learning had to be made mandatory for the first time, although the healthcare profession has not found much use. Most of the participants in this research were women. Others have found comparable results.[20] This may be a result of the survey's higher female participation rate and the fact that all first-year medical students were female. As per the current survey, 97.9% of students had some understanding of e-learning. According to research by Olam R et al., the awareness rate at Makerere University in Uganda was 96%. [21] According to Alqahtani et al. Research [22] shows that only 62% of Saudi Arabian medical schools' health science students were aware of e-learning. Due to their versatility, smartphones are used by over 90% of the students in this current study survey. It became clear that the new e-learning model deployed at the institutional level needed to work with laptops and cell phones. In this study, 83% of medical students were curious about online steaming dissection classes, and 78% were interested, but 51% had negative feelings and depression. 14% wanted to skip online dissection classes, and 45% decided they wanted to donate their bodies for future dissection. The positive thoughts from the present study students are similar to those found in a study by Sharma and Gupta. [23] In Australian research, Disbandara et al. [24] found that most students (>75%) agreed with all of the survey instrument questions, which represented favourable views of cadaveric dissection. The present research also supported a study by Izunya et al.[25], in which 90% of students agreed that dissection is necessary to understand anatomy. Despite the digital age, modern technology for teaching anatomy using 3-dimensional imaging equipment such as automatablee is relatively inexpensive for resource-poor countries such as Ghana. Additionally, cadavers served as the first patients for medical students, allowing them to become comfortable with a dead body before entering their clinical years. According to the results of Buch AC et al.[26], the benefits cited by students, such as quick delivery of learning materials and flexibility of time and location, are supported by online learning. The main obstacle observed in this research was the need for face-to-face encounters with patients. Acquisition of clinical skills with e-learning was also considered ineffective. Before and during the COVID-19 pandemic, similar concerns were reported.[27] Considering the previous surveys conducted during lockdown [28,29] students of both the courses in our survey had an overall fair opinion of e-learning as a learning tool. However, there were conflicting findings in the analogous study by Abbasi S et al. from Pakistan and Olam R et al. [30] The medical curriculum's specificity (a mix of knowledge acquisition and skill training), comfort and familiarity with

traditional teaching methods, and awareness of and access to gadgets, infrastructure, or Internet problems, particularly in developing countries, are all possible explanations for the disparity in perceptions. [31,32] According to the current survey, blended education is popular among medical students and closely follows traditional education as the desire for the future. Previous research from India and other countries revealed similar results[33]. Additionally, face-to-face contact benefits blended learning with the freedom and adaptability that come with e-learning.[34] A literature review showed that traditional classroom instruction is significantly better than online learning alone. [35] However, one study found that digital lectures can serve as an adequate alternative to in-person instruction for anatomy.[36] Table 7 summarizes a comparative analysis of the literature from comparable studies conducted on medical students during the COVID-19 pandemic [37,38.] In the medical field, e-learning can improve teaching and learning [32]. However, integrating e-learning into the medical curriculum requires careful preparation, and these surveys can be very helpful in identifying areas that need attention for a positive experience[33]. Evidence from the literature suggested that students made comparable comments and recommendations for the effective implementation of e-learning. [34] E-learning and blended learning can become well-recognized educational tools thanks to Competency-Based Medical Education (CBME), which was adopted for the undergraduate level of MBBS courses in India. Vertical and horizontal subject integration is made possible by learner-centred competency-based training, which enhances knowledge. The four learning categories of knowledge, skills, attitudes and communication are divided into the following competency levels (knows, how, and performs). It also aims to improve communication abilities [39,40]. The curriculum needs to be reorganized or changed immediately so that e-learning can be used regularly for teaching and training in different areas of medical science. Socio-demographic profile In terms of mean age, the gender distribution is compared with previous similar studies. About half of this study's AVMC& H students came from urban areas, while the remaining students came from semi-urban and rural areas, almost equally distributed. Most (87%) of the students were non-vegetarians. To our knowledge, this aspect, the dietary patterns of the students, was not studied in our study concerning attitude and emotional response to dissection. These findings are consistent with earlier studies by Inuwa et al. [41] and Agnihotri et al. [42]. Similarly, the physical and psychological characteristics of attending online streaming classes were also reported for performing dissection classes in our study based on questionnaire design. In our study, 93% experienced eye irritation and 56% experienced nausea in online classes, and 78% experienced euphoria before performing cadaveric dissection. Finally, only 4% of online cadaveric dissection classes experienced fear. Finkelstein, P *et al.,* [43], Evans EJ, *et al.,* [44]. In previous studies, most students reported that the initial exposure to a dead body caused an emotional shock. In contrast to this current study, only 15% expressed emotional trauma upon online streaming of cadaveric amputation risk. In contrast to most studies, only 27% experienced anxiety and stress, whereas, in our present study, only 14% showed anxiety and stress during online mode cadaveric dissection. Abu-Hijleh *et al.* 45 reported that 46% of their students experienced some level of fear before and during the initial dissection. The current study showed that approximately 78% of people on online cadaveric dissection had euphoria before dissection. Only 4% feared mutilation. Sivaraman *et al.,* [46] reported that more than three-quarters of students were upset at the start of the dissection. Whereas the current study found that approximately 51% of the students had negative feelings towards the dissected dead body and the remaining 24.8% of the students were ready to leave the online dissection classes at the beginning of the dissection. Lalit *et al.,* [47] reported that students who had prior contact with a dead human body were highly sensitive to emotional aspects and wanted more contact with anatomy department staff to discuss the emotional aspects of human dissection. In the current study, 83% of students reported that they were more eager to attend online streaming cadaveric dissection classes and 78% were more interested in dissection classes, and this helped them develop a better coping mechanism towards cadaveric dissection. Most students in the current study consider autopsies to be a more challenging event than danger or harm. This is consistent with previous studies by O'Carroll RE *et al.,* [48] and Dempster M *et al.,* [49]. However, many difficulties encountered during online learning can be solved using several measures. This is often true for theoretical courses when online learning can be just as effective as traditional teaching. Students in the medical profession should not rely solely on online learning as they are expected to apply what they have learned in real-world patient care situations. The survey distribution had to be done expeditiously due to the sudden onset of the pandemic. Therefore, relevant COVID-19 elements may impact the effectiveness of responses such as anxiety, worry, or uncertainty. Equipment questions were taken from several pre-verified surveys, some of which may still require verification. Although the questionnaire is well-balanced and simple to complete, adding additional items to each subject may be explored but will need to be verified first. A similar concept can be used at other medical colleges in the Puducherry region, as the exchange of experiences will certainly be a learning experience. As an alternative, other universities and settings have used online learning, and it will be helpful to learn from and share the experiences of others.

- ***Limitation(s)***

The professor's opinion from AVMC &H on using e-learning during the COVID-19 pandemic was not sought for the current research study. However, it may have offered a deeper investigation into the problem. In addition, students' perceptions about using e-learning as a teaching resource may be affected by the need for more technical support and infrastructure, including Internet access. Finally, the extent of e-learning in many areas of medical science can be better understood with the help of further surveys with a wider sample that includes students from other disciplines like dentistry, physiotherapy, laboratory technology, etc.

5. CONCLUSION AND FUTURE ASPECTS

As far as we know, this is the first study done in Puducherry to look at how first-year medical students prepare for remote and individual learning and how they learn online during the COVID-19 phase. Online education for next year's students will likely improve if these problems are fixed. During strange events like the COVID-19 pandemic, remote learning systems may be the only way to keep learning going. Our study found first-year medical students at Aarupadai Veedu Medical College and Hospital liked online instruction. Additionally, students have a good view of the institution, the professors, and their aptitude for online

study. During the COVID-19 campus lockdown, most students enjoyed online learning. Our study examines students' experiences during a pandemic outbreak and offers possible improvement areas. Medical education needs effective distance learning, and digital learning systems should take advantage of how fast they improve. Medical students should have the tools to make their study materials, dissection films, and tests to test their knowledge of anatomy. Learning anatomy teachers' opinions on using this platform for instruction is crucial. Our findings apply to e-teaching. The pre-pandemic study could be used to make and change the e-learning platform technology acceptance model. The model might include external factors and be tested in an online learning environment.

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7. ETHICAL APPROVAL STATEMENT

All Procedures performed in this study involving human participants were under the ethical standards of the Institutional ethical committee (IEC) of Aarupadai (approval number IEC NO: AV/IEC/2020/85). Furthermore, written consent was taken from the first-year medical students for participating in the study.

8. AUTHORS CONTRIBUTIONS STATEMENT

Prithviraj Nagarajan conceptualized, curated the data, and prepared the original draft. Sowmiya Ganesan, and Sridhar Krishnamoorthy, designed the study, and Ravikumar Sambandam analyzed the data. Vinothini Gunasekaran and Rajan Thangarasu provided valuable inputs toward designing the manuscript. Finally, all authors contributed and accepted the manuscript.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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