



# Effects of COVID-19 pandemic on anatomy education of medical and dental students of Pakistan; a reality check

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Received: 26 February 2022 / Accepted: 10 October 2022  
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## Abstract

**Purpose** Virtual anatomy education was the only way that supported the learning process of the students during the forced lockdown time of COVID-19 pandemic. The intention of the current study was to apprehend the expected challenges experienced by the medical and dental students during their cyber anatomy classes.

**Methods** This study was carried on 300 1st and 2nd year medical and dental students who joined their respective college in January 2020, and consented to participate in the study. A multiple choice questionnaire regarding their stance about these online classes was formed and student's feedback was taken.

**Results** Most (80%) of the students longed for their traditional anatomy learning i.e., dissection courses, didactic lectures, interaction and motivation from their mentors and peer. The students blamed the learning without live dissections, models and microscopic slides for their lack of confidence. More than 80% students blamed inappropriate gadgets, absence of high-band internet connections, as possible barriers in their digital learning. Lack of self-motivation was considered by 66% students.

**Conclusions** This situation of anatomy education while lockdown was not intentional and should not be taken as the silver bullet solution for a subject like anatomy. Although students had to face a lot of challenges but this shift to online mode went swiftly at the time of health crisis. This digital learning may extend for an indefinite period, the students' feedback will be helpful in bringing appropriate and timely modifications in digital anatomy education.

**Keywords** Anatomy education · COVID-19 · Dissection course · Students · Virtual

## Introduction

The culprit behind the pandemic COVID-19 is the acute respiratory syndrome caused by coronavirus 2 (SARS-CoV-2), first emerged in China, in late 2019 [1]. The World Health Organization (WHO) avowed this surge as “public health

emergency of international concern” on January 30, 2020 and later was declared as pandemic on March 11, 2020 [18]. The social, educational and physical impacts observed during this pandemic era went at a pace and scale without having any match in this century [9]. The virus affected the world, human lives, and medical education is no barring. First case of COVID-19 in Pakistan, was reported from Karachi in the end of February 2020, Government of Pakistan foisted mandatory lockdown on March 24, 2020 for 21 days which was extended further till September 2020. Schools and universities was forced to shift their education programs online in the midstream with little or no time for adoption [16]. With the improvement in the conditions, the government tried to unlock the country in different phases from September 2020 to resume the on campus education.

Anatomy is the basis of all the medical sciences, necessary to acquire a solid background knowledge to develop their clinical skills to healthcare workers. Cadaveric dissection is considered as a signature competence of this

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discipline [7]. The unexpected disruption due to COVID-19 pandemic imposed institutional closure had deprived the medical and dental students not only from access to cadavers, but to the other learning modalities like prosected specimens, models, bones microscopic slides and radiological images due to lockdown [15]. This pandemic COVID-19 had tried to craft a new chapter in the history of anatomy learning, for the subject that had never been delivered distinctively online or remotely before this in the country like Pakistan. The anatomists had to incorporate new online and virtual approaches to deliver anatomy curricula [4, 15]. The digital switching was the only option left for anatomists throughout the world and Pakistan is not the exception [9, 17]. This transformation from contact to distant learning is not easy for faculty as well as students. While the conservative anatomists had been trying to unlock technology to deliver best lectures, the digital anatomy learning had its own inevitable teething problems [15].

This study was intended to envisage the challenges confronted by the medical and dental under graduates during their digital anatomy learning. The first and second year medical and dental students had been privileged to experience the traditional on campus classes in dissection halls and microscopic laboratories as well and could genuinely associate. This analysis had been particularly designed to reflect the mental and physical learning state of the students during cybernetic classes and how these experiences affected their anatomy learning. As this digital learning went for short period, but the feedback of students helped to design the courses for future anatomy education in addition to the action plans how to resume dissection classes or experiences gradually when it became safe to do so [6–8].

## Materials and methods

A total of 300 first and second year medical and dental undergraduates (200 Medical and 100 Dental) from different medical colleges of Pakistan participated in this study. These medical and dental students were admitted to their respective colleges in January 2020, however, only those students who were willing to participate were taken in this study.

Objectives of the study were explained to each student once they resumed their on-campus classes after having more than 5 months experience of digital learning during the lockdown. A close ended multiple choice questionnaire was designed and emailed to the students (Table 1). The student's feedback was taken while preserving anonymity of the students. Data were collated and analyzed using MS Office 2007 Excel spreadsheet and program SPSS 20.0 (SPSS Inc. Chicago, IL, USA). The students belong to age group ranging from 17 to 21 years (mean age 19 years; 140 females and

160 males). Out of the 300 students, 80 belonged to rural while 220 to the urban area.

## Questionnaire

### Results

Majority of the students accepted COVID-19 as pandemic as per WHO, only 15% took it as an endemic. All the students had to depend on digital learning, 74% found themselves computer friendly pretty enough to hack this online learning. Most of them (81%) used smartphones; some (18%) utilized laptop/desktop and only two students were using tablet during their journey of digital learning. 80% of these students [accounted the lack of proper gadgets and bad internet connections as the barriers in their newly fangled learning process. About 80% blamed non availability of reference books and study material at their homes for their educational loss. 80% of them missed every aspect of traditional anatomy education i.e., cadaveric dissection, in person didactic lectures, discussion and competition with their peers and interaction with their mentors. Only 3% wished for cadaveric/histology lab exposure and 6% craved for discussion with their classmates whereas 6% desired to interact with mentors. More than 80% students acknowledged that the live cadaveric dissections helped them a lot in understanding and grasping the concepts easily. All the students agreed that neuroanatomy would have been more appealing with holding brain specimen in hand. Most of the students (76%) felt difficulty in understanding embryology without interactive sessions and 3-D models. Nearly half of students (58%) enjoyed distance learning by video recorded lectures, whereas 30% preferred power -point presentation while 12% favored theoretical write-ups.

Only 8.8% of the students were fully satisfied with these virtual classes whereas other nearly 11% were completely vexed. Only half of the students were appeased with the current assessment system. Although phobia of examination with dubious concepts were the main imminent challenges for the students, however, only 6% students did not feel such challenge.

Two third of the students were aware that because of COVID-19, the government had imposed suspension on the cadaveric provision in most of the medical institutions. If COVID-19 stayed as an endemic, students had mixed ideas for effective mode of anatomy learning in coming times; some favored virtual pro-section while other liked recorded dissections. Mostly the students (70%) bore difficulty with time management which they attributed to the comforts and discomforts at home. Loss of self-motivation was sensed by 66% of the students. Most of them (80%) agreed that they

**Table 1** Feedback questionnaire of the students

Feedback questionnaire of students			
Age (years)			
Gender male/female			
Home town (urban/rural)			
Sr. no.	Questions	Options	Answers
1	Do you know about COVID-19 pandemic?	Yes/no	
2	Do you know that WHO may declare COVID-19 as an endemic?	Yes/no	
3	Are you friendly enough with the computer to cope online learning?	Yes/no	
4	Which gadget do you prefer to attend the online classes?	Desktop/Smart phone/tablet/laptop	
5	Which of the following can be blamed as a barrier in learning process; lack of gadgets, high speed internet connections	Yes/no	
6	Was non availability of books or study material a problem in this journey	Yes/no	
7	Which mode of teaching was missed the most during these online classes online classes/studies?	Histology lab/Cadaveric/didactic lectures/PBL/peer and mentor feedback and interaction	
8	If you felt live dissections would have made concept comparatively easier to grasp?	Yes/no	
9	The concept of upper limb with live cadaveric dissection were better understood in comparison of lower limb taught via online classes	Yes/no	
10	Head and neck portion taught in live dissection classes and specimens were better understood then virtual classes	Yes/no	
11	Microscopic anatomy via online mode was tough to understand in comparison with live microscopic view	Yes/no	
12	Neuroanatomical concept with brain specimen in hand were better understood instead of online didactic lectures	Yes/no	
13	Embryological concepts were difficult to grasp without models	Yes/no	
14	Which mode do you prefer the most for your distance learning	Power point presentations/ theoretical classes/Video recorded classes	
15	Did you find assessment system satisfactory?	Yes/no	
16	Which mode of anatomy learning, should be preferred if COVID-19 becomes an endemic	Recorded real cadaver dissections/ Virtual dissections/prosections	
17	Did you feel that comforts/discomfort at home was cause of distraction	Yes/no	
18	Did you find any difficulty in time management?	Yes/no	
19	Did you feel lack of self-motivation during COVID-19 scenario?	Yes/no	
20	Did you miss your real college environment, colorful cultural, sporting events and companions?	Yes/no	
21	Did you find it helpful studying via virtual classes? [Give no. 1–5] 1 is completely dissatisfied and 5 is fully satisfied	1–5	
22	What forthcoming challenges did you feel, due to these online studies in the current academic year?	Nothing/fear of passing exams/uncertainty of concepts	
23	Any forthcoming challenges did you expect in your carrier because of these online classes?	Nothing/missing of some basic which may be helpful in clinics	

really longed for the campus environment, friends, cultural and sporting events.

## Discussion

The Covid-19 pandemic has brought seismic shift in anatomy for both the educators and students. The urgent shifting of

anatomy learning from dissection halls, histology labs and lecture rooms to homes due to this pandemic brought enormous challenges for learners as well as for technology. Unseen walls was sprung up which diffused the education system in addition to euphoria of campus life in different ways. It was unsure how long this digital switching over might go. The change was inevitable at that time. It was not opted by choice but as a precautionary measure, considering social distancing the only way that can bridge the safety with the continual education. Although long-term medical and dental colleges closures had never been wished, but impending especially of visual subject like anatomy was uncertain.

This study was designed to compare the challenges faced by the medical students during their remote and contact learning of anatomy. These first and second year medical and dental students were the ones who experienced both virtual classes system and traditional on campus classes, so could truly compare. The survey reflected how these conditions affected the mental and physical learning of these students. As this digital transition of anatomy might go for unknown period, the feedback of students may help to design future courses for this learning system. Because of the ongoing pandemic, institutions had to adapt zoom meetings, google classroom, Goto or cisco webex meetings for transforming contact learning to distance learning. This transformation was challenging for both teachers and the students which demanded a lot of preparations and extra efforts with no or little time for adaptation [14].

Virtual anatomy education was the only solution to continue this educational journey during this pandemic situation. Students, as the main stake holders, can provide the powerful feedback concerning the content and mode used to deliver it during virtual anatomy classes. So, this study was planned to acquire the student's point of view about digital anatomy education and to pin point the various problems being faced by these students during that era. The students participated in this study started their medical or dental education in January, 2020. They attended their anatomy lectures and practical in traditional on campus way for almost three months and later on was shifted to digital mode for more than 6 months. These students experienced both on campus traditional and digital modes of education, so they can compare and comment on the problems encountered in a far better way. Their feedback can be helpful in designing relevant and nouvelle modifications in digital anatomy education.

## Commencement of online anatomy learning after closure of Medical & Dental institutes

### Amid COVID-19

Most of the universities across Pakistan commenced the new academic year in January, 2020. The first case of corona

virus in Pakistan was reported from Karachi in the end of February 2020 and lockdown was imposed on 24th March 2020 with the closure of all the educational institutes. Schools and universities had been forced to shift their education programs online in the midstream with little or no time for adoption during the lock down [9, 12]. The students belonged to different geographical locations were sent back to their homes, some to rural and remote areas with limited or poor internet access. Almost 25% students of this study belonged to rural area and 80% blamed internet network as a potential barrier in their productive digital learning.

During this scenario, the students were depending on the digital learning system completely. The anatomy educator might had taken it for granted that these students belong to the millennial generation and would be proficient of these modern learning resources [16], but it was not so. It should had been ascertain that they were really familiar with the effective use of their computers and modern e-gadgets for their learning. Although 74% were digitally literate yet 26% were not well abreast to use these technical resources for online learning. They had to put extra efforts and spent more time to deal such issues. Most of the students used smart phones to attend their online classes, but its small screen might hindered the proper understanding of the visual and three dimensional concepts of anatomy. The continuous staring to focus the details could have strained the learner's eyes while leaning posture might have imposed unnecessary health issues among the students. As this pandemic was totally unpredicted, the students had to rely on this gadget, either due to financial crunch or urgent lockdown. Only 18% of them used desktop/laptop and 2% tablet for the online learning. 80% believed that the lack of proper gadgets and week internet connections were the main barriers in their e-learning journey. Due to this unforeseen lockdown, the 80% of the students belonging to distant areas did not have access to their books and study material which further stymied their learning. In this scenario, these physical challenges look minor, but these novel anatomy learners had to face a lot of difficulties in handling their studies without appropriate books and study resources.

### Loss of exposure to cadaver dissection and anatomical specimens

Cadaver dissection is indispensable for improving not only fine motor skills but also inculcate team based learning [15]. The dissection hall learning plays vital role in deep understanding of anatomical concepts. During the COVID-19 pandemic, the students did not have physical exposure to the cadaveric dissection. They could not make effective use of the various paramount learning modalities like prosecuted specimens, models, skeletons, bones, etc. to strengthen their conception. 80% of these novel students believed the

virtual anatomy classes as substantial challenge due to lack of exposure to these physical anatomical resources [17]. In this survey, the first year medical graduates had studied more than half of the upper limb in their dissection room demonstrations while second year were enjoying head and neck in their dissection rooms along with lectures of neuroanatomy during pre-pandemic period. The rest of the gross anatomy topics (Upper limb, lower limb, neuroanatomy and head & neck) were completed through online classes. The students strongly felt the lack of cognizance in these parts of the curricula because of lack of dissections. Most of the medical and dental students solicited that live dissections augmented their understanding and helped them in grasping the concepts more easily. All the students agreed that neuroanatomy would have been more interesting if studied having brain specimen in their hands. More than two third of the students registered that they had great difficulty in grabbing embryology concepts without interactive lectures, tutorials and models.

During these virtual classes, students were taught through prerecorded video lectures and power-point presentations. The prerecorded video lectures were appreciated by majority of the students as they found liberty to learn these topics at their own convenient pace where they can pause, rewind and replay videos multiple times [15, 17]. Although, anatomists learnt the use of new innovative virtual resources and skilled themselves with the new tools, however, this resulted in poor teacher students interaction. The attendance of the students was another imperative matter of concern in most of the institutes during COVID-19, as it was difficult to keep its actual record [6].

### Challenging in assessment system

The insurance of appropriate method of assessment was another challenge faced by the anatomy faculty along with the other educationists too who had been tackling any online course [2, 11, 18]. In our set-up, formative assessments were taken after completion of every topic. During this pandemic these students were evaluated through Google form and Google class rooms. The students were directed to post their answers within the allocated timeframe and the responses were evaluated later on by the faculty.

The assessment system also remained a point of concern among the students. Only half of the students were satisfied with the adopted evaluating system. Most of the students attempted their assignments by their own while they complained that others might have taken help either from the books or other study materials. This might have affected their comparative scores. To justify this deceitful part, pre-pandemic evaluations should be given more worth for internal assessment and when the situation allows return of on campus life shortly, anatomists may arrange

traditional evaluations for their finals. The anatomy faculty kept on devising the additional methods to ensure security and robust testing of the students.

### Impact on time management

70% of the students had difficulty with time management because they were distracted by the ongoing disturbances at home. While in campus, students shared same environment and circumstances which ensure equality to learn. During lock down, some of the students access these online classes from an air-conditioned room with hi-band Wi-Fi while other were struggling to find a quiet place in an overcrowded apartment with jittery internet.

The students may also be distracted by social media notifications and messages, popping up online games etc.

### Mental wellness of students during online anatomy learning

During the era of pandemic, academic anatomist remained concerned about student's mental wellness too. While academicians were trying to manage how to teach anatomy online, there had been a dire need to provide support to the students in this transition to e-learning who had been missing dissection of cadavers, attended microscopic laboratories and traditional didactic lectures [5].

Campus life is very much valued in student life, as real life college experience cannot be gained virtual. Even if an educational institute had been successful in conducting its online teaching, it would still be lacking in effective on campus activities. In this survey, majority of the students (80%) wanted to resume their pre COVID-19 campus life.

The students felt deprived of enjoying the direct interaction with their instructors and motivation through their peers.

According to this survey, 66% of the students had lack of self-motivation. Some motivational classes should had been planned for the mental fitness of students.

The uncertain circumstances reported by the media pandemic further inflated the anxiety among students.

Self-study has been seen as significant aspect of effective learning. The difficulties confronted by the students during this COVID-19 pandemic, could be lowered if they had been versed to self-study. Self-education might had helped in full filling the gaps created during their e-learning journey. Although self-directed learning had already been practiced at some medical & Dental institutes during pre-pandemic period, however, it's the high time to accept its importance.

During this COVID-19 pandemic, this online education had tried to evolve significant potential in students to bridge the gap by inculcating responsibility in them. No one can ensure success without adaptability. The introduction of



innovative teaching and learning approaches can improve their learning further [3]. For example, by reversing the traditional pedagogy i.e., studying prior to lectures may help the students to answer their concerns and apply their new knowledge. It will help them to groom themselves to be a better autonomy in anatomy education.

Although anatomists have worked determinedly for seamless transition to virtual learning environment, yet there has been a list of challenges faced by both the students as well as the educators. According to this study, only 8.8% of the students were satisfied with these digital anatomy classes while majority was not satisfied with virtual learning mode. These students should realize that this online mode was just to support their learning process during this pandemic while maintaining social distancing.

The students were provided with opportunities to view microscopic slides, radiological anatomy, and cadaveric prosecuted specimens in post-pandemic era before their exams.

This disruption in anatomy education during COVID-19 pandemic should be taken as a prospect to expand the horizon of anatomy education beyond the traditional didactic lectures to e-learning virtual mode [4, 13]. The educators should be fortified to explore all possible innovative teaching methods to offer improvements in anatomy teaching and evaluation system [10]. It can be envisioned that anatomy education will not remain the same as it was once during pre-pandemic period. In the post COVID-19 era, instead of obsoleting the conventional education methods, these should be blended with e-learning modes as the norm.

**Authors' contributions** ASQ and AS conceived and designed the project and finalized the manuscript, ZU, MR, UA conducted the survey and prepared the manuscript. HS applied the statistics.

**Funding** This study was not funded by any funding agency.

**Availability of data and materials** The data were entered on the Excel sheets and their percentages were calculated.

## Declarations

**Competing interests** The authors declare no competing interests.

**Conflict of interest** The authors declare no competing interests.

**Ethical approval** The study was conducted after the approval from the Ethical committees, Internal Review Boards of the University Medical and Dental College, Faisalabad. As this study included our own students, the verbal consent was taken after explaining them the details of the study. A separate consent for publication was asked too. As the Performa did not contains the personal details of the student and so identity remained anonymous.

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