

# Impact of SARS-CoV-2 Pandemic on Education of Medical Students

Chetan Sahni<sup>1</sup>, Deepa Devadas<sup>1</sup>, Amit Kumar Nayak<sup>1</sup>, Royana Singh<sup>1</sup>

<sup>1</sup>Institute of Medical Sciences, Banaras Hindu University, Varanasi

**Disclose and conflicts of interest: none to be declared by all authors**

## ABSTRACT

**Introduction:** the virus is changing the world and human lives; medical education is not an exception for this. Anatomy as a medical subject is the substratum in the medical education, which helps the clinicians to prosper their clinical knowledge. The dissection of cadavers during anatomy teaching is a signature learning experience in medical education system. Whole medical education system including anatomical education been impacted by the Covid-19 because of unexpected sudden nation-wide lockdown. The digital switchover in teaching is the only option at present not only for Indian anatomists but throughout the world and was achieved with least delays. This transformation is not easy for students as well as for faculty. Each faculty was trying to deliver the subject knowledge to the pupils however learning anatomy on virtual platform is not an easy task. It has its own ineluctable glitches.

In the present questionnaire based cross-sectional study, 93 out of 100 first year students of MBBS 2020-2021 batch (Institute of medical sciences, Banaras Hindu University) had participated. They reported, that their study been affected for 20 days on average. Out of 93 students, 34 students (37%) were not comfortable with online mode of teaching either due to poor internet connectivity or due to lack of good devices and due to unavailability of books and notes at home during lockdown. According to students, online learning mode of Anatomy is much difficult as compared to physical offline mode learning. Not only in anatomy, 69% students were also facing similar problem in learning the subject in biochemistry and physiology. 70% students reported uncertainty of concepts in online teaching, and fear of failure in exam because of not able to understand the certain topics in online teaching mode.

**Keywords:** SARS-CoV-2; Medical Education & Pandemic.

## Introduction

The reprobate for the pandemic COVID-19 was severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first emerged in China, in late 2019<sup>1</sup>. The World Health Organization (WHO) declared the outbreak as “public health emergency of international concern” on January 30, 2020 and as pandemic on March 11<sup>th</sup>, 2020<sup>2</sup>. The government of India also imposed mandatory lockdown on March 24, 2020 for 21 days which was extended till 31<sup>st</sup> May, 2020. On June 1<sup>st</sup>, 2020 the government started unlocking the country in different phases. In 2021, again the second surge of covid 19 outbreak happened. The govt. of India again impounds the lockdown and closure of all the educational institutes including medical colleges, many of them are still closed due to this pandemic. The significant concern is to contain the spread of COVID-19.

The virus is changing the world and human lives, medical education is no exception. Anatomy is the foundation stone of medical education from which clinicians develop their clinical skills. Cadaveric dissection is perceived as a signature experience of the discipline<sup>3</sup>. The COVID-19 pandemic imposed unexpected disruption to whole medical education

including anatomical education practice as the medical students lost access not only to cadavers, but also to a number of other learning modalities like models, museum specimens, bones and microscopic slides due to lockdown.

The digital switchover in teaching is the only option at present not only for Indian anatomists but throughout the world and was achieved with least delays<sup>3,4</sup>. The pandemic COVID- 19 is marking a novel episode in the history of anatomy education in India, as this subject has never before been taught exclusively online or remotely for medical students in the country. This transformation is not easy for students as well as for faculty. While each anatomist is unlocking technology to deliver best lectures for teaching anatomy however virtual anatomy learning has its own unescapable teething problems.

## Materials and Methods

The present study is based on close ended questionnaire (Annexure file). It is proposed to envision the challenges being faced by the medical students during their remote anatomy learning. The present first year medical students are the best to assess these virtual classes system as they have experienced the

traditional face to face classes, dissection halls and microscopic laboratories as well and may genuinely associate. As the digital learning may go for unknown period, the feedback of students may help to design future anatomy course for this learning system and to evaluate the impact of covid-19 on traditional medical education.

**Aim:**

1. To understand the mental and physical learning conditions of students during virtual classes.
2. To understand, how these conditions affecting the medical education.

**Inclusion criteria:** 1<sup>st</sup> year M.B.B.S. students of institute of medical sciences, Varanasi, who have learned anatomy both face to face (physical) and online (virtual) mode.

**Exclusion criteria:** 1<sup>st</sup> year M.B.B.S. students who have attended anatomy classes either face to face (physical) or online (virtual) mode only.

**Results**

In this questionnaire based cross-sectional study, 93 out of 100 first year students of MBBS 2020-2021 batch (Institute of medical sciences, Banaras Hindu

University) had participated. Out of them 77% were male and 33% were female with mean age of 19 years. All of them were well aware of covid-19 and SarsCov2. 27% (25 students) were affected by SarsCov2 infection in last one year. They reported, that their study been affected for 20 days on average. Out of 93 students, 34 students (37%) were not comfortable with online mode of teaching either due to poor internet connectivity or due to lack of good devices and due to unavailability of books and notes at home during lockdown (Fig.1). According to students, along with Embryology and histology learning, most difficult part was learning of Gross Anatomy on Prosected Cadaveric specimens during online teaching. More than 90% students reported that online learning mode of Anatomy is much difficult as compared to physical offline mode learning. Not only in anatomy, 69% students were also facing similar problem in learning the subject in biochemistry and physiology. Many students faced time management in study while staying at home in this lockdown period. They reported that they felt lack of self-motivation during online mode of teaching in pandemic. 70% students reported uncertainty of concepts in online teaching, and fear of failure in exam because of not able to understand the certain topics in online teaching mode (Fig.2).

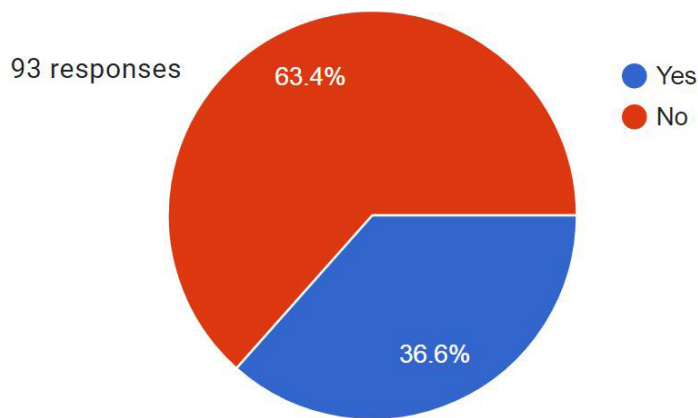


Figure 1. Percentage of students felt difficulty in understanding the subject via only online mode of teaching using gadgets like computer/laptop/smart phones/tab.

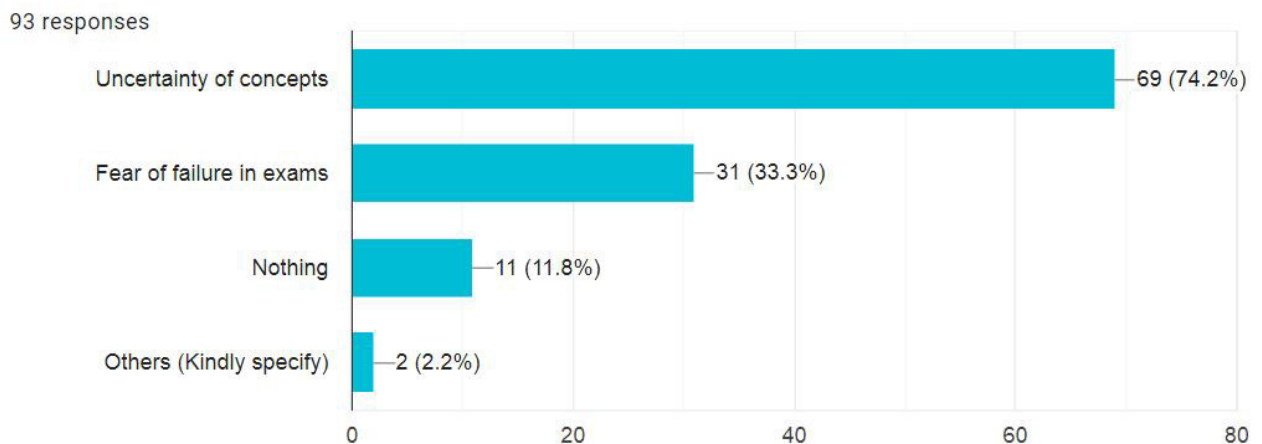


Figure 2. Student's responses on obscurity faced by the students during online mode of teaching.

**Table 1.** Close ended questionnaire for student's feedback.

Sr. n <sup>o</sup>	Question	Answer
1	Are you aware of COVID-19 pandemic?	Yes/no
2	Are you aware that as per WHO, COVID-19 may be an endemic?	Yes/no
3	Are you computer friendly enough to handle online learning?	Yes/no
4	Which gadget do you use to attend the online classes?	Smart phone/laptop–desktop/tablet
5	Do you feel lack of proper gadgets, high band width and strong internet connections; a barrier in your current learning process?	Yes/no
6	Do you feel lack of proper books or study material?	Yes/no
7	What do you missed the most in online classes/studies?	Cadaveric/histology lab/ Face to face lectures/ Discussion with your classmates/ Interaction with mentors All of them
8	Do live dissections help you to make the subject easy to grasp comparatively?	Yes/no
9	(You have studied upper limb (along with thorax and general embryology partially) with the aid of real cadaveric dissection classes while lower limb, abdomen via online Classes and the continuing part via virtual classes, which was easier to grasp?	Upper limb/lower limb Real cadaveric classes/ online classes.
10	Is microscopic anatomy tough to understand without spotting slides under microscope?	Yes/no
11	Is neuroanatomical study more interesting with brain specimen in your hand?	Yes/no
12	Do you find it difficult to understand embryology without models?	Yes/no
13	Which mode do you prefer the most for your distance learning?	Video recorded classes/theoretical write-ups/power-point presentations
14	Are you satisfied with current assessment system?	Yes/no
15	Do you know that due to COVID-19 the body donations are not accepted by medical institutes?	Yes/no
16	According to you what should be future mode of anatomy learning, if COVID-19 becomes an endemic (because of the scarcity of cadavers)?	Virtual dissections/pro-sections/recorded real cadaver dissections
17	Do you feel distracted by home comforts/discomforts?	Yes/no
18	Do you find any difficulty in time management?	Yes/no
19	Do you feel lack of self-motivation in current scenario?	Yes/no
20	Do you miss your real college environment, companions, cultural and sporting events?	Yes/no
21	Do 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 do you feel, due to these online studies in the current academic year?	Nothing/fear of passing exams/uncertainty of concepts
23	What forthcoming challenges do you feel, due to these online studies in your carrier?	Nothing/missing of some basic which may be helpful in clinics

## Discussion

With the spread of Covid 19, the medical fraternity has experienced a sudden and unforeseen crisis in the implementation of medical education worldwide. It has been predicted that 5-10 years may be required to

recover from the effects of this pandemic<sup>5</sup>. The rapid, unprecedented transition from traditional face to face teaching to the online learning platform imposed by the pandemic has presented challenges and frustrations to both educators and medical students. Under such

special circumstances, feedback from the students is a useful tool to understand the deficiencies in the online learning system so that necessary measures of improvement may be made in future.

The participants of this study were first year MBBS students admitted to the 2020-21 batch in the midst of Covid 19 pandemic. 90% of our study participants felt that online teaching was more difficult in comparison to offline methods. Other studies<sup>6,7</sup> have reported 42% - 65% students experiencing dissatisfaction with the sudden switch over to the digital learning platform. Singh *et al.*<sup>8</sup> observed in a questionnaire based feedback from medical students that 50.9% felt that physical classes were better than e-classes. In another study by Abbasi *et al.*<sup>9</sup>, 85 % of students preferred face to face learning over e-learning. All these findings indicate that despite being digitally literate, today's millennial generation may require time to adapt themselves to virtual learning methods on a routine basis. However, it is interesting to note that some studies done in the pre-covid era have shown that digital learning was well received by students and even helped in improving overall performance<sup>10, 11</sup>. This may be substantiated by the fact that online teaching was implemented in these settings along with the traditional face to face methods, which may have contributed to the better response.

The main hindrances to e-learning as observed in our study were low internet bandwidth, lack of proper digital study gadgets and unavailability of learning resource materials such as books and notes at homes. Such technological and infrastructural barriers to online education are a consistent finding in studies done by other authors in the Indian Subcontinent<sup>6-13</sup>. A rapid transition from traditional methods to virtual teaching is presently difficult in developing countries like India where such technological and infrastructural issues obstruct the smooth transition to online learning. Along with poor access to internet facilities, rising costs of internet data packages and mobile recharges may negatively affect digital learning of students from poor socioeconomic backgrounds. In addition, time management issues with lack of motivation have further contributed to apprehensions in the minds of students. Problems with time management have been reported in other studies also due to poor internet connectivity and distractions such as online games, social media messages and notifications<sup>6</sup>. A study by Khasawneh<sup>14</sup> observed 66.23% students experiencing time management issues and distractions at home with 63% reporting a lack of self-motivation. Apart from embryology and histology, our study participants found online learning of gross anatomy prosected specimens extremely difficult in the pandemic setting. A significant percentage of anatomical learning has been traditionally implemented through cadaver based instruction in the dissection hall, physical demonstration of microscopic slides in the histology

lab and 3D models to enhance understanding of key embryological concepts. Absences of such live demonstrations have made students feel a lack of thorough understanding in key subject areas, thus bringing down their confidence levels. 70% of the participants in this study experienced fear of failure in exams with uncertainty of many concepts in the syllabus content. Similar findings have also been reported in other studies<sup>6-7,14</sup>. It is found that practical learning has been highly compromised during this pandemic with students stating that basic medical science topics like anatomy dissection in virtual classes and online practice sessions were difficult for them to understand and comprehend<sup>7</sup>.

A sound knowledge of anatomy acts as a bedrock for medical education programs. This pandemic has indeed taught a lesson regarding the need to introduce effective methods of online teaching in the medical curriculum, so that we may be well prepared to face similar mishaps in future. The need of the hour is to develop teaching and learning strategies that can be made applicable in a prolonged pandemic environment. While it is comparatively easier to transfer traditional lectures to the digital platform, there are immense challenges in replicating the dissection hall and anatomy practical lab environment on to the virtual classroom. Cadaveric teaching has been considered the gold standard for anatomical instruction since the 17<sup>th</sup> century<sup>15</sup>. Medical professionals believe that dissection enables learning anatomy with relevant clinical correlates and facilitates development of professional skills<sup>16</sup>. Since most students find learning with the cadaver in the dissection hall and live demonstrations more effective, it is therefore necessary to develop appropriate safety guidelines that can facilitate cadaver based instruction even in a pandemic setting. A complete cadaveric Covid-19 assessment must be done before students are allowed to dissect and standard operating procedures(SOPs) must be strictly complied with to ensure safety of staff and students in the dissection hall<sup>17</sup>. Traditional cadaveric dissection cannot be overruled but must be complemented with virtual dissection in the post pandemic era<sup>18</sup>.

The key to imparting effective anatomy instruction to the medical student in future may thus lie in adopting a hybrid learning approach which includes both offline and online components. This will help in gradually increasing familiarity for both students and teachers with online teaching methodologies and improve future learning outcomes. Hybrid learning is increasingly being accepted among medical communities as it combines the best of both worlds<sup>5,19-20</sup>. The Flipped classroom concept in which the student studies the content beforehand itself can help in improving self-directed learning and may be experimented with for practical sessions. Flipped classroom combined with human anatomy web-

based learning system has shown promising effects in anatomy education and performance in exams by improving students' autonomous learning ability<sup>21-22</sup>. Periodic learning sessions may be held using virtual dissection software, simulation methods and digital anatomy resources such as Anatomage, Acland's Video Atlas etc. This will familiarise and encourage both students and teachers to utilise these tools for virtual learning. Students may also be motivated to attend webinars and access course management systems like moodle in order to enhance learning. A new Augmented Reality Magic Mirror (AR MM) system, which provides the advantage of a novel, interactive learning tool in addition to a regular dissection course, has been successfully evaluated on first year students and may be used as a tool for digital learning<sup>23-24</sup>. Students and teachers must be given regular training sessions to enhance their understanding and usage of new technologies and virtual education software. I.T. (information technology) teams of educational institutions must offer active support in producing digital faculty leaders and student coordinators who can help in paving the way for gradual transition to the virtual mode of learning.

### Conclusion

The anatomy classroom is a key area where the first year medical student lays a building block for higher

learning. Anatomy dissection and practical sessions also help the student to develop early professional skills and improve communication, leadership and team work abilities through interaction with peers and mentors. The unprecedented crisis brought in by Covid 19 has created great difficulties for students to adapt themselves to the rapidly implemented online mode of teaching. With WHO now declaring Covid-19 as an endemic to stay, an uninterrupted continuation of physical face to face anatomy classes seems unpredictable in future also. Hence, the need to integrate virtual learning with the traditional mode of education seems inevitable now. Necessary measures and innovative teaching methods must be developed to create a smooth transition from traditional to the digital learning platform. This will help both medical students and teachers to adapt effectively to such special circumstances if they occur in future.

### Funding declarations

IoE Seed grant (Banaras Hindu University) No. "R/Dev/D/IoE/Equipment/Seed Grant-II/2022-23/48676", is gratefully acknowledged.

### Acknowledgment

We are thankful to the undergraduate medical students (M.B.B.S. 1ST & 2ND semester students) to participate in this study.

### References

- Lu H, Stratton CW, Tang YW (2020) Outbreak of pneumonia of unknown etiology in Wuhan, China: the mystery and the miracle. *J Med Virol* 92:401-402. <https://doi.org/10.1002/jmv.25678>
- Velavan TP, Meyer CG (2020) The COVID-19 epidemic. *Trop Med Int Health* 25:278-280
- Pather N, Blyth P, Chapman JA et al (2020), Forced disruption of anatomy education in Australia and New Zealand: an acute response to the COVID-19 pandemic. *AnatSciEduc* 13:284-300
- Srinivasan DK (2020) Medical student's perceptions and an anatomy teacher's personal experience using an e-learning platform for tutorials during the COVID-19 crisis. *AnatSciEduc* 13:318-319
- Rajab MH, Gazal AM, Alkattan K. Challenges to Online Medical Education During the COVID-19 Pandemic. *Cureus*. 2020; 12(7): e8966.
- Singala J, Bansal A, Chaudhary P, Singh H, Patra A. Anatomy education of medical and dental students during COVID-19 pandemic: a reality check. *SurgRadiol Anat*.2021;43(4):515-521
- Dutta S, Ambwani S, Lal H, Ram K, Mishra G, Kumar T, Varthya SB. The Satisfaction Level of Undergraduate Medical and Nursing Students Regarding Distant Preclinical and Clinical Teaching Amidst COVID-19 Across India. *Adv Med EducPract*. 2021; 12: 113-122.
- Singh K, Srivastav S, Bhardwaj A, Dixit A, Misra S. Medical education during the COVID-19 pandemic: a single institution experience. *Indian Pediatr*. 2020;57(7):678-679
- Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding E-learning during Covid-19 at a private medical college. *Pak J Med Sci*. 2020 May; 36(COVID19-S4): S57-S61.
- Singh A, Min AK. Digital lectures for learning gross anatomy: a study of their efficacy. *Korean J Med Educ*. 2017; 29:27-32.
- Choi-Lundberg DL, Cuellar WA, Williams AMM. Online dissection audio-visual resources for human anatomy: Undergraduate medical students' usage and learning outcomes. *AnatSci Educ*. 2016; 9(6):545-554.
- Sharma N, Bhusal CK, Subedi S, Kasarla RR. Perception towards Online Classes during COVID-19 among MBBS and BDS Students in a Medical College of Nepal: A Descriptive Cross-sectional Study. *JNMA J Nepal Med Assoc*. 2021 Mar 31; 59(235):276-279.
- Chandrasinghe PC, Siriwardana RC, Kumarage SK, et al. A novel structure for online surgical undergraduate teaching during the COVID-19 pandemic. *BMC Med Educ*. 2020; 20(1):1-7.
- KHASAWNEH, R. R. Anatomy education of medical students during the COVID-19 pandemic. *Int. J. Morphol*.2021; 39(5):1264-1269.
- Iwanaga J, Loukas M, Dumont AS, Tubbs RS. A review of anatomy education during and after the COVID-19 pandemic: Revisiting traditional and modern methods to achieve future innovation. *Clin Anat*. 2021; 34(1):108-114.
- Ghosh SK. Cadaveric dissection as an educational tool for anatomical sciences in the 21st century. *AnatSci Educ*. 2017; 10(3):286-299.
- Onigbinde OA, Ajagbe AO, Oyeniran OI, Chia T. Post-COVID-19 pandemic: Standard operating procedures for gross anatomy laboratory in the new standard. *Morphologie*. 2021;105(350):196-203
- Onigbinde OA, Chia T, Oyeniran OI, Ajagbe AO. The place of cadaveric dissection in post-COVID-19 anatomy education. *Morphologie*. 2020. 15:S1286-0115(20)30125-9. doi: 10.1016/j.

morpho.2020.12.004. Epub ahead of print. PMID: 33358590.

19. Böckers A, Claassen H, Haastert-Talini K, Westermann J. Teaching anatomy under COVID-19 conditions at German universities: recommendations of the teaching commission of the anatomical society. *Ann Anat.* 2021; 234:151669.

20. Yoo H, Kim D, Lee YM, Rhyu IJ. Adaptations in Anatomy Education during COVID-19. *J Korean Med Sci.* 2021; 36(1):e13.

21. Yang C, Yang X, Yang H, Fan Y. Flipped classroom combined with human anatomy web-based learning system shows promising effects in anatomy education. *Medicine (Baltimore).* 2020; 99(46):e23096.

22. Cheng X, KaHo Lee K, Chang EY, Yang X. The “flipped

classroom” approach: Stimulating positive learning attitudes and improving mastery of histology among medical students. *AnatSci Educ.* 2017; 10(4):317-327.

23. Kugelmann D, Stratmann L, Nühlen N, Bork F, Hoffmann S, Samarbarksh G, Pferschy A, von der Heide AM, Eimannsberger A, Fallavollita P, Navab N, Waschke J. An Augmented Reality magic mirror as additive teaching device for gross anatomy. *Ann Anat.* 2018; 215:71-77.

24. Bork F, Stratmann L, Enssle S, Eck U, Navab N, Waschke J, Kugelmann D. The Benefits of an Augmented Reality Magic Mirror System for Integrated Radiology Teaching in Gross Anatomy. *AnatSci Educ.* 2019; 12(6):585-598.

### Mini Curriculum and Author’s Contribution

1. Chetan Sahni – MBBS, MD; Contribution- Study designing and questionnaire designing for the study. ORCID- 0000-0002-4301-4643

2. Dr. Deepa Devadas- M.D., Contribution- Writing the Manuscript. ORCID- 0000-0001-9392-0911

3. Dr. Amit Kumar Nayak- M.D., Contribution- Analysis of all responses of questionnaire. ORCID- 000-0002-0330-9172

4. Dr. Royana Singh- M.D., Phd., Contribution- Proof reading and editing of the Manuscript. ORCID- 0000-0002-8509-0652

Received: August 1, 2022  
Accepted: August 10, 2022

Corresponding author  
Chetan Sahni  
E-mail: chetansahni@bhu.ac.in