A cross sectional study on the online teaching strategies of gross anatomy and histology during the COVID-19 pandemic periods

Divia Paul. A[1], Manisha R. Gaikwad[2], Ranajit Das[3]

[1] *Department of Anatomy, Yenepoya Medical College, Yenepoya (Demed to be University), Deralakatte, Mangalore-575018, India*

[2] *Department of Anatomy, All India Institute of Medical Sciences Bhubaneswar – 751019 Odisha State, India*

[3] *Division of Data Analytics, Bioinformatics and Structural Biology (DABS), Yenepoya Research Centre Yenepoya (Deemed to be University) University Road, Deralakatte Mangalore, Karnataka 575018, India*

SUMMARY

The subsequent implementation of social distancing during the COVID-19 pandemic has forced universities to keep the students away from the institutions. The aim of the study was to conduct a survey through medical colleges among anatomy teachers along with an exploration of optimization of the transitions which can assist to improve the quality of online teaching. The objectives were to identify the virtual learning interventions implemented by different medical colleges in India during Covid-19 pandemic periods, and to identify suitable technological intervention for teaching anatomy from the educator's point of view. A cross sectional study was conducted by convenience sampling method. A differential rating scale questionnaire study was conducted. A hundred participants from the department of anatomy of 100 medical colleges with a minimum of 3 years of experience in teaching in the field were the samples. Faculty other than anatomy department of medical colleges was excluded. Consents were taken from each participant and participant information was shared by email.

The teachers were from both from Government and from Private Institutions. For most teachers, the biggest difficulty in implementing online teaching during the initial year of online teaching at 2020 was the unstable online teaching environments, platforms and tools (47%), followed by their unfamiliarity with online teaching techniques, platforms and tools (26%). Further, 17% had problems due to insufficient training and management of online teaching from college. This study assists to improve the design and quality of online teaching by suggesting for the change in infrastructure by arranging online portal hands-on coaching for rendering online education.

Key words: COVID-19 pandemic – Online teaching platforms – Optimization of the transitions – Nationwide survey – Technological interventions

Corresponding author:
Dr. Divia Paul. A. Assistant Professor Department of Anatomy, Yenepoya Medical College, Yenepoya (Deemed to be) University, Deralakatte, Mangalore-575018, India. Phone: +91 8075789347. E-mail: drdiviamanoj@gmail.com

INTRODUCTION

Anatomy is the subject that describes the identification as well as the concepts of the body structures of living things. Gross anatomy includes the study of major body structures by dissection and close observation of its narrowest sense, especially when concerned with the human body. Medical students do the dissection of human bodies themselves in anatomy laboratories. This is considered as the most effective method to deliver anatomical knowledge to medical students (Snelling et al., 2003). Web-based anatomy education has used various technologies, such as three-dimensional (3D) computer models (Fellner et al., 2017) but the educational worth and efficacy of these technologies remains controversial (Ghebreyesus, 2020). The subsequent implementation of social distancing during the COVID-19 pandemic has forced colleges and universities to empty their classrooms and keep the students away from the institutions (Kamenetz, 2020). Consequently, there has been a general shift from traditional face-to-face instruction to online teaching. Most institutions have switched to distance learning in the simplest and most convenient ways possible, including conferencing platforms, email, and phone (Lederman, 2020).

As we know, the achievement of online teaching depends on various technologies, including the appreciation of broadband and teaching platforms (Krenacs et al., 2010). Commonly used appreciative techniques includes synchronous live broadcasting teaching platforms, simultaneous live broadcasting software, teaching management platforms, virtual labs projects, screen capture and postproduction units and social media apps. These appreciative techniques were insufficient to meet the basic needs of online education caused medical college closures, as there were few other choices during the pandemic outbreak.

In India, as of 21 May 2020, there are 542 medical colleges recognized by the National Medical Commission (NMC). A nationwide survey among Indian professional anatomy teachers is required to assess the general situation of medical education online during the pandemic periods in India. This can provide teachers with some facts regarding effective online teaching. The aim of the study was to conduct a survey through medical colleges among anatomy teachers along with the optimization of the transitions which can assist the improvement of the quality of online teaching. The objectives were to identify the virtual learning interventions implemented by different medical colleges in India during Covid-19 pandemic periods, and to identify suitable technological intervention for teaching anatomy from the educator's point of view.

METHODOLOGY

A cross-sectional study was conducted from October 2021 to March 2022 and convenience sampling method was adopted. A differential rating scale questionnaire study was conducted. In order to get the correct representation, a multi-center study was conducted for data collection in which centers were selected by randomization from the different states of India. Based on information and queries with faculties working at different medical colleges, the researcher developed the tool for the study. Approval of the Institutional Ethics Committee of parent University, as well as prior permission from the authorized college in-charges of the concerned medical college were obtained. Informed consent was taken from each participant and participant information was shared to the concerned participants via email.

The confidentiality of the participants was maintained and they were assured that their participation and nonparticipation in the study would have no benefits. Faculties from the departments of anatomy from the medical colleges across India with teaching experience of more than 3 years were included in the study. Faculty of anatomy from different colleges other than medical colleges and faculty other than anatomy department of medical colleges were excluded. A hundred participants from 100 medical colleges with a minimum of 3 years of experience in teaching the field were the samples.

The tool consisted of 29 items on multiple choice questions type scale with open-ended answers. Questions were descriptive in nature. There were no negative statements. The items

in the questionnaires were focused on clinical medicine programs. The participants from each college were contacted previously to acquaint them with the study and to check their willingness to participate in it by personal contacting measures. Sample collection is by questionnaire method provided via Google forms and sent to the participant by link to personal email. The researcher developed demographic proforma and online teaching strategies scale based on key variables. The demographic proforma had three items including name of the medical College and university of current employment, current designation at present place of work and years of experience in teaching the field. The online teaching strategies scale based on key variables included 6 major orientations: namely principle implementation tools, mode of delivery, student-teacher interaction methods, perceptions and effectiveness, active learning, problems encountered and success rates. There were questions separately for theoretical and practical sections, which included gross anatomy and histology sections of anatomy based on key variable section.

The questionnaire adopted commonly used synchronous live broadcasting teaching platforms for the development of the tool more effectively. This includes simultaneous live broadcasting software, such as SWAYAM PRABHA (launched by MHRD under NMEICT INFLIBNET centre, Gandhinagar, Gujarat), CLOUDATOMY (Gurugram, haryana, Google suite (Google LLC, Mountain View, California, U.S.), Youtube live stream etc (Google LLC, Mountain View, California, U.S.), along with Zoom (Zoom Video Communications Inc., San Jose, CA), which is also popular in other parts of the world.

Based on various teaching management platforms, there were sections in the tool, such as Microsoft teams, (Microsoft Corporation, Redmond, Washington, U.S.), Google classroom (Google LLC, Mountain View, California, U.S.), Google Hangouts (Google LLC, Mountain View, California, U.S.), Google meet (Google LLC, Mountain View, California, U.S.),, Facetime (Apple Inc. , Cupertino, California, U.S.), etc., which are the most popular choices for anatomy teachers

working in India to upload and issue their teaching materials, which includes videos, presentations, exercises, etc. A few teaching management platforms, for example, Google Classroom and Microsoft teams, have upgraded their functions to support live broadcasting teaching.

The open free online courses and details were also used for formulating the questionnaire such as the virtual labs project (SWAYAM PRABHA) launched by MHRD under NMEICT INFLIBNET centre, Gandhinagar, Gujarat), the virtual simulation experiment teaching center: for example, 3D ORGANON VR ANATOMY(Medis Media Pty Ltd, Australia), VR Anatomy- Digital Solutions-Manipal Digital (India Partner & Distributor for 3D Organon to help you to transform Medical Education), ACTS-YEN (Yenepoya university, Mangalore) are also well- recognized on different course platforms as content providers for medical courses in India.

Screen capture and postproduction software, including Adobe premier - Adobe Inc. , San Jose, California, U.S, Adobe after effects - Adobe Inc. San Jose, California, U.S, final cut -Apple Inc., Cupertino, California, U.S. are extensively used worldwide. In addition, some social media apps, for example, WhatsApp (WhatsApp LLC (Facebook Inc.), Mountain view, California, U.S) and Telegram (Telegram FZ LLC, London, United Kingdom), also provided important knowledge about live broadcasting tools in India and helped to finalize the assessment section.

Data were collected by attached excel sheet along with the Google forms. All the 100 participants returned the answered Google questionnaire forms. The tools were pretested among 10 participants of a selected institution. The reliability of the tool was measured by using Crohnbach alpha formula. The calculated 'r' value is $0.8 > \alpha \geq 0.7$ and tool was found reliable and acceptable for assessment. Analysis of the data was done using the Statistical Package for the Social Sciences (SPSS) software package for Windows version 22.0 (SPSS Inc., Chicago, IL). This is to assess the feasibility and predictability of the tool by interpretation of data.

RESULTS

The given questionnaire was completed by faculties of various designations, ranging from lecturers, early-career Assistant Professors with three years of teaching experience to senior Professors with 25-27 years of teaching experience. The teachers were from both Government and Private Institutions. Overall, >90% teachers were used to face-to-face lectures from lecture halls before the COVID-19 pandemic set in and only ~8% teachers had experience in some sort of online teaching (Fig. 1). The scenario changed drastically during the pandemic with ~65% teachers moved to simultaneous live broadcasting where the teacher delivered the sessions live and another 24% opted for a mixed method of simultaneous broadcasting with some recorded broadcasting (Fig. 2).

For teacher and student interactions during simultaneous live broadcasting of online theoretical sessions, the majority (69%) opted for real-time voice communication on platforms such as Google Classroom and Microsoft Teams. Interestingly, only 9% teachers incorporated online assignment questions in PowerPoint presentations based on teaching management platforms. During the simultaneous live broadcasting of online theoretical sessions, 58% teachers talked most of the scheduled time and kept the last 10 minutes for clearing any doubts. However, ~34% teachers stressed more on teacher-student interactions than on pure didactic lectures. While 16% of them kept more than half of the scheduled time for the teacher-student interaction, another 18% kept little less than half of the scheduled time for the same. Unfortunately, 8% teachers did not schedule any interaction time during the simultaneous live broadcasting of online theoretical sessions.

For separate recorded broadcasting of online theoretical sessions, 25% teachers said that they opted for screen capture software to record only the slides and sound of the PowerPoint presentation, and he/she did not appear in the

Before the COVID-19 pandemic, how were the theoretical sessions (lectures) for gross anatomy and histology conducted in your Medical College?

- 90.20% Face-to-face teachings from the lecture halls
- 1.96% No experience of delivering online lectures
- 5.88% Blended teaching method followed at medical college with no experience of delivering online lectures
- 1.96% Blended teaching with a combination of online and face-to-face teaching
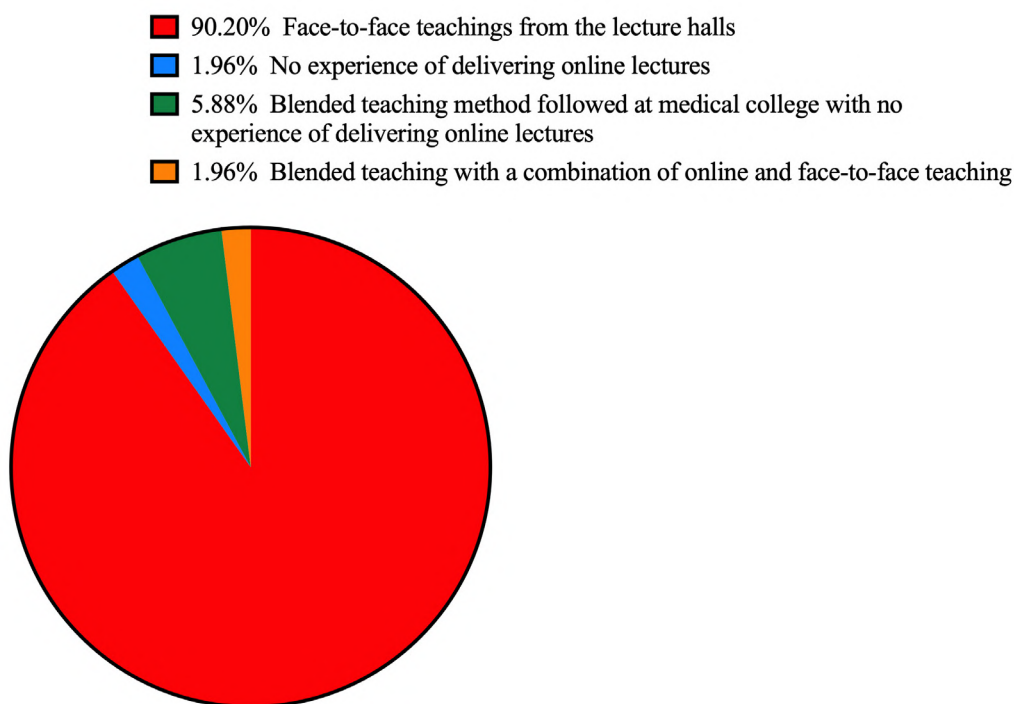

Fig. 1.- Before the Covid-19 pandemic, how were the theoretical sessions(lectures) for gross anatomy and histology conducted in your medical college. The Pie chart was plotted in GraphPad Prism v9. The plot shows that before the pandemic almost all theoretical sessions (>90%) used to be conducted on face-to-face basis.

recorded session. ~29% teachers had access to video cameras to record the session with 13% or without 16% post-production facilities.

However, 33% faculties had no experience of delivering recorded lectures. In terms of the content of the teaching materials, most of the teachers 29% kept the content the same as those for face-to-face teaching and did not change anything to suit online teaching. However, 50% o f teachers did reworking for improving the course content. While 25% of them made slight changes in the content, others completely redesigned the teaching materials to suit online teaching. Intuitively, before the COVID-19 pandemic, >90% of the practical sessions for gross anatomy and histology were conducted via face-to-face teachings from the dissection halls and histology labs.

During the COVID-19 pandemic, the format of the online practical sessions on gross anatomy and histology changed. Expectedly, ~94% medical colleges increased the use of visual media in the practical sessions. Thirty-four percent of teachers opted for simultaneous live broadcasting, where teacher delivers the sessions live for gross anatomy and histology and another 34% explored the mixed methods with some sessions by simultaneous live broadcasting and some by separate recorded broadcasting for gross anatomy and histology practical. During the COVID-19 pandemic, only 17% medical colleges employed some sort of virtual lab or virtual simulation experiments such as Swayam Prabha, 3D Organon virtual anatomy etc. for gross anatomy and histology practical sessions. Unfortunately, 83% medical colleges had no experience of delivering online practical sessions.

Similar to theoretical sessions, during the simultaneous live broadcasting of online practical sessions of gross anatomy and histology, most (44%) teachers talked most of the scheduled time and kept only the last 10 minutes for clearing any doubts. However, 43% teachers focused more on teacher-student interactions during

During the COVID-19 pandemic, what is the format of the online theoretical sessions followed for gross anatomy and histology at your Medical College?

■ 11.76% Separate recorded broadcasting where teacher records the sessions, and then uploads it to an Internet platform or disperses it to students (teacher and students engage separately).

■ 64.71% Simultaneous live broadcasting: teacher delivers the sessions live (teacher and students engage simultaneously)

■ 23.53% Mixed methods (some sessions by simultaneous live broadcasting and some by separate recorded broadcasting)
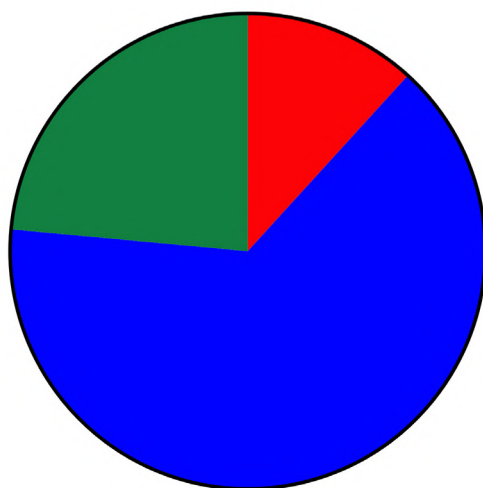

Fig. 2.- During the Covid-19 pandemic, what is the format of the online theoretical sessions followed for gross anatomy and histology at your medical college. The Pie chart was plotted in GraphPad Prism v9. The plot shows that during the pandemic almost all theoretical sessions (>88%) moved to some sort of online mode of teaching.

practical. While 20% of them kept more than half of the scheduled time for the teacher-student interaction, another 23% kept little less than half of the scheduled time for the same. Unfortunately, 12% of teachers did not schedule any interaction time during the simultaneous live broadcasting of online practical sessions, which might have impacted the holistic learning of these students.

During the COVID-19 pandemic, 26% of medical colleges implemented problem-based learning, 45% initiated an online small group discussion, 13% initiated microteaching and individualized tutoring, and 6% introduced term-based learning as means of active online learning for gross anatomy and histology. For the majority of the medical colleges (36%), the active learning program was implemented before the pandemic and has continued to be used during the pandemic. For another 16% medical colleges, some sort of active learning measure was implemented before the pandemic but was used only at selected time intervals and slots.

However, for 32% colleges it was not implemented before the pandemic and only implemented during the same. Further, during the COVID-19 pandemic, most medical colleges (42%) employed platforms for online courses to implement active learning of gross anatomy and histology. Well-known online platforms such as WhatsApp and YouTube were close second (41%) in terms of being implemented as the means of active learning.

The main pattern of online assessment at most medical colleges (73%) during the pandemic was online theory and practical tests, distantly followed by individual online assignments and seminars (12%). Interestingly, 5% of medical colleges did not have any online assessments of students while 6% of colleges employed assessment only by recording the attendance for online sessions. While for 63% of medical colleges, this online assessment was not implemented before the pandemic, 17% of colleges already implemented this, and it continued to be used during the pandemic.

Interestingly, while most teachers (55%) believe that 30-60% of learning outcomes are achieved

through online teaching, 23% believe that less than 30% of learning outcomes are achieved and 17% think that 60-80% of learning outcomes are achieved. Only 5% teachers think that 80-100% of learning outcomes are achieved. Overall, 50% of teachers are dissatisfied with the effectiveness of online learning during the COVID-19 pandemic and 38% are neutral about it. Only 13% of them are satisfied about it. According to most teachers (45%), the biggest gain from the online teaching during the COVID-19 pandemic in 2020 was the diversity of teaching methods, followed by the opportunity for developing novel teaching methods (37%) and novel contents (13%). However, in 2021, the biggest gain from the online teaching during the COVID-19 pandemic was the enhancement of interaction between teachers and students (30%) and the development of more individualized instruction (30%), closely followed by expediting the feedback process for students (27%).

For most teachers, the biggest difficulty in implementing online teaching during the initial year of online teaching at 2020 was the unstable online teaching environments, platforms and tools (47%), followed by their unfamiliarity with online teaching techniques, platforms and tools (26%). Further, 17% believe that the main problem was insufficient training and management for online teaching from college. However, for 2021 the biggest difficulty in implementing online teaching was the difficulty in grasping student progress and results of learning (46%), followed by difficulty in efficient interaction with students (36%). Further, 13% of teachers thought that it takes much longer time for preparing online teaching than traditional teaching. Given the current insufficient and inadequate infrastructure for online teaching, unsurprisingly most teachers (68%) prefer returning to traditional face-to-face classes as soon as the pandemic is over. However, 33% teachers are willing to continue some form of online teaching especially, or some theoretical classes even after the pandemic is over. Only 2% teachers want to continue to conduct both theoretical and practical classes online after COVID-19 pandemic.

DISCUSSION

The world has responded to a pandemic of contagious respiratory disease caused by a novel coronavirus, named COVID-19 by different approaches (Jernigan et al., 2020). On March 11, 2020, the World Health Organization declared the coronavirus outbreak a pandemic – i.e., the worldwide spread of a new disease (Ghebreyesus, 2020). The subsequent implementation of social distancing during the COVID-19 pandemic has forced colleges and universities to empty their classrooms and keep the students away from the institutions (Kamenetz, 2020). Consequently, there has been a general shift from traditional face-to-face instruction to online teaching (Lederman, 2020). In the present study, conducted among faculties of anatomy departments of various medical colleges in India, it was noted that though >90% teachers were used to face-to-face lectures from lecture halls before the COVID-19 pandemic set in and only ~8% teachers had experience in some sort of online teaching. The scenario changed drastically during the pandemic, with ~65% teachers moved to simultaneous live broadcasting where teachers delivered the sessions live and another 24% opted for a mixed method of simultaneous broadcasting with some recorded broadcasting. During the simultaneous live broadcasting of online theoretical sessions, 58% of teachers talked most of the scheduled time and kept the last 10 minutes for clearing any doubts. However, ~34% of teachers focused more on teacher-student interactions than on pure didactic lectures. Therefore, interspersing interactive sessions during didactic sessions may help to break the monotony if any. Most institutions, have switched to distance learning in the simplest and most convenient ways possible, including conferencing platforms, email, and phone (Lederman, 2020). As we know, the achievement of online teaching is heavily reliant on various technologies, including the appreciation of broadband and teaching platforms (Krenacs et al., 2010).

In recent years, techniques based on the internet have progressed greatly in India, producing a profound effect on education. Online teaching and learning activities are becoming popular among teaching academics and learners. India could manage to develop live broadcasting platforms and teaching management platforms, although initially there was a dependency from Chinese apps. In the present study, for teacher and student interactions during simultaneous live broadcasting of online theoretical sessions, the majority (69%) opted for real-time voice communication on platforms such as Google Classroom and Microsoft Teams. Interestingly, only 9% teachers incorporated online assignment questions in power point presentations based on teaching management platforms. Currently, technology helps for the transformation of the teaching from a "teacher-centered" approach to the "student-centered" process. Information technology used by teachers can help students improve their academic output. This is achieved by giving students more autonomy in learning (Yao et al., 2020). So, can technology further play an independent role, or even replace teachers to achieve students' completely autonomous learning? A growing number of colleges and universities have been implementing a transition from traditional face-to-face teaching methods to online teaching or a combination of online and traditional teaching (blending) (Orleans, 2014). Unfortunately, it was found in the present study that during the COVID-19 pandemic only 17% of medical colleges employed some sort of virtual lab or virtual simulation experiments such as Swayam Prabha, 3D Organon virtual anatomy, etc. for gross anatomy and histology practical sessions and 83% of medical colleges had no experience of delivering online practical sessions.

In the present study, for the majority of the medical colleges (36%), the active learning program was implemented before the pandemic and has continued to be used during the pandemic. The blended method of teaching involves replacing part of the face-to-face interaction with online instruction (Edginton and Holbrook, 2010). This means that technology is playing an increasing role, but the effective communication between teachers and students face-to-face is still indispensable and is a critical link for students' learning process. In India, well-known online platforms such as WhatsApp and

YouTube were close second (41%) in terms of being implemented as the means of active learning. Although familiarity in the software applications used by the faculties assisted them to blend with the online teaching scenarios in the present study, challenges to online education reported in the medical literature so far include issues relating to time management, use of technology tools, students' assessment, communication, and the lack of in-person interaction (Esani, 2010; Krenacs et al., 2010).

A study from United States indicated that that many teachers are attempting to transform their face-to-face teaching to an online environment of education (Hixon et al., 2012). With the advent of online teaching formats such as MOOC, and some more radical views with the help of artificial intelligence, virtual teachers can replace most of the roles of offline teachers. (Yao et al., 2020; Yu (2018) used large-scale academic monitoring data and found that the teacher-student relationship is the most essential factor that affects student performance. The results of the present study indicate that the main pattern of online assessment at most medical colleges (73%) during the pandemic was online theory and practical tests, distantly followed by individual online assignments and seminars (12%). Besides, online education may not be equitable in terms of access and the quality of teaching (Modna, 2020). Challenges to the online environment during an emergency may delay the adoption of technology-enabled education (Rajab et al., 2020). In contrast, other commentators have predicted that the COVID-19 pandemic would have a positive impact that will lead to wider acceptance of online and technology-enabled education (Krenacs et al., 2010).

Moreover, switching over to online instruction during an emergency acts as a reset button to the ailing traditional educational system (Chiasson et al., 2015). The transition to online education requires mutual support from the faculty as well as from the universities, planning such a transition. The survey indicated 80% of institutions confirmed that faculty members are being offered some support for their online courses (Lion and Stark, 2010). But the present study's scenario shows that, because of the current insufficient and inadequate infrastructure for online teaching, unsurprisingly most teachers (68%) prefer returning to traditional face-to-face classes as soon as the pandemic is over. However, 33% of teachers are willing to continue some form of online teaching especially or some theoretical classes even after the pandemic is over. Only 2% of teachers want to continue to conduct both theoretical and practical classes online after COVID-19 pandemic.

CONCLUSION

The results provided us a summary of current efforts in organizing online teaching of gross anatomy and histology teaching. This study helps to identify the problems faced by the faculty for online medical education during the pandemic periods in India. This study assists to improve the design and quality of online teaching by suggesting for the change in infrastructure by arranging online portal hands-on coa ching for rendering online education.

AUTHOR CONTRIBUTIONS

All authors hereby declare that their contribution was equal towards the formation of the manuscript.

REFERENCES

CHIASSON K, TERRAS K, SMART K (2015) Faculty perceptions of moving a face-to-face course to online instruction. *J College Teaching Learning (TLC)*, 12(3): 221-240.

EDGINTON A, HOLBROOK J (2010) A blended learning approach to teaching basic pharmacokinetics and the significance of face-to-face interaction. *Am J Pharmaceut Educ*, 74(5).

ESANI M (2010) Moving from face-to-face to online teaching. *Am Soc Clin Lab Sci*, 23(3): 187-190.

FELLNER FA, ENGEL K, KREMER C (2017) Virtual anatomy: the dissecting theatre of the future – implementation of cinematic rendering in a large 8K high-resolution projection environment. *J Biomed Sci Engineer*, 10(8): 367-375.

GHEBREYESUS TA (2020) World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19. 25 May 2020.

HIXON E, BUCKENMEYER J, BARCZYK C, FELDMAN L, ZAMOJSKI H (2012) Beyond the early adopters of online instruction: motivating the reluctant majority. *Internet Higher Educ*, 15(2): 102-107.

JERNIGAN DB, COVID C, TEAM R (2020) Update: public health response to the coronavirus disease 2019 outbreak – United States, February 24, 2020. *Morbidity and mortality weekly report*, 69(8): 216.

KAMENETZ A (2020) Panic-gogy': teaching online classes during the coronavirus pandemic. *NPR Special Series: The coronavirus crisis*.

KRENACS T, ZSAKOVICS I, MICSIK T, FONYAD L, VARGA SV, FICSOR L, MOLNAR B (2010) Digital microscopy: the upcoming revolution in histopathology teaching, diagnostics, research and quality assurance. *Microscopy: Science, Technology, Applications and Education*, 2: 965-977.

LEDERMAN D (2020) Will shift to remote teaching be boon or bane for online learning. *Inside Higher Educ*, 18.

LION RW, STARK G (2010) A glance at institutional support for faculty teaching in an online learning environment. *Educause Quarterly*, 33(3): 23-39.

MODNA Y (2020) The importance of online academic counseling meetings during the global Covid-19 pandemic to improve student confidence and academic performance: a review of outcomes.

ORLEANS M (Ed.) (2014) Cases on critical and qualitative perspectives in online higher education. IGI Global.

RAJAB MH, GAZAL AM, ALKAWI M, KUHAIL K, JABRI F, ALSHEHRI FA (2020) Eligibility of medical students to serve as principal investigator: an evidence-based approach. *Cureus*, 12(2): e7025.

SNELLING J, SAHAI A, ELLIS H (2003) Attitudes of medical and dental students to dissection. *Clin Anat*, 16(2): 165-172.

YAO J, RAO J, JIANG T, XIONG C (2020) What role should teachers play in online teaching during the Covid-19 pandemic? Evidence from China. *Sci Insight Educ Front*, 5(2): 517-524.

YU S (2018) The future role of AI teachers. *Open Educ Res*, 24(1): 16-28.

Brief outline of the methodology to be adopted

Development and description of the data collection tool
Data collection tools were the instruments used by the researcher to observe or measure the key variable in the research problem. The data collection tool used for the present study is demographic and key variable proforma which is developed to consolidate our experience in order to identify problems and further improvement the online teaching. The questions are aiming at teaching for the students of clinical medicine program.

Development of tool
The tool was developed by the researcher after reviewing the related literatures and guidance from experts and based on the research personnel experience; initially a first draft of the tool was developed. After validation, the necessary modifications will be made as per the suggestions of the experts. Thus a final draft of the tool was developed with twenty nine key variable related questionnaires which will be shared in Google forms via link.

The following consents were undertaken to prepare the tool
- Review of literature
- Consultation and discussion with experts
- Content validity of the tool
- Preparation of the final draft

The tool consists of two parts
Part I: **Section A: Baseline proforma** (3 questions coupled along with key variable questionnaire)
This section seeks the informations related to socio-demographic data of professionals.
Part ll: **Section B**: **Key Variables**
The key variables are categorised into six major orientations.
A)   Principle implementation tools
B)   Mode of delivery
C)   Student-teacher interaction methods
D)   Perceptions and effectiveness
E)   Active learning
F)   Problems encountered and success rates

<div align="center">TOOL</div>

Title of the topic: A cross sectional study on the online teaching strategies of gross anatomy and histology during the COVID-19 pandemic periods
Instruction to the participants:
You are cordially invited to take part in the research study titled above having participation duration of 20- 25 minutes. The questionnaire contains 29 questions developed in Google forms, shared via link. The questions are aiming at teaching for the students of clinical medicine program.
Description of tools: The questionnaire schedule consists of two parts

PART I: SECTION A: **Baseline proforma** (3 questions coupled along with key variable questionnaire)
This section seeks the informations related to socio-demographic data of professionals.

PART II: SECTION B: **Key Variables**
The ethical responsibilities are categorised into six major orientations. Namely,
A)   Principle implementation tools
B)   Mode of delivery
C)   Student-teacher interaction methods
D)   Perceptions and effectiveness
E)   Active learning
F)   Problems encountered and success rates
This section consists of twenty (26) multiple choice questions.

ART I: SECTION A: BASELINE PROFORMA (First 3 questions coupled along with key variable questionnaire)
Instruction to the participants:
Dear participants,
Kindly read the questions carefully, please provide your frank response, attempt all the items and place the tick **(√)** mark against the appropriate option whichever you feel suitable in the box [ ] provided against each question.
This section seeks the information's related to socio-demographic data of professionals.
CODE NO: _____

STRUCTURED QUESTIONNAIRE (Google form shared via link)
1.   **Name of the Medical College and University of your current employment (The answer to this question is for correlation analyses only, and no personal information will be disclosed) [Please fill in the space below]**...

2.   **Your Current Designation at present place of work**...

3.   **Years of experience in teaching field** ....

<div align="center">PART II: SECTION B: KEY VARIABLES</div>

MULTIPLE CHOICE QUESTIONS- 26 Questions (Google form shared via link)
4.   **Before the COVID-19 pandemic, how were the theoretical sessions (lectures) for gross anatomy and histology conducted in your Medical College?**
   a) Face-to-face teachings from the lecture halls
   b) Blended teaching with a combination of online and face-to-face teaching
   c) No experience of delivering online lectures
   d) Blended teaching method followed at medical college with no experience of delivering online lectures

5.   **During the COVID-19 pandemic, what is the format of the online theoretical sessions followed for gross anatomy and histology at your Medical College?**
   a) Simultaneous live broadcasting: teacher delivers the sessions live (teacher and students engage simultaneously)
   b) Separate recorded broadcasting where teacher records the sessions, and then uploads it to an Internet platform or disperses it to students (teacher and students engage separately).
   c) Mixed methods (some sessions by simultaneous live broadcasting and some by separate recorded broadcasting)
   d) Any Others (please elaborate)..

6.   **For simultaneous live broadcasting of online theoretical sessions, which platforms/tools does your Medical College employ?**
   a) Simultaneous live broadcasting software – If Yes, tick the appropriate
   Swayam Prabha (   ), Cloudatomy (   ), Google suite (   ), Youtube live stream (   ).
   b) Teaching management platform with Simultaneous live broadcasting capability –

If Yes, tick the appropriate
Microsoft teams (   ), Google classroom (   ), Google meet (   ), Google Hangouts (   ), Facetime (   ).
c) Social media If Yes, Tick the appropriate WhatsApp (   ), Telegram (   )
d) Any Other (please elaborate) ....

7. **For simultaneous live broadcasting of online theoretical sessions at your Medical College, how do the teacher and students interact?**
   a) Real-time voice communication (on platforms like Google Classroom (   ), Microsoft Teams (   ) or ....
   b) Real-time text communication (on platforms like Whatsapp (   ), Telegram   (   ) or...
   c) Real-time on-screen doubts via chat box, online voting or..
   d) Incorporating online assignment questions in power point presentations based on teaching management platform
   e) Organizing students into teams for online discussions (Small group discussion (SGD),   Self Directed Learning (SDL)
   f) Almost no interaction between teacher and students
   g) Any Other (please elaborate)...

8. **For simultaneous live broadcasting of online theoretical sessions at your College, how much time is used for student-teacher interaction?**
   a) More than half of the scheduled time of the classes are taken with teacher-student interaction
   b) Less than half of the scheduled time of the classes are taken with teacher-student interaction
   c) Almost no interaction between teacher and students
   d) The teacher talks most of the scheduled time and last 10 minutes is scheduled for clearing doubts

9. **For separate recorded broadcasting of online theoretical sessions, how does your College record the sessions for delivering it ?**
   a) Use a video camera to record the teacher delivering the session, without post-production
   b) Use a video camera to record the teacher delivering the session, with post-production
   c) Use a screen capture software to record only the slides and sound of the PowerPoint presentation, and the teacher does not appear in the recorded session
   d) We do not have any such experience of delivering recorded lectures
   e) Blended method of certain videos with postproduction and certain without postproduction
   f) Any Other (please elaborate) ....

10. **For separate recorded broadcasting of online theoretical sessions, what platforms/tools does your school employ for delivering the recorded session?**
    a) Simultaneous live broadcasting software – If Yes, tick the appropriate,
       Swayam Prabha (   ), Cloudatomy (   ), Google suite (   ), Youtube live stream (   ).
    b) Teaching management platform with Simultaneous live broadcasting capability –
       If Yes, tick the appropriate, Microsoft teams (   ), Google classroom (   ), Google meet (   ), Google Hangouts (   ), Facetime (   ).
    c) Social media If Yes, Tick the appropriate WhatsApp (   ), Telegram (   )
    d) Any Other (please elaborate) ....

11. **For either simultaneous live or separate recorded broadcasting of online theoretical sessions, what changes were made to the content materials? [Single choice] ***
    a) The content materials have been completely redesigned
    b) The content materials have been broken down into smaller parts
    c) The content materials have been adjusted slightly
    d) The content materials are the same as those for face-to-face teaching, and have not been changed
    e) Blended method of adjusting content materials and certain times without adjusting content materials

12. **Before the COVID-19 pandemic, how were the practical sessions for gross anatomy and histology conducted in your Medical College? [Single choice]***
    a) Face-to-face teachings from the dissection halls and histology labs
    b) Blended teaching with a combination of online and face-to-face teaching
    c) No experience of delivering online practical sessions
    d) Blended teaching method followed at medical college with no experience of delivering online practical sessions

13. **During the COVID-19 pandemic, has there been an increase in the use of visual media in the practical sessions at your Medical College? [Single choice] ***
    a) No change
    b) Yes, Increased by less than 50%
    c) Yes, Increased by more than 50%
    d) Any other ....

14. **During the COVID-19 pandemic, what is the format of the online practical sessions on gross anatomy and histology at your medical college? [Single choice] ***
    a) Simultaneous live broadcasting: teacher delivers the sessions live (teacher and students engage simultaneously) for gross anatomy and histology
    b) Separate recorded broadcasting where teacher records the sessions, and then uploads it to an Internet platform or disperses it to students for gross anatomy and histology (teacher and students engage separately).
    c) Mixed methods (some sessions by simultaneous live broadcasting and some by separate recorded broadcasting) for gross anatomy and histology
    d) Histology practical sessions were temporarily suspended and planned for the make-up sessions will be implemented when face-to-face classes resume while gross anatomy practical classes were continued by online platforms
    e) Any Other (please elaborate)..

15. **During the COVID-19 pandemic, what platforms/tools does your Medical College employ for gross anatomy and histology practical sessions? [Single choice] ***
    a) Virtual Labs Project Launched by MHRD under NMEICT (SWAYAM PRABHA)
    b) The Virtual Simulation Experiment Teaching Center (e.g 3D ORGANON VR ANATOMY)
    c) The virtual simulation experiment platform built by your Medical College (e.g ACTS-YEN)
    d) No such experience of delivering online practical sessions

16. **How much time is used for teacher-student interaction during the online gross anatomy and histology practical sessions at your medical college? [Single choice]***
    a) More than half of the scheduled time of the classes are taken with teacher-student interaction
    b) Less than half of the scheduled time of the classes are taken with teacher-student interaction
    c) Almost no interaction between teacher and students
    d) The teacher talks most of the scheduled time and last 10 minutes is scheduled for clearing doubts

17. **During the COVID-19 pandemic, what types of active online learning have been implemented for gross anatomy and histology at your Medical College? [Single choice]***
    a) Online small group discussion
    b) PBL (Problem-based learning)
    c) TBL (Team-based learning)
    d) Microteaching and Individualized tutoring
    e) Any Other (please elaborate) ....

18. **Before and during the COVID-19 pandemic, has active learning (please refer question [17] above for types of active learning) been implemented for gross anatomy and histology at your Medical College?? [Single choice]***
    a) It was implemented before and has continued to be used during the pandemic
    b) It was implemented before but were used only at selected time intervals and slots
    c) It was not implemented before but has been implemented during the pandemic
    d) It was not implemented before or during the pandemic
    e) It was implemented before but has been temporarily suspended during the pandemic

19. **During the COVID-19 pandemic, which tool was employed to implement active learning of gross anatomy and histology at your Medical College?**
    a) WhatsApp Web and YouTube
    b) Email
    c) Telephone
    d) Platforms for online courses
    e) Any Other (please elaborate) ....

20. **What is the main pattern of online assessment at your Medical College during the pandemic?**
    a) Online theory and practical tests
    b) Individual online assignments and seminars
    c) Subjective assessment by teachers after the sessions
    d) Only recording the attendance for online sessions
    e) No online assessments of students
    f) Any Other (please elaborate)..

21. **Before and during the COVID-19 pandemic, has online assessment been implemented for gross anatomy and histology at your Medical College? [Single choice]***
    a) It was implemented before and has continued to be used during the pandemic
    b) It was implemented before but were used only at selected time intervals and slots
    c) It was not implemented before but has been implemented during the pandemic
    d) It was not implemented before or during the pandemic
    e) It was implemented before but has been temporarily suspended during the pandemic

22. **How do you evaluate the extent of effectiveness of online learning performed during the pandemic? [Single choice]***
    a) Less than 30% of learning outcomes are achieved
    b) 30-60% of learning outcomes are achieved
    c) 60-80% of learning outcomes are achieved
    d) 80-100% of learning outcomes are achieved
    e) More than 100% of learning outcomes are achieved

23. **Are you satisfied with the effectiveness of online learning during the COVID-19 pandemic?**
    a) Very satisfied
    b) Satisfied
    c) Neutral
    d) Dissatisfied
    e) Very dissatisfied

24. **What is the biggest gain of your Medical College from the online teaching during the COVID-19 pandemic during initial year of online teaching at 2020?**
    a) Good opportunity for developing novel teaching methods
    b) Diversity of teaching methods
    c) Development of content materials for teaching
    d) Any Other (please elaborate)

25. **What is the biggest gain of your Medical College from the online teaching during the COVID-19 pandemic during the current year of online teaching at 2021?**
    a) Enhancement of interaction between teachers and students
    b) Expediting the feedback process for students
    c) Development of more individualized instruction
    d) Any Other (please elaborate) ....

26. **What are the biggest difficulties you have encountered in implementing online teaching during initial year of online teaching at 2020?**
    a) Insufficient training and management for online teaching from college
    b) Unstable online teaching environments, platforms and tools
    c) Unfamiliarity with online teaching technique, platforms and tools
    d) Not adapting to novel teaching concepts and methods
    e) Insufficient online teaching resources

27. **What are the biggest difficulties you have encountered in implementing online teaching during this year of online teaching at 2021?**
    a) Content materials that are not easily amenable to online teaching
    b) Difficulty in grasping student progress and results of learning
    c) Difficulty in interacting effectively with students
    d) The much longer time needed for preparing online teaching than for traditional teaching
    e) Any Other (please elaborate) ....

28. **Would you like to continue online teaching after the COVID-19 pandemic? [Single choice]***
    a) Willing to continue to conduct the theoretical sessions online
    b) Willing to continue to conduct practical sessions online
    c) Willing to continue to conduct both theoretical and practical sessions online
    d) Willing to continue to conduct some theoretical and practical sessions online
    e) Prefer returning to traditional face-to-face classes

29. **What suggestions do you have for the further development of effective online teaching of gross anatomy and histology [Please fill in the space below]**
    ....