

A Systematic Review of Online Teaching during COVID-19 Pandemic: A Lock Opened in Lockdown

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ABSTRACT

Background: The medical curriculum emphasizes learner-centeredness and small group live classroom teaching. The lockdown imposed due to the coronavirus disease-2019 (COVID-19) pandemic turned into an opportunity and medical education had to adopt an online teaching method.

Aim and objective: This systematic review aims to gain insights into the various aspects of online learning. The systematic review was done using two databases, PubMed and Web of Science. The manuscripts were analyzed on aspects like information on online platforms, choosing a platform, feedback about online learning, and assessment strategies.

Results: The online platforms used for teaching were Zoom, Google Meet, and Microsoft Teams. Google forms being popular for online assessment. Feedback about online learning in medical education suggested an overall good acceptance.

Implication: Implementing blended learning in medical education to be considered even after the COVID-19 pandemic is over.

Keywords: Coronavirus disease 19 pandemic, Medical education, Online teaching.

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INTRODUCTION

The heart and soul of medical education is traditional classroom lectures. Traditional lectures can be described as one which is delivered live, face to face, using blackboard, PowerPoint presentation (ppt), and minimal student interaction. Online lectures, on the other hand, are teaching done using digital technology. It can be described as one in which students can watch lectures at their pace or in real-time and are designed using audio along with ppt, blackboard; but with low to minimal interaction.¹

Online learning, hence, is a learning experience that can be synchronous or asynchronous and requires the necessary digital infrastructure.²

The 21st century is predominantly an era of digital information. Medical education too is evolving to keep pace and come into the mainstream of the digital generation. Integration of online learning with the medical curriculum was a need of the hour. As the proverb says "Change is the only constant", it was necessary to reform the teaching and learning methodology for medical students. This was instigated during coronavirus disease-2019 (COVID-19) pandemic.³

The COVID-19 was declared as a pandemic by the World Health Organization on March 11, 2020.^{4,5} Nationwide lockdown was imposed in India since then. Subsequently, there were academic disruptions in delivering the designed medical curricula.^{4,5} Online teaching in medical education was on the cards for a long time. Some institutes had incorporated online methods for teaching and assessment to some extent. But, this COVID-19 pandemic with ensuing lockdown has opened the lock of online teaching for many medical colleges.

The I MBBS students, especially the 2019–2020 batch, have witnessed a lot of new reforms in the curriculum. Competency-based medical education (CBME) has been implemented from this academic year. Now due to this COVID-19 pandemic, online teaching as a new mode of learning had to be implemented. Thus, restructuring of medical education befitting the 21st century was set in motion by the COVID-19 crisis.⁶

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In 1913, Dr William Osler said, "The lecture has its value, but its day has gone, and it should give place to other methods better adapted to modern conditions".⁷

The review was undertaken to understand the online platforms available, choosing an appropriate one, the assessment method used and the feedback of medical undergraduates about online learning during the COVID-19 pandemic.

MATERIALS AND METHODS

Study Design

The PRISMA guidelines were followed for preparing this systematic review.

The objective of this systematic review was to assess various aspects of online learning in medical education during the COVID-19 pandemic.

Literature Sources and Searches

The Web of Science and PubMed databases were searched for the following terms in the title and abstract: "medical education" OR "online learning" OR "online learning in medical education" "IN" OR "AND" COVID-19 pandemic.

The start date of the study was taken from the announcement of the COVID-19 pandemic in March 2020 to July 2020, as online learning was adopted by most of the medical institutes by now.

Inclusion Criteria

The participant, intervention, comparison, and outcome (PICO) search in the field of evidence-based medicine was considered for including the studies.

- Participants: medical undergraduate students.
- Interventions: online learning, including e-learning, m-learning, and learning management system (LMS).
- Comparisons: could not be performed.
- Outcomes: the methods of online teaching adopted during the COVID-19 pandemic and its continued implementation in medical education.

All types of study designs were included due to the lack of sufficient literature. The publications related to online learning during the COVID-19 pandemic included original articles, reviews, perspectives, personal viewpoints, and commentary.

Study Selection and Data Extraction

The articles were scrutinized and selected by both the reviewers after screening the titles, abstracts followed by reading the full text. Duplicate articles found in both databases were excluded manually. The results of findings in full-text articles were counter-checked by the reviewers.

Quality Assessment

The available articles were studied and the key points were discussed in detail.

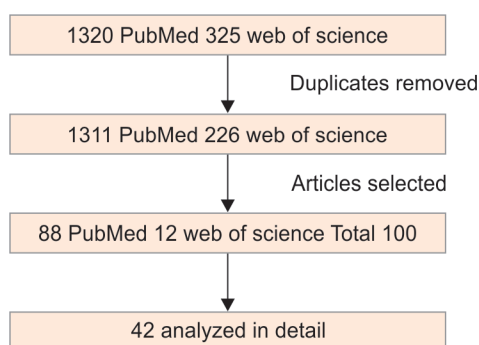
RESULTS

Search Results

The search results from PubMed yielded 1,320 and 325 from Web of Science. Duplicate articles were removed and only relevant articles were selected which came down to 88 from PubMed and 12 from Web of Science articles. A total of 100 articles were included and out of these 42 were analyzed in detail (Flowchart 1). The findings of these articles were summarized on the following crucial aspects and sub-aspects of online learning during the COVID-19 pandemic.

- Information on online platforms/learning skills—Faculty preparedness/Faculty development program and student awareness.
- Choosing the right platform—Specifications of online platforms, online learning method used in medical education.

Flowchart 1: Study sources and inclusion flow diagram



- Assessing the effectiveness of online learning—Feedback of students on the online learning experience.
- Assessment methods—Used and proposed.

Information on Online Learning Platforms/Learning Skills

- Faculty preparedness/Faculty development program (FDP).

The role of faculty was like “sage on the stage” which had to be transformed to “guide by the side”. This transition needed some facilitation for most of the faculty, as online teaching was not used till the lockdown due to the COVID-19 pandemic has compelled it to do so. The information about various online teaching platforms had to be obtained either by attending webinars or self-exploring and learning. In India, the Academy of Health Professional Educators (AHPE) conducted such webinars with hands-on training. Methods of online teaching such as synchronous and asynchronous were introduced in this webinar. The online teaching tools that were introduced were Google Classroom, the use of Zoom app, online broadcast software, use of social media to mention a few.

Synchronous learning means it occurs in real-time where teachers and students can interact. This can be achieved through videoconferencing, virtual classrooms which can mimic traditional classroom settings. Asynchronous learning, on the other hand, is student-centered and learning occurs independently of place and time.⁸ This can be done through pre-recorded lectures or by voice-over narrative with screen sharing.

To make the online teaching more interactive and to engage students, use of tools like Pear Deck, Kahoot, Edpuzzle, Socrative, Quizz, and Gosoapbox were introduced. Apart from this, the use of an LMS like Moodle was explored.

There are some acclaimed resources like The International Federation of Medical Students Association (IFMSA) (2017) and the Association of Medical Education in Europe (AMEE) (2020) which provide evidence-based technology and materials. Specific websites like “iCollaborative”, via the Association of American Medical Colleges (AAMC) (2020), and “Pivot MedEd” are designed to support medical educators’ transition to online learning during COVID-19 (Canadian Medical Education Faculty Development Network, 2020).⁹

Digital literacy of the faculty could thus be achieved for effective online teaching.^{5,10}

- Students awareness.

Generation Z students are hyper-connected to technology. They may be already familiar with some of these online learning platforms and social media.¹¹

Choosing the Right Online Teaching Method/Platform

One Size Does Not Fit All

The tools for online learning should have features serving the purpose of effective teaching and learning outcomes as well. There are various factors to be considered in choosing any particular platform.

The feature of video and/or audio streaming capability, or facility of pre-recording lecture, interactive streaming, the hardware requirements, and screen sharing are some essential points to be considered.

From an institutional point of view, the number of participants, time limit, availability of recording features, and cost are the

deciding factors. Whereas from a student’s perspective, the major consideration was the accessibility of the internet network, bandwidth for online learning.⁵

The common factors (institutional and students) were those system requirements should be minimal and should be supported by operating systems like Windows, Mac, iOS, Android, etc. The most important thing is content security.¹²

Thus, online education requires adequate infrastructure, investment, and human resources as well. Some of these requirements may be challenging in rural areas and developing countries.¹³

The access to, utilization, and receptiveness of information are the factors that can create a digital divide.

The most crucial factor above all these is that the online learning platform should justify the pedagogical approach of teaching and learning.¹⁴

Table 1 shows the information on the various videoconferencing and collaboration platforms available.

Videoconferencing is widely used as an online teaching tool during the COVID-19 pandemic. However, it cannot replace classroom teaching.

There was widespread use of one of these platforms by many medical institutes through all phases of medical undergraduates as well as for residents.¹⁵⁻¹⁷

Webinars seem to be a reliable tool that allows interaction between learners and lecturers. Platforms like Zoom and Proximie provide virtual collaboration and video communication.¹⁷

Remote emergency learning may be implemented immediately without appropriate infrastructural support. This can buy some time for proper infrastructural arrangements to be made for online learning.¹⁴

Recently, Universal Design for Learning (UDL) based on the principle of multiple means of engagement (motivation), representation (content communication) and, action and expression (demonstration and assessment of learning) has been applied in surgical education.¹⁸

Telegram is picking up steam recently as a new platform for online learning. The features of this application are ease of access, unlimited participants, unlimited sharing of files in various formats, collaborative learning, and of course security.¹⁹

The role of social media in medical education is equally popular. Tweetorial (a series of tweets on Twitter on a specific topic), Podcasts, YouTube, SketchyMedical, Picmonic, and Anki are alternative platforms available.²⁰

Table 2 shows a description of online platforms used in some medical institutes.

Assessing the Effectiveness of Online Learning—Importance of Feedback

Feedback is an important and integral component of medical education. Seeking feedback about online learning is of paramount importance to enhance teaching and learning skills. The information on the advantages, barriers, and disadvantages of online learning

Table 1: Information on various videoconferencing and collaboration platforms

Platform	No. of participants	Time limits	Chat feature	Recording	Cost	Breakout groups
Google Meet https://apps.google.com/intl/en/meet/pricing/	150	None	Yes	No	Free until July	No
Zoom https://zoom.us/pricing	100	40 minutes	Yes	Yes	Free	No
Microsoft Teams https://www.microsoft.com/en-ww/microsoft-teams/compare-microsoft-teams-options?market=af	100	60 minutes	Yes	No	Paid Free	Yes Yes
Google Hangouts https://support.google.com/hangouts/thread/34351988/video-call-participant-limits?hl=en	300 10	No None	Yes Yes	Yes No	Not free Free	Yes No
FreeConferenceCall.com https://www.freeconferencecall.com/global/in/features	1,000	6 hours	Yes	Yes	Free	No
Facebook Live https://www.facebook.com/formedia/solutions/facebook-live	No limit	4–8 hours	In comments	No	Free	No
BlueJeans https://www.airtel.in/business/enterprise-hub/marketplace/bluejeans/plans	50	2 hours	Yes	Yes	Not free	Yes
Cisco Webex meeting https://www.webex.com/pricing/index.html	50 (100 for COVID-19)	50 minutes	Yes	Yes	Free for 90 days	Yes
GoToMeeting https://www.goto.com/pricing/meeting	150	40 minutes	Yes	Yes	Not free	Yes

Table 2: Description of online platforms used in some medical institutes

<i>Authors</i>	<i>Country/state</i>	<i>Platform used</i>	<i>Method/key findings</i>
Chick et al. ²¹	Boston, MA	GoToMeeting	<ol style="list-style-type: none"> 1. Flipped classroom strategy by providing didactic material in the form of a prerecorded video lecture that they can watch during any free time 2. Created a novel closed Facebook group titled "ABSITE Daily", to provide daily practice questions 3. Academic conference <i>via</i> teleconference 4. Facilitated use of surgical videos
Roy et al. ²²	India, Kolkata, West Bengal	Zoom	Anatomy department implemented flipped classroom mode by posting study material followed by Zoom sessions
Iqbal et al. ¹⁹	Saudi Arabia	Telegram	Conducted exploratory study to understand students' perception about the utility of Telegram for online learning
Singh et al. ²³	India, Jodhpur, Rajasthan	Google Classroom coupled with GoogleMeet	For third to eighth semester students Online classes, short videos for lab procedures, and case-based clinical examination
Almarzooq et al. ²⁴	Brigham and Women's Hospital	Microsoft Teams	Poll audiences for better engagement and quicker feedback Stream and record conferences Easily share material including slides, articles, and figures
Longhurst et al. ²⁵	United Kingdom and the Republic of Ireland	"Panopto", "Zoom", "Collaborate Ultra", and "Big Blue Button"	Lecture recording Practical sessions were delivered using Digitized cadaveric or 3D virtual resources Assessment strategies used were Online digital spotters, Multiple choice questions (MCQs), Open book examination
Joseph, Joseph, Conn et al. ²⁶	Anglia Ruskin University	Zoom, BigBlueButton, and Microsoft teams YouTube videos	Podcasts, webinars, narrated presentations, synchronous small-group tutorials, asynchronous formative assessments combined with later synchronous large group feedback Laboratory work (anatomy, physiology, microbiology, and biochemistry labs) was replaced by YouTube videos Use of timed, non-invigilated examinations

can assist in overcoming and taking appropriate measures for effective improvised methods.

Feedback about the online teaching method can be obtained from the faculty and students using Google forms or interviews.

Online learning is suitable for remote learning as it is flexible, boosts self-directed learning, especially in asynchronous learning. Nevertheless, online learning is ineffective for hands-on training, hampers academic integrity as maintaining discipline, monitoring attentiveness, and misconduct during an assessment is not possible.¹⁶

Good response and acceptance of shifting to online learning during the COVID-19 pandemic were revealed in feedback from faculty and students. Faculty supported and favored inculcating online teaching, whereas blended learning post-pandemic was suggested by the students.²⁷

Physical classroom is preferred over online classes, an interesting paradox revealed in another feedback from students.

Assessment Drives Learning—The Cornerstone of Teaching and Learning

The ultimate goal of teaching and learning is that learning outcomes should be measurable. The alternative strategies for assessment during this COVID-19 pandemic are another major concern. Orientation of faculty and students to certain factors regarding online assessment is essential.²⁸

Assessment is a process to measure knowledge, skills, and attitude. It can either be formative which means the assessment

for learning and provides feedback, or summative which is the assessment of learning.

The type of assessment depends on whether synchronous or asynchronous methods are used for online learning. Assignments and portfolios can be used for assessing knowledge and skills in asynchronous methods. In the synchronous method, multiple-choice questions (MCQs), objective structured practical/clinical examination (OSPE/OSCE), online video calls for viva can be used not only to assess knowledge but skills as well.²⁹

Open book examination (OBE) via an online system can be conducted in home setup during COVID-19.³⁰

e-OSPE by combining Google Classroom and Google forms could be a novel online assessment method.³¹

Thus, online assessment should be a continuous process to monitor students learning and improve teaching by the faculty. Assessment could be self-assessment, knowledge assessment, practical assessment, or written assignment or project.¹

Formative assessment is emphasized in the new CBME curriculum. Creating a quiz using Google form seems to be a good option, as prompt feedback can be given to the students. However, conducting summative assessment in an unmonitored manner in remote settings is a major hurdle.⁵ To overcome this and avoid academic misconduct, online proctoring of exams is an emerging trend. Use of web-cam computer technology, scanning fingerprints, software for recording audio and video, even a 360° room environment scan are the features of online proctored exams. Students can be monitored and student identity can be verified as

well. E-assessment in this manner would be outcome-based in the true sense of CBME.³²

Assessment of psychomotor domain which includes performing practical may not be feasible for preclinical subjects. An alternative could be e-OSPE.

DISCUSSION

The current COVID-19 pandemic has reset the human lifestyle in the true sense. Medical education too is not exempted from this and classroom teaching was switched to online teaching.

The generational gap in online learning can be bridged by a digital literate faculty and tech-savvy students using an appropriate online platform.

The widely used and emerging online platforms are Google classroom, Zoom, Microsoft Teams, and Facebook live. Whereas, Facebook, Instagram, Telegram, Twitter, and YouTube are the most accepted social media platforms.¹¹

Asynchronous mode of online learning designed using slidecast seems to be convenient both for teachers and students. This mode is also flexible and appropriate for adult learners. Synchronous mode if made interactive is more apt to engage students and enhance learning.

The student-centered approach can thus be changed to a learner-centered approach and the students to become e-learners.³³ The role of medical teachers is being shifted to that of a facilitator and they can be newly designated as e-teacher. The COVID-19 pandemic has in a way catalyzed the transition of medical education from traditional to online learning. The classroom didactic lectures analogous to Fischer's lock and key model (of enzyme action) were taken over by the online teaching analogous to the well-accepted Koshland's induced fit theory. This implies that the medical faculty as well as the students have undergone the conformational changes to incorporate online teaching and learning as an integral mode, and ensured its effectiveness during this lockdown period of the COVID-19 pandemic. The lock of online teaching was thus opened with the key of the COVID-19 pandemic. The well-known proverb "Necessity is the mother of invention" has been apt in this COVID-19 pandemic situation, wherein online teaching platforms were explored and suitable ones were utilized.

Online teaching can be undertaken with the pedagogical approach wherein the students can learn in a flexible, self-paced manner along with interaction with teachers and other peers as well. Self-directed learning can be achieved to a greater extent.

Good teaching practices also need to be emphasized in online learning. The teaching method should be in accordance with the curriculum objective, synchronous/asynchronous mode of teaching, self-directed learning must be encouraged, and an opportunity for formative assessment should be provided.³⁴

Thus, an ongoing faculty development program, reduced emphasis on cognitive domain and increased interactivity using gamification apps, counseling for academic integrity, and proctored exams for transparent assessment can be recommended for online learning post-COVID crisis.¹⁶

The real challenge, therefore, is to keep this flame of online teaching ignited in medical education even after the COVID-19 pandemic is over and routine physical teaching resumes. Blended methods of incorporating classroom teaching with some aspects of online teaching must be supported, encouraged, and continued in medical education post-COVID-19 pandemic also. Considering social distancing norms, large group teaching can be online and

small groups can be conducted in the classroom if this situation prevails.

CONCLUSION

Coronavirus disease-2019 pandemic has influenced the healthset (change in lifestyle), mindset (classroom to online teaching), and even the heartset of medical education. Online learning should be blended with traditional methods. Feedback should be a two-way process to facilitate effective teaching-learning. Assessment drives learning is the cornerstone for any teaching methodology and should be included irrespective of the learning method used.

The endeavor to embed online learning with traditional teaching methods is essential post-pandemic otherwise online learning will be like the bridge on the river Choluteca.³⁵

By implementing online learning in medical education it can become one of the pillars of digital India.

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