**Virtual Teaching Modality - an inevitable reality in Health Education in Post-COVID era**

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INTRODUCTION

The role of virtual platforms in imparting medical education was recognized in the last decade of the previous century itself .(1,2) But, modern teachers, comfortable in the more established didactic instruction models, have been resilient to change. In recent times, traditional models have been challenged like never before, especially after humanity’s introduction to the COVID-19 pandemic.(3) While the magnitude of the problem appears impressive, a precedent can be drawn from the severe acute respiratory syndrome (SARS) epidemic in 2002, when medical schools in Hong Kong had to adapt to online problem-based learning techniques.(4) These learning environments ended up gaining immense popularity and widespread adoption in subsequent years as well.

Even before COVID-19, there was already high growth and acceptance of education technology, with global EdTech investments reaching US$18.66 billion in 2019, and the overall market for online education projected to reach $350 Billion by 2025.(5, 6) A significant surge in usage is seen in language apps,  video conferencing tools, virtual tutoring, and [online learning software](https://www.zdnet.com/article/online-learning-gets-its-moment-due-to-covid-19-pandemic-heres-how-education-will-change/), since the COVID-19. With large-scale public health efforts to prevent the spread of the novel coronavirus, traditional education systems have faced closures in over 160 countries impacting more than 1.5 billion students, with over 300 million in India itself.(7) In practice, these large numbers translate to disrupted learning as well as diminished economic opportunities for the university students. This is also reflected in the estimates of the Centre for Monitoring Indian Economy, which showed a spike in unemployment rates from 8.4% in mid-March to 23% in early April (8). The timing of the pandemic, and the consequential closure of schools and universities coincided with very crucial assessment period, cancelling or postponing many examinations, adversely impacting the graduating students who are now facing an uncertain future. The timing of the pandemic, and the consequential closure of schools and universities coincided with the assessment period, resulting in the cancellation or postponement of exit examinations.

As some institutions are now rudely forced to transform into their online avatars overnight, novel opportunities are being advertised and made available for students. While it may be too early to understand how students and teachers will cope with online learning as they figure out the kinks, it is certain that the impact of the coronavirus on education is becoming poignantly real. In normal times a move to online learning would have been in the quest to create a new and more effective methods. While some worry that the hasty nature of the transition online may have hindered this goal, others plan to make e-learning a part of their *‘new normal’*. Nevertheless, the possibility of combining the traditional and online methods, harnessing the best from both, is an exciting proposition.

Apart from the education sector, the lockdown has spawned an unprecedented use of technology to keep operations running across various other sectors, such as administration and healthcare as well. The UNICEF has suggested that governments bolster core child protection services to make sure schools remain open and active throughout the pandemic while requesting parents to ensure children’s devices have the latest software updates, including antivirus, among other things. Since physical classes are unlikely to resume in the near future, the Ministry of Human Resource Development (HRD) has been favourably advocating that online courses while making several platforms available to ensure the academic calendar doesn’t suffer much disruption from lockdown. The National Council for Educational Research and Training (NCERT) has developed a curriculum to suit the online education pattern. However, the long-term impact shall remain a subject of research in the times ahead.

Unlike the education sector, which was well-established, the Indian healthcare system was already thinly stretched, even before the pandemic, with a combination of high demand in the face of insufficient resources, with low numbers of skilled health professionals and medical educators. Educating medical professionals is the key to good clinical care. The continued medical education (MedEd) has suffered a blow amid mandatory confinement in the pandemic, raising concerns and leading medical educators to rethink options. MedEd becomes even more important in times when medical literature on the subject pours in by the minute, and guidelines change every fortnight (9). Nevertheless, the continued delivery of high-quality medical education becomes an immense challenge for medical educators while coping with escalating clinical responsibilities. The problem is further compounded in a country spanning 542 diverse medical colleges, enrolling nearly 80,000 medical students every year from dissimilar backgrounds (10).

The current paper reviews the origin and growth of online, virtual teaching-learning platforms in medical and health education over the last three decades, suggesting that online-teaching has come. We have explored the existent online MedEd-delivery models and evaluated the preparedness of archetypal Indian instruction systems as well as the challenges that lie ahead.

METHODS

A PubMed search using the keywords online, virtual, medical, health, teaching, and learning combined using operators *or* and *and*, appearing in the title of articles published in English, conducted in May 2020 reveals 216 published articles on this subject. A quick screen of titles allowed us to shortlist 42 items for further evaluation. Additional material was curated from Google search using the same keywords and another articles were added. The present write up presents our understanding of the transformation towards online education-delivery models that we are currently witnessing.

DISCUSSION

While online education delivery platforms were being explored by leading universities worldwide, even before the COVID-19 pandemic, other institutions and colleges have been forced to adopt them in varying proportions lately.

The World Bank Group published a report delineating several measures taken by educational institutions to counter the disruption in traditional classroom teaching. (11) These include video-conferencing, employing mobile-based methods, using curated content, setting-up help modules, and, most importantly, improved communication with all stakeholders.

On similar lines, the National Program for Technology Enhanced Learning (NPTEL) was initiated by the Ministry of Human Resource Development of the Government of India as early as 2003 in association with the Indian Institutes of Technology (IIT) and the Indian Institute of Science (IISc). (12) NPTEL started offering open online courses in 2014, which were certified by the IIT and IISc. Programs have recently been initiated with medical content creation coordinators using the NPTEL and Swayam platforms. Lamentably, the adoption of similar models in medical education has been slow.

*The impact of COVID-19 pandemic on teaching and learning activities in leading global universities (information obtained from the institution’s official website)*

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| --- | --- | --- | --- |
|  | **Pre-COVID** | **COVID** | **Remarks** |
| Harvard University, Boston, USA | 50 undergraduate, 134 graduate and 32 professional degrees were offered both online and off campus. | Curated websites to Learn, Teach, Work, Research and Socialize Remotely | The dedicated website is a one-step solution to the problems of e learning. Inclusion of research activities will especially ensure continued higher education |
| Cambridge University, UK | Traditionally a university that takes pride in rich campus life it offers, with small and focused group teaching at the heart of their education | Working in collaboration with the ministry of education, to scale up online teaching by organizing online activities. | Online education to be continued in the next academic year as well. |
| Karolinska Institute, Sweden | Campus based education with a lot of online resources for students, and wide range of lab services for research | While theoretical teaching and examinations are to be done remotely using digital means, practical training continues on campus after due approval of concerned faculty | The country’s decision to not impose lockdown and resolve to issuing strict advisories on social distancing has allowed the pre COVID era education to sustain up to a large extent |
| Peking University, China | MOOK courses, and free courses on EdX and Coursera in addition to on campus teaching |  |  |
| Indian Institute of Technology | In addition to on campus teaching, online courses for student aid and certification were available on NPTEL platform. | Operations have entirely shifted online, with only crucial research activities being conducted offline which require lab facilities. Online lectures conducted by using application based on synchronous learning. | IITs were already extensively invested in online teaching and are well versed with technology. The functions are especially smooth as both the faculty and students are comfortable with technology employed in online mode. |
| Indian Institute of Management | On campus, case study and project work centered education which incorporated extensive hands on experience | From online convocation to introduction of ePG program, which are a hybrid of online, classroom and project work-based learning to online admissions, the entire operations seem to have shifted online | The IIMs have gone one step ahead by introducing ePG courses, accepting the online mode as an integral part of future of education |
| Indian Institute of Science, Bangalore | Rich campus education involving research work and small group teaching | Curated a website to publish innovations and research work related to COVID. Teaching by video conferencing and recorded lectures. | Since the institute was facing difficulty in continuing the research work, which is core of their education system, thus they focused on solving this problem first. |
| All India Institute of Medical Sciences, Delhi | Premier academic, training and research institute that mostly had on campus education and training facilities | Teaching learning for UG students has been continued in online mode. But PG students have continued to serve as frontline workers in the pandemic, their education almost coming to a halt. The training activities of the institute have been continued by means of prerecorded videos | The COVID National Teleconsultation center and COVID mental health helpline are services that should be sustained. |
| Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh | Being a post graduate training and research institute, it had compulsory off campus residential degree courses. With some part-time certification courses available as well. | The creation of PGIMER COVID 19 portal will continue the medical training of health care workers |  |
| Johns Hopkins University, Baltimore, USA | Dozens of online masters and certification courses were offered. Already had partnership with Coursera. This was in addition to on campus courses | No data available until May 2020 |  |

It is noteworthy that the various leading universities have increased ongoing research on pandemic (Table 1). Besides, they have used the official university websites to disseminate information about various aspects of the disease. While most of these universities were earlier either offering additional certification courses online or providing some online resource material for students enrolled in the on-campus degree courses, now virtual teaching modality has become an integral part.

*Unique challenges for the Indian Medical Education System*

Over the ages, the Indian education system has firmly held on to its traditional roots, epitomizing the guru-shishya culture. Although the methods have evolved over time, the inherent hierarchical arrangement has been closely guarded. India’s attachment to the conservative thought is reflected in its government’s decision to open market to online education for the top 100 universities in the National ranking framework (NRF), but barring medical courses entirely out of it (13).

However, this approach has come under severe strain in recent times. The lockdown has resulted not only in unforeseen delays in exit examinations but has also disrupted new intake while reducing the process to a *virtual* trickle. Considering the value of practical bedside clinical teaching, it would not be surprising if graduating students perform poorly and lack competency in patient care skills.

Unlike ever before, the greater need for trained medical personnel has led to an even more significant impact of disrupted medical education. The Indian healthcare system had already been struggling with a 1:1445 doctor to patient ratio that was far from the ideal 1:1000, as suggested by the World Health Organization (14). With the arrival of the pandemic, this problem has been compounded further by infecting the first-line responders, forcing them into isolation and their contacts into quarantine. The juxtaposition of a crippled medical education system in these demanding times will have a destructive consequence on not only the present but also future of the Indian healthcare system unless we rapidly understand the need and adapt rapidly to adopt an alternative mode of training in the virtual space. Fortunately, some Indian institutions have taken virtual leaps in the last few weeks.

As the Indian medical education system advances with baby steps towards virtual platforms, an important consideration is to evaluate if this is merely an adaptive response to the situation, or is this change here to stay. Conservatively, MedEd has been viewed more as a “practical, skill-oriented learning” to be mastered bedside, than a course pursued over a gadget from a distance. While the focus on the importance of hands-on experience for quality medical care is not misplaced, it may be possible to view the medical curriculum into two parts – the patient care skills and theory-based knowledge. While the traditional bedside method works best for the former, e-learning might be a better solution for the latter. Furthermore, the introduction of virtual reality and simulation programs can obviate the need for the live human patient for a lot, if not all, clinical skills. In fact, the success of simulation programs to teach the effects of the autonomic nervous system on animal tissue to undergraduate medical students has already been reported (15). While the reach of these simulations is potentially superior to the traditional classroom teaching, such programs' availability remains a limiting factor in their impact. Whether online medical degrees can be accepted or not is a question that can wait. The issue of compulsory inclusion of e-learning methods in the course of medical degree needs an answer now. Perhaps the first step is understanding what part of medical curriculum can be efficiently taken up in online mode of learning.

It is interesting to note that while for the Indian medical colleges, a shift from classroom chalk-talk to webinars and online quizzes feels like a sudden shift, the Indian medical student is not all that new to this form of learning. The enrolment in various private coaching institutes like Delhi Academy of Medical Sciences (DAMS) and Dr Bhatia Medical institute, subscription to mobile/web-based applications like *Marrow* and *Prep ladder,* and a plethora of YouTube channels available online have already exposed students to various forms of online learning (16-19). Swayam, the online portal of Government of India, has made a basic course in Biomedical Research compulsory for all the postgraduate students in the previous year. Even earlier, the Swayam portal has offered a variety of massive open online courses (MOOC) certified by the Indian Council of Medical Research (ICMR) or by Revised National Tuberculosis Control Program (RNTCP), among others. Furthermore, the revised curriculum of the undergraduate medical program, initiated in 2019, incorporates a learner-centred Self-Directed Learning (SDL) approach, in which the student is encouraged to decide how and what he should study. Therefore, with the pattern of internet services consumption by the next generation student, it is logical to assume that SDL anyway would have had a large share of the internet-driven online teaching-learning process. Moreover, the trend of students posting educational videos on social media and student organizations conducting webinars and panel discussions in the virtual space further indicates that the Indian student is ready to move on.

*Strengths and limitations of online learning*

Despite the inevitable need and rapid acceptability of online teaching among Indian students it is prudent to weigh the pros and cons of the new modalities.

An online student-centric, user-driven education system has the potential to kick-start innovation in the recipient mind. It has been interesting to note that in the short time, learning consortiums have shaped new coalitions with diverse stakeholders (including governments, publishers, educators, technology providers and telecom network operators), all coming together to utilize digital platforms as solutions. The teaching expertise in institutions coupled with seamless service delivery of these platforms heralds an inevitable revolution. Available on-demand, online platforms offer not only greater flexibility of time and location over the traditional classrooms, but also offers more teaching opportunities and diverse teaching experiences. Further, the online model allows greater ease in sharing and accessing information. Moreover, they offer the possibility of improved engagement and ongoing assessment which translates into better note-taking, less distractions and improved retention. (20-21) Finally, the Open University in UK has shown that online courses conserve energy with 85% fewer carbon-dioxide emissions per student (22).

While the online education platforms are indeed promising, it is also important to view the flip side of the coin especially in an Indian context. The quality of learning is in-turn dependent on that of the digital access. It has been reported that 95% students in Switzerland, Norway and Austria have a personal computer, this proportion is only 34% in Indonesia and even lower in other developing countries (23). More than half of the total students may not have access to online learning facilities. Students without reliable access to internet and technology would struggle to leap over the widening digital learning divide. (24) An academic institution is not just limited to imparting of instruction, but plays an important role in developing individual personality, building relationships and networks in the real world. Online *virtual* lacks the offline *real-world* touch. Additionally, the threat of predatory individuals stalking gullible minds and security concerns involved with online meeting platforms cannot be ignored in the unsupervised virtual world (25). Furthermore, the impact of online learning and the resulting increase in screen time in isolation would impact students in unforeseen patterns, often compromising on discipline and punctuality, and resulting in overall poorer mental health.

Moreover, the need for teachers to be available ‘*online’* and accessible to respond to student queries in addition to the significant inputs required in terms of learning new technology can be draining. Technical glitches deserve their own mention, because when they occur, they can have an immediate demoralizing impact on both teachers and students (9). For effective online teaching in professional institutions, a dedicated back-end technical team becomes essential.

To circumvent some of these problems, the Indian government is already using the age-old All India Radio (AIR) for effective communication. The Ministry of Human Resource Development is collaborating with the Ministry of Information & Broadcasting to air Swayam Prabha channels on direct to home (DTH) platforms to address the digital divide. Swayam Prabha is a bouquet of educational channels run by the government, covering disciplines such as arts, science, commerce, performing arts, social sciences, and humanities, besides engineering, technology, law, medicine, agriculture, etc. They cater to school as well as college students. There has been a surge in the viewership of the online and increased downloads on *DIKSHA*, a government-run platform for students and teachers to access educational content.

*Comparing some online teaching and learning platforms*

Online Teaching-learning platforms could be synchronous or asynchronous. Synchronous learning is the most popular learning method; it most closely mimics a classroom lecture. All participants interact in a virtual space at the same time although they may be physically situated at distant locales, enabling real-time communication and promoting interaction. On the other hand, an asynchronous model is a student-centred platform that helps on-demand self-paced learning, where lecturers are uploaded on the online platform, which can be accessed at any time but lacks real-time communication. (Illustrated in Table 2)

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| --- | --- | --- |
|  | **Synchronous Online Learning** | **Asynchronous Online Learning** |
| Principle | Group of students participate in a learning experience at the same time. | Group of students participate at a different time |
| Real time communication | Yes | No |
| Student-teacher interaction | Yes | Maybe |
| Peer interaction | Yes | Maybe |
| Social isolation | No | Yes |
| Self-paced learning | No | Yes |
| Examples | Webinar Jam  GotoWebinar  Webex Meet  Zoom Cloud | Udemy  Coursera  Google Classroom |

Since professional courses mainly rely on interactive classroom teaching, Synchronous online learning may be the most preferred option. Furthermore, platforms such as Youtube and Facebook, which were used earlier for entertainment purposes are being used to impart education by uploading pre-recorded lecture or doing a live stream. Companies all across the world have developed various applications providing this facility. These applications differ in cost, and user interface number of participants, program layout, and other unique features. In the table given below we compare the most basic plan available on the company’s website. (Illustrated in Table3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **WebinarJam** | **GotoWebinar** | **Zoom** | **Webex Meet** |
| Cost | 41$/month | 89$/month | 59$/month/host | 39$/month |
| No. of Participants | 2,000 | 100 | 10,000 | 200 |
| Mobile application | Yes | Yes | Yes | Yes |
| Polling feature | No | Yes | Yes | No |
| Unique feature | Automatically records all meetings, can be mailed to all participates latter | Pre-recorded webinars can be uploaded | Allows live broadcasting on Facebook and YouTube. | Provides follow up analytics on audience participation. |
| User interface |  |  |  |  |

CONCLUSION

It seems likely that the COVID-19 pandemic is here to stay, and physical distancing protocols may be in place for longer than we currently anticipate. As the virus finds new susceptible hosts, medical students may soon be pressed into active patient-care duties. The need for online training platforms to rapidly augment the primary care workforce assumes broader importance in these times. Moreover, the young student generation is ready, and various platforms available for the teachers to tinker with technology. Nevertheless, a wise and judicious approach while moving forwards is prudent; lest the established good of the old is sacrificed in favour of the charm for the new. The educational learning environment is the sum of personal attributes, social factors, an evolving curriculum, and a physical/virtual space which needs to be balanced as we walk the tight-rope of skill development over the gorge of the current pandemic.

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