Original Article

Effectiveness of exclusive E-learning during COVID-19 in a medical school in India – A student perspective

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Abstract

Purpose: India went into lockdown due to the COVID-19 pandemic which led to the closure of all the educational institutes. We had to adapt to the new system of complete online teaching and learning in a short span of time. The present study aimed to evaluate the effectiveness of exclusive E-learning during the present COVID-19 pandemic through student feedback.

Methods: A 21-item validated questionnaire on three independent elements – technology and resources (6 questions), content and design (7 questions) and opinion on E-learning (8 questions) – was designed to evaluate the effectiveness of the E-learning programme. The questionnaire was e-mailed to 400 students across the four batches out of which 227 responded.

Results: E-learning design was thought to be vital for attracting users by 74.2% though 83.8% opined that E-learning needs self-motivation and 81.9% felt that it needs more commitment when compared to conventional teaching and learning. Several (36.7%) perceived that they could not correlate the lectures without clinical or practical training; however, 60.3% felt that abstract concepts were well explained with images. Despite 69.6% of the participants having access to a dependable computer or laptop, only 55.5% had uninterrupted internet access. The mean effectiveness of E-learning was significantly lower for the final year (69.9 $\pm$ 9.48) when compared to 1st-year (75.1 $\pm$ 11.33) and 2nd-year (76.7 $\pm$ 10.15) medical students.

Conclusions: The students rapidly adapted to exclusive E-learning, but it was seen that it only has a complementary role and it is perceived as less effective when compared to traditional teaching.

Keywords: COVID-19, E-learning, medical education

INTRODUCTION

In February 2020, the the World Health Organization (WHO) declared severe acute respiratory syndrome coronavirus 2 disease (COVID-19) a global health emergency.[1] On 24th March 2020, as India went into lockdown, all the medical institutions had no option but to deliver the second half of the academic year virtually.

In the academic year 2019–2020, the medical education curriculum in India has undergone huge changes with the

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introduction of competency-based medical education. This has transformed medical education from a traditional method to a more learner-centred approach by reducing the didactic lectures, introducing integrated learning, promoting self-directed learning, problem-based and team-based learning. These curricular changes have made it even more challenging to plan a well-structured and distant mode of education. The uncertainty and complexity of the present situation, the transformation of the content to an online format and adaptation to technology by the unacquainted faculty and students in a very short time were the other major challenges.

The imperativeness to execute E-learning classes was no longer an option. This situation presented us with an opportunity to reconstruct and re-evaluate medical education and update our teaching practices tailoring them to the tech-savvy newer generation learners and maximise student learning outcomes. We had a plan in progress to restructure the curriculum content, train the faculty and students and provide the required infrastructure and support system as the way forward. While E-learning has been used in medical education for a very long time, it was never the only method of content delivery across the basic sciences and clinical years.

E-learning was not the primary form of education in medical colleges in India before the pandemic. E-learning has its own set of advantages and disadvantages. While continuity of education during pandemic, flexibility of time and location are some of the advantages, availability of resources such as laptops, computers, reliable and uninterrupted access to the internet, technological factors, distractions and lack of interaction are some of the disadvantages of E-learning.[2] Understanding the perspective of the students is very important in maximising the potential benefits of the programme and the potential of exclusive E-learning on the learning, learner's behaviour and their learning outcomes.

Most medical schools in developing countries still believe in traditional classroom teaching and bedside teaching as a way of teaching–learning.[3,4] The data on the effectiveness of E-learning during the pandemic are mixed.[5-7] For this reason, the study aims to evaluate the effectiveness of exclusive E-learning during the present COVID-19 pandemic through student feedback.

MATERIAL AND METHODS

A questionnaire-based cross-sectional study was done at Apollo Medical College, Hyderabad during November 2020

to January 2021. Institutional Ethics Committee approval was obtained to conduct this research.

The 4th-year undergraduate course (MBBS) at Apollo Institute of Medical Sciences and Research has nine semesters – 1st year (2 semesters), 2nd year (3 semesters), 3rd year (2 semesters) and 4th year (2 semesters). The 400 students were taught by 92 faculties during the pandemic. Teaching was conducted via E-connect using software such as Google classroom™, big marker, free conference call. IT infrastructure and software preferred by faculty were provided to students and faculty for effective delivery and troubleshooting. Each session comprised 45 min of synchronous E-learning followed by 15 min of interactive discussion.

The questionnaire was designed with 30 questions under the elements technology and resources, content and design and opinion on E-learning. The three elements are independent variables. The reliability and validity of the questionnaire were done on a group of four senior faculties. The reliability was tested using an internal consistency test (with a Cronbach's alpha coefficient) which was 0.86 and validated by the Kaiser-Meyer-Olkin (KMO) and Bartlett's test. A KMO value around 1 is considered good and value of 0.6 as acceptable. Questions with KMO values lower than 0.5 are dropped from the analysis.

A 21-item validated questionnaire was used to collect data. The questions under three elements are technology and resources (six), content and design (seven) and opinion on E-learning (eight). The questions in each element are graded on a 5-point Likert scale: 1 - strongly disagree, 2 - disagree, 3 - somewhat agree, 4 - agree and 5 - strongly agree.

The above questionnaire was made into an electronic questionnaire through Google Forms™ and sent to all the students via E-mail and Whatsapp™. Those willing to participate answered the questions/took the survey. The questionnaire is designed in a way to ensure all the questions are answered.

Statistical analysis

The values for each response under the elements are expressed as percentages of agreed (combining the strongly agreed and agreed), neutral and disagreed (combining the strongly disagreed and disagreed). Mean and standard deviation values were calculated for continuous variables such as score of elements and total score, and proportions were calculated for categorical variables. 95% confidence intervals were calculated for both continuous and

categorical variables. Each question is scored individually as well as total in groups. Level of significance was considered as 0.05. IBM SPSS windows version 24.0 (SPSS Inc, Chicago, Illinois, USA) was used for statistical analysis.

RESULTS

Of the 400 participants, 227 responded (36, 67, 64, 60 from 1st, 2nd, 3rd and 4th year, respectively) and sent in their responses to the questionnaire (56.5%).[8]

Table 1 shows that 79.25% of the participants disagreed that the design allows face-to-face interaction with the faculty, though 74.2% believed that design is important for attracting users. 64% agreed that presentation of the content was clear and concise, and 60.3% felt that usage of images and illustrations was used while explaining abstract concepts. However, 14.5%–25% were neutral on all the seven questions.

Table 2 shows that despite 69.6% of the participants had the access to dependable computer or laptop, only 55.5% of the students had uninterrupted internet access. Strangely, 7.1% of the participants stayed neutral on access to dependable computers or laptops which maybe because they did not always have an access and had shared resources with other family members. A larger group (64.5%) had been trained with E-learning programmes previously and has acquired basic computer skills. However, only 50.4% of the respondents felt that E-learning tools were user friendly, understandable and clear.

Table 3 shows that 83.6% of the students had been convinced that E-learning needs a lot of motivation and commitment (81.9%) when compared to conventional learning. 50.7% were opined that E-learning stimulates self-directed learning and 44.5% agreed that it can improve quality of learning while 42.7% stayed neutral. Further, despite 23.3% of the participants had no access

Table 1: Likert scale response of 227 participants to the seven questions under the Element I - content (4) and design (3)

Element I	Agreed (%)	Neutral (%)	Disagreed (%)
Content			
Could correlate the content of the lectures in the absence of dissection/practical's/clinical	40.6	22.7	36.7
Content is presented in clear and concise way	64.0	14.2	21.8
Abstract concepts were explained with images, illustrations, *etc*.	60.3	25.0	14.7
Content meets your learning requirements	56.0	20.2	23.8
Design			
Design allows face-to-face interaction with the faculty	6.2	14.6	79.2
Design provides support and feedback	46.9	21.8	31.3
Design is important for attracting users	74.2	15.6	10.2

Values expressed as percentages

Table 2: Likert scale of 227 participants to the six questions under the Element II - technology readiness and availability of resources

Element II	Agreed (%)	Neutral (%)	Disagreed (%)
Technology readiness			
Tools are clear, understandable and user-friendly	50.4	24.8	24.8
Previously attended E-learning training programme and have acquired technical skills	64.5	20.8	14.7
Prior experience of using E-books, E-journals	46.7	28.6	24.7
Previously used online educational courses	34.0	37.2	28.8
Resource availability			
Have good band width with uninterrupted Internet access	55.5	17.6	26.9
Have access to a dependable computer/laptop	69.6	7.1	23.3

Values are expressed as percentages

Table 3: Likert scale response of 227 participants to the eight questions under the Element III - opinion on E-learning among medical students

Element III-opinion	Agreed (%)	Neutral (%)	Disagreed (%)
Technology is the critical readiness factor	73.9	21.7	4.4
It stimulates self-directed learning	50.7	32.9	16.4
It increases productivity	23.5	42.7	33.8
Plays a complementary role in medical curriculum	33.6	48.2	18.2
It can improve quality of learning	44.5	37.3	18.2
It is more effective than conventional learning	14.3	24.1	61.6
Needs more commitment than conventional learning	81.9	14.5	3.6
It needs a lot of self-motivation and concentration than conventional	83.6	11.1	5.3

Values are expressed as percentages

to dependable computer or laptop (Table 2), 73.9% were of the opinion that technology is the readiness factor for E-learning. Strangely, 48.2% had stayed neutral on whether the E-learning plays a complementary role in medical education.

Each positive statement was given a score of 3 for 'strongly agree and agree', 2 for 'neutral' 1 for 'disagree and strongly disagree'. The maximum score calculated for each element was content and design (21), opinion on e-learning (24) and technology and resources respondents scoring (18) separately, and a total score (63) for all the three elements was calculated; percentages and mean scores were arrived for each element and total for all the three elements.

Likert scale response of 227 participants as per the academic year is shown in Table 4. Mean scores were compared across academic years by one-way ANOVA with *post hoc* test of least significance difference method. When the mean values of the different elements were compared across the batch year of students, a significant difference among the batches of students with the 4th-year students perceiving it significantly ($P < 0.05$) less effectively (66.4 ± 13.48) than the 1st- and 2nd-year students (74.0 ± 15.79 and 74.0 ± 14.90, respectively). It could be due to the fact that clinical exposure is much more important for the 3rd- and 4th-year students which is lacking during COVID-19 pandemic.

The means scores were similar for technology and access to resources and opinion on E-learning across batches ($P > 0.05$). However, there was a trend across the batches for overall mean scores. The response rate was 60 and above for all years, except the 1st-year students who are new to the educational system.

Relationships of three elements were assessed by Pearson's correlation coefficient and it was statistically significant ($P < 0.001$). It was used to assess the relationship between the continuous variables. Correlation between content and design with technology

readiness and availability of resources is 0.400 and opinion is 0.614. Similarly, the relationship between technology readiness and availability of resources and opinion is 0.470.

DISCUSSION

This study shows encouraging results, elucidating that most students were inclined to adopt E-learning provided they have reliable, uninterrupted access to the internet. Even though the students were satisfied with E-learning content and design, they felt that conventional methods than E-learning could better implement the curriculum– learning and complete E-learning will not meet their learning requirements.

The study showed that 79.2% of the students felt that it lacks face-to-face interaction with the faculty, though the sessions allow for virtual interaction with faculty. The learning process encompasses interaction and collaboration between learners, teachers and peers. Central to this is the face-to-face feedback and discussion with the lecturers during conventional teaching, enhancing students' self-efficacy, motivation and competence.[9] It cannot be replaced entirely with online interaction such as chats or virtual group discussions. Similar results are reported from a study in India, where 50% of the students preferred physical classroom rather than E-classroom during the current pandemic.[10,11]

Most students believed that they could not correlate the theory topics taught via E-learning, despite live virtual anatomy dissections, small group discussions, visual demonstration of procedures, case-based discussions, student seminars and flipped classrooms done at our institute. However, 60.3% of the students noticed that abstract concepts were taught effectively during practical sessions and group discussions. This lack of correlation indicates that, however good the content design is, E-learning cannot entirely replace bedside teaching, dissection and practical sessions. Though the content was

Table 4: Likert scale response of 227 participants as per the academic year

Academic year	Number of participants	Element-I (content and design)	Element-II (technology readiness and availability of resources)	Element-III (opinion)	Total
4th year	60	66.4±13.48*	71.0±16.69	71.3±10.12	69.9±9.48
3rd year	64	69.8±18.28*	73.3±19.80	75.0±13.93	73.0±14.78
2nd year	67	74.9±14.59*	78.5±14.52	76.9±11.54	76.7±10.15
1st year	36	74.0±14.90*	76.5±14.32	74.7±12.09	75.1±11.33
All	227	71.0±15.79	74.7±16.88	74.6±12.12	73.6±11.90
P-value		0.012	0.67	0.72	0.10

Values are expressed as Mean±SD

*4th-year students perceived it significantly (*P* < 0.05) less effectively than the 1st- and 2nd-year students

SD=Standard deviation

well planned and executed using the most interactive online platforms, students perceived that lack of face-to-face classroom or bedside Interaction with faculty was a limiting factor.[12] This is cited as one of the significant reasons for student dissatisfaction with E-learning. It lacks faculty support in understanding difficult topics and providing feedback.[13,14] Studies show that E-learning might not be very suitable for specific content or certain subjects that require more practical demonstration or communication.[15] Similar results were not seen pre-COVID as the entire curriculum and learning experience was offline.[16]

The majority of the students (73.9%) felt that technology is the key to virtual education. The resources available online might not be used to its full potential if there are technical issues. Readiness in adapting to technology is an essential factor in implementing an effective E-learning system.[17]

Only 55% of the students had reliable and uninterrupted access to the internet. Although there are an observable surge and adoption in online education globally and rapid transition to E-learning in many universities, there is a considerable gap between the urban and rural regions in terms of reliable and uninterrupted internet access. This could be a barrier to the usage of E-learning as a method of delivery during these times. These results are consistent with other studies that show that issues with accessibility to the internet and limitations in the speed and bandwidth can decrease the effectiveness of E-learning, especially in developing countries. [18-20] Unfortunately, the questionnaire did not identify the problems related to reliable internet access.

Although the millennial generation is very tech-savvy, internet usage for online education, courses and the library has been slightly lower. Technological awareness, access and training on using contemporary E-libraries are the most critical factors in adaptation and acceptance of E-learning. Student's training to effectively use E-libraries including E-journals, E-books, evidence-based articles and research databases facilitate self-directed learning.[21-23]

E-learning requires a certain degree of commitment than conventional teaching. Most of the students felt that E-learning's role is complementary, and specific lectures can be replaced with E-learning, paving the way forward for a blended approach in the future. Blended learning is increasingly being accepted in many of the universities since it offers the best of both worlds.[24]

Factors such as low motivation and higher distractions might stem from high levels of anxiety and stress due to COVID-19, low self-efficacy and poor engagement between learners and facilitators. 44.5% have agreed that technology could decrease quality of learning. Only 23.5% were opined that it increases productivity and impacts their professional learning goals.[15,25]

Consistent with other studies were our results showing that the hospital's patient pool and elective surgeries conducted during the pandemic had come down by 30%. The practical training, even with virtual telemedicine consults, has decreased.[26] The negative perception of E-learning during COVID-19 may have been the primary reason.[27] These results show statistical significance across the student's academic year. The 4th-year and 3rd-year students, whose crux of learning is clinical and practical training, were less satisfied with E-learning than the 1st- and 2nd-year students.

Several studies have shown that E-learning is comparable or slightly better than traditional learning in terms of knowledge, skills acquired and student satisfaction.[28,29] Similar studies done in India during COVID-19 pandemic shows that students perceived E-learning as less significant when compared to traditional learning.[30]

The distinct advantage of E-learning is that it ensures continuity of education during these unprecedented social distancing times and uncertainty when the educational institutions will resume teaching.

E-learning is being rapidly adopted and has been a successful transition in many Institutes during this pandemic. Our students have earnestly adopted and moved beyond the conventional method to keep their academics continued. However, in the medical field, social interaction and communication between peers, teacher–student and doctor–patient are crucial and cannot be compromised. Our students perceive that E-learning limits this face-to-face interaction and fails to meet their learning needs, particularly clinical skills, which can only be acquired by demonstrations and practice. Although E-learning provides flexibility and convenience, the feeling of isolation and various distractions reduce its effectiveness.

On the other hand, the content has to be more effective, customised and should meet every individual requirement to ensure a successful E-learning module. The majority of our students believe that E-learning cannot wholly replace conventional classroom/bedside learning (conventional module); however, a blended module would significantly benefit the end-users (i.e., students).

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. Acta Biomed 2020;91:157-60.
2. Dhawan S. Online learning: A panacea in the time of COVID-19 Crisis. J Educ Technol Syst 2020;49:5-22.
3. Singh HK, Joshi A, Malepati RN, Najeeb S, Balakrishna P, Pannerselvam NK, *et al*. A survey of E-learning methods in nursing and medical education during COVID-19 pandemic in India. Nurse Educ Today 2021;99:104796.
4. Olum R, Atulinda L, Kigozi E, Nassozi DR, Mulekwa A, Bongomin F, *et al*. Medical education and E-learning during COVID-19 pandemic: Awareness, attitudes, Preferences, and barriers among undergraduate medicine and nursing students at Makerere University, Uganda. J Med Educ Curric Dev 2020;7:2382120520973212.
5. Al-Balas M, Al-Balas HI, Jaber HM, Obeidat K, Al-Balas H, Aborajooh EA, *et al*. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: Current situation, challenges, and perspectives. BMC Med Educ 2020;20:341.
6. Rajhans V, Memon U, Patil V, Goyal A. Impact of COVID-19 on academic activities and way forward in Indian Optometry. J Optom 2020;13:216-26.
7. Rajab MH, Gazal AM, Alkattan K. Challenges to online medical education during the COVID-19 pandemic. Cureus 2020;12:e8966.
8. Saldivar MG. Primer on Survey Response Rate. Learning Systems Institute, Florida State University; 2012. Available from URL: https://mgsaldivar.weebly.com/uploads/8/5/1/8/8518205/saldivar_primer_on_survey_response.pdf. [Last accessed on 2021 Dec 01].
9. Keis O, Grab C, Schneider A, Öchsner W. Online or face-to-face instruction? A qualitative study on the electrocardiogram course at the University of Ulm to examine why students choose a particular format. BMC Med Educ 2017;17:194.
10. Singh K, Srivastav S, Bhardwaj A, Dixit A, Misra S. Medical education during the COVID-19 pandemic: A single institution experience. Indian Pediatr 2020;57:678-9.
11. Ferrel MN, Ryan JJ. The impact of COVID-19 on medical education. Cureus 2020;12:e7492.
12. Oliver D. Medical education and COVID-19: A personal view. Croat Med J 2020;61:213-4.
13. Gerdprasert S, Pruksacheva T, Panijpan B, Ruenwongsa P. An interactive web-based learning unit to facilitate and improve intrapartum nursing care of nursing students. Nurse Educ Today 2011;31:531-5.
14. Sweeney J, O'donoghue T, Whitehead C. Traditional face to face and web based tutorials: A study of university students' perspectives on the roles of tutorial participants. Teach High Educ 2004;9:311-23.
15. Docherty A, Sandhu H. Student-perceived barriers and facilitators to e-learning in continuing professional development in primary care. Educ Prim Care 2006;17:343-53.
16. Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding E-learning during COVID-19 at a private medical college. Pak J Med Sci 2020;36:S57-61.
17. Al-Araibi AA, Naz'ri Bin Mahrin M, Yusoff RC. Technological aspect factors of E-learning readiness in higher education institutions: Delphi technique. Educ Inf Technol 2019;24:567-90.
18. Atkins S, Yan W, Meragia E, Mahomed H, Rosales-Klintz S, Skinner D, *et al*. Student experiences of participating in five collaborative blended learning courses in Africa and Asia: A survey. Glob Health Action 2016;9:28145.
19. Burrola-Mendez Y, Bonilla-Escobar FJ, Goldberg M, Pearlman J. Comparing the effectiveness of a hybrid and in-person courses of wheelchair service provision knowledge: A controlled quasi-experimental study in India and Mexico. PLoS One 2019;14:e0217872.
20. Liyanagunawardena TR, Aboshady OA. Massive open online courses: A resource for health education in developing countries. Glob Health Promot 2018;25:74-6.
21. Masters K, Ellaway R. e-Learning in medical education Guide 32 Part 2: Technology, management and design. Med Teach 2008;30:474-89.
22. Obi IE, Charles-Okoli AN, Agunwa CC, Omotowo BI, Ndu AC, Agwu-Umahi OR. E-learning readiness from perspectives of medical students: A survey in Nigeria. Niger J Clin Pract 2018;21:293-300.
23. Almaiah MA, Al-Khasawneh A, Althunibat A. Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. Educ Inf Technol (Dordr) 2020;1-20.
24. Liu Q, Peng W, Zhang F, Hu R, Li Y, Yan W. The effectiveness of blended learning in health professions: Systematic review and meta-analysis. J Med Internet Res 2016;18:e2.
25. Regmi K, Jones L. A systematic review of the factors – Enablers and barriers – Affecting E-learning in health sciences education. BMC Med Educ 2020;20:91.
26. Vailas M, Sotiropoulou M, Mulita F, Drakos N, Ambalov E, Maroulis I. The impact of COVID-19 on surgical training at a tertiary hospital in Greece: A 'hidden infectious enemy' for junior surgeons? Eur Surg 2021;1-6.
27. Chatziralli I, Ventura CV, Touhami S, Reynolds R, Nassisi M, Weinberg T, *et al*. Transforming ophthalmic education into virtual learning during COVID-19 pandemic: A global perspective. Eye (Lond) 2021;35:1459-66.
28. Khan AM, Patra S, Gupta P, Sharma AK, Jain AK. Rapid transition to online teaching program during COVID-19 lockdown: Experience from a medical college of India. J Educ Health Promot 2021;10:99.
29. Khalil R, Mansour AE, Fadda WA, Almisnid K, Aldamegh M, Al-Nafeesah A, *et al*. The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: A qualitative study exploring medical students' perspectives. BMC Med Educ 2020;20:285.
30. Kaur N, Dwivedi D, Arora J, Gandhi A. Study of the effectiveness of e-learning to conventional teaching in medical undergraduates amid COVID-19 pandemic. Natl J Physiol Pharm Pharmacol 2020;10:563-7.