



Future of e-Learning in Medical Education—Perception, Readiness, and Challenges in a Developing Country

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Background: Medical institutes in India and globally were widely affected by the COVID-19 pandemic, and there was an almost immediate need to adapt modules for delivery on e-learning platforms. This study was undertaken to gauge the future and usefulness of e-learning in medical education by analyzing the perception, attitude, and readiness of healthcare learners during the ongoing pandemic.

Methodology: A quantitative survey was conducted among the healthcare community, during lockdown i.e., over a period of five weeks from 8th May to June 13, 2020. A survey questionnaire was developed to understand the demographic details, knowledge, infrastructure access, and attitude of the healthcare professionals. It was circulated through snow-balling technique with one hundred healthcare and allied professionals (linked with Project ILBS-ECHO) as the initial seeds. Each person was asked to then circulate the survey to 20 or more of their contacts and so on for the proposed duration of the study. Identifying information was anonymized before and ethical approval was obtained prior to initiating the survey.

Results: A total of 3,004 healthcare professionals voluntarily participated in the survey. The respondents were mostly young adults, with 61% of participants being <30 years of age. About 65.41% used e-learning platforms for obtaining knowledge and skills during the pandemic, despite 71.1% of the respondent reporting cyber security concerns. Significant advantages of e-learning mentioned by participants was reduction in travel time and assistance in maintaining social distancing (68.21%) without compromising learning.

Conclusion: With learners consistently jumping on to the bandwagon, the trend can be anticipated to continue post pandemic. For this reason, the study tried to highlight the awareness, perceptions, and potential challenges faced by Indian healthcare and allied professionals regarding e-learning as a method of education.

Keywords: e-learning, medical education, education technology, pandemic, developing countries

INTRODUCTION

Nations across the globe have enacted sanctions to try and minimize the spread of the novel corona virus, which was initially reported in China but rapidly transitioned into a pandemic affecting the entire world within a few weeks of its origin. (WHO, 2020a). For various reasons, such as, to flatten the curve, to curtail individual interactions to alleviate and contain the spread of COVID-19, and to reduce the risk of exposure, many countries imposed nation-wide lockdowns, closing public institutions and educational institutions, including medical and nursing colleges (Devi 2020). India imposed a nation-wide lockdown on March 23, 2020, since then medical educators as well as students have been obligated to work from home (WHO, 2020c). This led to a disruption of routine didactic lecture classes, demonstrations, seminars, workshops, tutorials, clinical postings (ward, outpatient department (OPD), Operation Theaters (OT)), and internal assessment examinations (Chandna 2020; Rose 2020). The cessation of such educational activities has left the working healthcare workers (HCWs) bewildered and confused as they are engaged in providing healthcare to the COVID-19 sufferers (Ahmed et al., 2020). HCWs have to resort to self-learning methods and various online platforms for updating themselves about COVID-19 as they are the ones at the forefront dealing with patient care during the pandemic, and hence need regular updates in knowledge.

In addition to this, no definitive steps have been proposed by the Council of India (MCI), the Indian Nursing Council (INC.), or any other statutory bodies to initiate teaching and learning among medical students. However, a few institutions with the capacity and facility to organize online classes, workshops, and CMEs have voluntarily come up with certain e-courses via various online platforms to overcome this teaching challenge (WHO, 2020b; FutureLearn, 2020; Medvarsity Online Ltd, 2020; Harvard University, 2020). This transition from offline to online teaching remains limited as the concept of technology-based education is still in its infancy in India. Moreover, absence of clinical teaching with a 'live' patient, reduced interactions and discussions, uninterrupted internet access, provision of infrastructure, and familiarity with the technology are the major barriers in e-learning implied in medical education (Sahi et al., 2020). Despite this, administration of technology-based learning has become a necessity during the pandemic, because a large fraction of the medical community, especially the nurses, have been redirected to fight COVID-19. E-learning also offers several advantages, such as easy accessibility to educational material, being able to study in a preferred environment, and studying while maintaining social distancing and continuing their medical duty (Iyer et al., 2020).

Moreover, the complete and partial lockdowns are being continued in states where the pandemic is attaining peak, resulting in continued closure of educational and medical institutes (Shaurya, 2020). The continued closure of medical and nursing institutes has severely impacted the education and learning of the HCWs (Liang and Wang, 2020). Medical education should continue where possible on online platforms to keep the medical community updated (Feldacker et al., 2017).

Thus, it is important to highlight the perception, readiness, and challenges associated with e-learning among HCWs, so that necessary improvements can be made. With this background the study aimed to assess the perception, readiness, and associated challenges with e-learning among healthcare and allied professionals during the lockdown period in India.

METHODOLOGY

An online survey using SurveyMonkey platform was conducted among Indian healthcare and allied professional communities during the proposed study duration of five weeks (8th May to June 13, 2020). The survey was circulated through snow-balling technique with one hundred healthcare and allied professionals (linked with Project ILBS ECHO) as the initial seeds. Each person was requested to then circulate the survey to 20 or more of their contacts and so on throughout the proposed duration of study. Propagation of study seeds was through online platforms and no incentive was provided on completion of the survey questionnaire. An effort was made to propagate the survey to a varied group of healthcare and allied professionals, including those who have been using e-learning related platforms, new users, and probable users.

The online questionnaire for the study consisted of a consent form which clearly stated the background and objectives of the study. It also informed the respondent that they were free to withdraw at any time, without giving a reason. Participation in the survey was anonymous and completely voluntary.

The questionnaire utilized in the study consisted of four sections consisting of 28-assessment questions and an additional optional question was added to invite suggestions from participants on improving the e-learning experience. Four sections of the questionnaire were: 1) Demographic details (age, sex, income level, employment, location, and level of education); 2) Knowledge Assessment (seven questions to assess the existing knowledge and skills regarding e-learning); 3) Challenges and Logistics Assessment (four questions to understand the infrastructure availability to acquire information through e-learning platforms); 4) Perception and Readiness assessment (Eight questions regarding perceived usefulness of e-learning by the participants and their willingness to seek out knowledge through an e-learning platform post lockdown/pandemic).

Data was extracted in MS-Excel from the online survey platform. Personal details of the participants like name, mobile number, and email ids were excluded from the final data sheet and unique identity numbers were allotted to maintain anonymity and confidentiality of the participants. Data was further coded and cleaned before analysis. For the purpose of analysis and for better understanding, the categories of the variables were combined. The age groups were simplified as less than 30 years, 31–50 years, and 51 years and above (Graaf-Ruizendaal et al., 2013). Similarly, the postgraduates and PhD categories were combined as a new category: Post-graduates and above. For performing the requisite analysis, 'may be' option was merged with 'no' option for all the variables in the analysis. This

TABLE 1 | Demographic profile of the healthcare workers (N = 3004).

Characteristics	n(%)
Age category (N= 2961)	1806 (61.0)
Less than 30 years	1044 (35.3)
31–50 years	111 (3.7)
More than 51 years	
Gender (n = 2854)	889 (31.1)
Male	1965 (68.9)
Female	
Education Qualification (n= 2989)	89 (3.0)
High school and intermediate	216(7.2)
Diploma	1624 (54.3)
Undergraduate	1060 (35.5)
Post graduate and above	
Place of residence	1454 (48.4)
Delhi	1550 (51.6)
Outside Delhi	

was done as being unsure is similar to no, and so the two were considered a single category. The descriptive analysis of categorical variables was represented as frequencies and percentages.

Univariate analysis was performed and odd ratios (OR) along with 95% confidence interval (CI) and *p*-values were documented. Variables that were found to be significant in univariate analysis were included in logistic regression. The statistical significance level was fixed to conventional value of *p*-value <0.05 (two-tailed). All the data analysis was performed using SPSS software (version 22).

Ethical clearance for the research was obtained from Institute Ethics committee (IEC) of Institute of the Liver and Biliary Sciences (ILBS) via letter number F (37)/(1)/9/ILBS/DOA/2020/20,217/338; dated 7th May 2020.

RESULTS

A total of 3,004 valid responses were received till the closure of survey by the researchers on June 13, 2020. All valid responses were tabulated and analyzed using IBM-SPSS version 22. The majority of the respondents were young adults, with 61% being less than 30 years of age; approximately 68.9% were females. There was more participation from undergraduates (54.3%) followed by post graduates and above (48.4%), while 1.2% of respondents were Diploma holders with a high school and intermediate education; nearly (51.6%) of the respondents were residing outside the National Capital region of Delhi (Table 1).

Awareness

The respondents affirmed that they are aware (74%) of available e-learning platforms, with 63.8% responders employing “Zoom” as a learning platform to avail knowledge, followed by “Google class” (22.04%) and “Skype” (12.85%) (12,13). Approximately 65.4% of the HCWs utilized online platforms during the survey period for upgrading their knowledge and skills. The majority of the participants engaged in e-learning classes through smart phones (75.95%) (Table 2).

Perception

Most of the participants cited that use of e-learning platforms aided in the improvement of their digital skills (71.21%), while a noticeable 65.21% of HCWs perceived e-learning to play a major role in minimizing the impact of the pandemic on education and training systems in the country (Table 2). However, a considerable number of respondents perceived traditional classroom training to be more effective (73.77%) as well as more convenient (68.74%). The key advantage of e-learning as alluded to by responders was minimization of travel requirements (68.21%), followed by a wider reach (60.79%) - especially during the COVID-19 pandemic, which requires social distancing measures - and better retention (58.19%).

Challenges

Around 61.35% respondents observe cyber security as a concerning issue to become more receptive toward e-learning technologies (Table 2), though only one third (33.82%) of participants were challenged by the technological requirement of e-learning platforms. 75.63% of the study cohort reported unstable internet connections as a major constraint while seeking e-learning.

Univariate analysis was used to assess the association of various factors affecting the use of e-learning. The analysis suggested the odds of using e-learning among age groups less than 30 years and 31–50 years were 1.72 (95%CI: 1.08–2.74) and 1.28 (95%CI: 0.79–2.06) times the odds of using e-learning among the age group above 51 years (*p* = 0.002). It was found that male participants had significantly higher odds of availing e-learning platforms (OR:1.52; 95%CI: 1.23–1.87, *p* < 0.001) as compared to their female counterparts. Results suggested HCWs belonging to the Delhi region tend to use e-learning platforms more as compared to HCWs residing outside Delhi (OR: 2.46; 95%CI 2.04–2.96; *p* < 0.001). In addition, HCWs having proper infrastructure (OR:1.41; 95%CI 1.16–1.71; *p* < 0.001), having no lapse in knowledge while using e-learning platforms (OR:2.19; 95%CI 1.79–2.68; *p* < 0.001), and considering e-learning helps in improving their digital skills (OR:1.81; 95%CI 1.45–2.25; *p* < 0.001) availed the e-learning platforms more than their respective participants. Moreover, participants who considered learning technologies beneficial in minimizing the impact of COVID-19 on the education and training sector (OR:1.25; 95%CI 0.95–1.65; *p* 0.108) and HCWs who believed e-learning reduces the financial burden on resources during the pandemic (OR:1.23; 95% CI 0.99–1.57, *p* 0.601) were more likely to use e-learning platforms during the pandemic, however these results were not significant (Table 3).

The predictors found to be significant were included in the final multi-variate model. The multi-variate analysis suggested people residing in Delhi, having no lapses in technical knowledge while using e-platforms for classes, having suitable infrastructure and considering the e-learning helps in improvising their digital skills were found to be significantly associated with the higher usage of e-learning. Other predictors like age categories, gender, education and other factors could not reach statistical significance after adjusting for other factors (Table 3).

TABLE 2 | Awareness, perception and challenges associated with e-learning among healthcare workers.

Awareness about e-learning platforms	n(%)
Awareness about different E-learning platforms	
Yes	2222 (74.0)
No	782 (26.0)
Commonly Employed E Learning Platforms	
Zoom	1908 (63.82)
Google Class	662 (22.04)
Google Hangout	341 (11.35)
Cisco WebEx	266 (8.85)
Microsoft Meet	246 (8.19)
Skype	386 (12.85)
Others (Teams, Goto meetings, Whereby, Starleaf, Signal, Facebook, Recorded webinars, WhatsApp, Course Era)	225 (7.49)
e-learning used as	
Trainer	775 (25.80)
Trainee	1683 (56.03)
Moderator	709 (23.60)
IT Facilitator	89 (2.96)
Devices used for e-learning	
Mobile and tablets	2277 (75.95)
Laptops	808 (26.90)
Desktops	125 (4.16)
Used e-learning during Pandemic	
Yes	1,965 (65.41)
No	1,039 (34.59)
Perception of e-learning	
Aids in improving your digital skills	
Yes	2139 (71.21)
No	865 (28.79)
Beneficial in minimizing the impact of COVID-19 on education and training sector	
Yes	1959 (65.21)
No	1045(34.79)
Reduces the financial burden on resources during this pandemic	
Yes	1629 (54.23)
No	1375 (45.77)
More effective than class learning	
Yes	788 (26.23)
No	2216 (73.77)
More convenient than in-class learning	
Yes	939 (31.26)
No	2065 (68.74)
Benefits of e-learning	
Cater to wider audience	1,826 (60.79)
Economical	1,732 (57.66)
Better Retention	1,748 (58.19)
Reduces travel time and maintain social distancing	2,049 (68.21)
Save time	28 (0.93)
e-learning will takeover the conventional mode	
Yes	1761 (58.62)
No	975 (32.46)
May be	268 (8.92)
Recommend e-learning to your peers	
Yes	1722 (57.32)
No	1282 (42.68)
Use e-learning Post COVID	
Yes	1261 (41.98)
No	1743 (58.02)
Challenges of e-learning	
Concerns regarding privacy	
Yes	1,843 (61.35)
No	1,161 (38.65)
Lapse in technical knowledge while using e-platforms for classes	
Yes	1,016 (33.82)
No	1,988 (66.18)

(Continued on following page)

TABLE 2 | (Continued) Awareness, perception and challenges associated with e-learning among healthcare workers.

Awareness about e-learning platforms	n(%)
Proper infrastructure for e-learning facility	
Infrastructure	1,859 (61.88)
Internet connection	2,272 (75.63)
Good connectivity	1,829 (60.89)
All of these	1,467 (48.83)

DISCUSSIONS

The lockdown imposed to curb the transmission of COVID-19 has brought medical education to a standstill. The medical educators and students are struggling to overcome the teaching challenges by exploring other available alternatives. Despite limited preparedness, medical education should continue to provide updated information to the HCWs deployed in fighting the COVID-19 pandemic. This study was conceptualized during the lockdown period imposed due to the COVID-19 pandemic in India to understand the use, acceptability, and reach of e-learning programs among healthcare professionals in order to develop more sustainable, encompassing, and equitable e-learning strategies post pandemic.

The results of the study revealed approximately 74% of the HCWs were aware about the e-learning platforms, though only 65.41% have utilized e-learning platforms during lockdown imposed due to COVID-19. The use of e-learning during lockdown was found to be higher (65.41%) in the present study as compared to a study on undergraduates and post graduates' students (31.5%) in West Bengal, India (12). This could be attributable to the fact that previous study was carried out among students pursuing non-medical courses, availing online learning for completion of syllabus whereas in the present case the survey population included healthcare and allied professionals seeking advancement in medical sciences-especially COVID-19-through available e-learning platforms. As in previous studies, "Zoom" was the most preferred e-learning platform as compared to other existing platforms (Abbasi et al., 2020). The prevalence of mobile and tablets was found to be the most common mode of attending e-classes (75.95%); which is similar to previous studies from Pakistan and Spain (García-Martínez et al., 2019;Abbasi et al., 2020).

The study emphasized that, regardless of having privacy concerns related to such applications, e-learning was perceived as an aid in improving digital skills (71.21%), and people also perceived it as beneficial in reducing the impact of COVID-19 in the education and training sector (65.21%), as well as limiting the financial burden during the pandemic (54.23%). This is in line with a Pakistani study on medical students, which suggests online learning is important in the times of such pandemics where face-to-face training becomes difficult but necessary. Further, this can be explained by the importance of rationalizing and optimizing existing resources for front-line workers during the crisis to constantly motivate them, reinforcing them, and updating them about upcoming personal hygiene and infection control measures (Iyengar et al., 2020).

Additionally, younger participants (<30 years of age) with higher levels of education, like post-graduates and above, tend to utilize more e-learning platforms as compared to their counterparts. This is

primarily due to better digital literacy among the younger groups as seen in the present as well as in previous studies (O'Doherty et al., 2018). Moreover, there were higher odds of healthcare professionals who believe that e-learning facilitates in improve their digital skills. Similarly, people were more likely to undertake e-learning if they had the infrastructure to do so, and believed e-learning was beneficial and reduced financial burden. However, we could not correlate the finding with other studies.

About 57.32% of the respondents appear to be conclusive toward recommending online learning platforms to their colleagues, although only 41.98% intended to use e-learning platforms post-COVID times. This could be ascribed to the pessimistic perception of the study participants toward e-learning. Participants considered e-learning (26.23%) to be less effective than traditional learning (73.77%) and less convenient (31.26%) than traditional learning (68.74%). These findings are in agreement with the study conducted in medical professionals with only 15% of the participants considering e-learning to be superior than traditional learning methods (Abbasi et al., 2020). A few studies have suggested that social presence, social interaction, and student's satisfaction level toward e-learning are important aspects of learning which are difficult to achieve in e-learning (Qureshi et al., 2012;Singh and Min, 2017;Bali and Liu 2018), however, these factors were beyond the scope of the study. In addition, according to a systematic review there is no evidence that offline learning works better than traditional mode (Pei and Wu 2019).

Moreover, challenges incurred to access e-learning play an important role in making the e-learning effective and convenient (Qureshi et al., 2012). The study participants reported that 61.35%had privacy-related concerns, 33.82% had technical lapses in their digital knowledge, and only 48.83% had all the infrastructure required, such as a separate room (61.88%), internet connection (75.63%), and good internet connectivity (60.89%). The previous studies also suggested similar challenges across the developing countries (Gormley et al., 2009; Abbasi et al., 2020;Kapasia et al., 2020). In addition to this, 75.63% of the study participants have faced unstable internet connections as a major constraint while exploring e-learning. This could be attributable to poor connectivity and signal issues prevailing across the country irrespective of the telecom service providers. The challenge of poor internet connectivity in the country has been highlighted earlier in previous studies also (Shrivastava and Shrivastava 2019; Shrivastava and Shrivastava, 2020).

The study is the first of its kind to describe the use of e-learning among healthcare workers as the world was struggling with the newly discovered coronavirus. The study described the use of e-learning among the healthcare workers who were involved in long duty hours, still updating their knowledge by availing e-learning platforms. In addition, our study can still be generalized to the other areas and

TABLE 3 | Univariate and multivariate analysis assessing the factors affecting use of e-learning.

Characteristics	Not used	Used	Crude	p-value	Adjusted OR	p-value
	N = 1039	N = 1965	(OR 95% CI)		(95% CI)*	
Age category				0.001		
Less than 30 years	584 (32.3)	1222 (67.7)	1.91 (1.30–2.81)		2.20 (1.34–3.62)	0.002
31–50 years	380 (36.4)	664 (63.6)	1.60 (1.08–2.36)		1.64 (1.00–2.70)	0.050
More than 51 years	53 (47.8)	58 (52.2)	Ref		Ref	
Gender				<0.001		0.068
Male	255 (28.7)	634 (71.3)	1.38 (1.16–1.63)		1.22 (0.99–1.50)	
Female	700 (35.6)	1265 (64.4)	Ref		Ref	
Education Qualification				<0.001		
High school and intermediate	39 (43.8)	50 (56.2)	1.21 (0.74–1.99)		1.86 (0.98–3.50)	0.056
Undergraduate	592 (36.4)	1032 (63.6)	1.65 (1.24–2.19)		1.49 (1.04–2.14)	0.031
Post graduate and above	292 (27.5)	768 (72.5)	1.85 (1.94–3.35)		2.22 (1.53–3.22)	<0.001
Diploma	105 (48.6)	111 (51.4)	Ref		Ref	
Place of residence				<0.001		<0.001
Outside Delhi	868 (43.7)	1120 (56.3)	1.87 (1.60–2.17)		2.27 (1.87–2.78)	
Delhi	171 (16.8)	845 (83.2)	Ref		Ref	
Lapse in technical knowledge				<0.001		<0.001
Yes	171 (16.8)	845 (83.2)	Ref		Ref	
No	868 (43.7)	1120 (56.3)	0.26 (0.22–0.31)		0.40 (0.32–0.50)	
Concern regarding Privacy using e-learning platforms				<0.001		<0.001
Yes	400 (21.7)	1443 (78.3)	4.41 (3.76–5.18)		2.19 (1.80–2.66)	
No	639 (55.0)	522 (45.0)	Ref		Ref	
Aids in improving your digital skills				<0.001		<0.001
Yes	483 (22.6)	1656 (77.4)	6.17 (5.19–7.32)		2.77 (2.22–3.47)	
No	556 (64.3)	309 (35.7)	Ref		Ref	
Suitable infrastructure for e-learning				<0.001		<0.001
Yes	310 (31.1)	1157 (78.9)	3.37 (2.87–3.95)		1.69 (1.38–2.07)	
No	729 (47.4)	808 (52.6)	Ref		Ref	
e-learning technologies beneficial in minimizing the impact of COVID-19 on education and training sector				<0.001		<0.001
Yes	433 (22.1)	1526 (77.9)	4.86 (4.13–5.72)		1.81 (1.43–2.32)	
No	606 (58.0)	439 (42.0)	Ref		Ref	
e-learning reduces the financial burden on resources during this pandemic				<0.001		0.012
Yes	352 (21.6)	1277 (78.4)	3.62 (3.09–4.24)		1.34 (1.07–1.69)	
No	687 (50.0)	688 (50.0)	Ref		Ref	

communities as India is a developing country and many areas of the country still lack having access to stable internet connection (75.63%). Moreover, around one-third (33.82%) of the participants were feeling challenged while using e-learning platforms. These statistics could be similar to other non-medical education communities as well, because of comparatively less use of such technologies for e-learning purposes in developing countries like India. Our study also raises concerns regarding the training of students on how to effectively use such e-learning platforms, so that these platforms can be used frequently during situations where face-to-face or traditional teaching are not possible.

Similar to other online surveys, the present study too has the inherent drawbacks of self-reported surveys. First is the inherent design of the study like sampling technique; the study is only restricted to people with internet access and understanding of English language. Secondly the study was conducted during lockdown and when e-learning was the only available learning tool during this period. This might have biased the survey responses, but since it has been discussed that this might be the learning platform in coming times; there was a felt need to understand the attitude and perception of healthcare and allied professionals toward medical education via online platforms. This could help in redefining a number of training courses

being planned for them. With limited time and feasibility, the present study could not collect data on quality of the e-learning and student's satisfaction with e-learning which could have impacted its use and perception. In addition to this, one of the limitations of the study is 'may be' and 'no' options were merged as a single option while analyzing the data as it was considered being unsure is similar as no but the validity of this post-hoc analysis was not determined earlier.

Despite these limitations, this is one of the largest study to assess the perception and challenges of e-learning among medical fraternity, especially nurses. To the best of our knowledge, the present study is one of the pioneer studies exploring the factors associated with uptake of e-learning in medical education among HCWs at the time of pandemic crisis with such a large sample size. The study highlights the lack of proper infrastructure (such as stable internet connection, separate room and devices to connect e-learning platforms) with most of the participants, despite the increased usage of such platforms during lockdown. Further, the study also highlights despite having limited technical knowledge on how to use it, participants are trying to use e-learning platforms to enhance their medical knowledge and keep themselves updates about the COVID-19 scenarios out of compulsion as this is the only source of learning in times of lockdown. However, several participants have indicated not to use such e-learning platforms in future because of several challenges such as privacy concerns and limited infrastructure. Thus, our study raises concerns about formulating stringent laws that will ensure privacy of the user and government to take necessary steps in providing stable internet connections. The study also highlights the need to train the student communities on how to use e-learning platforms so that more individuals can benefit from e-learning platforms especially during times of pandemic.

CONCLUSION

Based on the results of the online survey, the outcome of the study proposes that, regardless of infrastructure limitations and slight apprehensions, a modest majority of healthcare professionals in India are aware of and open to retrieving information through digital learning portals. The e-learning helps in gaining knowledge and reinforcing infection and prevention practices during the ongoing pandemic situation among healthcare workers. The study concluded that online teaching is feasible and inexpensive and could be incorporated as a part of the training process of healthcare workers in India beyond the current lockdown. Measures ensuring the security of the participants and access to relevant and updated content can further supplement in enhancing the reach of e-learning.

RECOMMENDATIONS

- (1) The arrangement and the competencies acquired by educationalists, overseers, and learners can be employed in the post-pandemic period, particularly presuming a parallel condition in future.
- (2) Future studies assessing the teaching methodologies, quality of the e-learning and student's satisfaction with existing tools and platforms is to be assessed for better implementation and

knowledge gain. This will help in understanding people's readiness for online education.

- (3) The lesson learned from the pandemic of 2020 may force a generation of new laws, regulations, platforms and solutions for future cases, when the countries, government and population will be more prepared than today.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institute Ethics Committee, Institute of Liver and Biliary Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SS, AJ, and AB conceived and planned the study. SS, AB, AK, AP, and GA carried out the study. AR, SS, and MV worked out almost all of the technical details, and performed the numerical calculations for the data collected. SS, AJ, AR, and MV contributed to the interpretation of the results. SS and AR took the lead in writing the manuscript. All authors provided critical feedback and helped to shape the research, analysis and manuscript. Both SS, AR, AB, and MV authors contributed to the final version of the manuscript. SS supervised the implementation of overall project.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2021.598309/full#supplementary-material>.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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