



**VICTORIA UNIVERSITY**  
MELBOURNE AUSTRALIA

## *Online Teaching in an Un-prepared Country during COVID-19: An Interview Study on Final Year Medical and Dental Students*

This is the Published version of the following publication

Dhahri, Adeel Abbas, Memon, Ayesha Majeed, Hashmi, Fazila, Dhahri, Maria, Ghufran, Samar, Mian, Muhammad Amer, Memon, Abdul Sattar, Rao, Ahsan, Darwish, Nourelhuda, Iqbal, Muhammad, Qureshi, Abdul Hafeez, Choudhary, Salmaan Majeed, Mohammad, Elsamoual, Ahmad, Raheel, Ahmad, Muhammad Salah Muhammad, Dhahri, Mehvish Adeel, Yousfani, Saadullah, Kumar, Pardeep, Dhahri, Prince Ali, Yousufzai, Yasar, Arain, Hira Saleem, Khan, Muhammad Mudasir, Mustafa, Faizan Ghulam, Akhtar, Riaz, Arain, Anum Saleem, Hafeez, Gulzam, Malhi, ShewaRam, Iqbal, Muhammad, Aziz, Ifra, Nankani, Danish, Hussain, Muhammad Wajahat, Kausar, Muhammad Ali, Saqlain, Muhammad, Chawla, Shilpa, Azhar, Hamza, Haneef, Hajrah, Arain, Seerat Fatima, Shahid, Muhammad Sultan, Iqbal, Sania, Mughal, Maryam, Awan, Shariq Ahmed, Mehbub, Hummaz, Qiam, Fahad, Abro, Jazib Gulrez, Khattak, Talha, Bhatti, Dujanah, Umbrin, Izza, Shehdio, Waqas, Shaikh, Mubashir, Arain, Sohail Yousuf, Memon, Mehmood, Dhahri, Sunbal, Kumar, Jai, Ilyas, Muhammad, Chaudhary, Tayyab, Nawaz, Sunila, Bilal, Hira, Faraz, Naila, Chawla, Rajesh, Dhahri, Sharjeel Abbas, Shaikh, Sameer, Baqai, Shehla, Afzal, Farooq, Choudhary, Abdul Majeed and Khan, Abul Fazal Ali (2021) Online Teaching in an Un-prepared Country during COVID-19: An Interview Study on Final Year Medical and Dental Students. *Journal of Pharmaceutical Research International*, 33 (45B). pp. 30-39. ISSN 2456-9119

The publisher's official version can be found at  
<https://journaljpri.com/index.php/JPRI/article/view/3583>  
Note that access to this version may require subscription.





# **Online Teaching in an Un-prepared Country during COVID-19: An Interview Study on Final Year Medical and Dental Students**

**Adeel Abbas Dhahri<sup>1\*</sup>, Ayesha Majeed Memon<sup>2</sup>, Fazila Hashmi<sup>3</sup>, Maria Dhahri<sup>4</sup>, Samar Ghufuran<sup>5</sup>, Muhammad Amer Mian<sup>6</sup>, Abdul Sattar Memon<sup>7</sup> and Medical Education Pakistan (MEP) Collaborators Group<sup>8#</sup>**

<sup>1</sup>Royal Infirmary of Edinburgh – NHS Lothian, United Kingdom.

<sup>2</sup>Dow University of Medical & Health Sciences, Karachi, Pakistan.

<sup>3</sup>Liaquat University of Medical & Health Sciences, Jamshoro, Pakistan.

<sup>4</sup>DHQ Indus Hospital, Badin, Pakistan.

<sup>5</sup>Akhtar Saeed Medical and Dental College, Lahore, Pakistan.

<sup>6</sup>Central Park Medical College, Lahore, Pakistan.

<sup>7</sup>ISRA Medical University, Hyderabad, Pakistan.

<sup>8</sup>Various Institutes.

## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

## **Article Information**

DOI: 10.9734/JPRI/2021/v33i45B32775

### Editor(s):

(1) Dr. Barkat Ali Khan, Gomal University, Pakistan.

(2) Dr. Juan Carlos Troiano, University of Buenos Aires, Buenos Aires, Argentina.

(3) Dr. Sachin Kumar Jain, IPS Academy College of Pharmacy, India.

### Reviewers:

(1) T. Vigneswari, Sri Manakula Vinayagar Engineering College, India.

(2) Rayachoti Eswaraiiah, Vasireddy Venkatadri Institute of Technology, India.

(3) Mohammed Muayad Taha, University of Technology, Iraq.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/73472>

**Original Research Article**

**Received 22 August 2021**  
**Accepted 23 September 2021**  
**Published 04 October 2021**

\*Corresponding author: E-mail: [adeeldhahri@hotmail.com](mailto:adeeldhahri@hotmail.com);

#(MEP) Collaborators Group: Ahsan Rao, Nourelhuda Darwish, Muhammad Rafaih Iqbal, Abdul Hafeez Qureshi, Salmaan Majeed Choudhary, Elsamoual Mohammad, Raheel Ahmad, Muhammad Salah Muhammad Ahmad, Mehvish Adeel Dhahri, Saadullah Yousfani, Pardeep Kumar, Prince Ali Dhahri, Yasar Yousufzai, Hira Saleem Arain, Muhammad Mudasir Khan, Faizan Ghulam Mustafa, Riaz Akhtar, Anum Saleem Arain, Gulzam Hafeez, ShewaRam Malhi, Muhammad Husnain Iqbal, Ifra Aziz, Danish Nankani, Muhammad Wajahat Hussain, Muhammad Ali Kausar, Muhammad Saqlain, Shilpa Chawla, Hamza Azhar, Hajrah Haneef, Seerat Fatima Arain, Muhammad Sultan Shahid, Sania Iqbal, Maryam Mughal, Shariq Ahmed Awan, Hummaz Mehbub, Fahad Qiam, Jazib Gulrez Abro, Talha Khattak, Dujanah Bhatti, Izza Umbrin, Waqas Shehdio, Mubashir Shaikh, Sohail Yousuf Arain, Mehmood Memon, Sunbal Dhahri, Jai Kumar, Muhammad Ilyas, Tayyab Chaudhary, Sunila Nawaz, Hira Bilal, Naila Faraz, Rajesh Chawla, Sharjeel Abbas Dhahri, Sameer Shaikh, Shehla Baqai, Farooq Afzal, Abdul Majeed Choudhary, Abul Fazal Ali Khan.

## ABSTRACT

**Aims:** To assess medical students' perception of online teaching to suggest transforming the future curriculum in low-economic countries.

**Study Design:** Cross-sectional online interview study.

**Place and Duration of Study:** A team of collaborators interviewed final year medical and dental students of Pakistan from 07/08/2020 till 17/09/2020.

**Methodology:** A questionnaire was developed based on open and close-ended questions in Google forms; focusing on institutional preparedness, views on online education, the institute's closure and COVID-19, and long-term effects of closure of the institute. Independent fellow researchers systematically analyzed the unaltered transcripts of the responses, and themes were then identified and coded to conclude the results. SPSS version 23 used for analysis. As this study was based on final year students.

**Results:** In response to an invitation email, 2442/2661 (91.77%) students voluntarily participate in this qualitative study. Most participants were females (1614, 66.10%). Closing down institutes was directly linked to a lack of motivation and feel of helplessness. As most showed dissatisfaction with online teaching compounded by psychological effects, students feared losing clinical skills and life during the pandemic.

**Conclusion:** The psychological impact of the crisis led to resistance to accepting the change for a better outcome. Incorporating telemedicine, different interactive learning style to online teaching, and resilience training would result in fruitful outcomes. Developed countries may also guide build infrastructure in developing countries to develop a more robust online teaching methodology in the long-run.

**Keywords:** COVID-19; undergraduates; medical education; online teaching; telemedicine in clinics; learning styles.

## 1. INTRODUCTION

When the World Health Organization declared Coronavirus disease 2019 (COVID-19) as a pandemic on 11<sup>th</sup> March 2020, social distancing advised restraining the SARS-CoV-2 virus [1]. To hamper its spread Pakistan government wisely responded through many steps like the closure of educational institutes from mid of March 2020, directly affecting thousands of students. While the world witnessed pandemic after a long time, low-economic countries like Pakistan were not ready to suddenly face change in the education system's infrastructure. This unpreparedness significantly stunned the medical education system leading to the aftermath on the students [2].

As face-to-face academic activities ceased, students enforced to stay at home at the expense of physiological and psychological consequences. To make abrupt changes in the curriculum delivery, institutes faced challenges to overcome the need, especially for those at the final stage of undergraduate studies. Amidst a delay in delivering the education multiplied by uncertainty about the future and social isolation, depression and anxiety intensified [3].

For many years online or virtual teaching has been used as an additional teaching tool or a replacement for classroom teaching method in developed countries, validated by different learning styles. Learning methods in an online teaching class can be incorporated into lecture-style learning and problem-based learning (PBL) or team-based learning (TBL) styles [4,5]. Unfortunately, the scenario is relatively opposite within developing countries like Pakistan due to wide range of modifiable issues like financial and universal availability of information technology (IT). As there was uncertainty about pandemic duration, the Higher Education Commission (HEC) of Pakistan instructed medical institutes to equip and ready themselves for exclusive online teaching [6]. While under-resourced, medical institutes did manage to overcome the demands of online teaching. Most of these teachings were lecture-based with a delayed start than expected. Although this reflected the educational system's positive progress to the standardized system, the parallel unseen psychological impact continued to jolt the student population. Lack of teaching within the hospital's clinical environment further ignited the psychological burn-out among the fragile students [3].

During the current pandemic, as expected, the psychological effects multiplied within the final year medical students. We conducted an online interview survey to assess their perception of online teaching during the COVID-19 pandemic to suggest transforming the educational curriculum in a developing country like Pakistan.

## 2. MATERIAL AND METHODS

Pakistan has 169 registered medical and dental institutes (114 and 55, respectively) in the public and private sectors, where about 15900 students study [3]. We conducted an online interview aimed at final year students of medical and dental colleges in Pakistan in both the public and private sectors. Final year students were selected as a cohort group to interview because their curriculum is clinically oriented, and currently, they are the most vulnerable group who will soon start their careers. The online interview was conducted when all the educational institutes were closed aimed at social distancing. This interview period lasted from 07/08/2020 till 17/09/2020.

A team of 58 collaborators, comprising consultants, post-graduate students and undergraduate students, was recruited. This team was named *Medical Education Pakistan (MEP) collaborators group*, who voluntarily helped in this national survey to interview the participants. Any students appearing in their final year exit exam were excluded from this survey. All the survey participants were aware of the survey's objectives, including their identity and data confidentiality. Informed consent was taken from all the participants.

The interview questionnaire consists of mandatory close and open-ended questions, developed by four consultants and a researcher on teaching and clinical posts. The questionnaire was prepared using 'Google Forms'. All the participants first received invitation emails, and upon their consent, were interviewed. Based on rating-scale items, short close-ended questions focused on demographic details, institutional preparedness and their views on online education. On the other hand, open-ended in-depth questions focused on the effects of the institute's closure on education, the psychological effects of the COVID-19, and the long-term effects of the institute's closure on their learning.

The sample size was calculated as 376 using a WHO-sample size calculator with a 95%

confidence level, and a 5% margin of error and data was analyzed using SPSS 23.

Two independent fellow researchers, not present at the interview, repeatedly checked the unaltered transcripts of the responses to open-ended questions to confirm variations in the responses. These researchers were of both gender with vast experience in clinical academic fields of medicine. The data was then systematically analyzed to key themes to conclude the data. The final themes were identified and then developed into a framework for coding the qualitative data body.

The study was performed in line with ethical guidelines for internet-mediated research [7]. This study has been reported according to 'Consolidated criteria for Reporting Qualitative Research' (COREQ) checklist [8].

## 3. RESULTS

MEP collaborators group sent out invitation emails to 2661 final year medical and dental students in Pakistan, of which 2442 (91.77%) agreed to participate in this questionnaire-based qualitative study. Those who dropped out (219, 8.23%), did not specify any reason for opting out. Out of these 2442, 828 (33.90%) were male participants, while 1614 (66.10%) were females. Most of the students (2086, 85.42%) were studying in medical institutes, while 356 (14.58%) were in dental institutes.

On asking direct questions, nearly three-fifths of the students stated that their institutes were not well prepared for online teaching before closure (1540, 63.10%). However, more than two-thirds of the participants confirmed that their institute timely started online teaching (1972, 80.75%). Most of the students also disagreed with the fact that online teaching is helpful (1124, 46.03%). All the results in detail are shown in Fig. 1.

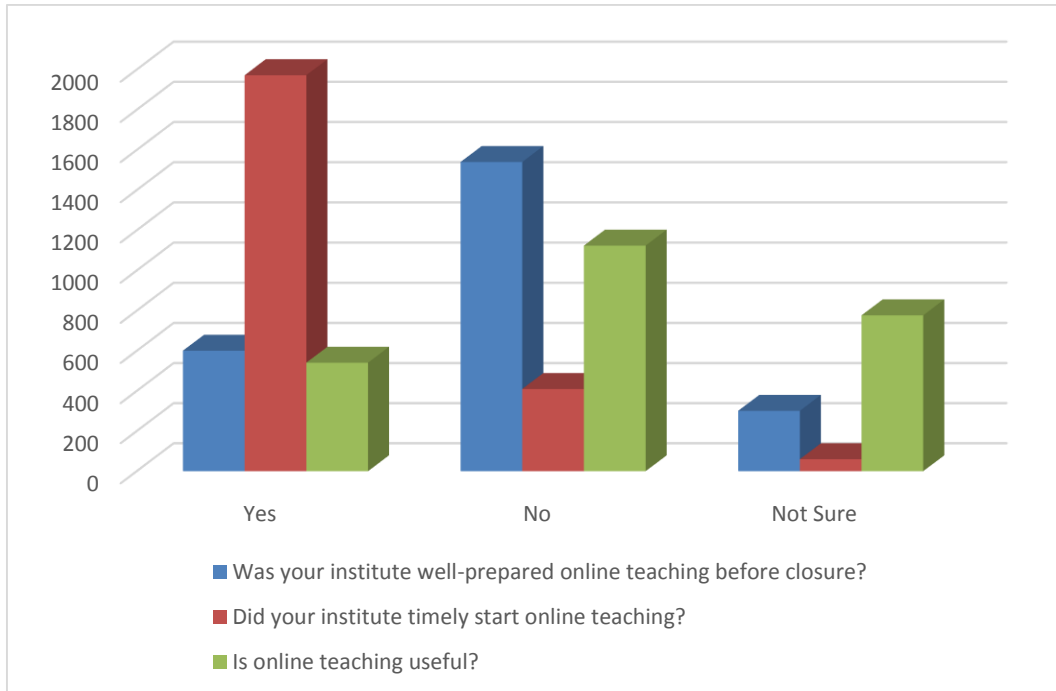
When asked to answer first open-ended question; whether closing institutes during the COVID-19 pandemic affected their education, most common replies fell into themes like loss of motivation (526, 21.54%), helplessness, (528, 21.62%) dissatisfaction with online teaching (450, 18.43%), and loss of clinical skills (424, 17.36%), (Fig. 2).

Closing institutes was directly linked to a lack of motivation and feel of helplessness. While staying at home impeded motivation, there was a

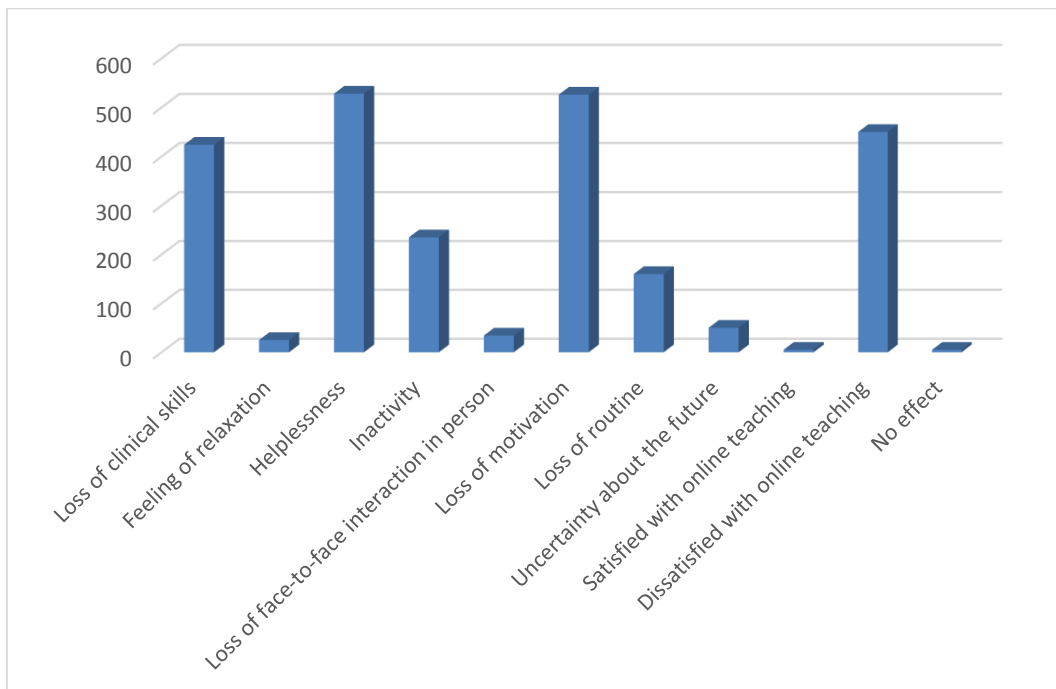
definite loss of clinical and practical skills. While the majority mentioned dissatisfaction with online teaching, some did find isolation to find relaxation (Table 1 in Supplementary File).

identified themes like loss of clinical skills (760, 31.12%), and psychological effects (1063, 43.53%). The rest of the salient features are mentioned in Fig. 3.

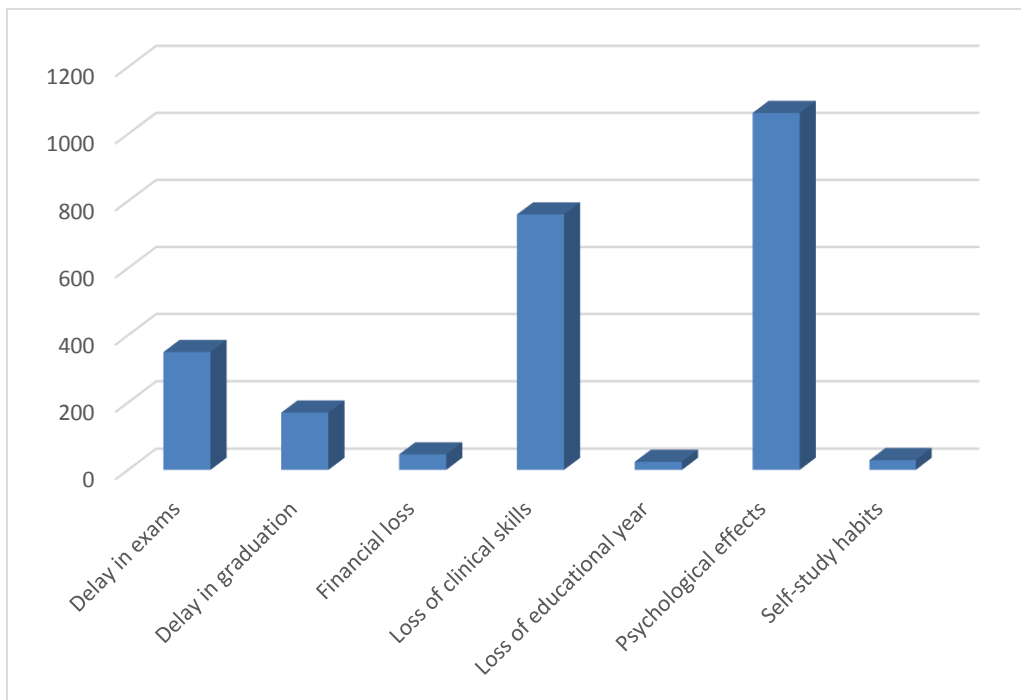
The question on long-term effects on students' future learning on the closure of institutes



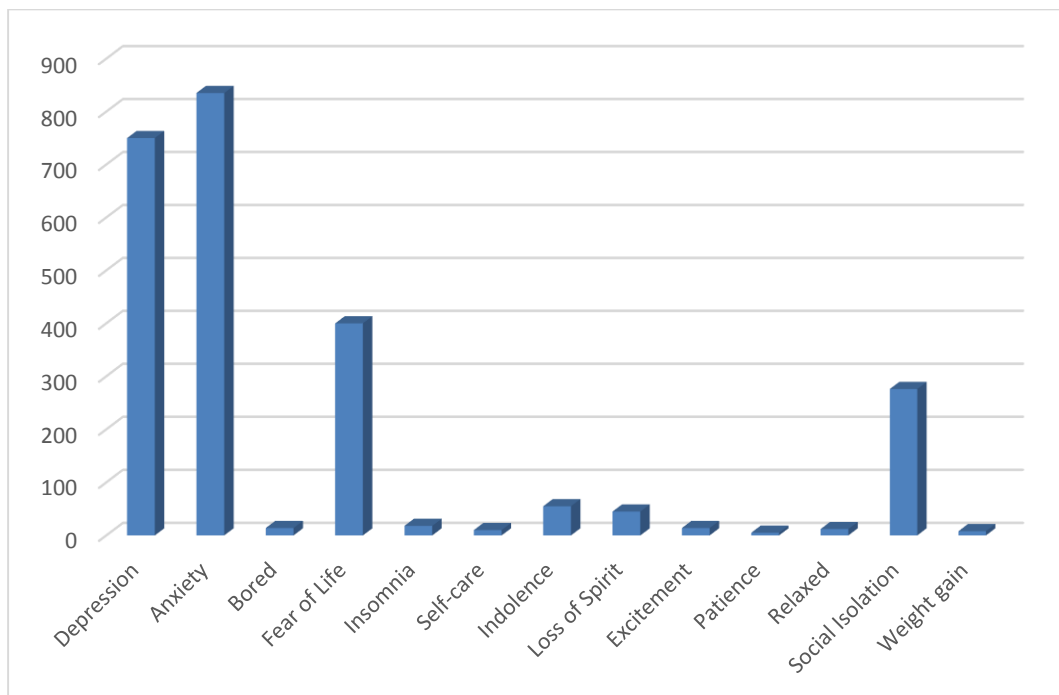
**Fig. 1. Close-ended Questions**



**Fig. 2. Open-ended Question # 1  
How closing institute affected your education?**



**Fig. 3. Open-ended Question # 2**  
**What long-term effects on your future learning you fore-see after your institute decided to close?**



**Fig. 4. Open-ended Question # 3**  
**What changes COVID-19 has brought in you?**

The psychological effects suffuse and dominate thoughts, fore-seen by undergraduate students, as a long-term sequel of institute closure during

the COVID-19. Another central theme identified confirmed the fear of loss of clinical skills with delay in exams. However, few did understand the

current pandemic related crisis and appreciated administrative decisions (*Table 2 in Supplementary File*).

The last open-ended question was whether the student had noticed any change in himself/herself since the COVID-19 pandemic. Themes identified symptoms of depression (750, 30.71%), anxiety (835, 34.20%), fear of life (400, 16.38%), and social isolation (276, 11.30%). The rest of the themes have been mentioned in Fig. 4.

Most of the students confirmed the presence of psychological changes they noticed since the start of the COVID-19 pandemic (*Table 3 in Supplementary File*).

## 4. DISCUSSION

### 4.1 The Lag

The COVID-19 has already exerted long-term effects on medical education worldwide, especially when subsequent waves jolt it to the deep. In-person active teaching and learning styles were directly affected due to social distancing rules in the institutional environment, challenging students to adapt to what they were never tailored. Active teaching style outside of the classroom meant transferring knowledge and skills to the future doctors with swift evolution of the digitalized system in a motivational and realistic fashion. Such instantaneous and unavoidable changes to the learning style in the multitasking curriculum pose a radical threat to the students' psychological well-being [3]. This fact has been supported by the results of open-ended questions when asked from students during our study.

We all know how the COVID-19 has romped emotions among undergraduate medical students who remained in a state of uncertainty during the current pandemic. Psychological symptoms can significantly hinder their learning ability and further hopelessness among them. Most literature has proven that depressive symptoms are more common in medical students due to challenging curriculum and delays in initiating online teaching [3]. Our study also identified stress-related psychological symptoms in the undergraduate population. When asked about feelings related to their institutes' closure, most of them agreed to face such symptoms. Our survey results also revealed that most students voiced dissatisfaction with online

classes in general, which may be related to psychological symptoms. This dissatisfaction was in addition to the loss of motivation when students felt isolated at home, multiplied by a delay in starting online teaching. Resilience training of undergraduate medical students as part of the curriculum in developing countries can have extensive benefits, including facing a crisis and early adaptation of sudden change during such catastrophic times.

With an increasing number of COVID-19 cases, the Government of Pakistan imposed a lockdown in the entire country during the first wave, which led to the cessation of all significant economic and educational activities [3]. Institute closure placed medical education on hold, meaning medical and dental students had to learn from home for at least a few months. While there was uncertainty, many students fear losing their academic years, so the need for online teaching was recognized, and educational institutions were encouraged to implement online teaching [6]. Many educational institutes introduced online lecture-based teaching as a national response to the pandemic, but the online educational framework was missing. Our survey confirmed that institutes lag the recent advances as a developing nation and are not ready to cope with a crisis like this pandemic. The severities of this lag are still under investigation while the second wave hit the countries. Our participants also questioned online teaching and found it less engaging or enjoyable, favoring face-to-face education in the classroom environment. This request can be reflected by curriculum demands, institutional unpreparedness, unstable internet connection, and resistance to change. Our survey results suggested that the psychological impact of COVID-19 also played an essential role in the non-acceptance of online teaching.

### 4.2 Current Online Teaching Status

Being an under-resourced country, not every university in Pakistan has established an IT department [9]. This reality is compounded because unstable internet services throughout the country led to an unfriendly environment for the students trying to join an online lecture series from home [10]. On the other hand, fully-fledged institutional-based specific online teaching software's are not only easy to assess but also user friendly. These modalities include low-cost online teaching tools like Zoom, Google classroom and Moodle. An additional advantage of these online software is that it does not require specific training or expertise to operate.



Moreover, many online videos are also available regarding its usage [11]. A study assessing online teaching effectiveness during crisis showed positivity towards online teaching. Students' perspectives are critical because they are at the receiving end and quality depends upon the feedback. However, acceptability was questionable due to identifiable technical difficulties and lack of technical support [12]. Till March 2020, Pakistan online education system remained in a primitive state. Since then, educational institutes all over the country were forced to familiarize themselves with different online learning modalities and forums in the matter of a fortnight.

The infrastructure of developed countries is well balanced, especially in medical education [5]. On the other hand, like Pakistan, developing countries needed to learn from their failures more effectively from developed countries. Recently published literature concluded that educational bodies and stakeholders need to realize time and invest in building digital learning infrastructure within medical institutes [13]. Although the Educational bodies in Pakistan had come forward with policy guidance on continued learning during interruptions, continuous and long-term support from the stakeholders is still required at a larger scale to combat the current crisis within the ongoing crisis [14]. We understand that it is a complicated process of bringing change; implementation should reduce the impact of a future crisis. The developed countries did not face the same challenge in the health education system as any developing country due to the routine use of advanced hybrid teaching methods [5]. With the 'smart lockdown' policy defined by the government, some institutes in Pakistan started a hybrid teaching method when the positivity rate declined below 5%, with online and face-to-face teaching methodology. These institutes also started vaccinating students and teaching faculty as per government guidance before moving to a hybrid teaching method. The current pandemic is an eye-opener for all the developing countries to prepare themselves for future trismus effects of future crises and take long-term measures to incorporate the routine use of hybrid teaching methods into their curriculum.

### 4.3 Long-Term Adjustments

In our study, participants mentioned a lack of clinical exposure in outpatients and wards, leading to low acceptance of online lecture series teaching methods when their curriculum heavily

demands clinical exposure. A future proposal can be national digitalization in developing countries, flipped classrooms during online teaching, and interactive lecture series. Whether there is a place for 3D online teaching in developing countries is still questionable while adopting a more straightforward solution [15].

A delay in online teaching haunted students' professional growth; bridge courses were not adequately and correctly defined. Starting online teaching was indeed a required step in the light of the pandemic situation but significantly nudged by lack of trained teachers, underdeveloped institutional media labs, lack of developed, facilitated servers by institutions. Few published studies have concluded that a transitional period of training and adaptation is necessary for creating effective educational online content. Another supporting literature states that most medical and dental students still prefer conventional teaching methods because they find it a comfortable learning form [16,17]. On the contrary, literature does support the fact that online teaching did help to continue medical education during the current pandemic [5]. While students' perception regarding online teaching remains in limbo, there remains a barrier to change and accept online teaching in crisis in under-developed countries. Financial support of the institutes and educational system to build its infrastructure with the universalization of its applicability may help overcome negative perception and acceptance.

We suggest having an online learning environment (VLE) compatible with smartphones. The medical and dental institutes should be able to provide internet wi-fi devices to the students. An excellent example is the distribution of laptops and wi-fi devices to the merit student by the Higher Education System (HEC), helping financially unstable students. Also, online libraries, research journals, and educational videos should be accessible to the students to groom their medical basics and clinical knowledge. Collaborative medical and dental academic videos by medical schools globally should be available to students to enhance their online learning experience. The current pandemic is an entirely new challenge for educational institutes in developing countries. Designing and defining a bridge course for the medical students would have had offered swift and smooth adaptability in these countries. However, Pakistan still managed to run these online education programs nationwide quickly by

preparing themselves and the students to be in line among the medical students globally.

As the subsequent waves hit the countries, education bosses and stakeholders should step forward to develop consensus or guidelines for institutional management and response during a future crisis. Where psychological effects dominate, providing an opportunity of getting vaccinated may reduce stress levels among undergraduate students. This will avoid career on hold as waves of infection stagger around.

#### 4.4 A Way Forward

During the current pandemic, telemedicine as digital communication has played a significant role in the healthcare system aimed at social distancing [18]. Incorporating telemedicine into online teaching will be a valuable tool and is highly recommended for the students missing clinical outpatient rotations. Telemedicine, as a multidisciplinary telephonic or video telemedicine call, can augment students' interactivity in learning communication skills and the disease's pathological presentation. Although it seems unrealistic, any technologies and methodologies can be incorporated with the online educational system during the current pandemic and post-pandemic period as a hybrid system. Examples include integrating problem-based learning, case-based learning or team-based learning to make online teaching more interactive. The flipped classroom is another example that can easily be incorporated to make online teaching fun-filled learning. Other methods include national digitalization to make learning hybrid for students with few dedicated hours of online teaching per week in the post-pandemic period. Revolutionizing the educational system with Extended Reality (XR) is another way forward to new dimensions. Under this umbrella, 3D ward-based type learning and digital mannequin or avatars can be made available in the long run. Although XR can be difficult to adopt at a pace due to different reasons like an economic burden on the developing countries, more straightforward methods, as explained earlier, will be easier to adapt and engage.

We know that developing countries were unprepared for the current pandemic, especially to handle the educational crisis. This state of affairs is alarming as further hits can cause significant aftermath in the educational system leaving footprints with further regression in its growth for a more extended period. Developed

countries must generously guide to upgrade the educational system and help developing countries develop plans from their learning.

We identified few limitations to our study. This study did not investigate the standards of the type of internet connection and facility availed for online learning, especially in the remote or rural areas of the country. We also identified that as subsequent waves of pandemic hit the country, it was difficult to define and quantify different responses by the institutes when the smart lockdown policy was adopted in different parts of the country. Another limitation is the teachers' training capabilities to conduct online classes as per students' perception. Hence, this study does not represent whether the institutes' professionally trained teachers to conduct online classes.

#### 5. CONCLUSION

This survey has confirmed how the psychological impact of any crisis can lead to resistance to accepting the change for a better outcome. Since the countries are still fighting for economic stability, better strategies are required to cope with the educational system during a pandemic. However, the study appreciated that though our country was not prepared for the online teaching system, it still managed to start it on time. Despite this fact, there is a need to search for the glitches to bring about the improvement. The developing countries should learn and prepare themselves for future crisis. If still no notice is taken by them, the future will progress to regression and further disaster. Incorporating telemedicine, a hybrid learning system, and an interactive learning style into online teaching will have fruitful results. Our study will also help the other countries of similar socioeconomic status to learn from our results.

#### SUPPLEMENTARY LINK

Supplementary file Available in this link: <https://journaljpri.com/index.php/JPRI/libraryFiles/downloadPublic/20>.

#### ETHICAL APPROVAL AND CONSENT

The study was performed in line with ethical guidelines for internet-mediated research. All the respondents were consented and informed about the objectives of the study including confidentiality of the data to participate in anonymized, non-experimental [7].

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Cucinotta D, Vanelli M: WHO Declares COVID-19 a Pandemic. *Acta Biomed.* 2020;91:157-160. DOI:10.23750/abm.v91i1.9397
2. Ahmed SAKS, Ajisola M, Azeem K, Bakibinga P, Chen Y-F, Choudhury NN, Fayehun O, Griffiths F, Harris B, Kibe P, Lilford RJ, Omigbodun A, Rizvi N, Sartori J, Smith S, Watson SI, Wilson R, Yeboah G, Aujla N, Azam SI, Diggle PJ, Gill P, Iqbal R, Kabaria C, Kisia L, Kyobutungi C, Madan JJ, Mberu B, Mohamed SF, Nazish A, Odubango O, Osuh ME, Owoaje E, Oyebode O, Porto de Albuquerque J, Rahman O, Tabani K, Taiwo OJ, Tregonning G, Uthman OA, Yusuf R. Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements. *BMJ Global Health.* 2020, 5:e003042. DOI:10.1136/bmjgh-2020-003042
3. Dhahri AA, Arain SY, Memon AM, Rao A, Mian MA. The psychological impact of COVID-19 on medical education of final year students in Pakistan: A cross-sectional study. *Ann Med Surg (Lond).* 2020;60:445-450. DOI:10.1016/j.amsu.2020.11.025
4. Anderson LC, Krichbaum KE. Best practices for learning physiology: combining classroom and online methods. *Advances in Physiology Education.* 2017;41:383-389. DOI:10.1152/advan.00099.2016
5. Dost S, Hossain A, Shehab M, Abdelwahed A, Al-Nusair L. Perceptions of medical students towards online teaching during the COVID-19 pandemic: A national cross-sectional survey of 2721 UK medical students. *BMJ Open.* 2020;10:e042378. DOI:10.1136/bmjopen-2020-042378
6. Shehzadi S, Nisar Qasim A, Hussain Muhammad S, Basheer Muhammad F, Hameed Waseem U, Chaudhry Naveed I. The role of digital learning toward students' satisfaction and university brand image at educational institutes of Pakistan: a post-effect of COVID-19. *Asian Education and Development Studies.* 2020, ahead-of-print.
7. Ethics Guidelines for Internet-mediated Research; 2017. Accessed:https://www.bps.org.uk/news-and-policy/ethics-guidelines-internet-mediated-research-2017
8. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care.* 2007, 19:349-357. DOI:10.1093/intqhc/mzm042
9. Nasim M. Medical education needs to change in Pakistan. *J Pak Med Assoc.* 2011;61:808-811.
10. Sarwar H, Akhtar H, Naeem MM, Khan JA, Waraich K, Shabbir S, Hasan A, Khurshid Z. Self-reported effectiveness of e-Learning classes during COVID-19 pandemic: A nation-wide survey of pakistani undergraduate dentistry students. *Eur J Dent.* 2020;14:S34-s43. DOI:10.1055/s-0040-1717000
11. Farooq F, Rathore FA, Mansoor SN. Challenges of online medical education in pakistan during COVID-19 pandemic. *J Coll Physicians Surg Pak.* 2020;30: 67-69. DOI:10.29271/jcpsp.2020.Supp1.S67
12. Iqbal S SA, Iqbal N. Perceptions of undergraduate dental students towards elearning in lahore medical and dental college. *Pakistan Journal of Medical and Health Sciences;* 2016. 10:1191-1193.
13. Khuwaja HMA, Maqbool A, Rahim KA, Hanif S, Karim A. Status of digital learning practices in health sciences education in Pakistan. *Journal of Pakistan Dental Association.* 2020, 29:S30-35. DOI:10.25301/JPDA.29S.S30
14. COVID-19 policy papers policy guidance note 5: Online readiness; 2020. Accessed:07/12/2020: Available:https://www.hec.gov.pk/english/H ECAnnouncements/Pages/default.aspx.
15. Sieben A, Oparka R, Erolin C. Histology in 3D: development of an online interactive student resource on epithelium. *Journal of Visual Communication in Medicine.* 2017;40:58-65. DOI:10.1080/17453054.2017.1332480
16. Crawford J, Butler-Henderson K, Rudolph J, Malkawi B, Glowatz M, Burton R, Magni

- P, Lam S. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*. 2020;3:1-20.  
DOI:10.37074/jalt.2020.3.1.7.
17. 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-s61.  
DOI:10.12669/pjms.36.COVID19-S4.2766
18. Dhahri AA, Iqbal MR, Pardoe H. Agile application of video telemedicine during the COVID-19 pandemic. *Cureus*. 2020;12:e11320.  
DOI:10.7759/cureus.11320

---

© 2021 Dhahri et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

*Peer-review history:*

*The peer review history for this paper can be accessed here:*  
<https://www.sdiarticle4.com/review-history/73472>