

The Impact of the COVID-19 Pandemic on the Education of Medical, Dental and Non-Medical Healthcare Professionals in Bangladesh: Findings and Connotation

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Abstract

Introduction: Lockdown measures in response to the COVID-19 pandemic had an appreciable impact on the education of all medical, dental and non-medical healthcare professional students. These included the closure of universities necessitating a rapid move to e-learning and a new practical approach to conducting teaching-learning classes. However, initially, there was a lack of knowledge and expertise regarding e-learning approaches and the affordability of internet bundles and equipment. **Materials and Methods:** We conducted two pilot studies to assess such current challenges, replaced by a two-stage approach including a full investigation involving 32 private and public universities during

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Submitted: 01-May-2023 **Revised:** 14-May-2023

Accepted: 16-May-2023 **Published:** 27-May-2023

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How to cite this article: Lutfor AB, Jahan F, Siddiqui TH, Chowdhury K, Ahmad R, Nusrat N, *et al.* The impact of the COVID-19 pandemic on the education of medical, dental and non-medical healthcare professionals in Bangladesh: Findings and connotation. *Adv Hum Biol* 2023;13:S85-95.

Access this article online

Quick Response Code:



Website:
www.aihbonline.com

DOI:
10.4103/aihb.aihb_53_23

the early stages of the pandemic, followed by a later study assessing the current environment brought about by the forced tops. **Results:** The top challenges at the start of the pandemic included a lack of familiarity with the e-learning approaches, the cost of the internet, a lack of IT equipment and the quality of the classes. To address identified challenges, universities offered support to staff and students. Since then, e-learning approaches have widened the possibilities for teaching and learning at convenient times. However, challenges remain. **Conclusions:** There were considerable challenges at the start of the pandemic. Several key issues have been addressed with hybrid learning here to stay. The remaining challenges include a lack of ICT equipment. However, new innovations will continue.

Keywords: Bangladesh, COVID-19, healthcare professional education, hybrid learning, internet affordability, lockdown measures, teaching flexibility

INTRODUCTION

The SARS-CoV-19 (COVID-19) pandemic appreciably increased morbidity and mortality across countries with considerable cost implications.^[1-5] Public health measures were introduced across countries at the start of the pandemic to try and slow the spread of the virus, and its consequences, in the absence of effective vaccines and treatments.^[6,7] These initiatives included lockdown measures, reduced public transport alongside travel restrictions and the closure of borders, closure of hospital clinics with healthcare activities directed towards managing patients with COVID-19 and introduction of contact tracing and quarantining measures.^[6-10] These measures typically proved effective; however, they were variably introduced across countries impacting subsequent morbidity and mortality rates certainly initially.^[7,9,11-14]

As the part of lockdown measures, initially, there were closures of educational institutes, including universities, globally.^[15-19] Face-to-face teaching activities were replaced by e-learning and other approaches, with a necessary paradigm shift to online educational teaching, including virtual laboratories.^[19-24] In the case of healthcare students, this resulted in a rapid shift to online lectures and coursework alongside simulations^[22,25] [Figure 1].

However, there were many challenges initially, especially among low- and middle-income countries (LMICs), with students and lecturers unfamiliar with this learning approach at the start of the pandemic.^[17-19,26-28] In addition, there were considerable issues with the availability of suitable IT equipment, including computers, among healthcare professional (HCP) students, quiet places within homes for learning, the prohibitive costs certainly initially of internet bundles as well as the reliability of the internet^[17,18,29] [Figure 2]. There were also concerns with the transfer of knowledge if face-to-face teaching from senior staff and practical teaching and learning sessions were suspended, potentially impacting on the ability of healthcare students to manage patients on qualification^[17,30] competently. This is particularly important in Bangladesh, with a high prevalence of both infectious and non-infectious diseases.^[31,32] This includes increasing rates of antimicrobial resistance exacerbated by inappropriate prescribing and dispensing of antibiotics, including patients with COVID-19.^[32-35] Knowledge transfer also help address misinformation surrounding COVID-19, including vaccine hesitancy among key stakeholder groups, including university students.^[36-40] Finally, there have been concerns with students regulating their online learning habits, especially if there are challenges and barriers, although this is not universal.^[27,41,42]

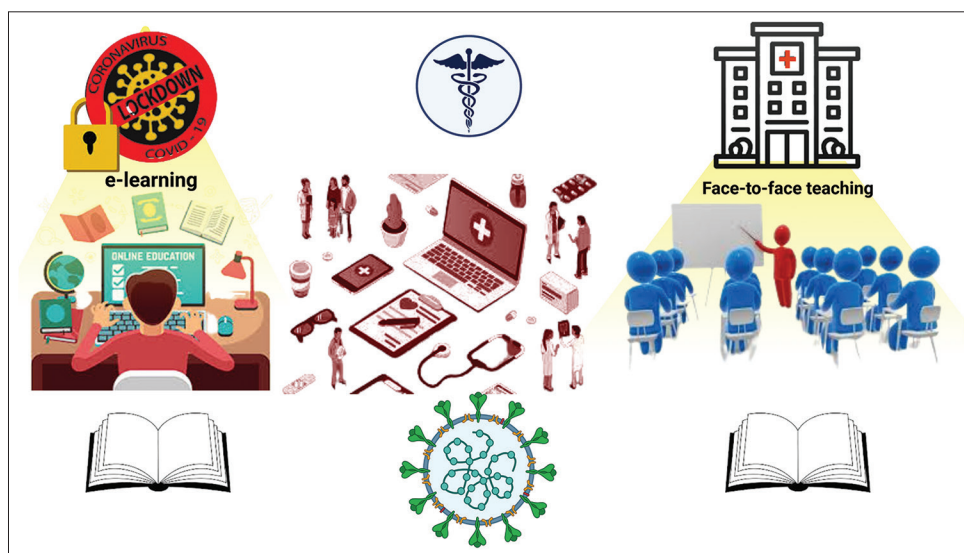


Figure 1: Schematic diagram showing the contrast between face-to-face teaching and e-learning. This figure has been drawn utilizing the premium version of BioRender with the License number TK256DJ3VO. Image Credit: Susmita Sinha.

However, as restrictions have eased, there has been a return to face-to-face lectures, practical teaching-learning sessions and demonstrations across countries. It is likely, though, that a blended learning multi-modal approach for both HCP students and post-qualification, incorporating critical attributes of the various methods, including virtual laboratories, will persist as the challenges to distant learning, including availability and familiarisation with new technologies as well as ensuring good communication skills and empathy with patients, are increasingly addressed.^[21,23,43-51]

Our initial pilot study among senior-level physicians and educators of physicians and dentists in Bangladesh found little experience with e-learning among faculty members and students at the pandemic's start, alongside concerns with

poor internet access and the cost of internet bundles.^[24] The universities responded by instigating teaching classes for educators on e-learning techniques and providing adequate personal protective equipment for both students and educators during teaching and practical sessions to reduce the spread of the virus. Several recommendations were also made for future pandemics.^[24] A similar situation was seen among non-medical HCPs in a mirror pilot study in Bangladesh; however, educators in private universities found their universities more readily adopted e-learning approaches and resumed face-to-face classes more quickly than educators in public universities in Bangladesh.^[52]

We wanted to build on these findings to provide additional guidance to all key stakeholder groups to improve the education of future HCPs during successive waves of the current and future pandemics. Alongside this, chart changes in learning approaches for HCPs in Bangladesh following the instigation of blended learning. Consequently, we initially extended our pilot study to include an appreciable number of HCP educators across Bangladesh, as well as more recently following this up to assess the extent of ongoing changes to learning approaches and the implications for the future. These were the key objectives for this research, with the combined findings used to guide future groups for this and future pandemics. A graphical abstract illustrating this paper is in Figure 3.

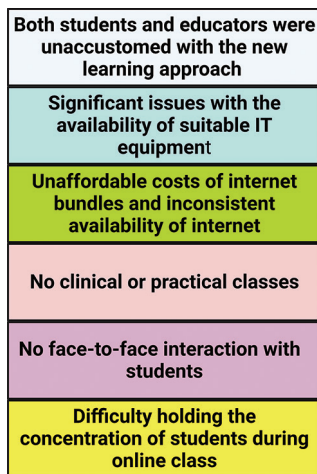


Figure 2: Diagram showing challenges met among healthcare students of low and middle-income countries. This figure has been drawn utilizing the premium version of BioRender with the License number EA256FEA29. Image Credit: Susmita Sinha.

MATERIALS AND METHODS

This involved a two-stage approach. The first stage involved an extension of the two pilot studies conducted throughout Bangladesh during the early stages of the COVID-19 pandemic. The methodology employed for this comprehensive study was precisely the same as two pilot studies undertaken in Bangladesh, which have been extensively described.^[24,52]

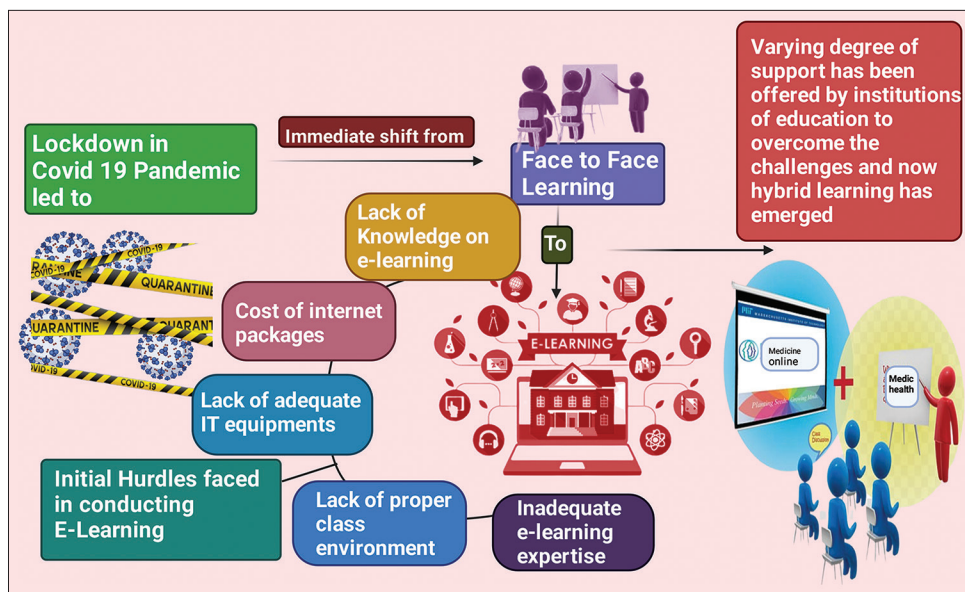


Figure 3: Graphical Abstract of this paper. This figure has been drawn utilizing the premium version of BioRender with the License number BA2565OXAL. Image Credit: Rahnuma Ahmad.

Briefly, a pragmatism approach was again used to ascertain the situation regarding HCP education following the initiation of lockdown measures. This included current challenges and how these were addressed.^[24,52] Deductive and inductive judgments were subsequently used to provide future guidance to all key stakeholder groups.^[53-55]

The questionnaire that was successfully piloted was subsequently sent to HCP educators throughout Bangladesh, including those in both private and public universities. Both private and public universities were chosen to reflect the current situation with university education in Bangladesh.^[24,52] The universities were purposely selected to enhance response rates, in line with other studies.^[56-58] Box 1 contains the finalized questions. As before, the findings were grouped into themes to guide the current and future pandemics.^[59,60]

The second stage conducted during February 2023 involved ascertaining the current situation concerning the uptake of mixed teaching methods in Bangladesh following the early lockdown measures and ongoing concerns. A pragmatic approach that used purposeful sampling was again adopted. This was facilitated by using the eight focal co-authors throughout Bangladesh. Subsequently, ask them to target three to seven original educators with agreed questions.

The questions included:

- What has been the impact of the enforced changes in HCP education following the closure of the universities on the current education of HCPs compared with the pre-pandemic situation? If there have been changes, in your opinion what have been the top 2 changes seen?
- Similarly, are both students and educators now more familiar with e-learning approaches since the start of the pandemic to assist with these changes (Yes/No). If not, is there a reason for this?

Box 1: Nine questions were included in the questionnaire

1. What challenges has COVID-19 presented to health sciences education?
2. How did health sciences institutions respond immediately to the challenges presented by the COVID-19 pandemic in Bangladesh?
3. What support was harnessed to help mitigate the challenges faced by higher learning institutions?
4. What lessons can be learned to prepare higher learning institutions in health sciences education for future pandemics?
5. Did all students have access to the necessary equipment, e.g., computers, etc., to undertake e-learning at the start of the pandemic (computers had to be bought for students in Africa)-especially given comments in question 4? If not-how was this addressed in reality?
6. Could all students afford the various internet bundles to undertake e-learning at the start of the pandemic?
7. Were any courses/tutorials instigated early by the medical schools at the start of the pandemic for the teachers to become familiar with the new platforms such as zoom, etc.?
8. Were there any challenges with students undertaking e-learning at home, including access to a quiet room, reliable internet facilities, etc.?
9. Have any support services now been introduced for students and lecturers due to the pandemic? If so, please describe

- Has the availability of necessary equipment/IT support (e.g., lab tops) improved among students since the pandemic's start to assist with a more extraordinary hybrid approach to teaching (Yes/No)?
- Has Internet connectivity improved since the pandemic started to assist with these changes (yes/no)? What about the issues of affordability?

The questionnaire was based on the experience of the co-authors, like other situations involving the co-authors across a range of LMICs.^[12,17,24,33,61]

A thematic analysis was subsequently undertaken, like the pilot studies.^[24,62-64] This way, rapidly ascertain the current situation, with central themes explored more comprehensively if the need arises in future studies.

RESULTS

We will first document the findings from the comprehensive review of critical activities and challenges surrounding HCP education in the early stages of the pandemic before discussing the current situation.

Demographics of the participating educators and universities

Table 1 describes the details of the 105 educators among 32 participating universities across Bangladesh that took part in the study broken down by university type, i.e., private or public, as well as the extent of courses offered in the various participating universities.

Key challenges and responses in the early stages of the pandemic

Tables 2 and 3 describe the challenges educators and students face across university and institution types in the early stages of the pandemic following their closure as part of lockdown measures. Table 4 documents a range of immediate responses.

Table 5 describes some of the activities undertaken to address the challenges at the start of the pandemic, followed by Table 6, discussing potential lessons to be learned for future pandemics.

Current situation

Seven focal points provided five completed questionnaires, and one focal point provided two completed questionnaires from the original list of 105 educators. Overall, 37 participants from 18 institutions, both private and public, took part in the second phase.

Table 7 shows the critical impact of the enforced changes in HCP education following the closure of the universities on the current education of HCPs compared with the pre-pandemic situation. This includes the top four responses that were ascertained from the thematic analysis broken down by the type of educator, with similar responses seen regarding the challenges faced by educators and students at the start of the pandemic and the answers [Tables 3-6].

Table 8 contains the further details of the positive impact of the enforced changes to HCP education because of the lockdown and other measures.

DISCUSSION

We believe this is the first study in Bangladesh and possibly among LMICs that follows up on the forced changes in HCP education because of lockdown and other measures. The challenges among educators and students in Bangladesh at the start of the pandemic with the rapid conversion to e-learning included limited familiarity with this approach, impacting the quality of classes and assessments certainly initially, disruption to the academic year, poor internet connectivity among public universities and costs, pertinent ICT equipment as well as available places for quiet learning. These challenges among educators and students were like other countries, especially other LMICs.^[17,18,21,22,25,29,65-67]

The support that was harnessed to help both educators and students cope with the new e-learning environment included

Table 1: Demographic characteristics of the responders

Participant institutions	Number of institutions	Departments	Number of responders
Private medical	11	Physiology	3
		Biochemistry	7
		Pharmacology	5
		Community medicine	2
		Microbiology	6
		Pathology	6
		Forensic medicine	2
		Surgery	1
		Medicine	4
		Pediatrics	6
Public medical	7	Urology	1
		Physiology	1
		Biochemistry	3
		Pharmacology	2
		Microbiology	9
		Surgery	1
		Medicine	4
		Orthopaedics	3
		Gynaecology and obstetrics	2
		ENT	1
		Ophthalmology	2
Private university	3	Anaesthesiology	1
		Paediatric surgery	2
		Microbiology	3
Public university	8	Pharmacy	1
		Microbiology	9
		Pharmacy	9
		Biochemistry	1
Dental institute	5	Biotechnology and genetic engineering	3
		Dentistry	5
		Dentistry	5
Total	32		105

ENT: Ear, nose and throat

e-book libraries and other online resources, support to make internet bundles affordable to all students alongside permission to purchase the necessary ICT equipment where pertinent, training on e-learning approaches and equipment as well as mental health support [Figure 4]. This was like other LMICs, with blended learning here to stay, including gamified training platforms.^[17,22,45,48-50,67,68] These combined approaches should help address student concerns about the potential loss of learning opportunities because of lockdown and other measures and its subsequent impact on their confidence and mental health,^[69,70] which mirrors the situation in other countries.^[71-77]

It was encouraging to see that following the forced changes in the education of HCPs because of lockdown measures, the educators believed that online education had widened their options, with both educators and students becoming familiar with online platforms. This was almost universal among educators and students in the follow-on study [Table 8]. However, there were still concerns with conducting practical teaching learning programs, gaining clinical experience remotely, and keeping students attentive during online classes. As mentioned, we are seeing gamified training platforms and other approaches being instigated to help address concerns for this and future pandemics.^[68,78-80]

It was also encouraging to see that internet connectivity had improved since the pandemic's start, as this is critical for a continued hybrid approach to learning. However, there were still concerns in some situations, which needs addressing going forward. There were also concerns that the availability of necessary ICT equipment and support has not improved for students among most educators surveyed (60.5%). This also needs to be urgently addressed for educators and students to take full advantage of hybrid learning opportunities arising from this and future pandemics.

We are aware of several limitations of this study. First, purposeful sampling was used to identify the educators for the initial and

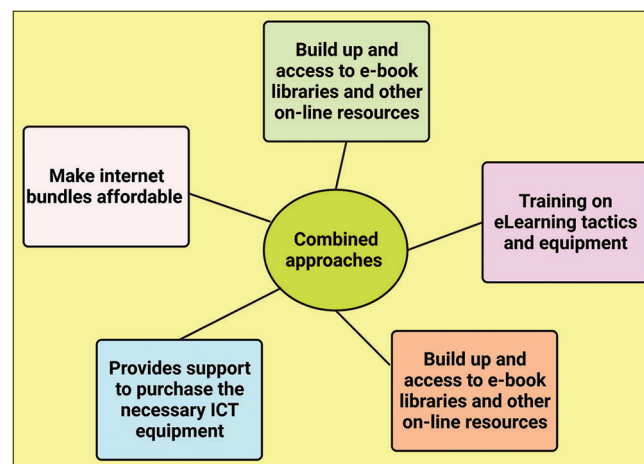


Figure 4: Schematic diagram showing combined approaches that were taken to help both educators and students. This figure has been drawn utilizing the premium version of BioRender with the License number NF256FI341. Image Credit: Susmita Sinha.

Table 2: Top seven challenges educators face in the early stages of the pandemic

Institutions	Top 7 challenges						
	No clinical or practical classes	Teachers unfamiliar with online classes	Academic sessions are delayed causing interruption of the academic calendar	The quality of classes and assessment tests compromised	No face-to-face interaction with students	Poor internet connection	Difficulty holding the concentration of students during online class
Private medical	√	√	√	√		√	√
Public medical	√	√	√	√		√	√
Private university	√		√	√	√		√
Public university	√	√	√	√	√	√	
Public dental	√			√	√	√	√

Table 3: Challenges students face in the early stages of the pandemic

Questions	Private medical, n (%)	Public medical, n (%)	Private universities, n (%)	Public universities, n (%)	Dental institutions, n (%)
Did all students have access to the necessary IT equipment, e.g., computers, etc.	No: 34 (79) Yes: 7 (16.28) Not known: 2 (4.65) Smartphone: 22	No: 23 (82.14) Yes: 5 (17.86)	No: 4 (100)	No: 22 (100)	No: 5 (100)
Could all students afford the various internet bundles to undertake e-learning	No: 29 (67.44) Yes: 14 (32.56)	No: 21 (75) Yes: 7 (25)	No: 3 (75) Yes: 1 (25)	No: 22 (100)	No: 5 (100)
Were any courses/tutorials instigated early in the pandemic for teachers and students to become familiar with the new platforms such as zoom, etc.	No: 36 (83.72) Yes: 7 (16.28)	No: 11 (39.28) Yes: 17 (60.71)	No: 1 (25) Yes: 3 (75)	No: 12 (54.55) Yes: 10 (45.45)	No: 3 (60) Yes: 2 (40)
Were there any challenges with students undertaking e-learning at home	Yes: 39 (90.7) Not known: 4 (9.3)	Yes: 27 (96.43) No: 1 (3.57)	Yes: 4 (100)	Yes: 21 (95.45) No: 1 (4.54)	Yes: 5 (100)
Have any support services been introduced to help students learn during the pandemic?	Yes: 27 (62.8) No: 16 (37.2)	Yes: 19 (67.86) No: 7 (25) No reply: 2 (7.14)	Yes: 4 (100)	Yes: 14 (63.63) No: 8 (36.36)	Yes: 4 (80) No: 1 (20)

Table 4: Immediate response of health science institutions to the challenges to educators and students presented by the COVID-19 pandemic

Institutions	Top seven responses						
	Face-to-face classes were suspended, and online learning introduced	Enhanced capacity to diagnose and manage COVID-19 cases, e.g., RT-PCR lab, COVID-19 wards	Strengthened triage in IPC	Assessment of students via online examinations	Course materials converted to e-lectures	Provision of PPE and sanitizers for any face-to-face learning and demonstrations	Training educators on e-learning approaches
Private medical	√	√	√	√	√		
Public medical	√	√		√		√	
Private university	√	√		√	√		
Public university	√	√	√	√	√		√
Public dental	√	√	√			√	

RT-PCR: Real-time reverse transcription–polymerase chain reaction, PPE: Personal protective equipment, IPC: Infection, prevention and control

subsequent studies to enhance the response rate. This approach was used as our objective was to understand the initial and current situation to provide future guidance rather than specific quantitative analyses surrounding particular points. Second, we did not validate the questionnaire. However, we undertook extensive pilots, and the questionnaire was based on the current literature supplemented by the vast knowledge of the co-authors. We have used this approach to good effect in previous studies undertaken by the co-authors in this and related fields.^[11,12,17,18,61,81,82]

CONCLUSIONS

In conclusion, there were considerable challenges among educators and healthcare students following lockdown measures at the start of the COVID-19 pandemic. These included a lack of familiarity with e-learning approaches, including the technology, concerns with the cost of internet bundles, lack of necessary ICT equipment, especially among students, disruption of the academic calendar and issues with conducting practical sessions

Table 5: Support harnessed to help mitigate the challenges of lockdown measures institutions face

Institutions	Support provided
Private medical	<ul style="list-style-type: none"> Arrangements to start online classes and examinations were made by the institute Provision of free Wi-Fi Provision of laptops for teachers Training on preventive measures against COVID Supply of protective equipment, e.g., PPE, masks, hand sanitisers and building handwashing stations
Public medical	<ul style="list-style-type: none"> Provision of free Wi-Fi Arrangements to start online classes and exams by the institutes Supply of protective equipment, e.g., PPE, masks, hand sanitizers, building hand washing stations Training on preventive measures against COVID-19 Provision of laptops for educators
Private university	<ul style="list-style-type: none"> Arrangement to start online classes and examinations made by the institutes Provision of laptops for educators Training on online teaching for educators Regular communication and mental support to students Facilities for proper screening and treatment of COVID-19-affected educators
Public university	<ul style="list-style-type: none"> Financial support for students, e.g., loans to purchase ICT equipment for online courses, reduced tuition, registration and accommodation fees Provision of free Wi-Fi and use of board band for unlimited net use for academic sessions Arrangements to start online classes and examinations Establishment of appropriate assessment methods for students, including their security Training on online teaching for educators
Public dental	<ul style="list-style-type: none"> Arrangement to start online classes and examinations made by the institutes Provision of free Wi-Fi Training on preventive measures against COVID-19 Provision of multimedia in lecture galleries Preparing alternative curriculum for pandemic situations in which the contents had to be concise, more practical and clinically oriented

PPE: Personal protective equipment, ICT: Information and communications technology

Table 6: Lessons learned to prepare the institutions for future pandemics

Institutions	Lessons learned
Private medical	<ul style="list-style-type: none"> Both teachers and students must have training on E-learning to fully address pandemic restrictions Every medical college should have an e-book library, develop online resources and update them regularly Internet packages and computers should be affordable for students A rapid response team/committee should be formed to face any kind of emergency in every institution in the future An online platform should be created by every institute where lectures, practicals, and clinical classes among the different educators should be uploaded and ready for students
Public medical	<ul style="list-style-type: none"> Establishment of blended education systems Both teachers and students must have training in e-learning A rapid response team/committee should have been formed to address future emergencies adequately Every medical college should have an e-book library, develop online resources, and update these regularly Adequate support systems to address the physical and mental stress arising from pandemics and associated preventative measures
Private university	<ul style="list-style-type: none"> Blended education systems must be introduced Development of preventive measures for future pandemics, e.g., lab establishment, infection control measures, primary health education at the school level, and awareness about personal protection Alternatives to practical classes should be sought Both educators and students must have training in e-learning Internet packages and computers should be affordable for the students
Public university	<ul style="list-style-type: none"> Blended education system Both teachers and students must have training in e-learning Every medical college should have an e-book library, develop online resources, and update them regularly Public health and research institutes should be more active, and research should be more enriched to deal with future pandemics effectively
Public dental	<ul style="list-style-type: none"> Both educators and students must have training on e-learning Every college should have an e-book library, develop online resources, and regularly update them Blended education systems were introduced Adequate support to meet the physical and mental stress brought about by the pandemic Robotic surgery should be encouraged

Table 7: The impact of the necessary changes in healthcare professional education following the closure of the universities on the current education of healthcare professionals

Type of institutions	Top four responses			
	Online education has widened the options for education delivery at convenient times-thereby increasing the utilization of education	Both teachers and students have learned to communicate via online platforms	Students get theoretical knowledge via online education, but they are poor in practical and clinical experience	Students are less attentive to the classes and look for direct answers on the web rather than extracting them from textbooks and papers
Medical education	√	√	√	√
Non-medical healthcare professionals	√			√
Dental education	√	√		

Table 8: Changes following the challenges faced by the students during the pandemic

Questions	Response	Medical education, n (%)	Dental education, n (%)	Non-medical health professionals, n (%)
Has internet connectivity improved since the start of the pandemic to assist with these changes	Yes	27 (100)	1 (100)	6 (60)
	No	0	0	4 (40)
Are both students and staff now more familiar with e-learning approaches since the start of the pandemic to assist with the changes in educational methods?	Yes	26 (96.3)	1 (100)	10 (100)
	No	1 (3.7)	0	0
Has the availability of necessary equipment/IT support (e.g., laptops) among students improved since the start of the pandemic to assist with a more extraordinary hybrid approach to teaching	Yes	7 (25.93)	1 (100)	7 (70)
	No	20 (74.07)	0	3 (30)

and simulations. Encouragingly, several of these issues have been addressed in Bangladesh, with hybrid learning here to stay. However, some problems remain. These include a lack of necessary ICT equipment and support among several students. These issues must be resolved before complete hybrid learning can be instigated for all students. Alongside this, new innovations will continue to improve hybrid knowledge further.

Author contributions

Substantial Contributions to the Conception and Design: ABL, THS, KC, RA, PS, HL, AE, NA, SI, TZ, FA, NN, SK, BG, MH.

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Agreement to be accountable For All Aspects of the Work in Ensuring that Questions Related to the Accuracy or Integrity of Any Part of the Work are Appropriately Investigated and Resolved: ABL, FJ, THS, KC, RA, IS, PS, HL, AE, NA, TJM, SI, SN, TZ, FA, SS, NN, RK, NKB, SK, KH, KCB, SF, MH, ARMLK, SA, SM, RA, SS, FB, SAK, NSN, MAR, FRK, MB, NK, FY, MAB, MAT, TT, TSA, ARMM, CS, JAK, FA, SC, GA, SS, BG, MH.

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Finally, all authors have read and agreed to the published version of the manuscript.

Institutional review board statement

There was no ethical approval as we were not dealing with patients. This aligns with previous studies conducted by the co-authors and with institutional guidance.^[11,82-87]

Informed consent statement

No informed consent as not dealing with patients. This is again in line with previous studies conducted by the co-authors and with institutional guidance.^[11,82-87]

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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