

# Navigating Post Covid-19 education: An investigative study on students' attitude and perception of their new normal learning environment

Anshoo Agarwal<sup>Corresp., 1</sup>, S.Geetha Subramaniam<sup>2</sup>, Osama Kattak<sup>3</sup>, Gulam Saidunnisa Begum<sup>4</sup>, Afaf Taha<sup>1</sup>, Naglaa Ahmed Bayomy<sup>5</sup>, Abdulhakim Bawadekji<sup>6</sup>, Amin Khalid Makhdoom<sup>7</sup>, Maali Subhi Alshammari<sup>7</sup>, Farooq Ahmad Chaudhary<sup>Corresp. 8</sup>

<sup>1</sup> Pathology Department, Faculty of Medicine, Northern Borders University (NBU), Arar, Saudi Arabia

<sup>2</sup> INTI International University, Nilai, Malaysia

<sup>3</sup> Department of Restorative Dentistry, Jouf University, Sakaka, Saudi Arabia

<sup>4</sup> Department of Biochemistry, College of Medicine and Health Sciences, Suhar campus, National University, Muscat, Oman, Muscat, Oman

<sup>5</sup> Anatomy Department, Faculty of Medicine, Northern Borders University (NBU), Arar, Saudi Arabia

<sup>6</sup> Department of Biological Sciences, College of Science, Northern Borders University (NBU), Arar, Saudi Arabia

<sup>7</sup> Faculty of Medicine, Northern Borders University (NBU), Arar, Saudi Arabia

<sup>8</sup> Department of Community Dentistry, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan

Corresponding Authors: Anshoo Agarwal, Farooq Ahmad Chaudhary  
Email address: dranshoo3@gmail.com, chaudhary4@hotmail.com

**Background:** The incidence and aftermath of the COVID-19 pandemic brought about a drastic change in medical education around the world. Traditional classrooms made way for online classrooms in order to ensure that learning continued in a safe and secure environment. However, how well health professional students perceived and accepted these changes have not been fully gauged yet. Therefore, the aim of this study is to evaluate the perception of health professional students about their new educational climate. **Methods:** A modified and validated Dundee Ready Education Environment Measure (DREEM) questionnaire was used to collect data regarding student perception of their educational climate. **Results:** The mean DREEM scores for three time periods were in the accepted positive range of 101 to 150 indicating that most of the students perceived the changes positively. The results indicated that most students preferred blended learning over online learning or face-to-face learning alone. Areas of concern that need improvement were identified by poor item-wise scores. **Conclusion:** Strategic remedial measures for these concerns need to be developed to improve the quality of education received by the students. However, the results of our study indicated that most of the students were able to adapt positively to the new education environment due to the change in the circumstances during COVID.

1 **Navigating Post Covid-19 education: An investigative study on students' attitude and**  
2 **perception of their new normal learning environment**

3

4 Anshoo Agarwal\*<sup>1</sup>, S.Geetha Subramaniam<sup>2</sup>, Osama Kattak<sup>3</sup>, Gulam Saidunnisa Begum<sup>4</sup>, Afaf  
5 Taha<sup>1</sup>, Naglaa Ahmed Bayomy<sup>5</sup>, Abdulhakim Bawadekji<sup>6</sup>, Amin Khalid Makhdoom<sup>7</sup>, Maali  
6 Subhi Alshammari<sup>7</sup>, Farooq Ahmad Chaudhary\*<sup>8</sup>

7

8 <sup>1</sup> Pathology Department, Faculty of Medicine, Northern Borders University (NBU), Arar,  
9 Saudi Arabia.

10 <sup>2</sup> INTI International University, Nilai, Malaysia

11 <sup>3</sup> Department of Restorative Dentistry, Jouf University, Sakaka, Saudi Arabia.

12 <sup>4</sup> Department of Biochemistry, College of Medicine and Health Sciences, Suhar campus,  
13 National University, Muscat, Oman.

14 <sup>5</sup> Anatomy Department, Faculty of Medicine, Northern Borders University (NBU), Arar,  
15 Saudi Arabia.

16 <sup>6</sup> Department of Biological Sciences, College of Science, Northern Borders University  
17 (NBU), Arar, Saudi Arabia.

18 <sup>7</sup> Faculty of Medicine, Northern Borders University (NBU), Arar, Saudi Arabia.

19 <sup>8</sup> Department of Community Dentistry, Shaheed Zulfiqar Ali Bhutto Medical University,  
20 Islamabad, Pakistan.

21

22 Corresponding Author:

23 1. Anshoo Agarwal, Pathology Department, Faculty of Medicine, Northern Borders  
24 University (NBU), Arar, Saudi Arabia.

25 E-mail: dranshoo3@gmail.com

26 2. Farooq Ahmad Chaudhary, Department of Community Dentistry, Shaheed Zulfiqar Ali  
27 Bhutto Medical University, Islamabad, Pakistan.

28 Email: chaudhary4@hotmail.com

29

30 **Abstract:**

31 **Background:** The incidence and aftermath of the COVID-19 pandemic brought about a drastic  
32 change in medical education around the world. Traditional classrooms made way for online  
33 classrooms in order to ensure that learning continued in a safe and secure environment. However,  
34 how well health professional students perceived and accepted these changes have not been fully  
35 gauged yet. Therefore, the aim of this study is to evaluate the perception of health professional  
36 students about their new educational climate.

37 **Methods:** A modified and validated Dundee Ready Education Environment Measure (DREEM)  
38 questionnaire was used to collect data regarding student perception of their educational climate.

39 **Results:** The mean DREEM scores for three time periods were in the accepted positive range of  
40 101 to 150 indicating that most of the students perceived the changes positively. The results  
41 indicated that most students preferred blended learning over online learning or face-to-face  
42 learning alone. Areas of concern that need improvement were identified by poor item-wise  
43 scores.

44 **Conclusion:** Strategic remedial measures for these concerns need to be developed to improve the  
45 quality of education received by the students. However, the results of our study indicated that  
46 most of the students were able to adapt positively to the new education environment due to the  
47 change in the circumstances during COVID.

48

## 49 INTRODUCTION

50 Medical education, over the years, has relied on traditional teaching methods and physical  
51 classrooms to impart the necessary knowledge and skill sets to future health professional  
52 students. Nevertheless, educational institutions all around the world were forced to use e-learning  
53 platforms when COVID-19 was declared a pandemic in order to support students in continuing  
54 their studies (Kaul et al. 2021). This inevitable and sudden transformative change tested the  
55 flexibility and adaptability of teachers, students, and institutions alike. In a manner of speaking  
56 the pandemic opened several opportunities for the improvement of how medical knowledge is  
57 delivered to future health professional students. It served as a platform for the evolution of  
58 medical education (Kaul et al. 2021).

59 A primary challenge brought about by this change in the field of medical education was the  
60 transition from traditional classrooms to remote learning techniques such as live meetings and  
61 pre-recorded lectures. While educators were expected to impart the same quality and quantity of  
62 knowledge as before to students through electronic means, students were expected to understand,  
63 conform, and exhibit the expected growth in their skill sets. This posed a variety of problems  
64 (Chaudhary et al. 2022; Nimavat et al. 2021). E-learning required students to be more  
65 independent, and self-reliant and exhibit a certain amount of self-discipline to keep pace with the

66 curriculum. Further, for medical and nursing students the absence of clinical experience during  
67 the lockdown period was a major source of concern (Azlan et al. 2020) along with feelings of  
68 loneliness and depression due to isolation (Tahir et al. 2022). With institutions suspending  
69 regular classes, health profession students were at the risk of receiving less than an adequate  
70 amount of exposure to all the necessary spheres of knowledge and skills. The opportunity for  
71 students to learn directly from clinical experience and interaction with patients was largely  
72 reduced due to safety concerns. This stood to weaken their performance both in exams and their  
73 ability to become skilled health professional students (Ahmed et al. 2020).

74 The online learning had a number of distinct advantages too. It introduced flexibility into the  
75 students' study routine, providing them with the opportunity to learn according to their  
76 individual convenience. It made way for a student-oriented learning process which permitted  
77 them to study at their own pace. Students also showed a preference for recorded lectures over  
78 live classes, as they can be repeatedly listened by students (Kim et al. 2020). Safety during the  
79 pandemic, cost and time conservation and convenience have all been cited to be advantages of  
80 online education (Hussein et al. 2020). Several new challenges have also come to the forefront.  
81 The interferences to normal life like changes in regimen added stress from COVID-19 lockdown,  
82 isolation, and access to good internet connections have all made e-learning much more  
83 challenging for a significant number of students (Hussein et al. 2020; Shahrivini et al. 2021).  
84 Virtual classrooms limit teacher-student interaction which is an essential element in any given  
85 environment. More importantly, students have been discouraged by the reduction in the practical  
86 and clinical aspects of learning during the COVID period (Abbasi et al. 2020; Javed et al. 2021).  
87 On the other hand, simulation-based learning has been recommended to counter the absence of  
88 direct clinical experience during the pandemic (Abdulrahman et al. 2022).

89 The need for collecting feedback from both teachers and students is essential to understand the  
90 type of changes and improvements needed for better delivering the curriculum via e-learning  
91 (Nimavat et al. 2021). Moving forward, the future of medical education depends on how well the  
92 students, educators, and institutions adapt to the changes. Medical education cannot be restricted  
93 to traditional learning methods as online methods have been shown to be as effective as physical  
94 classrooms (Kim et al. 2020). The pandemic has created an opportunity to create a flexible but  
95 competent learning environment for students (Nimavat et al. 2021). Currently, the blended  
96 learning technique is widely considered as it encompasses both synchronous and asynchronous  
97 learning strategies. This will encourage students to be more involved in the process of their  
98 education (Lapitan Jr et al. 2021). Therefore, the aim of this study was to identify the extent of  
99 favorable and unfavorable aspects of remote learning. This knowledge will be valuable in  
100 designing future learning practices for efficient curriculum design and knowledge delivery.

101

## 102 **MATERIAL & METHODS**

103 This descriptive cross-sectional study was conducted at Northern Border University (NBU),  
104 Arar, Saudi Arabia among the health professional students from the colleges of  
105 medicine, applied science, and nursing. The ethical approval for study was obtained from the  
106 local committee of bioethics, Northern Border University (Ref: MED-2022-11-1371). The  
107 students were selected using a random sampling method. Students who enrolled in courses in the  
108 Universities after the start of the pandemic and students who passed out from their respective  
109 universities before normal classes resumed after the pandemic were excluded from the study. A  
110 modified version of the DREEM questionnaire was employed to collect the necessary data. The  
111 perception of the students of their educational environment was analyse before, during and after

112 COVID-19. Dundee Ready Education Environment Measure (DREEM) analysis is a widely  
113 validated method to analyse educational environments, particularly in Health professional  
114 educational institutions (Al-Ahmari et al. 2022; Miles et al. 2012). DREEM analysis was chosen  
115 for this study as it provides the possibility of identifying the strengths and weaknesses associated  
116 with each institution or country independently and taking focused remedial measures as per  
117 individual scores. A modified version of DREEM was used in this study which was verified by  
118 an expert medical education team. DREEM inventory evaluates student perception under 5  
119 domains constituting a total of 50 items. Items 4, 9, 13,17, 25, 35, 39, 48, and 50 are negative  
120 statements and hence were reverse scored. The 50 items are scored on a 5-point Likert scale, as  
121 follows: Strongly agree – 4.0, Agree – 3.0, Uncertain – 2.0, Disagree -1.0, and strongly disagree  
122 - 0. For individual items, a mean score of  $\geq 3.5$  is considered a true positive. Items with a mean  
123 score of  $\leq 2$  indicate problem areas and concerns. A mean score of 2–3 is an item that needs can  
124 be bettered for maximum benefit to students. The responses to the questionnaire are used to  
125 generate an overall score with a maximum value of 200. Completion of the inventory will be  
126 undertaken on a voluntary basis, and data anonymity will be maintained. Items 6,8,13,37,41,47  
127 and 50 were modified to reflect the aims of the present study. The five domains of student  
128 perception and the maximum possible scores for each domain are,

- 129 1. Student Perception of Learning (SPL) – 12 items with a maximum score of 48
- 130 2. Student Perception of Teachers (SPT)- 11 items with a maximum score of 44
- 131 3. Student’s Academic Self Perception (SASP) – 8 items with a maximum score of 32
- 132 4. Student’s Perception of Atmosphere (SPA) – 12 items with a maximum score of 48
- 133 5. Student’s Social Self Perception (SSSP) – 7 items with a maximum score of 28

## 134 RESULTS

135 The responses to the modified DREEM indicated that students perceived their educational  
136 environment positively in all three timelines and all colleges (Figure 1). The initial study  
137 conducted during the pre-covid period was extended after considering the impact of COVID on  
138 medical education. A total of 300 valid responses were received and considered for each of the  
139 three timelines. The respondents were 53.4% male and 46.6 % female. The results showed an  
140 increase in the total DREEM scores during the pandemic and after when regular classes had  
141 begun as compared to the pre-covid period. Medical students perceived the changes brought  
142 about by the pandemic positively to a good extent.

143

144 The mean scores for individual items of the DREEM questionnaire for pre-COVID, COVID,  
145 and post-COVID periods are listed in Table 1. Of the 5 domains SPT alone marked a decrease in  
146 score during the COVID and post-COVID periods when compared to the pre-COVID period.  
147 The highest positive score was recorded for item 47 (I prefer blended learning over face-to-face  
148 learning) for COVID and post-COVID durations. The lowest negative score was given to item  
149 19 (My social life is good) during the COVID timeline. Several problem-prone areas were  
150 identified with scores lower than 2. Table 2 lists the country-wise distribution of domain scores  
151 and Table 3 lists the overall mean scores for each domain.

152

## 153 **DISCUSSION**

154 Due to the COVID-19 pandemic, students' learning environments had to transition to an online  
155 setting, and this had a significant impact on students' subjective happiness. DREEM has long  
156 been used to gauge the environment associated with educating medical students. It has been used  
157 as an effective tool to identify both strengths and weaknesses in a given institution (Al-Ahmari et

158 al. 2022; Miles et al. 2012). In our study too, we utilized DREEM to understand the full impact  
159 of the COVID pandemic on health professional students studying in different colleges of  
160 Northern Border University in Saudi Arabia. Data analysis revealed that health professional  
161 students have adapted well to their new environment, irrespective of the intensity of the changes  
162 around them. This is consistent with previous studies conducted in various universities in other  
163 countries (Miles et al. 2012; Syed et al. 2021).

164 We observed an overall increase in the DREEM scores of the COVID and post-COVID timeline  
165 in comparison to the pre-pandemic period (Figure 1). Though all three timelines reported  
166 positive scoring, this observed increase in DREEM scores during and after the pandemic can be  
167 attributed to the flexibility introduced into the otherwise tight schedule of health professional  
168 students with the introduction of online learning (Lin et al. 2021). This increase was in line with  
169 other similar studies in which health professional students aligned with the blended learning  
170 principle. Effective time management, where students may choose their own learning pace, was  
171 one of the reported advantages of online learning (Vishwanathan et al. 2021). Students felt  
172 virtual classrooms to be more relaxed than physical classrooms. However, the overall positive  
173 score does not fully reveal the true picture. Several items that received ratings of less than 2 were  
174 reported as areas of concern. These areas need to be paid special attention for improvement.

175  
176 SPL domain showed an increase in scores during and after a pandemic. In the pre-COVID  
177 period, students reported being too tired to enjoy learning (Table 1). However, the score  
178 improved during COVID when e-learning was introduced. Another area of concern in this  
179 domain was the authoritarian nature of teachers. This has been reported in other studies as well  
180 (Vishwanathan et al. 2021). Nimavat *et al* recommended adopting both the synchronous mode

181 (Live classroom, virtual lab, etc.) which will allow students to immediately interact with their  
182 peers and the educator during live online sessions, and the asynchronous mode in which students  
183 can think through issues later with their classmates via the internet (chat rooms and discussion  
184 forums (Nimavat et al. 2021).

185 The only domain to report a reduction in scores during the pandemic and post-pandemic  
186 timelines was Student Perception of Teachers (SPT). The data obtained highlighted faculty-  
187 centered teaching, lack of effective communication skills of the faculty teaching, and the lack of  
188 social life as areas of concern (Table 1). During the pandemic and in its aftermath, the social  
189 lives of students were severely hindered. Students reported feeling lonely and depressed. Anxiety  
190 and frustration due to isolation and lack of communication affected a significant population of  
191 health professional students (Aristovnik et al. 2020; Shahrivini et al. 2021). In our current study  
192 too, items 19 and 28 scored negatively indicating students' mental health was impacted by the  
193 lockdown and ensuing isolation period.

194 The item scores in the SPA domain indicated the presence of a technological gap among both  
195 students and teachers. Though this was amplified during the transition from physical to virtual  
196 classrooms. Studies indicated the reluctance of teachers to accept and make themselves familiar  
197 with the new technology platforms that were made available to aid virtual learning (Nimavat et  
198 al. 2021). As a result, e-learning's effectiveness was somewhat diminished. Due to a lack of  
199 technology, poor internet access, and resistance to change on the part of both students and  
200 teachers, Abbasi et al.'s study in Pakistan concluded that learners prefer face-to-face instruction  
201 (Abbasi et al. 2020). Just using online sessions that encompass only pre-recorded lectures and  
202 occasional face-to-face sessions may not be enough to increase student participation. Azlan *et al*

203 recommended improving the efficiency and scope of online education by considering  
204 collaborative educational tools and mediums (Azlan et al. 2020).

205 Abbasi *et al*, in their study, reported how e-teaching and learning experiences limited the number  
206 of interactions between teachers and their students (Abbasi et al. 2020). In congruence with this,  
207 the score of item 49 (I am able to ask questions whenever I want) dropped significantly during  
208 the COVID timeline when e-learning was made exclusive for safety.

209 Students' responses provide some useful descriptive information regarding how they perceived  
210 about distinct learning environments. The connections between the physical and psychosocial  
211 learning environments that have been found are important because maintaining a suitable  
212 learning environment becomes an ongoing challenge for educators as a poor learning  
213 environment may prevent students from learning. It's possible that a learning environment's  
214 inadequacies could also lead to a general unease that comes up on a psychosocial level, affecting  
215 the standard of the learning environment. Overall, the study reveals that they had positive  
216 perceptions of their learning environments, which were reflected by relatively high levels of task  
217 orientation, cooperation, student cohesiveness, and satisfaction. This study has also served the  
218 dual purpose of establishing the need for a blended learning environment for improving the  
219 educational environment of health professional students while exposing the challenges and  
220 concerns plaguing medical education. Emphasis needs to place on making the learning  
221 atmosphere stress-free by encouraging students to interact and participate more both in physical  
222 and virtual platforms. A healthy and efficient educational environment is essential for nurturing  
223 both the professional and personal growth of future health professional students (Aga et al.  
224 2021). The COVID-19 pandemic has significantly impacted medical schools around the world,  
225 with the Middle East being no exception (Gordon et al. 2020). Our study also showed similar

226 results. The outbreak made it impossible for students to attend lectures or study in small groups,  
227 and the whole curriculum shifted online (Rose 2020). To stop the spread of the infection,  
228 clinical rotations had to be put on hold until the social distance was reduced (Chaudhary et al.  
229 2021; Gaur et al. 2020; Kim et al. 2020). Medical students relatively accepted the online format  
230 and were generally content with the online course (Gaur et al. 2020) despite the sudden transition  
231 to online learning. Although most students had favourable opinions of the online format, many of  
232 them also mentioned feeling lonely and missing their interpersonal relationships as a result of the  
233 social distance policy. Happiness is referred to as subjective well-being and is described as "a  
234 global evaluation of life satisfaction"(Zheng et al. 2021). Considered in context with its  
235 relationship with academic performance and empathy, more recent studies have highlighted the  
236 significance of emotional well-being in health profession students (Chaudhary et al. 2020; Khalil  
237 et al. 2020). The improvement of the well-being of students as a fundamental human need and  
238 the promotion of social connectivity are both potential responsibilities of healthcare institutions  
239 (Dworkin et al. 2021). To further understand how health profession students' subjective  
240 happiness changes over time, it is important to look into how they perceive their educational  
241 environment (Yoo & Kim 2019). A few educators have just employed the DREEM to look into  
242 the association between the learning environment and students' well-being. Positive evaluations  
243 of the medical school's learning environment were found to greatly reduce students' stress in one  
244 study (Gordon et al. 2020); in another, it was discovered that Student's Social Self-perceptions,  
245 one of the DREEM subscales, significantly correlated with subjective happiness (Kim et al.  
246 2020). The association between this and COVID-19 has, however, barely been explored in  
247 investigations. Pre-pandemic data were not taken into consideration in the studies that already  
248 exist on health profession students' satisfaction and stress following COVID-19 (Isaradisaiikul et

249 al. 2021; Rose 2020; Stormon et al. 2022). Therefore, it can be difficult to figure out whether  
250 students' perspectives have changed for better or for worse following COVID-19 (Meo et al.  
251 2020). As far as we understand, only a few studies have looked into how students perceived the  
252 learning environment and how happy they were both before and after the outbreak (Villanueva et  
253 al. 2021). Our study was designed to evaluate pre-pandemic data to contrast with post-pandemic  
254 data. As a result, we could look into how COVID-19 affected health students students' views of  
255 the learning environment and their subjective happiness.

256 As a result of the pandemic, the learning environment go beyond traditional classroom education  
257 and had a quick shift to online learning. Since its introduction, E-Learning has become a widely  
258 used instructional strategy. Blended learning, or a combination of traditional classroom training  
259 and online instruction, is likely to become an accepted method of education in the medical field.  
260 The purpose of blended learning is to increase educational effectiveness by combining the  
261 benefits of in-person and online learning. Blended learning in health professions education has  
262 shown that more successful than traditional classroom instruction in terms of knowledge  
263 acquisition. This form of teaching and learning has been used in higher education for many  
264 years.

265 Our study results revealed that the student's preferences towards blended learning rather than  
266 physical classes or e-learning alone need to be taken into consideration for building a beneficial  
267 medical education system. One of the major areas of improvement needs to be SPT. Importance  
268 needs to be given to both the educational and mental growth of students for the improvement of  
269 this domain. It has been made evident that both students and faculty need to be in line with  
270 technological advances to maximize the efficiency of blended learning.

271

272 **CONCLUSION**

273 Students perceived the changes brought about by the pandemic positively to a good extent,  
274 however, there are emerging and evolving connections between the physical and psychosocial  
275 learning environments related to the use of new information technologies. In particular,  
276 psychosocial aspects may affect how satisfied learners are with learning in these settings. A  
277 regular training session is recommended for teachers and students alike to remove the reluctance  
278 exhibited by them towards new technologies. Further, medical universities should keep in mind  
279 the mental and social health of students while designing curriculum and should establish a  
280 support system for vulnerable students.

281

282 **REFERENCES**

283

- 284 Abbasi S, Ayoob T, Malik A, and Memon SI. 2020. Perceptions of students regarding E-learning  
285 during Covid-19 at a private medical college. *Pakistan Journal of Medical Sciences*  
286 36:S57.
- 287 Abdulrahman KAB, Alamri AA, and AlSheikh MH. 2022. Medical Education in the era of  
288 COVID-19.
- 289 Aga SS, Khan MA, Al Qurashi M, Khawaji B, Al-Mansour M, Shah SW, Abushouk A, Abdullah  
290 Alabdali H, Alharbi AS, and Hawsawi ME. 2021. Medical students' perception of the  
291 educational environment at college of medicine: a prospective study with a review of  
292 literature. *Education Research International* 2021:1-14.
- 293 Ahmed H, Allaf M, and Elghazaly H. 2020. COVID-19 and medical education. *The Lancet*  
294 *infectious diseases* 20:777-778.
- 295 Al-Ahmari MM, Al Moaleem MM, Khudhayr RA, Sulaily AA, Alhazmi BAM, AlAlili MIS,  
296 Alqahtani AM, and Alassaf HSN. 2022. A Systematic Review of Publications Using the  
297 Dundee Ready Education Environment Measure (DREEM) to Monitor Education in  
298 Medical Colleges in Saudi Arabia. *Medical Science Monitor* 28.
- 299 Aristovnik A, Keržič D, Ravšelj D, Tomaževič N, and Umek L. 2020. Impacts of the COVID-19  
300 pandemic on life of higher education students: A global perspective. *Sustainability*  
301 12:8438.
- 302 Azlan CA, Wong JHD, Tan LK, Huri MSNA, Ung NM, Pallath V, Tan CPL, Yeong CH, and Ng  
303 KH. 2020. Teaching and learning of postgraduate medical physics using Internet-based e-  
304 learning during the COVID-19 pandemic—A case study from Malaysia. *Physica Medica*  
305 80:10-16.

- 306 Chaudhary FA, Ahmad B, Ahmad P, Khalid MD, Butt DQ, and Khan SQ. 2020. Concerns,  
307 perceived impact, and preparedness of oral healthcare workers in their working  
308 environment during COVID-19 pandemic. *Journal of occupational health* 62:e12168.
- 309 Chaudhary FA, Ahmad B, Gul M, Rafiq A, Qasim Butt D, Rehman M, and Ahmad P. 2021. The  
310 Psychological Impact of the COVID-19 Pandemic on Oral Health Care Workers and its  
311 Impact on Their Willingness to Work During this Pandemic. *Archives of Psychiatry  
312 Research: An International Journal of Psychiatry and Related Sciences* 57:179-188.
- 313 Chaudhary FA, Ahmad B, Javed MQ, Mustafa S, Fazal A, Javaid MM, Siddiqui AA, Alam MK,  
314 and Ud Din S. 2022. Teledentistry awareness, its usefulness, and challenges among  
315 dental professionals in Pakistan and Saudi Arabia. *Digital Health* 8:20552076221089776.
- 316 Dworkin M, Akintayo T, Calem D, Doran C, Guth A, Kamami E, Kar J, LaRosa J, Liu Jr J, and  
317 Perez Jimenez I. 2021. Life during the pandemic: an international photo-elicitation study  
318 with medical students. *BMC medical education* 21:244.
- 319 Gaur U, Majumder MAA, Sa B, Sarkar S, Williams A, and Singh K. 2020. Challenges and  
320 opportunities of preclinical medical education: COVID-19 crisis and beyond. *SN  
321 comprehensive clinical medicine* 2:1992-1997.
- 322 Gordon M, Patricio M, Horne L, Muston A, Alston SR, Pammi M, Thammasitboon S, Park S,  
323 Pawlikowska T, and Rees EL. 2020. Developments in medical education in response to  
324 the COVID-19 pandemic: a rapid BEME systematic review: BEME Guide No. 63.  
325 *Medical teacher* 42:1202-1215.
- 326 Hussein E, Daoud S, Alrabaiah H, and Badawi R. 2020. Exploring undergraduate students'  
327 attitudes towards emergency online learning during COVID-19: A case from the UAE.  
328 *Children and youth services review* 119:105699.
- 329 Isaradisaikul SK, Thansuwonont P, and Sangthongluan P. 2021. Impact of COVID-19  
330 pandemic on happiness and stress: comparison of preclinical and clinical medical  
331 students. *Korean journal of medical education* 33:75.
- 332 Javed MQ, Chaudhary FA, Mohsin SF, AlAttas MH, Edrees HY, Habib SR, and Riaz A. 2021.  
333 Dental health care providers' concerns, perceived impact, and preparedness during the  
334 COVID-19 pandemic in Saudi Arabia. *PeerJ* 9.
- 335 Kaul V, de Moraes AG, Khateeb D, Greenstein Y, Winter G, Chae J, Stewart NH, Qadir N, and  
336 Dangayach NS. 2021. Medical education during the COVID-19 pandemic. *Chest*  
337 159:1949-1960.
- 338 Khalil R, Mansour AE, Fadda WA, Almisnid K, Aldamegh M, Al-Nafeesah A, Alkhalifah A,  
339 and Al-Wutayd O. 2020. The sudden transition to synchronized online learning during  
340 the COVID-19 pandemic in Saudi Arabia: a qualitative study exploring medical students'  
341 perspectives. *BMC medical education* 20:1-10.
- 342 Kim JW, Myung SJ, Yoon HB, Moon SH, Ryu H, and Yim J-J. 2020. How medical education  
343 survives and evolves during COVID-19: our experience and future direction. *PloS one*  
344 15:e0243958.
- 345 Lapitan Jr LD, Tiangco CE, Sumalinog DAG, Sabarillo NS, and Diaz JM. 2021. An effective  
346 blended online teaching and learning strategy during the COVID-19 pandemic.  
347 *Education for Chemical Engineers* 35:116-131.
- 348 Lin Y, Kang YJ, and Kim D-H. 2021. Pre-medical students' perceptions of educational  
349 environment and their subjective happiness: a comparative study before and after the  
350 COVID-19 pandemic. *BMC medical education* 21:1-9.

- 351 Meo SA, Abukhalaf AA, Alomar AA, Sattar K, and Klonoff DC. 2020. COVID-19 pandemic:  
352 impact of quarantine on medical students' mental wellbeing and learning behaviors.  
353 *Pakistan Journal of Medical Sciences* 36:S43.
- 354 Miles S, Swift L, and Leinster SJ. 2012. The Dundee Ready Education Environment Measure  
355 (DREEM): a review of its adoption and use. *Medical teacher* 34:e620-e634.
- 356 Nimavat N, Singh S, Fichadiya N, Sharma P, Patel N, Kumar M, Chauhan G, and Pandit N.  
357 2021. Online medical education in India—different challenges and probable solutions in  
358 the age of COVID-19. *Advances in medical education and practice*:237-243.
- 359 Rose S. 2020. Medical student education in the time of COVID-19. *Jama* 323:2131-2132.
- 360 Shahrivini B, Baxter SL, Coffey CS, MacDonald BV, and Lander L. 2021. Pre-clinical remote  
361 undergraduate medical education during the COVID-19 pandemic: a survey study. *BMC*  
362 *medical education* 21:1-13.
- 363 Stormon N, Sexton C, Ford PJ, and Eley DS. 2022. Understanding the well-being of dentistry  
364 students. *European Journal of Dental Education* 26:1-10.
- 365 Syed TP, Faheem S, and Hassan S. 2021. Medical Students' Perception of Educational  
366 Environment and Effect of COVID-19 Pandemic on Learning. *Journal of Medical*  
367 *Academics* 4:11-15.
- 368 Tahir S, Imran N, Haider II, Mustafa AB, Rehman A-u, Azeem MW, and Javed A. 2022. A  
369 study to evaluate the impact of COVID-19 on Lifestyle of Medical students. *Pakistan*  
370 *Journal of Medical Sciences* 38.
- 371 Villanueva EW, Meissner H, and Walters RW. 2021. Medical student perceptions of the learning  
372 environment, quality of life, and the school of medicine's response to the COVID-19  
373 pandemic: a single institution perspective. *Medical science educator* 31:589-598.
- 374 Vishwanathan K, Patel GM, and Patel DJ. 2021. Impact and perception about distant online  
375 medical education (tele-education) on the educational environment during the COVID-19  
376 pandemic: Experiences of medical undergraduate students from India. *Journal of Family*  
377 *Medicine and Primary Care* 10:2216.
- 378 Yoo D-M, and Kim D-H. 2019. The relationship between students' perception of the educational  
379 environment and their subjective happiness. *BMC medical education* 19:1-10.
- 380 Zheng M, Bender D, and Lyon C. 2021. Online learning during COVID-19 produced equivalent  
381 or better student course performance as compared with pre-pandemic: empirical evidence  
382 from a school-wide comparative study. *BMC medical education* 21:1-11.

383

**Table 1** (on next page)

Table 1. Mean score of individual items of DREEM

1 Table 1. Mean score of individual items of DREEM.

	<b>DOMAINS AND ITEMS</b>	<b>Pre-COVID</b>	<b>COVID</b>	<b>Post-COVID</b>
	<b>SPL</b>			
1	Encouraged to take part in classroom events	2.2	2.5	2.5
2	The educators provided thorough information regarding the course of study.	2.5	2.4	2.6
3	A good support system for stressed-out students	2.4	<b>1.9</b>	2.3
4	Exhausted and unable to enjoy the course	<b>1.8</b>	2.6	2.6
5	My approaches to learning were successful.	2.4	2.2	2.4
6	The course coordinators promoted a student-centered teaching approach.	2.2	2.6	2.6
7	A lesson is frequently motivating.	2.3	2.7	2.5
8	The instructors pushed active participation from the students.	2.4	2.2	2.3
9	The trainers are authoritarian.	<b>1.8</b>	2.2	<b>1.9</b>
10	I am confident that I will pass this year.	2.5	2.1	2.3
11	The environment remains tranquil while lecturing.	2.4	2.6	2.6
12	A well-planned course	2.1	2.3	2.2
	<b>SPT</b>			
13	There is faculty-centered teaching.	2.2	<b>1.9</b>	2
14	This course rarely makes me feel bored.	2.1	2.2	2.1
15	In this course of study, I have close friends.	2	<b>1.5</b>	<b>1.7</b>
16	My competency is being developed by what is being taught.	2.3	2.2	2.1
17	In this course, cheating is a concern.	2	<b>1.5</b>	2.1
18	Faculty members can effectively communicate with learners.	2	<b>1.8</b>	2
19	My social life is satisfying.	2.2	<b>1.4</b>	2.1
20	The content of the lesson seems extremely defined.	2.3	2.2	2.1
21	I believe I am being adequately prepared for my future as a professional.	2.2	2.3	2
22	The teaching helps to develop my confidence	2.4	2	2.2
23	During lectures, there is a comfortable environment.	2.1	2.7	<b>1.9</b>
	<b>SASP</b>			
24	The teaching time is effectively utilized.	2.3	3.1	2.9
25	The teaching above places a strong emphasis on factual learning.	2.9	3	2.8
26	The work from last year provided an effective foundation for this year's work.	2.4	2.9	2.6
27	I am able to remember any information that I need.	2.2	3.1	2.9
28	I don't often feel lonely.	2.2	<b>1.8</b>	2.4
29	Students receive quality feedback from the faculty members.	<b>1.7</b>	2.9	2.6
30	There are prospects for me to enhance my interpersonal abilities.	2.2	2.1	2.8
31	My work has taught me a lot about empathy.	2.4	2.9	2.8
	<b>SPA</b>			
32	Constructive criticism is provided by the faculty.	2.4	2.8	2.7
33	Socially, I feel relaxed during lectures.	2.6	<b>1.9</b>	2.6
34	During lectures, there is an informal atmosphere. / PBL	2.1	2.8	2.3
35	The course is disappointing to me,	2.2	2.4	2.5

36	I have good concentration abilities.	2.2	2.3	2.6
37	The tutor has access to the newest technology.	2.4	<b>1.6</b>	2.3
38	I am informed of the course's learning objectives.	2.5	2.4	2.5
39	The lecturers become agitated during classes.	2.1	2.3	2.2
40	The instructors for the course are well-prepared for their classes.	2	<b>1.9</b>	2.1
41	My knowledge of technology continues to develop here, which has made learning enjoyable.	2.4	2.2	2.2
42	The enjoyable aspect of the course exceeds its stress.	<b>1.8</b>	2.2	1.9
43	My learning is inspired by the environment.	2.3	2.4	2.3
	<b>SSSP</b>			
44	My ambition for continuous improvement is encouraged by the teacher's guidance.	2.6	2.3	2.6
45	I feel that a lot of what I must learn is related to my course.	2.9	2.8	2.9
46	My classroom provides an amazing environment to acquire knowledge.	2.5	2.6	3.1
47	I choose blended learning over classroom instruction.	2.2	3.4	3.5
48	The focus of the lesson is overly teacher-centered.	2.1	2.4	2.3
49	I'm convinced that I am able to ask whatever questions I want.	2.8	2.1	2.7
50	I support distance learning over face-to-face teaching.	<b>1.7</b>	2.1	<b>1.9</b>

2

**Table 2** (on next page)

Table 2. Distribution of mean score college-wise.

1 Table 2. Distribution of mean score college-wise.

<b>Domain</b>	<b>Pre-COVID</b>	<b>COVID</b>	<b>Post-COVID</b>
<b>College of Medicine (Male Campus)</b>			
Students' Perception of Learning	29	31	31
Student's Perception of Teachers	22	20	22
Students' academic self-perception	18	21	22
Students' perception of the atmosphere	31	28	30
Students' social self-perception	17	20	21
<b>TOTAL</b>	<b>117</b>	<b>120</b>	<b>126</b>
<b>College of Medicine (Female Campus)</b>			
Students' Perception of Learning	30	31	33
Student's Perception of Teachers	24	23	24
Students' academic self-perception	16	19	18
Students' perception of the atmosphere	30	29	29
Students' social self-perception	18	19	19
<b>TOTAL</b>	<b>118</b>	<b>121</b>	<b>123</b>
<b>College of Applied Science (Male Campus)</b>			
Students' Perception of Learning	28	30	27
Student's Perception of Teachers	26	26	27
Students' academic self-perception	17	19	20
Students' perception of the atmosphere	29	24	30
Students' social self-perception	16	18	20
<b>TOTAL</b>	<b>116</b>	<b>117</b>	<b>124</b>
<b>College of Applied Science (Female Campus)</b>			
Students' Perception of Learning	23	24	23
Student's Perception of Teachers	22	18	18
Students' academic self-perception	19	23	24
Students' perception of the atmosphere	27	30	31
Students' social self-perception	16	15	18
<b>TOTAL</b>	<b>107</b>	<b>110</b>	<b>114</b>
<b>College of Nursing (Female Campus)</b>			
Students' Perception of Learning	27	28	30
Student's Perception of Teachers	22	20	20
Students' academic self-perception	15	24	23
Students' perception of the atmosphere	24	29	26
Students' social self-perception	17	18	19
<b>TOTAL</b>	<b>111</b>	<b>119</b>	<b>118</b>
<b>College of Nursing (Male Campus)</b>			
Students' Perception of Learning	25	26	29
Student's Perception of Teachers	27	23	23
Students' academic self-perception	19	25	24
Students' perception of the atmosphere	21	23	23
Students' social self-perception	17	16	17
<b>TOTAL</b>	<b>109</b>	<b>113</b>	<b>116</b>

2

**Table 3** (on next page)

Table 3. Overall mean of DREEM analysis.

1

2

Table 3. Overall mean of DREEM analysis.

<b>Domains</b>	<b>Pre-COVID</b>	<b>COVID</b>	<b>Post-COVID</b>
<b>SPL</b>	27	28.3	28.83
<b>SPT</b>	23.83	21.67	22.33
<b>SASP</b>	18.33	21.83	21.83
<b>SPA</b>	27	27.17	28.17
<b>SSSP</b>	16.83	17.67	19
<b>TOTAL</b>	<b>112.99</b>	<b>116.64</b>	<b>120.16</b>

3

# Figure 1

Figure 1: Variation of Domain scores during the three timelines

