Original Article

Impact and perception about distant online medical education (tele-education) on the educational environment during the COVID-19 pandemic: Experiences of medical undergraduate students from India

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Abstract

Introduction: The impact of online medical education using videoconferencing platforms on the education environment during the present COVID-19 pandemic is not known. The objectives were to evaluate the impact of online teaching using videoconferencing platforms on the education environment, satisfaction, and perception of the medical undergraduate students to online teaching. **Methods:** This prospective observational survey undertaken at a medical college included voluntarily participating medical undergraduate students from first (2nd semester), second (4th semester), and third year MBBS (6th and 8th semesters). The education environment was evaluated using the validated Dundee Ready Education Environment Measure (DREEM). The perception of the students was evaluated using questionnaire with five point Likert scale response. **Results:** The response rate in our survey was 77.5% (465 out of 600 students). The mean DREEM score of medical undergraduate students was 132.3 ± 19.8. Domains of DREEM evaluated were students' perception of learning (30.1 ± 6.3), students' perception of teachers (29.7 ± 4.6), students' academic self-perception (21.3 ± 4.9), students' perception of atmosphere (32.5 ± 6.2), and students' social self-perception (18.7 ± 3.5). Two hundred and fifty five students (54.8%) were extremely satisfied and quite satisfied with the online teaching–learning modalities. Two hundred and fifty eight students (55.5%) rated online learning methods to be very useful and quite useful during the lockdown period. **Conclusion:** The educational environment at our medical college was positive and students had a positive perception and attitude toward the role of the videoconferencing platforms for learning (telemedicine) during the COVID-19 pandemic lockdown.

Keywords: COVID-19, education, educational technology, graduate medical education, medical, undergraduate, videoconferencing

Introduction

The abrupt stopping of traditional teaching methods because of the lockdown imposed by the Government of India due to COVID-19 outbreak and rapid transition to digital teaching methods is bound to have adverse repercussions on medical

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students.[1-3] Zoom, Google meet, and Webex are some of the digital platforms used for online teaching in medical schools during the present pandemic.[4]

The objective of training of the Indian medical graduate is to enable them to function effectively as family physician, General practitioner, Doctor at a primary health center of community health center in both rural and urban setting. The objective of our training programme is to equip the medical undergraduate student to become competent primary care doctors who can participate in the prevention and treatment of diseases. It has been suggested by authors from India that fostering a positive and conducive teaching and learning environment is crucial toward delivery of better quality medical education.[5] The first step in developing a positive environment is to audit the existing teaching learning environment at our Institute so that appropriate corrective measures could be implemented.

Studies have been published recently regarding perception of students of online teaching.[6-10] However, none of the studies have investigated the educational environment as perceived by the medical students using validated questionnaire, with the use of digital medical education and none of the studies have evaluated student satisfaction with online medical education during the COVID-19 pandemic and this remains the key message from the present study. The students are a key stakeholder in the teaching–learning process and it is pertinent to know their views, perception, and assessment of the efficacy of the online methods and the medical educational environment during the time of the pandemic.

The objective of the study was to evaluate the education environment at our institute during the COVID-19 pandemic and also to evaluate perceptions, experience, and satisfaction of medical students with the use of videoconference platforms for online teaching.

Methods

Setting

This study was conducted after obtaining approval from the Institutional Ethics committee (approval number: PUIECHR/PIMSR/00/081734/2901) of the Institute. Our medical college is located in a rural area of a low-middle income country. Our Institute took the initiative to implement videoconferencing platforms such as Zoom Meet (www.zoom.us; San Jose, CA, USA) and Google Meet for delivering medical education to undergraduate students.

Study design and participants

First MBBS (2nd semester), second MBBS (4th semester), and third MBBS (6th and 8th semesters) students who attended the online lectures and gave written informed consent for participating in the study were included in this prospective, cross-sectional observational survey. Students that did not attend a single session of interactive e-learning session hosted by the institute and not giving consent for their data to be included in the study were excluded from the survey.

In order to gain maximum participation, information regarding the study was posted on various WhatsApp groups of the students of the institute. Survey response was collected from 6th May 2020 to 20th May 2020 using Google forms.

The student demographic information, perception, experience, and satisfaction were assessed using a questionnaire designed by the researchers based on the methodology as previously published [Table 1].[11-13]

The students were invited to complete the Dundee Ready Education Environment Measure (DREEM) which has sufficient validity and reliability and is one of the most widely used outcome instrument in medical education perception studies from various medical schools across different countries.[14-16] The DREEM consists of 50 questions that evaluate 5 domains. The DREEM score tends to range from 0 (worst educational environment) to 200 (model, best and ideal educational environment). The interpretation of the overall DREEM score, the sub-domains of the DREEM and the individual items of the DREEM were done based on previously published values.[17,18]

Statistical analyses

Data pertaining to the DREEM, its five sub-domains and items of DREEM were presented as mean, standard deviation, and range. ANOVA test with Bonferroni correction for multiple post-hoc comparisons was used to compare the statistical significance of difference in the mean values of DREEM and its five sub-domains in MBBS medical students of first year, second year, and third year. IBM SPSS version 19 was used for the statistical analysis.

Ethical issues consideration

An independent person who did not have any direct/indirect role in the future of the medical undergraduate students was involved in online consent and data collection.[19] The consent form for voluntary participation and the participant information sheet were presented in the online survey. Confidentiality was assured to the participating students. Student participation was voluntary and did not involve any inducements like course credits and neither did it involve any loss of benefits.[19] The data collected in online format was stored in a secure database. The independent researcher coded the data obtained so that the final data contained only codes and did not contain any student or faculty identification information.[19]

Results

Study participants

Six hundred medical undergraduate students were approached and 469 students completed the Google survey forms.

Table 1: Survey questions for students

- E-mail address
- Age
- Gender
- Year of medical school (1st MBBS/2nd MBBS/3rd MBBS)

Feedback on access to online lectures

- What device did you use to attend the Zoom Meet/Google Meet?
  - o Smart phone
  - o Tablet
  - o Laptop
  - o Desktop
  - o Smart TV
- Where did you attend the Zoom Meet/Google Meet?
  - o Home
  - o Hostel room
  - o Any other place
- Did you have any issue with internet connection?
  - o No
  - o Yes
- How many lectures have you attended over Zoom Meet/Google Meet as part of your MBBS teaching at our Institute?
  - o None
  - o 1-5
  - o 6-10
  - o ≥ 11

Feedback on videoconference platform for online lectures

- How did you find Google classroom as a repository for class lecture material?
  - o Extremely useful
  - o Quite useful
  - o Somewhat useful
  - o Not so useful
  - o Not at all useful
- Compared to conventional teaching method, how would you rate your overall experience with Zoom Meet/Google Meet/Google classroom?
  - o Outstanding
  - o Excellent
  - o Average
  - o Fair
  - o Poor
- How would you rate your satisfaction with using Zoom Meet/Google Meet/Google classroom as a tool for receiving medical education?
  - o Extremely satisfied
  - o Quite satisfied
  - o Somewhat satisfied
  - o Not so satisfied
  - o Not at all satisfied
- How do you rate the utility of Zoom Meet/Google Meet classes during the lockdown period?
  - o Very useful
  - o Quite useful
  - o Useful
  - o Rarely useful
  - o Not useful
- You might have spoken to your friends in other medical colleges. How do you rate the utilization of e-learning using Zoom Meet/Google Meet/Google classroom at our Institute?

Contd...

Table 1: Contd...

  - o Outstanding
  - o Excellent
  - o Average
  - o Fair
  - o Poor
- What are the advantages of learning using Zoom Meet/Google Meet/Google classroom? Answer each option with a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)
  - o More efficient use of study time
  - o Promotes acquisition of both superficial and deep learning
  - o Better for taking notes
  - o Not getting disturbed by fellow students
  - o Engaging experience
- What are the disadvantages of learning using Zoom Meet/Google Meet/Google classroom? Answer each option with a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree)
  - o Promotes acquisition of superficial learning rather than in-depth learning
  - o Not interactive
  - o Limited class time
  - o Limited opportunity to ask questions to faculty members
  - o Internet connection is slow/interrupted
  - o Access to mobile smart device
- What is your preferred e-learning method?
  - o Zoom Meet
  - o Google Meet/Google classroom

However, four students did not give consent for their data to be included in the study hence data from 465 medical undergraduate students (response rate = 77.5%) was included in the present study. Two hundred and thirty six male (50.8%) and 229 female (49.2%) undergraduate students participated in the study. The mean age of students was 20 years ± 1.3 [range: 17–24 years]. There were 114 students (24.5%), 105 students (22.6%), and 246 students (52.9%) from first year MBBS, second year MBBS, and third year MBBS course, respectively.

Overall DREEM score

The mean DREEM score of all medial undergraduate students of our institute was 132.3 ± 19.8 [range: 72–192]. The DREEM score was in the range of 51–100 points for 6% of the medical students, in the range of 101–150 points for 78.7% of students, and 15.3% students rated the DREEM score in the range of 151–200 points. The response of students for various sub-domains of the DREEM has been given in Table 2.

Students' perception of teaching [learning] (SPL)

The mean SPL sub-domain score of DREEM of all medical undergraduate students of our institute was 30.1 ± 6.3 [range: 4–48]. At our institute, teaching and learning was viewed positively by students based on the interpretation of the mean SPL. Students gave the highest ranking [2.83 points] to the item "teaching time is put to good use." Two items were identified to be problematic areas and they were "the teaching

Table 2: DREEM score and sub-domains

Sub-domain and items	Strongly agree *n* (%)	Agree *n* (%)	Unsure *n* (%)	Disagree *n* (%)	Strongly disagree *n* (%)
Students' perception of teaching (SPL)					
I am encouraged to participate in the class	65 (14%)	264 (56.8%)	97 (20.9%)	34 (7.3%)	5 (1.1%)
The teaching is sufficiently concerned to develop my confidence	59 (12.7%)	228 (49%)	121 (26%)	46 (9.9%)	11 (2.4%)
The teaching encourages me to be an active learner	62 (13.3%)	249 (53.5%)	94 (20.2%)	50 (10.8%)	10 (2.2%)
The teaching is well focussed	72 (15.5%)	229 (49.2%)	109 (23.4%)	46 (9.9%)	9 (1.9%)
The teaching is sufficiently concerned to develop my competence	51 (11%)	242 (52%)	115 (24.7%)	44 (9.5%)	13 (2.8%)
I am clear about the learning objectives of the course	57 (12.3%)	291 (62.6%)	80 (17.2%)	33 (7.1%)	4 (0.9%)
The teaching is often stimulating	54 (11.6%)	235 (50.5%)	127 (27.3%)	40 (8.6%)	9 (1.9%)
The teaching time is put to good use	70 (15.1%)	292 (62.8%)	66 (14.2%)	27 (5.8%)	10 (2.2%)
The teaching is student-centred	54 (11.6%)	280 (60.2%)	98 (21.1%)	30 (6.5%)	3 (0.6%)
Long term learning is emphasized over short term	54 (11.6%)	221 (47.5%)	142 (30.5%)	37 (8%)	11 (2.4%)
The teaching is too teacher-centred	42 (9%)	154 (33.1%)	171 (36.8%)	90 (19.4%)	8 (1.7%)
The teaching over emphasizes factual learning	38 (8.2%)	201 (43.2%)	169 (36.3%)	44 (9.5%)	13 (2.8%)
Students' perception of teachers (SPT)					
The teachers are good at providing feedback to students	104 (22.4%)	299 (64.3%)	51 (11%)	9 (1.9%)	2 (0.4%)
The teachers have good communications skills with patients	110 (23.7%)	282 (60.6%)	57 (12.3%)	12 (2.6%)	4 (0.9%)
The teachers are knowledgeable	171 (36.8%)	271 (58.3%)	18 (3.9%)	5 (1.1%)	0
The teachers give clear examples	127 (27.3%)	261 (56.1%)	65 (14%)	8 (1.7%)	4 (0.9%)
The teachers are well prepared for their classes	132 (28.4%)	275 (59.1%)	46 (9.9%)	10 (2.2%)	2 (0.4%)
The teachers provide constructive criticism here	67 (14.4%)	190 (40.9%)	149 (32%)	53 (11.4%)	6 (1.3%)
The teachers ridicule the students	27 (5.8%)	97 (20.9%)	162 (34.8%)	129 (27.7%)	50 (10.8%)
The teachers get angry in class	19 (4.1%)	60 (12.9%)	120 (25.8%)	188 (40.4%)	78 (16.8%)
The teachers are authoritarian	34 (7.3%)	150 (32.3%)	161 (34.6%)	97 (20.9%)	23 (4.9%)
The teachers are patient with patients	81 (17.4%)	251 (54%)	110 (23.7%)	18 (3.9%)	5 (1.1%)
The students irritate the teachers	33 (7.1%)	101 (21.7%)	139 (29.9%)	124 (26.7%)	68 (14.6%)
Students' academic self perception (SASP)					
I am able to memorize all I need	38 (8.2%)	193 (41.5%)	134 (28.8%)	86 (18.5%)	14 (3%)
Much of what I have to learn seems relevant to a career in medicine	61 (13.1%)	280 (60.2%)	101 (21.7%)	18 (3.9%)	5 (1.1%)
I feel I am being well prepared for my profession	62 (13.3%)	214 (46%)	133 (28.6%)	42 (9%)	14 (3%)
Last year's work has been a good preparation for this year's work	56 (12%)	239 (51.4%)	142 (30.5%)	24 (5.2%)	4 (0.9%)
My problem-solving skills are being well developed here	46 (9.9%)	192 (41.3%)	160 (34.4%)	54 (11.6%)	13 (2.8%)
I am confident about passing this year	89 (19.1%)	251 (54%)	99 (21.3%)	21 (4.5%)	5 (1.1%)
I have learned a lot about empathy in my profession	88 (18.9%)	276 (59.4%)	87 (18.7%)	12 (2.6%)	2 (0.4%)
Learning strategies which worked for me before continue to work for me now	59 (12.7%)	241 (51.8%)	130 (28%)	29 (6.2%)	6 (1.3%)
Students' perception of atmosphere (SPA)					
The atmosphere is relaxed during lectures	74 (15.9%)	305 (65.6%)	47 (10.1%)	33 (7.1%)	6 (1.3%)
I feel able to ask the questions I want	74 (15.9%)	306 (65.8%)	64 (13.8%)	18 (3.9%)	3 (0.6%)
I feel comfortable in class socially	82 (17.6%)	293 (63%)	63 (13.5%)	20 (4.3%)	7 (1.5%)
There are opportunities for me to develop interpersonal skills	63 (13.5%)	258 (55.5%)	109 (23.4%)	28 (6%)	7 (1.5%)
The atmosphere is relaxed during seminars/tutorials	80 (17.2%)	287 (61.7%)	73 (15.7%)	21 (4.5%)	4 (0.9%)
The enjoyment outweighs the stress of studying medicine	71 (15.3%)	230 (49.5%)	117 (25.2%)	34 (7.3%)	13 (2.8%)
The atmosphere motivates me as a learner	64 (13.8%)	265 (57%)	92 (19.8%)	36 (7.7%)	8 (1.7%)
I am able to concentrate well	58 (12.5%)	251 (54%)	93 (20%)	53 (11.4%)	10 (2.2%)
The atmosphere is relaxed during the ward teaching	68 (14.6%)	267 (57.4%)	96 (20.6%)	28 (6%)	6 (1.3%)
This medical college is well timetabled	128 (27.5%)	268 (57.6%)	49 (10.5%)	13 (2.8%)	7 (1.5%)
I found the experience disappointing	26 (5.6%)	110 (23.7%)	141 (30.3%)	143 (30.8%)	45 (9.7%)
Cheating is a problem in this course	34 (7.3%)	102 (21.9%)	163 (35.1%)	113 (24.3%)	53 (11.4%)
Students' social self perception (SSSP)					
I have good friends in this college	190 (40.9%)	236 (50.8%)	27 (5.8%)	6 (1.3%)	6 (1.3%)
There is a good support system for students who get stressed	109 (23.4%)	232 (49.9%)	88 (18.9%)	25 (5.4%)	11 (2.4%)
I am too tired to enjoy this course	38 (8.2%)	101 (21.7%)	136 (29.2%)	155 (33.3%)	35 (7.5%)
I am rarely bored on this course	53 (11.4%)	180 (38.7%)	131 (28.2%)	84 (18.1%)	17 (3.7%)
My accommodation is pleasant	74 (15.9%)	247 (53.1%)	112 (24.1%)	18 (3.9%)	14 (3%)
My social life is good	117 (25.2%)	276 (59.4%)	54 (11.6%)	13 (2.8%)	5 (1.1%)
I seldom feel lonely	62 (13.3%)	153 (32.9%)	122 (26.2%)	92 (19.8%)	36 (7.7%)

over-emphasizes factual learning" and "the teaching is too teacher-centred" [1.72 points].

Students' perception of teachers (SPT)

The mean SPT sub-domain score of DREEM of students of our institute was 29.7 ± 4.6 [range: 8–44] and this can be interpreted as teachers are moving in the right direction. The students rated the item "teachers are knowledgeable" the highest [3.31 points].

Students' academic self-perception (SASP)

The mean students' academic self-perception (SASP) score of students of our institute was 21.3 ± 4.9 [range: 0–32] which can be interpreted as feeling more on the positive side. "I have learnt a lot about empathy in my profession" was rated the highest [2.94 points] by the students. There were no problematic areas in this sub-domain as all items were rated in the range of 2–3 points.

Students' perception of atmosphere (SPA)

The mean students' perception of atmosphere **(**SPA) score of students of our institute was 32.5 ± 6.2 [range: 6–48] and can interpreted as a more positive and conducive atmosphere. "This medical college is well timetabled" was rated the highest [3.07 points]. There were no problematic areas in this sub-domain as all items were rated in the range of 2–3 points.

Students' social self-perception (SSSP)

The mean SPA score of students of our institute was 18.7 ± 3.5 [range: 5–28] and can be interpreted as a good social place. The students rated "I have good friends in this college" the highest [3.29 points]. There were no problematic areas in this sub-domain as all items were rated in the range of 2–3 points.

Separate score of 50 items of DREEM

Three items (teaching is too teacher centred, teaching overemphasizes factual learning and authoritarian teachers) were identified to be problematic areas and as areas of concern because of mean score <2.

DREEM and sub-domains in various student groups

There was a statistically significant difference in the DREEM score in students [Figure 1] studying in first, second, and third year of MBBS course ($P < 0.0001$), however this difference was observed only between students of first year MBBS and third year MBBS ($P < 0.0001$; 95% CI: 4.5–15.1). Comparison between other cohorts of MBBS students was insignificant. Figure 2 presents the difference in sub-domains of DREEM score such as SPL, SPT, SASP, SPA, and SSSP between the first, second, and third year MBBS students. There was a significant difference in the SPL scores among students of different years ($P < 0.0001$) and the only significant difference observed was between first and third year MBBS students ($P < 0.0001$; 95% CI: 1.5–4.9). There was a significant difference in the SPT scores among students of different years ($P = 0.001$) and the only significant difference observed was between first and third year MBBS students ($P = 0.001$; 95% CI: 0.7–3.2). There was a significant difference in the SASP scores among students of different years ($P < 0.0001$) and the significant differences were only seen between students of first year MBBS and second year MBBS ($P = 0.005$; 95% CI: 0.5–3.6) and between students of first year MBBS and third year MBBS ($P < 0.0001$; 95% CI: 1.5–4.1). There was no significant difference between SASP score of second and third year MBBS students. No significant difference was observed in the SPA and SSSP scores among students of different years.

Student response and perception to online learning

Smart phone [$n = 403$ (86.7%)] was the most commonly used electronic device for e-learning, followed by laptop [$n = 45$ (9.7%)], tablet [$n = 14$ (3%)], and desktop [$n = 3$ (0.6%)].465 students (100%) attended the videoconference lectures from their home. Majority of the students [$n = 295$ (63.4%)] faced issues with internet connectivity while attending the lectures. Majority of the students [$n = 417$ (89.7%)] had attended 11 or more e-lectures. Detailed response of the students' perception has been provided in Table 3.

Google classroom was found to be extremely useful and quite useful as repository for class room material by 331 students (71.2%). Majority of the students (41.7%) found e-learning methods to be average as compared to traditional methods. 187 students (40.2%) rated Zoom meet/Google meet to be outstanding and excellent compared to traditional method of learning. There were 255 students (54.8%) who were extremely satisfied and quite satisfied with the e-learning modalities. E-learning methods were rated to be very useful and quite useful during the lockdown period by 258 students (55.5%). E-learning methods were perceived to be more effectively used at our institute compared to other institutes by 308 students (66.3%).

Two hundred and ninety two students (62.8%) perceived that e-learning methods promoted efficient use of time. Hundred and ninety nine students (42.8%) perceived that e-learning promoted acquisition of both superficial and deep learning. Two hundred and fifty students (53.8%) perceived that e-learning method was better for taking class notes. Two hundred and eighty nine students (62.1%) perceived that e-learning method was effective in preventing them from getting disturbed by fellow students. Two hundred and sixty one students (56.1%) perceived that e-learning method to be an engaging experience. Two hundred and thirty two students (49.9%) perceived e-learning method to be an interactive experience. Two hundred and seventeen students (46.7%) perceived that class time was not limited during e-learning method. Two hundred and sixty five students (57%) perceived that students had adequate opportunity to ask questions during e-learning method. Two hundred and forty four students (52.5%) perceived slow and interrupted internet connection to be a limiting factor for e-learning method. Overall, undergraduate medical students had a positive perception toward e-learning methods.

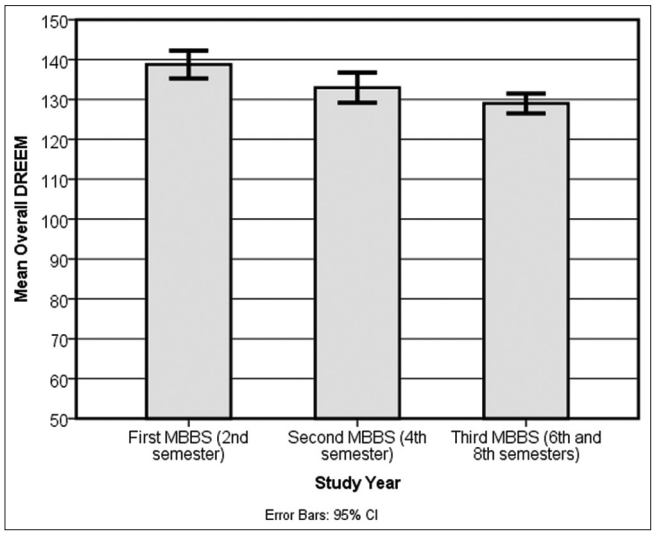

Figure 1: There was significant difference in the Dundee Ready Educational Envirnonment Measure (DREEM) score between first year MBBS and third year MBBS students as indicated by no overlapping of the 95% confidence intervals of the means. There was no significant difference in DREEM score between first year and second year MBBS students and between second and third year MBBS students due to overlapping of the 95% confidence intervals

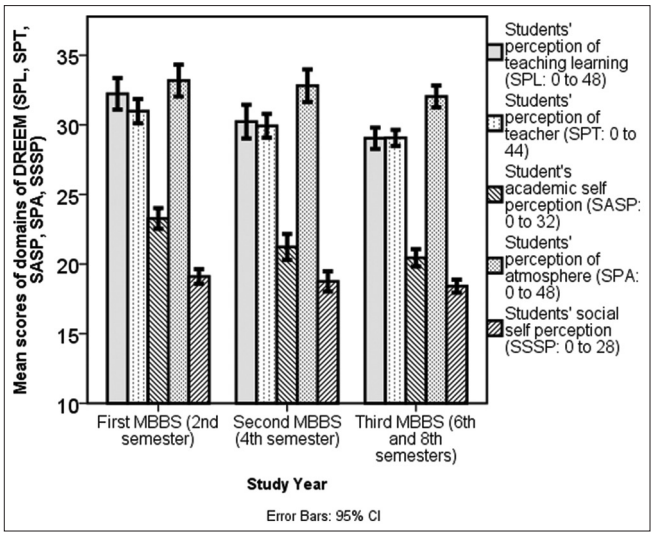

Figure 2: Significant different between various sub-groups of students were observed for mean scores of SPL, SPT and SASP. Students in the third year MBBS had significantly lower SPL, SPT and SASP scores compared to first year MBBS students. No significant difference in the mean score of SPA and SSSP were observed between the sub-groups as suggested by overlapping of the 95% error bars

Discussion

COVID-19 has posed a challenge for medical education and suggestions have given by to improve the integration of digital teaching and videoconference methods.[20,21]

Unique features of the study are this is the first study to evaluate the educational environment in our country during the COVID pandemic and our evaluation was centred purely on the digital teaching learning methods adopted during the pandemic. Also validated and globally accepted DREEM score was used to evaluate the educational environment during the pandemic. Traditional classes were suspended and hence this makes the present study unique and gives useful information that can be adapted by other medical colleges during the present pandemic and any pandemics in future.

DREEM and sub-domains

The overall mean DREEM score in our study was 132.3 and this is interpreted as more positive than negative. A systematic review on the educational environment in various colleges conducting medical and paramedical courses around the world reported that 80% of the colleges had an overall mean DREEM score in the range of 101–150.[22]

The mean DREEM score reported for medical undergraduate students from various medical colleges in India has been in the range of to 101.1–123 and the DREEM score reported by students of our medical college is much better than previously reported values.[23-31]

The mean SPL, SPA, and SSSP score in our study were slightly higher than previously reported values from other medical colleges of the country which are in the range of 22.7–29.4, 24.6–30.2, and 14.2–17.5, respectively.[23-31]

The mean SPT and SASP score of our study was within the range of previously published values which were from 23 to 30.4 and 16.7 to 21.2, respectively.[23-31] The three areas of concern (teaching is too teacher centred, teaching overemphasizes factual learning and authoritarian teachers) has been unanimously reported by various other studies.[23-31]

The DREEM score and sub-domains scores of SPL, SPT, and SASP were significantly lower in third MBBS students as compared to first year MBBS students in our study. Our findings of lower DREEM score concur with the findings of a systematic review.[22] The lower DREEM score in third year MBBS students could be because of limited opportunities for traditional bedside teaching in the wards during the pandemic, reduced hands on opportunities for clinical interaction with patients, and no opportunities to attend operating theatre sessions as part of undergraduate teaching.

Concerns have been expressed over the mental health of medical students during the COVID-19 pandemic.[32] Our study has demonstrated that the medical undergraduate students have adequate peer support and mentorship support from the teaching faculty and this is reflected by the positive scores of SSSP sub-domain of the DREEM score.

Students' perception toward online learning

Students had a positive experience, perception, and attitude toward online learning with majority of the students perceiving positive utility, satisfaction, and advantages of online learning during the COVID-19 pandemic.

Table 3: Student feedback on e-learning using videoconferencing platforms

Question	Response 1 *n* (%)	Response 2 *n* (%)	Response 3 *n* (%)	Response 4 *n* (%)	Response 5 *n* (%)
How did you find google classroom as a repository for class lecture material?	Extremely useful 110 (23.7%)	Quite useful 221 (47.5%)	Somewhat useful 109 (23.4%)	Not so useful 23 (4.9%)	Not at all useful 2 (0.4%)
Compared to conventional teaching method, how would you rate your OVERALL EXPERIENCE with Zoom Meet/Google Meet/Google classroom	Outstanding 26 (5.6%)	Excellent 161 (34.6%)	Average 194 (41.7%)	Fair 47 (10.1%)	Poor 37 (8%)
How would you rate your SATISFACTION with using Zoom Meet/Google Meet/Google classroom as a tool for receiving medical education	Extremely satisfied 49 (10.5%)	Quite satisfied 206 (44.3%)	Somewhat satisfied 125 (26.9%)	Not so satisfied 71 (15.3%)	Not at all satisfied 14 (3%)
How do you rate the UTILITY of e-learning using Zoom Meet/Google Meet/Google class room during the lockdown period	Very useful 108 (23.2%)	Quite useful 150 (32.3%)	Useful 178 (38.3%)	Rarely useful 25 (5.4%)	Not useful 4 (0.9%)
You might have spoken to your friends in other medical colleges. How do you rate the utilization of e-learning using Zoom Meet/Google Meet	Outstanding 97 (20.9%)	Excellent 211 (45.4%)	Average 124 (26.7%)	Fair 25 (5.4%)	Poor 8 (1.7%)
Perceived advantages (more efficient use of time)	Strongly agree 60 (12.9%)	Agree 232 (49.9%)	Neither agree nor disagree 126 (27.1%)	Disagree 38 (8.2%)	Strongly disagree 9 (1.9%)
Perceived advantages (promotes acquisition of both superficial and deep learning)	Strongly agree 38 (8.2%)	Agree 161 (34.6%)	Neither agree nor disagree 157 (33.8%)	Disagree 89 (19.1%)	Strongly disagree 20 (4.3%)
Perceived advantages (better for taking class notes)	Strongly agree 66 (14.2%)	Agree 184 (39.6%)	Neither agree nor disagree 111 (23.9%)	Disagree 78 (16.8%)	Strongly disagree 26 (5.6%)
Perceived advantages (not getting disturbed by fellow students)	Strongly agree 67 (14.4%)	Agree 222 (47.7%)	Neither agree nor disagree 113 (24.3%)	Disagree 50 (10.8%)	Strongly disagree 13 (2.8%)
Perceived advantages (engaging experience)	Strongly agree 42 (9%)	Agree 219 (47.1%)	Neither agree nor disagree 134 (28.8%)	Disagree 52 (11.2%)	Strongly disagree 18 (3.9%)
Perceived disadvantages (promotes acquisition of superficial learning rather than in-depth learning)	Strongly agree 28 (6%)	Agree 135 (29%)	Neither agree nor disagree 149 (32%)	Disagree 120 (25.8%)	Strongly disagree 33 (7.1%)
Perceived disadvantages (not interactive)	Strongly agree 28 (6%)	Agree 88 (18.9%)	Neither agree nor disagree 117 (25.2%)	Disagree 193 (41.5%)	Strongly disagree 39 (8.4%)
Perceived disadvantages (limited class time)	Strongly agree 14 (3%)	Agree 94 (20.2%)	Neither agree nor disagree 140 (30.1%)	Disagree 167 (35.9%)	Strongly disagree 50 (10.8%)
Perceived disadvantages (limited opportunity to ask questions to faculty members)	Strongly agree 19 (4.1%)	Agree 73 (15.7%)	Neither agree nor disagree 108 (23.2%)	Disagree 203 (43.7%)	Strongly disagree 62 (13.3%)
Perceived disadvantages (internet connection is slow or interrupted)	Strongly agree 112 (24.1%)	Agree 132 (28.4%)	Neither agree nor disagree 97 (20.9%)	Disagree 89 (19.1%)	Strongly disagree 35 (7.5%)
Perceived disadvantages (access to mobile device)	Strongly agree 48 (10.3%)	Agree 119 (25.6%)	Neither agree nor disagree 140 (30.1%)	Disagree 114 (24.5%)	Strongly disagree 44 (9.5%)

There are very few studies that have evaluated perception of homogenous cohort of medical undergraduate students pursuing the MBBS course at various stages of their training. Inclusion of students from first, second, and third MBBS helps evaluation of the efficacy of online teaching of preclinical, paraclinical, and clinical subjects.

The survey response rate of a study reporting student perception of international students pursuing traditional Chinese medicine was 57%.[9] Two studies did not report the response rate of their surveys.[7,8]

We observed that 55% students reported satisfaction with online classes and 56% students perceived online classes to be useful. Our proportion of students perceiving beneficial effect of online lectures in our study was lower than that reported by Verma *et al.*[7] We used a five-point Likert scale for our questions for the responses, whereas Verma *et al.* did not report the number of questions and the type of response (binary option or Likert scale) used to elicit perception of students. Another possible cause could be that we included first, second, and third MBBS students, whereas the study by Verma *et al.* consisted of fourth MBBS students. The study by Verma *et al.* had a smaller sample size of 140 students compared to our sample size of 465 students. Also the study by Verma *et al.* did not report response rate of their survey.

The study by Rafi *et al.*[6] elicited perception of medical students toward their preference (online class or traditional class), ideal duration of each online lecture, and barriers to online teaching. They used multiple choice questions responses instead of the Likert scale, thereby limiting the nature of questions that could be asked to the medical students to assess their perception to novel and innovative methods. Our study aimed to capture a range of responses from the medical students and hence we used a five-point Likert scale for our questions.

We noticed that medical students had a positive perception toward the utility of online lectures, whereas another study[10]

reported that majority of their medical students reported negative perception to online learning methods. Possible causes for this difference in perception could be a heterogenous cohort consisting of MBBS and Dentistry students and a low survey response rate of 47.8%.

Medical students of our Institute perceived that one of the advantages of online teaching was more effective time management and this concurred with observations of a recently published qualitative study.[33] The use of videoconference platform during the present pandemic has not adversely affected the educational environment and consequently can be viable option for continuing teaching learning methods during the present pandemic and could be used in the future as well if we were to face such pandemic in the future.

Conclusion

Videoconferencing interactive platforms for teaching and learning are perceived to be effective modality by medical undergraduate students during the COVID-19 pandemic.

Ethical approval

The study was approved by Parul University Institutional Ethics Committee for Human Research (PU-IECHR) on 28th April 2020 and the approval number was PUIECHR/PIMSR/00/081734/2901.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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