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Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_1077_20

Transition from physical to virtual classroom amidst COVID-19 crisis: Analyzing students' perspective to drive improvement in the current online teaching methodology

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Abstract:

BACKGROUND: Among the COVID crisis, medical education is forced to shift to the virtual mode, for which neither the students nor the teachers are prepared. Currently, we replaced traditional classroom teaching (CT) by live online classes (LOC), power-point presentations with voiceovers (UPV), or only power point presentations (UP). Uncertainty of this situation necessitates analysis of the experiences of its stakeholders to improve the implemented online teaching methodologies in coming time. The present study aims to analyze and compare the effectiveness of online teaching methodologies among themselves and against traditional CT.

MATERIALS AND METHODS: A cross-sectional, survey based, observational study was conducted on 250 MBBS first year students after 1 month of implementation of online teaching program. Responses were collected on Likert scaling from 1 to 5, and data were analyzed using the Kruskal-Wallis H-test, ANOVA with multiple comparisons *post hoc* Turkey test, and an independent *t*-test.

RESULTS: The students perceived that the understanding, convenience for attending class, notes-taking, visibility, audibility, raising queries and overall experience was best in traditional setup. The understanding of the topic and overall experience of the students was not affected by gender. Internet connectivity problem popped up as the major issue that adversely affected the online teaching experience.

CONCLUSIONS: Majority of students perceived that the traditional CT is best, but at the same time, they felt that a combination of live online classes and power point presentations with voice over can replace the traditional online classes.

Keywords:

COVID-19, distance education, medical education, teaching methods

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Received: 23-08-2020

Accepted: 04-09-2020

Published: 30-06-2021

Introduction

The world stands humbled under the tremors of COVID-19, rampaging across the globe, impacting every sphere of life, causing human beings to reinvent their approach toward life. One of the major sectors impacted by the pandemic is the education sector with schools and colleges being the first to closed by the governments

to implement the social distancing. With no possibility of physical interaction, educators pivoted to modes of online dissemination of education accompanied by its own challenges.^[1-3]

For years' medical education was driven heavily by physical proximity and experiential learning but with advancement in technology, revolutionary changes

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How to cite this article: Chopra J, Rani A, Chopra S, Manik P, Singh RR. Transition from physical to virtual classroom amidst COVID-19 crisis: Analyzing students' perspective to drive improvement in the current online teaching methodology. *J Edu Health Promot* 2021;10:241.

occurred in teaching learning methodologies.^[4] The use of technology in the form of e-learning is more widely used in the Western countries, and it has become an important mode of delivering instruction in higher education,^[5] whereas its use in medical education in India is at a nascent stage and is mostly limited to use of audio visual aid for teaching in classroom; uploading power point presentations, dissection videos and procedural videos, and data search for research work. In only few medical colleges in India, Learning Management Systems such as Moodle and TUSK are used to provide instructional content, take assessment, and supervise learning.^[2] Currently, most of the medical colleges in India are laggards in the digital infrastructure.

Until now, online teaching was used in medical education as an adjunct to the classroom teaching (CT),^[6] for clinical skill learning^[7] or teaching students by distance-learning method as a part of a program.^[8] Several studies are published where e-learning is implemented on experimental basis and views of the students and teachers have been analyzed which implies that online teaching accounted for a small part of the entire program. Whereas now amidst the COVID crisis, it is imposed upon us to completely shift the entire teaching-learning program to virtual mode, which incurs a tectonic shift for all stakeholders.

In our institution, the undergraduate students were mainly taught by the traditional teaching method using the blackboard and power point presentations. Only some of the power point presentations were uploaded on the virtual classroom. As the COVID-19 crisis affected a lockdown in India, we pivoted to online teaching with *ad hoc* methods. Currently, the CT has been replaced by streamed online lectures using Google Suite's learning management system (LOC). This synchronous mode of delivery provided avenue for instructor-student interaction. For certain topics, asynchronous mode of delivery was opted, in which power-point presentation recordings with voiceover (UPV) were shared through Google Classroom or YouTube or only power point presentations were uploaded (UP) on virtual classroom at university website. This mode offers the liberty to go through the content at one's own pace.^[9]

This study aims to analyze and compare the effectiveness of online teaching methodologies against traditional CT. Having no clarity on what this pandemic entails for medical teaching, we aim to improve the online teaching strategy by incorporating learnings from students' initial experience.

Materials and Methods

A cross-sectional, observational study was conducted on 250 volunteer 1st-year MBBS students, to analyze

the students' initial experiences for online teaching methodologies with a questionnaire, designed on Google form, comprising majorly of closed-ended and a few open-ended questions.

Ethical considerations

The study was approved by the Institutional Ethics Committee and compliance to Helsinki declaration on Rights of Participants in a Research was fully ensured. The participation in the study was totally voluntary, and the participants were permitted to withdraw from study at their choice without having any negative implications. The students were included in the study group only after explicitly taking informed consent.

After 1 month of implementation of online teaching programs, the students' initial learning experience in the three online teaching methodologies (LOC, UPV, and UP) as compared to CT was surveyed. The questionnaire enquired about: Demographic profile, previous exposure to any type of online teaching; understanding of the topic taught; convenience in attending the classes; visibility of instruction media; audibility of instructor; convenience in taking notes; doubt resolution; opinion regarding assessment in online mode of teaching; difficulties encountered in the online mode of teaching; preference for teaching methodology based on overall experience; preference for different blends of online teaching methodologies to which they have been exposed; suggestions for improvement of current online teaching methodologies.

The students responded to the questions on a Likert scale from 1 to 5 for all the four teaching learning methods (TLM). The data were entered in MS Excel spread sheet and Statistical Package for the Social Sciences (SPSS) software version 25 (IBM Inc., USA) was used for analyzing the data. Nonparametric Kruskal-Wallis H-test was applied to compare student responses to the four TLM to ascertain if there was any statistically significant difference in understanding, convenience, visibility, audibility, and overall experience amongst the four groups. For comparing the difference created by the transitions from one methodology to another in students from different locations, ANOVA with multiple comparisons *post hoc* Turkey test was used, and an independent *t*-test was used to compare the differences between two groups. $P < 0.05$ was considered as statistically significant.

All the three online methodologies were compared among themselves and with traditional CT. The influence of gender, residential location, and problems faced by the students was analyzed on preference for the online teaching methodologies.

Results

In the present study, out of 250 students, 86.4% responded out of which 73.6% were male and 26.4% females. The mean age of the students was 19 years (17–28 years). Nearly 28.2% students were currently residing in village, 30.1% in small city, 27.3% in big city, and 14.4% in metropolitan city. As only 13% students had attended online classes during premedical period, so its effect on the perception was not analyzed. 92.6% students were using mobile phone, whereas 16.3% used laptop/tablet/desktop to attend these classes. 90.7% students were using mobile data and only 9.3% had access to Wi-Fi or broadband.

Understanding of the topic taught

According to the students' perspective the understanding of the topic was best in CT followed by UPV, LOC, and least with UP. Although gender did not significantly influence understanding in any TLM, but in CT and LOC, the understanding of males was slightly higher

Table 1: Effect of demographic profile on understanding of students

Understanding	Mean±SD			
	CT	LOC	UPV	UP
Overall	4.03±0.79	3.20±0.87	3.44±0.99	2.80±1.02
Significance*	0.000			
Gender				
In males	4.04±0.80	3.21±0.87	3.36±1.01	2.79±1.05
In females	4.00±0.76	3.18±0.89	3.67±0.89	2.82±0.95
Significance	0.680	0.918	0.051	0.812
Geographical location				
In village	4.05±0.76	2.93±0.87	3.34±0.79	2.93±0.87
In small city	3.94±0.79	3.37±0.84	3.42±1.07	2.75±1.00
In big city	3.93±0.85	3.15±0.78	3.56±1.04	2.71±1.11
In metropolitan city	4.36±0.66	3.45±0.99	3.45±1.06	2.77±1.15
Significance**	0.065	0.008	0.476	0.659

Kruskal-Wallis H-test was applied. Significance level <0.05. *All pairwise-comparisons also showed statistically significant difference: CT versus LOC-*P*=0.000, CT versus UPV-*P*=0.000, CT versus UP-*P*=0.000, LOC versus UPV-*P*=0.025, LOC versus UP-*P*=0.002, UPV versus UP-*P*=0.000, **In LOC, the statistical significance was driven by the difference in understanding between the students in villages and small cities (*P*=0.039) and village and metropolitan cities (*P*=0.015). SD=Standard deviation, CT=Classroom teaching, LOC=Live online classes, UPV=Voiceovers

than females, whereas in UPV and UP, it was better in females [Table 1].

It was interestingly observed that in CT, the level of understanding of students from the metropolitan city was the highest followed by those from the village, whereas in LOC, the understanding of the students from the village dropped to the lowest and that of students from metropolitan cities still remains the best. The understanding of the students in any of the teaching methodology groups among different geographical location was not significantly different except in live online class [Table 1].

Convenience of attending classes, taking notes, visibility, audibility, raising queries, creative and critical thinking, and need for assignment

For students, the most convenient setting for attending the class was CT, whereas in online TLM, it was UPV. The highest rating for visibility of the instruction media was for UPV. The audibility was rated highest in CT and lowest in LOC. It was most convenient to take notes in UPV method and least in LOC [Table 2].

The students were divided into two groups on the basis of internet connectivity issues, and then, the visibility and audibility rating of these groups was compared applying independent t-test. Significant difference was observed (*P* = 0.001 and *P* = 0.000 respectively), affirming the fact that lower rating for visibility and audibility were driven majorly due to internet issues (mean visibility and audibility for students facing internet connectivity issue: 3.28 ± 1.12 and 2.95 ± 1.02 vs. students facing no internet connectivity issue: 3.78 ± 0.88 and 3.69 ± 0.94, respectively).

41.20% students said that it was easy for them to raise queries in CT, 21.30% found it easy in online methodologies, whereas 31.48% students said that in both the methodologies they were equally comfortable. 6.02% students admitted that in none of the mode, it was easy for them to raise queries.

Table 2: Difference in audibility, visibility, and convenience of students in each methodology

Parameters	Mean±SD				Significance
	CT	LOC	UPV	UP	
Convenience in attending class	3.76±0.86	3.20±1.00	3.50±1.06	3.20±1.14	0.000*
Visibility of instruction media	3.80±0.90	3.41±1.08	3.90±0.95	3.81±0.97	0.000**
Audibility	4.05±0.86	3.14±0.91	3.83±1.04	NA	0.000***
Convenience in taking notes	3.75±0.87	2.89±1.07	3.88±0.94	3.61±1.00	0.000****

Kruskal-Wallis H-test was applied. Significance level <0.05. * The difference among all pairs was statistically significant (CT vs. LOC *P*=0.000, CT vs. UPV *P*=0.046, CT vs. UP *P*=0.000, LOC vs. UPV=0.018 and UP vs. UPV=0.039) except for LOC vs. UP (*P*=1.000), **The difference between live online classes and the other three methods was highly significant (LOC vs. CT *P*=0.002, LOC vs. UPV *P*=0.000, LOC vs. UP *P*=0.000) while among other pairs were not significant (CT vs. UP *P*=1.000, CT vs. UPV *P*=0.857 and UP vs. UPV *P*=1.000), ***The difference among all pairs was statistically significant (LOC vs. UPV *P*=0.000, LOC vs. CT *P*=0.000, UPV vs. CT *P*=0.047), ****The difference between live online classes and the other three methods were highly significant (LOC vs. CT-0.000, LOC vs. UPV-0.000, LOC vs. UP-0.000), but the difference between other pairs was not significant (CT vs. UP *P*=1.000, CT vs. UPV *P*=1.000 and UP vs. UPV *P*=0.055). SD=Standard deviation, CT=Classroom teaching, LOC=Live online classes, UPV=Voiceovers

27.31% students were in agreement of the fact that online teaching promotes critical and creative thinking, 27.78% disagreed, whereas 44.91% were neutral. On enquiring students about the need for assignment following online teaching, 50.9% students agreed, 23.1% disagreed, and remaining were neutral. Females perceived this need more than males (3.63 ± 0.94 vs. 3.24 ± 1.17 , $P = 0.013$), and the difference was statistically significant.

Overall experience

The overall experience of students was the best for CT. Among online methodologies, it was best for UPV followed by LOC and least in UP and was not significantly associated with gender. The overall experience of males was higher for CT and LOC, whereas females preferred UPV and UP [Table 3].

Although there was no statistically significant difference in overall experience for any of the teaching methodology among any geographically located group, but the rating of the students from metropolitan city was the highest for every methodology except for UP. The experience of students from village was second best in CT, whereas it falls to the lowest level in LOC and UPV [Table 3].

Transition from classroom teaching to online teaching methodologies

Although a significant decline in understanding and overall experience was observed on transition from CT to any of the online methodology but was not affected by gender or geographical location except the difference in understanding on transition from CT to LOC. This was driven by the significant difference between students from villages and small cities. On transition from CT to LOC maximum drop in understanding and overall experience was observed in students from

Table 3: Effect of demographic profile on overall experience of students

Overall experience	Mean±SD			
	CT	LOC	UPV	UP
Overall	4.02±0.79	3.25±0.92	3.51±1.02	2.95±1.06
Significance*	0.000			
Gender				
In males	4.04±0.83	3.28±0.94	3.45±1.00	2.93±1.07
In females	3.98±0.69	3.16±0.88	3.68±1.04	3.00±1.02
Significance	0.440	0.363	0.144	0.745
Geographical location				
In village	4.05±0.76	3.15±0.81	3.46±0.79	2.79±0.81
In small city	3.92±0.82	3.31±1.00	3.48±1.07	2.97±1.04
In big city	4.00±0.89	3.17±0.91	3.58±1.12	3.03±1.22
In metropolitan city	4.23±0.56	3.48±0.96	3.58±1.12	2.77±1.20
Significance	0.475	0.310	0.755	0.515

Kruskal-Wallis H-test was applied. Significance level <0.05. *The difference among all pairs was statistically significant (CT vs. LOC- $P=0.000$, CT vs. UPV $P=0.000$, CT vs. UP $P=0.000$, LOC vs. UPV $P=0.019$, UPV vs. UP $P=0.000$) except between LOC and UPV ($P=0.068$). SD=Standard deviation, CT=Classroom teaching, LOC=Live online classes, UPV=Voiceovers

the village, while on transition to UPV and UP, the fall was maximum in the metropolitan group, but these differences were not significant [Table 4].

Opinion regarding replacement of classroom teaching

25.93% students opined that nothing can replace traditional CT. 44.44% said that LOC with UPV and 16.67% said that only UPV can replace it. 6.48% were of opinion that LOC with UP and 6.48% said that only LOC can replace CT.

Discussion

E-learning offers several advantages over traditional CT. It eliminates the barrier of time and space, is convenient, ensures instructors availability, allows flexibility over content and pace, and hence, provides more control over learning.^[10-14] It has been demonstrated to increase retention rate and better utilization of content.^[15] However, the students have also perceived that CT is more effective for obtaining the learning objectives and motivates them to attend the classes.^[16]

In a study, the Indian medical students were enquired about their perspective regarding incorporation of e-learning into medical curriculum. 80.5% opined that it would enhance understanding,^[17] but, in the present study, postimplementation of online teaching, students responded that understanding was best in CT. A significant drop in understanding of students from village was observed in LOC method [Table 1], probably because they faced highest internet and electricity problems as compared to other geographical groups [Table 5]. The internet connectivity significantly affected the audibility and visibility which aptly explains the fall. Internet connectivity and technology hiccups have been identified as the major demerits of online education.^[11,18]

The drop in the understanding of the students of the metropolitan city was maximum on switching to UPV and UP method, probably because self-discipline, and disturbance at home issues were more prevalent in this group. Although these students were able to access online classes, but they lacked in self-discipline and were distracted by the amenities available at home, leading to drop in understanding. The flexibility in time frame which is supposed to be the greatest advantage of asynchronous online teaching methodology^[12,14,18] can become a shortcoming if students lack self-discipline, as in online teaching the onus of learning lies on the learner.^[19,20] Therefore, to succeed in this new learning environment, the learner needs to develop appropriate learning style.^[11] The students of village were least affected when transitioned from CT to UP methodology,

Table 4: Effect of demographic profile on the understanding and overall experience on transition from classroom teaching to online teaching methodologies

Demographic profile	Mean±SE		
	CT-LOC	CT-UPV	CT-UP
Effect on understanding			
Gender			
Male	0.830±0.08	0.679±0.10	1.252±0.10
Female	0.825±0.16	0.333±0.16	1.175±0.17
T-test (t, P)	0.033, 0.973	1.823, 0.070	0.389, 0.698
Geographical location			
Village	1.115±0.13	0.705±0.13	1.115±0.14
Small city	0.569±0.15	0.523±0.16	1.185±0.16
Big city	0.780±0.13	0.373±0.19	1.220±0.20
Metropolitan city	0.903±0.18	0.903±0.18	1.581±0.18
ANOVA (F, P)	2.770, 0.043*	2.104, 0.101	0.990, 0.398
Effect on overall experience			
Gender			
Male	0.755±0.09	0.585±0.10	1.107±0.11
Female	0.825±0.14	0.298±0.15	0.983±0.15
T-test (t, P)	-0.403, 0.687	1.463, 0.145	0.630, 0.529
Geographical location			
Village	0.902±0.12	0.590±0.14	0.984±0.14
Small city	0.615±0.16	0.446±0.16	1.138±0.16
Big city	0.831±0.15	0.424±0.20	1.034±0.20
Metropolitan city	0.742±0.19	0.645±0.20	1.194±0.21
ANOVA (F, P)	0.754, 0.521	0.339, 0.797	0.264, 0.851

Significance level <0.05. *The difference between village and small city was statistically significant P=0.026. SE=Standard error, CT=Classroom teaching, LOC=Live online classes, UPV=Voiceovers

probably, because they had lesser self-discipline issues. Although UPV is an asynchronous methodology as UP, but the students from the village were affected highly when transitioned from CT to UPV, probably because downloading of presentation with voice over consumes much more data as compared to power point presentations without voice over [Tables 4 and 5].

Surprisingly, in our study, the students felt that class-room setting was more convenient to attend, which was not in the consensus with the observations of Mansour and Mupinga.^[11] For taking notes, UPV setting was rated highest followed by CT and LOC. In UPV mode students can pace the lecture as per their notes-taking speed,^[14] whereas, in classroom though teachers are able to pace their lectures based upon visual cues but the students come with different ability so “one-size-doesn’t-fit-all”.^[11] In LOC, since teachers are devoid of visual cues, the pace of teaching cannot be moderated toward the grasping and note-taking speed [Table 2].

The overall experience of our students was the best for CT and was not significantly affected by the gender or geographical location. Hence, apart from the issues discussed above, the absence of physical co-presence

could be a major factor affecting it. In a virtual classroom, the learning environment is abstract and some students miss these physical cues more while few thrive in this new setting.^[21] In online methodologies, we observed that the highest rating was for UPV (recorded videos), as also observed by Nanda *et al.* where students preferred videos over internet in e-learning.^[17] This preference could be as in this mode students are able to download the classes and go through it without any interruptions like missing slides or voice lags or cracks. Even in localities where internet connectivity was not so good, though the downloading took time, but once downloaded, the students can go through content and take notes according to their own pace. As these classes were with voice over so the only thing that they missed was interaction. In LOC, internet connectivity issue drastically moderated the overall experience. Although the online learning has many virtues but has been disliked by the students^[11,16] [Table 3].

Online learning should encourage higher order thinking, but in the present survey, only 27.31% students felt so. Online learning demands proactive engagement in academic material, self-directed, and self-motivated approach from students to enhance their experience.^[9,22] Perhaps, these first year students are not ready to be independent learners and require a bit more experience to get used to the new setup.^[17]

To ensure active engagement of students in pursuit of learning, teachers should incorporate problem-solving activities, quizzes, or assignments following online sessions. This will provide feedback of their understanding and will warrant self-discipline. In the present study, 50.9% students perceived need for assignments and females perceived this need more.

There is a higher level of satisfaction for blended learning among the medical students.^[23,24] In the present study, while one-fourth of students opined that traditional CT is not substitutable, but majority (44.44%) said that LOC with UPV can replace CT. They suggested that providing live and recorded lectures can substitute didactic lectures and CT can be limited to interactive and practical sessions.^[25]

From the ongoing discussion, it is evident that in the initial phases of implementation of online teaching during the period of COVID-19 pandemic, students did not have very good experience of synchronous teaching methodology majorly due to internet connectivity issues. Moreover, 92.6% students have to attend classes and access e-books (as they didn’t have hard copies) on the small screen of mobile phones, which was very uncomfortable and further deteriorated their experience. If these students would have access to books and been in

Table 5: Problems faced by students of various geographical locations

Geographical location	Internet (%)	Electricity (%)	Self-discipline (%)	Disturbance (%)
Village	88.5	23.0	27.9	37.7
Small city	70.8	6.2	36.9	41.5
Big city	71.2	8.5	32.2	27.1
Metropolitan city	61.5	9.7	35.5	48.4

campus to avail the equal opportunity to access net, then probably the perception would have been different. In addition, we cannot neglect the fact that students were used to classroom environment and were not familiar with new educational and information technology, therefore, they may have trouble learning this way.^[16]

Based on the feedback of students, to enhance their learning experience in the present scenario, it was inferred that either the recording of LOC or the PPT with voiceover of these classes should be provided to the students to overcome the internet connectivity issues. This will help them in making their own notes, which they can revise, instead of revisiting presentations and online books, further reducing their screen time. If this crisis persists, apart from these modifications at the user-end, a need for improvement in internet connectivity and uninterrupted power supply is mandatory at national level for the successful implementation of online teaching programs.

In the quick transition to the world of online teaching, medical teachers currently perceive the potential of technology as a delivery medium only and have merely transitioned their CT online. However, technology offers a much wider spectrum of tools and to take its utmost advantage, teachers need to develop comfort with technology. They need to increase interactivity and monitoring, provide learner support and promote feedback to hone the overall experience for students.^[22] With COVID-19 upending traditional CT, there is a need for faculty development programs for implementing good online teaching practices so that technology can be used in effective and efficient way. This time has given us opportunity to explore the emergent technology so that transformative changes can be made in the medical education technology that can be blended with traditional teaching once this crisis is over.

In the present study, perception of only first year MBBS students of our institution were taken, that too for theory classes. The present study will be expanded to include the students of higher phases as well as other institutions of state so that the results can be generalized.

Conclusions

On abrupt transition from traditional to online teaching, students perceived that the understanding, convenience

for attending class, notes-taking, visibility, audibility, raising queries, and overall experience was better in the traditional setup. In online teaching methodologies, the UPV mode was preferred over LOC and UP. Gender neither affected the understanding nor the overall experience of the students in any mode of teaching. Female students perceived significantly more need for assignments to increase discipline in the home environment. A large number of students felt that a combination of LOC and UPV can replace traditional online classes.

Acknowledgment

The authors wish to express their gratitude to all the participating students for their valuable contributions.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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