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Online Formative Assessments in Medical Education During COVID-19

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ABSTRACT

Background: This study aimed to evaluate perception of medical students regarding online mode of assessments and to compare the academic outcomes of various methodologies adopted for online formative assessments.

Methods: This was a descriptive cross-sectional study. This study was conducted in the department of biochemistry at the constituent medical college of Health University in India and included 150 first year medical undergraduates of either gender. The institutional ethical clearance and written informed consent was taken prior to the study from all the enrolled participants. A series of online formative assessments were designed in the form of multiple choice, short answer questions, case-based learning, and viva-voce to satisfy each learning outcome. Google platform was used for conducting online formative assessment. The participants were asked to fill questionnaire based on 5-point Likert scale to obtain information on challenges and perceptions related to OFA. Academic performance was evaluated and compared for various modes of assessments.

Results: The mean age of the participants was 19.34±0.947 years. Most of the students were from urban areas and majority (73.33%) preferred MCQs. 60.67% respondents favored conduction of e-assessments. 80.67% of students agreed that solving clinical cases in the online assessments contributed to clinical learning.

Conclusions: Formative online assessment can be used as an intervention to reshape medical education sector during times when infection controls and physical isolation measures are crucial to avoid spread of disease.

Keywords: Formative assessment; medical education; online assessment.

INTRODUCTION

The COVID-19 pandemic, in addition to its effect on global health and economy, has also had an impact on medical education.[1,2] During this time, most universities shifted to an online mode. In India the system of online education in medicine is like a massive social experiment.[3]

Formative assessment can be defined as one form of self-assessment by the student which intends to provide feedback to the both teacher and the student.[4] Issues such as constructive alignment of assessment with learning outcomes, strategic evaluation of components suited to the environment, and integration of digital literacy should be considered when planning online formative assessment (OFA).

Medical institutions have used OFA before[5], however, studies on OFA in India are scarce. Therefore, to address these gaps, this study aimed to evaluate medical students' perceptions regarding the online mode of assessments and to compare the academic outcomes of various methodologies of OFA.

METHODS

This descriptive cross-sectional study was conducted at the Department of Biochemistry at a constituent medical college of Health University in India. The participants were 150 first-year medical undergraduate students of either gender involved in online teaching learning who were enrolled in the study in the year 2020-21. Ethical clearance was obtained and written informed consent was obtained from all enrolled participants prior to the

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study. The study was conducted in accordance with the guidelines provided by the World Medical Association Declaration of Helsinki. The students were informed of their voluntary participation and confidentiality assurance at the beginning of the study.

To maximize the effectiveness of curriculum-based medical education (CBME) implemented by the regulatory body for medical education in India, and to maintain continuity in education during COVID-19, relevant components in biochemistry were selected and online assessments were conducted for a period of one month (one per week).[6] These were designed to address learning at critical times during COVID-19.

Discussions with colleagues about their experiences, choosing technology, designing assessments, and using online resources were done extensively before finalizing the assessment and technology. A strategic evaluation to identify the strengths and weaknesses of assessments with a holistic perspective shaped at the conceptual level based on assumptions, principles, and purposes. A step-by-step process on how to use the technology, providing ongoing support for students, and ensuring that the teacher is familiar with and has experience in the online environment introduced to students was taken care of.

Keeping assessments consistent with deep and meaningful learning, and considering the scope of class, four different online assessment methods were undertaken: multiple-choice questions (MCQs), viva -voce, short-answer questions (SAQs), and clinical case-based questions. These aimed to evaluate students' cognitive skills, such as their ability to reason quantitatively, as well as technical skills, such as the ability to use clinical cases to enhance thinking and problem solving. Thereafter, a series of assessments were concisely designed to satisfy each learning outcome on the topics taught online, and prior information on the assessment schedule was intimated. Student attendance was also noted. The students had no prior knowledge that their assessment scores would be evaluated in the present study.

We incorporated Google as an assessment module for biochemistry. WhatsApp and email modes were also used for communication with students and other faculty members. Before introducing the formative assessments, sufficient time was allocated to fully brief students on how to set up and use the technology. Question papers on all chosen assessment methods were circulated to students via Google forms as per the schedule notified in the departmental time table. The case studies were presented in the form of videos, photographs, and reasoning-based questions. The students were instructed to submit their answers in the given time frame. Oral viva voce was conducted on Google Meet on a one-to-one basis, which included all topics assessed in MCQs, SAQs, clinical case-oriented, and new topics. Various measures have been taken to avoid web-based cheating. These included stringent time constraints in solving the questions and operational webcams, ensuring screen sharing during the assessment.

The students who appeared in OFA were introduced to a questionnaire to gather their perceptions and experiences regarding online assessments, which also included a few open-ended questions. Outcomes of various online assessment methods have also been examined. Feedback via a questionnaire based on 5-point Likert scale was collected from all participants.

All the teaching faculty of the Department of Biochemistry were involved in the evaluation of these various assessment formats to avoid bias in assessing the students. They were assessed anonymously and the scores were awarded. Question responses were collected via Google Forms and analyzed.

Electronically fed data was analyzed using the appropriate software. Qualitative data were described using numbers and percentages, and quantitative data were described using minimum and maximum range, mean, and standard deviation. Student's t-test was used to compare the two groups for normally distributed quantitative variables. collected data were downloaded in Microsoft Excel spreadsheet format and analyzed using IBM SPSS.

RSULTS

The baseline characteristics of all 150 participants are shown in Table 1. Most participants were male (n = 81, 54%). The mean age of the participants was 19.34±0.947 years (range 17-22 years). The majority of students belong to the 19-20 years age group and were from urban areas106(70.67%), followed by semi-urban 27(18%), and rural 17(11.33%) areas. Most students used laptops as devices for attempting online formative assessments, and 85 (56.67%) students had prior exposure to online assessments.

Students' responses were taken regarding their preference of online assessment modalities. Majority of students (73.33%) opted for MCQs, followed by clinical

cases (83, 55.33%), viva-voce (23, 15.33%), and SAQs (20, 13.33%), ambiguity in preference was opted by 86 (57.33%) students (Figure 1).

Most of the students responded favorably with the conduction of e-assessments 91(60.67%). Large number of respondents (139, 89.33%) agreed that suitable instructions before e-assessments were given and (116, 77.33%) found navigation of online assessment to be easy. 77.34% of participants were satisfied with the layout and organization of e-paper, and only a few (3.33%) were dissatisfied. More than 50% of participants reported that sufficient time was allotted to attempt the assessments and 67.33% reported that syllabus was appropriately covered before conducting the assessments. The study participants satisfied with frequency of online assessments and with the course content of the assignments were 63.34% and 68.66%, respectively.

83 (55.33%) students agreed that prior exposure to online teaching was useful for e-assessments. 69 students disagreed that online-assessments allow learning environment as traditional classroom teaching and learning, 33% were neutral. Perspective regarding blended teaching and assessments was also enquired from the participants. Majority of students (70%) preferred blended teaching and learning. A total of 80.67% of students agreed that solving clinical cases in the online assessments contributed to clinical learning (Figure 2).

Percentage of students reporting technophobia and that of no fear in handling electronic device was similar (38.67%, 38% respectively), whereas, 23.33% remained neutral in their response. Majority of the study participants (100, 66.67%) reported that poor internet connection was a major impedance for online assessments and 49.33% reported that distracting home environment was unsuitable for online assessments. Out of 150 study participants, 104 (69.33%) agreed that typing the answers on electronic device was more time consuming as compared to writing on paper in a traditional classroom assessment. 41.34% faced performance pressure during online assessments and 36% were neutral. 77(51.33%) students agreed (51, 34%) and strongly agreed (26, 17.33%) that they faced difficulties in peer relation in social environment due to online assessments (Figure 3).

MCQs, clinical case-based questions, viva-voce, and short answer questions were attempted by 135, 146, 144, and 143 students, respectively. The maximum and minimum scores of various online modalities are shown in figure 4. The minimum difference between mean percentage scores of MCQs, SAQs, clinical cases, and viva-voce was found in viva-voce (5.65±1.63) and SAQs (5.56±1.38) assessments and the maximum difference was noted in MCQs (7.35±1.41) and SAQs (5.56±1.38) assessments which was found to be statistically significant (p value 0.0001). As compared to MCQs, wider standard deviation was observed in clinical-case based assessments.

Table 1. Baseline characteristics of first year undergraduate medical students.

S No	Variables	n(%)
1	**Gender**	
	Male	81 (54%)
	Female	69 (46%)
	Total	150(100%)
2	**Age group**	
	17-18 years	23(15.33%)
	19-20 years	114(76%)
	21-22 years	13(0.86)
3	**Demographic information**	
	Rural	17(11.33%)
	Semi-urban	27(18%)
	Urban	106(70.67%)
4	**Gadgets used for**	
	e-assessments	67(44.67%)
	Laptop	64(42.67%)
	Mobile	19(12.66%)
	Tablet	
5	**Prior exposure to**	
	e-assessments	85(56.67%)
	Yes	65(43.33%)
	No	

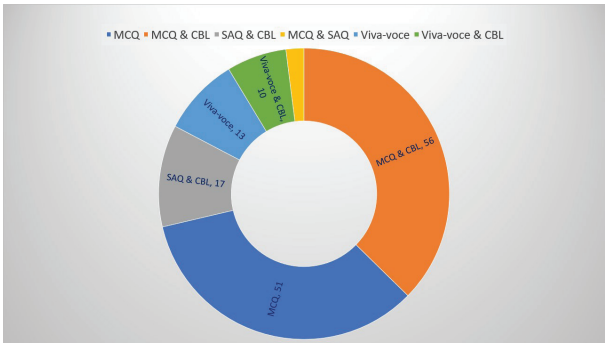
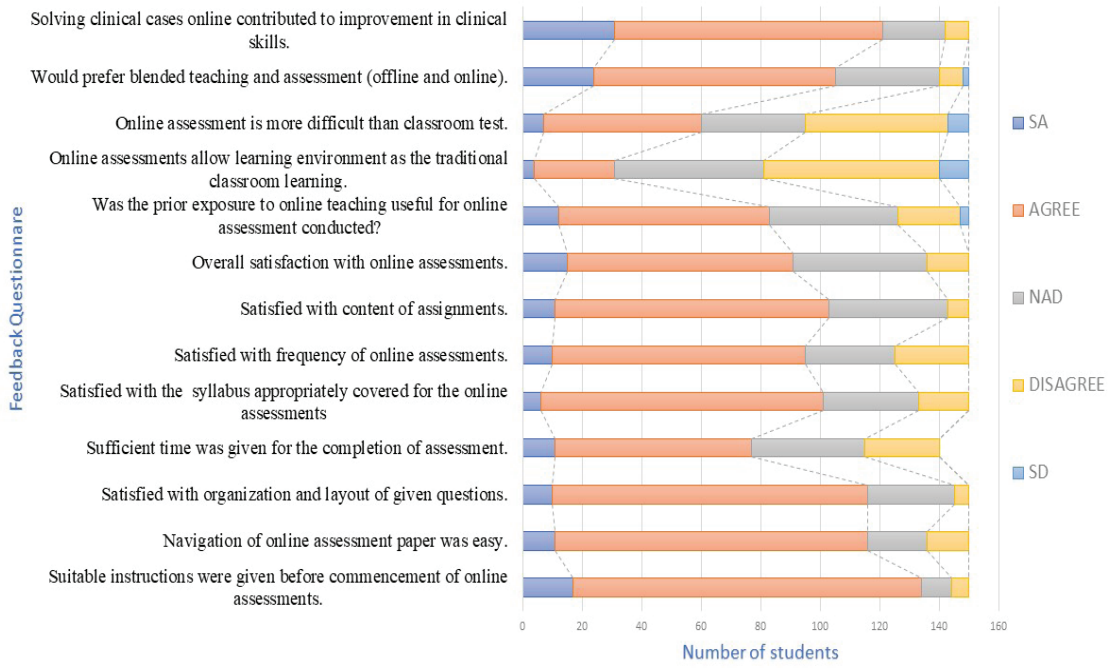


Figure 1. Sunburst chart showing choice of participants for online formative assessment methods (n-150).



SA; Strongly agree, SD; Strongly disagree, NAD; Neither agree or disagree

Figure 2. Feedback of first year medical undergraduate students towards online formative assessments.

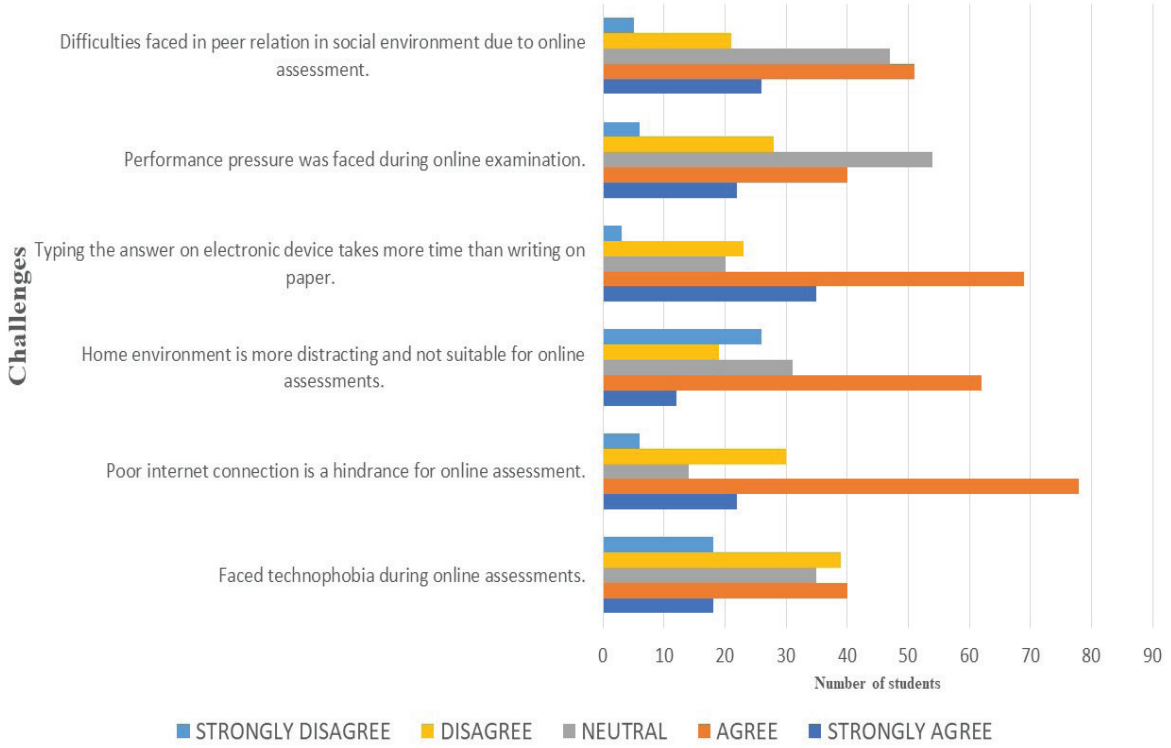


Figure 3. Challenges encountered by first year medical undergraduate students during online formative assessments.

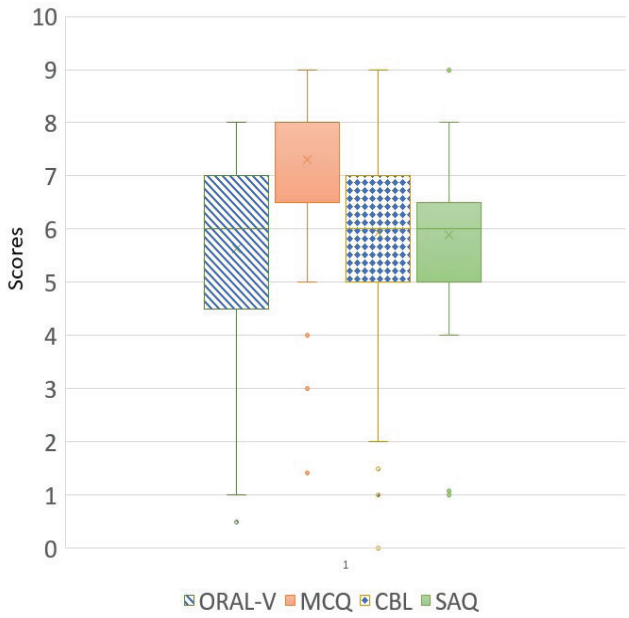


Figure 4. Comparison of scores by various assessment methods.

DISCUSSION

This study evaluated the performance and perception of 150 undergraduate medical students in the context of various modes of online formative assessments conducted during COVID-19. Formative assessments are an important part of medical education and shape the quality of learning and teaching.

In the present study, the majority of students were from urban areas, followed by semi-urban and rural areas. These results are in accordance with the study of Snekalatha et al.[7] Number of students using mobiles and laptops to attempt OFA was similar to that in our study. However, high ratio of mobile users has been reported in other studies.[7,8]

In our study, more than 50% of students had prior exposure to online assessments. This may be attributed to Internet culture and mock test practices prevalent in the academic activities of schools in urban areas. In the present study, most students preferred MCQs as a mode of online formative assessment. An integrative review exploring the formative online multiple-choice test in nurse education reported that these tests are widely used with good efforts in nurse education.[9] MCQs is associated with higher chances of cheating.[10] Our methodology adopted in the present study minimizes the chances of cheating and maintains the authenticity of the assessment. This is supported by other studies.[11,12]

The three factors that motivate students to use formative assessments are feed-up, feedback, and feed-forward.[13,14] Most of the students responded favorably to the e-assessments. The majority agreed that suitable instructions before e-assessments were given, and navigation of the online assessment was easy. Students were satisfied with the layout and organization of e-paper, and more than 50% reported that sufficient time was allotted to attempt the assessments and that the syllabus was appropriately covered in the assessments. Students were satisfied with the frequency of online assessments and course content of the assignments. The postulated advantages of OFA include easy access and availability, utilizing interactive features such as images, provision of immediate and individualized feedback, alongwith the scores allowing timely interventions.[15,16]

In our study, students' responses were similar in terms of online teaching, allowing learning as traditional teaching. Muflih S et al, in their study reported that majority of students had moderate attitude towards online learning and were generally supportive of traditional classroom learning.[17] In the present study, majority of students (70%) preferred blended teaching

learning method of OFA as compared to traditional and online teaching learning individually. A systematic review and meta-analysis in pharmacy education reported that blended teaching is associated with better academic performance and achievement than didactic teaching.[18]

It has been reported that online MCQ and case-based learning (CBL) enhance critical thinking and hence fulfil the objective of learning.[19] In our study, 80.67% of students agreed that solving clinical cases in online assessments contributed to clinical learning. However, Muflih S et al reported in their study that students were not optimistic about gaining professional skills and core-competencies online.[17] The time constraint is likely to impact the ability to provide a comprehensive formative assessment task to complement the learning.[20] Compared to offline learning, online learning has advantages to enhance undergraduates' knowledge and skills, therefore can be considered as a potential method in undergraduate medical teaching.[21] Students consider feedback function being an important factor to use the OFAs as it helps them to check their understanding and guide their future learning directions which are again the feed forward function of OFAs.[22]

In the present study, the challenges faced by medical students during online assessments were poor Internet connection, distracting home environment, typing answers more time consuming, performance pressure, and technophobia. A province-wide survey on emerging evidence on students' online learning experience during the COVID-19 pandemic identified several major concerns, including issues with internet connections, problem with IT equipments, limited collaborative learning opportunities, reduced learning motivation, and increased learning burdens.[21] Other issues reported are internet connectivity, lack of faculty training and institutional support, maintaining students' engagement, and problems with understanding the unique dynamics of online education.[23]

In the present study, the percentages of respondents reporting technophobia and no fear of handling electronic devices were similar. Previous studies have shown that students who were unsuccessful in setting up online learning platforms could potentially experience a decline in confidence and enthusiasm for online learning, which would cause a subsequent unpleasant learning experience.[24,25] Therefore, both the readiness of the Internet infrastructure and students' technical skills remain significant challenges for the mass adoption of online learning.

Having stable Internet accessibility is critical to students' learning experiences during online learning. In the present study, the majority of students reported poor Internet connection as a major impedance for online assessments, and 49.33% reported that distracting the home environment was unsuitable for online assessments. Similar findings have been reported earlier.[7] Western countries like America scored significantly higher in digital readiness compared to Asian countries.[26] Performance pressure during online assessments was also reported by study participants in the present study. Similar results were also observed in a previous study.[7] However, another study reported that online self-assessment allows learners to evaluate their skills anytime and anywhere, which reduce the anxiety and pressure that some students faced in traditional assessment approaches.[27]

Although the number of students attempting MCQs was less than that of other modes of assessment in the present study, we observed that students scored the maximum in MCQs based formative assessments. This may be attributed to previous exposure of online MCQs based assessments through various online software as found in study by Kumar LR.[28] However, a study done in Australia, reported that online quiz attempts correlated with high tutorial attendance, high scores.[29]

COVID-19 may not be the last pandemic and many more may follow in future. To prevent academic and clinical training from being jeopardized, developing online teaching learning programs will contribute to face the pandemic and prepare for health emergencies.

The strengths of this study include the investigation of various modes of online assessment methods for formative assessment using a well-planned methodology. The findings of this study related to the challenges faced and student feedback will be helpful for integrating digital literacy in the curriculum. Our study has a few limitations. Firstly, various web-based conferencing tools were not used. A mixed qualitative and quantitative approach has not been undertaken which could add a new knowledge to scientific world. Further, sample size is small, feed and observed effects would be substantially influenced by specialty and there is need to investigate across other specialties also.

CONCLUSIONS

With the emergence of infectious diseases, there is a high probability of medical teaching being transformed for some duration into virtual teaching. Therefore, a

significant challenge is posed in providing continuity and maintaining academic performance in medical education. The present study show that formative online assessment is a robust educational methodology to supplement traditional assessments and can be used as an intervention to reshape the medical education sector during times when infection control and physical isolation measures are crucial. The challenges faced need to be addressed so that online assessment can be used successfully to empower medical students to help prevent major delays in teaching learning.

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