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Buzz or Fuss: Gauging the online learning environments in undergraduate medical education – a Mixed-Method study

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ABSTRACT

This mixed method study with sequential explanatory design aimed to explore enablers and disablers of online learning environments in medical education and was conducted from August 2021 to January 2022. A cross-sectional survey was conducted on 64 medical teachers and 66 medical students from Pakistan followed by 2 focus group interviews involving 6 participants from each cohort. The mean online education experience scores for medical students and teachers were 2.188 + 1.361 years and 1.881 + 1.145 respectively. Most participants perceived that online modalities are underutilized. Online video was utilized more by students compared to the teachers ($p<0.05$), and quizzes were the most utilized online assessment tools for both groups ($p<0.05$). Thematic analysis unearthed 27 enablers and 23 barriers to the online learning environment. "Ease for use" was the most cited enabler for a productive online learning environment by both groups followed by "Organization of learning" among the teachers and "feedback provision" among the students. Among barriers, both students and teachers talked about "feelings of isolation" as the main barrier to learning, followed by "distractions" quoted by students and "lack of academic honesty" quoted by teachers. The identified enablers and barriers of learning in online learning environments provide a practical map for institutions to evaluate their online ecosystems. The results endeavor to contribute to the ongoing efforts of educators, administrators, and policymakers in creating inclusive, and effective online learning environments.

Keywords: *online, e-learning, learning environments, enablers, barriers*

CORRESPONDING

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INTRODUCTION

Learning in an online environment has shown an uprising trend particularly in the past few years following the coronavirus disease 2019 (COVID-19) pandemic (1). This transformational change has evolved from advances in the multimedia and information technology sectors coupled with rapid accessibility to the Internet. In undergraduate medical education, traditional learning has been supplemented with online learning in the form of blended learning and flipped classrooms (2). The rate at which online learning was being incorporated in the field of medicine was further accelerated when the advent of the COVID-19 pandemic made its impact worldwide (3). However, the transition to implementing online education in undergraduate medical education in its full essence is interrupted by the absence of a live patient and the lack of infrastructural facilities as perceived by the students (4).

As the online learning landscape of higher education continues to evolve, it is crucial to evaluate the effectiveness of online learning and to identify factors promoting or inhibiting students' experience in online learning environments. Previous studies have introduced some basic factors that could have contributed towards the formation of effective online learning environments, namely computer skills, and student-teacher interaction(5,6). However, with the expansion of digital learning, there is a dire need to bridge the gap between the ideology behind effective online learning environments and what is practically happening on the ground while delivering online education in undergraduate health professions programmes. By identifying the key issues and strengths of the digital environments as observed by the key stakeholders, improvement in the quality of education can be brought about. A robust research will further validate various factors that define the dimensions of online learning environments in undergraduate medical education. With this background in mind, this study aimed to gauge the online learning environments in undergraduate medical education. The main objective of the study was to explore the enablers and barriers to the online learning environment. The quantitative part aimed to determine the extent of use of different modalities of online learning environments by the participants while the qualitative part aimed to explore the enabling and inhibiting factors of online learning environments in medical education.

METHODOLOGY

This mixed-method study, with an explanatory sequential design, was carried out from August 2021 to January 2022 after obtaining Ethical approval from the Human Research Ethics Committee Universiti Sains Malaysia (USM/JEPeM/ 21050350). A total of 80 undergraduate medical students and 80 medical teachers were invited via a web-based survey through two social media platforms—Facebook and WhatsApp –to participate in the study. Participation was voluntary and the identity of the participants was kept anonymous. Participants filled out the pre-tested survey questionnaire that measured their practice in using online learning in undergraduate medical education (can be retrieved from: https://forms.gle/H7RmzTP8gkFRCcvL9). Inclusion criteria included medical students who have had at least one year of online education and medical teachers who also had at least one year of conducting learning on online platforms. The form also included an option to participate in the focus group discussions.

Following the cross-sectional survey, 2 focus group discussions with the 12 volunteering participants were held (1 for medical teachers and 1 for medical students with 6 participants each). The participants were recruited among the participants from the cross-sectional survey, who volunteered to join this session. Focus group discussion aimed to identify the barriers and enablers for online learning environments in undergraduate medical education. Each focus group discussion was held online via Zoom application. Before the online meeting, the participants were given an identification code that was to be used as their profile name (Medical teachers: MT1, MT2 etc. and medical students: MS1, MS2) to maintain their anonymity. The chat room was used as a forum allowing participants to write their comments along with verbal expression. This allowed participants to express their views freely either verbally or in written form. The interviews were recorded, and transcribed following member checking to ensure data authenticity.

Figure 1 demonstrates the flow of steps involved in this mixed method study.

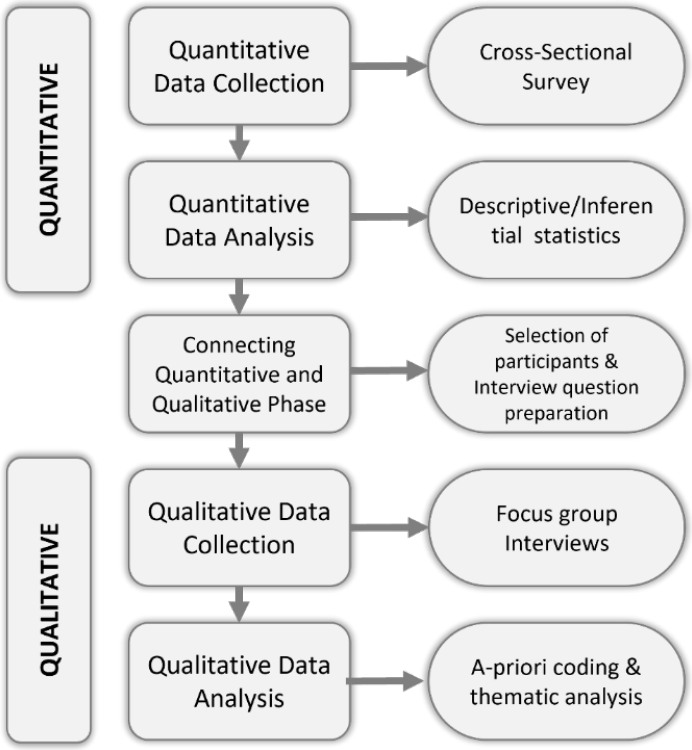

Figure 1: Mixed Method Study with Explanatory Sequential Design used in this study.

Quantitative data from the survey questionnaire was analysed through SPSS software 25.0. Continuous data was presented in the form of mean ± SD whereas categorical data was represented in the form of proportions and percentages. A p-value of <0.05 was taken as significant.

Qualitative data analysis was performed through Atlas*ti* software version 7.5.7. Thematic analysis was done via Apriori coding using the technology-enhanced learning environment in medical education (TELEMED) framework. According to this model, functional components of technology-enhanced learning environments in medical education are divided according to the need for existence within the virtual learning interface (Figure 2). For this purpose, the computer screen in the model delineates the components *outside* the virtual learning platform (learners, learning facilitator, content material and institutions) and components *within* the virtual learning platform (technological usability, cognitive enhancement, pedagogical practices, and social representations).

Thematic analysis was performed by two independent researchers based on Apriori coding, to identify related enablers and barriers as quoted by the interviewees within each of the components of the TELEMED framework. Intercoder reliability was performed to check the credibility and accurate representation of the data analysed.

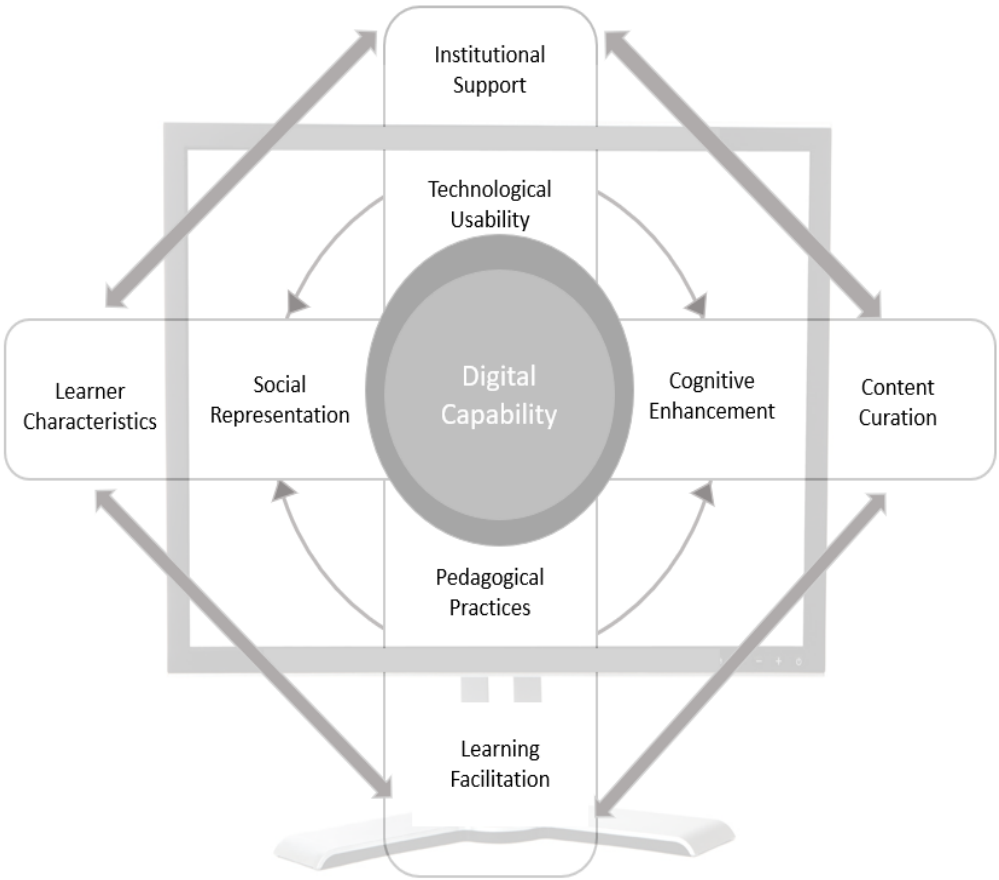

Figure 2: TELEMED Model as Framework for this study
TELEMED: Technology Enhanced Learning Environment in Medical Education

RESULTS

1. Cross-sectional Survey:

Out of 160 invited participants, 130 responded making an overall response rate of 81.25% (66/80 medical students, 64/80 medical teachers). There were 63 male (49.3%) and 67 female (50.7%) participants, with most of the students (40%) and teachers (30.8%) being between 21 to 30-year-old, and 41- to 50-year-old respectively. In terms of their academic qualification, 114/130 (87.69%) were from undergraduate medical education while 16/130 (12.31%) were from postgraduate medical education. Among the participants, 77/130(59.2%) participants belonged to the private sector and 53/130 (61.8%) were from the public sector. Table 1 shows the distribution of demographic data of participants for the two groups.

a. Demographic Characteristics of study participants in each group.

Table 1: Demographic Characteristics of study participants in cross-sectional survey

Demographic Characteristics	Medical Teachers (n=64)	Medical Students (n=66)
Gender		
Male	30	33
Female	34	33
Age		
21- 30 years	1	51
31-40 years	15	3
41- 50 years	28	12
51- 60 years	10	
>60 years	10	
Academic Level		
Undergraduate	58	60
Postgraduate	6	4
Institution		
Public Sector	23	30
Private Sector	41	36

Figure 3 represents the distribution of undergraduate students participating in the study. Year 5 students were the most represented in the study, accounting for 36% of the undergraduate students (27/60) followed by 25% students from 4th year MBBS (15/60).

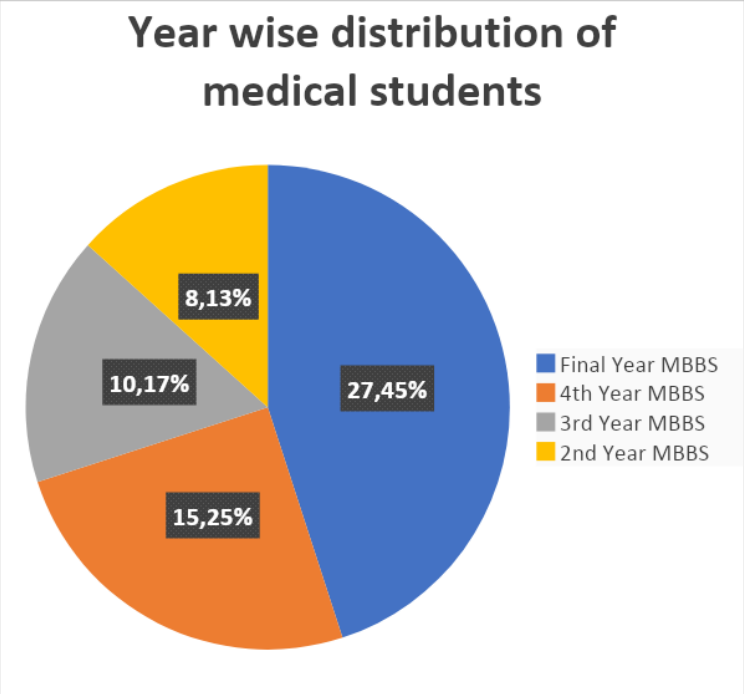

Figure 3: Year wise distribution of participating undergraduate medical students

b. ***Online educational practices of study participants***

Participants rated their online teaching/learning experience in years. As seen from Table 2, the mean experience of online education for teachers was 2.188 ± 1.361 years as compared to 1.881 ± 1.145 years for medical students. There was no statistical difference between the two groups for online experience (p=0.169).

Table 2: Online education experience in years in both groups.

Online education practice	Medical Teachers (n=64)	Medical Students (n=66)	*p-value*
Online Education experience (Years)			
1.0 – 1.5 years	13	18	
1.5 – 2.0 years	24	33	
2.0 – 2.5 years	10	2	
2.5 – 3.0 years	3	2	
3.0- 3.5 years	3	2	*p=0.169*
3.5- 4.0 years	-	-	
4.0- 4.5 years	-	3	
4.5 – 5.0 years	1	3	
>5.0 years	10	3	
MEAN ± SD	2.188 ± 1.361	1.881 ± 1.145	

Participants rated their use of online learning management system (Figure 4). As seen from Figure 4, 72% of participants quoted using their university's own developed portal followed by Google Classroom by 53% of participants. MOODLE was the third most use learning management system (27.9%).

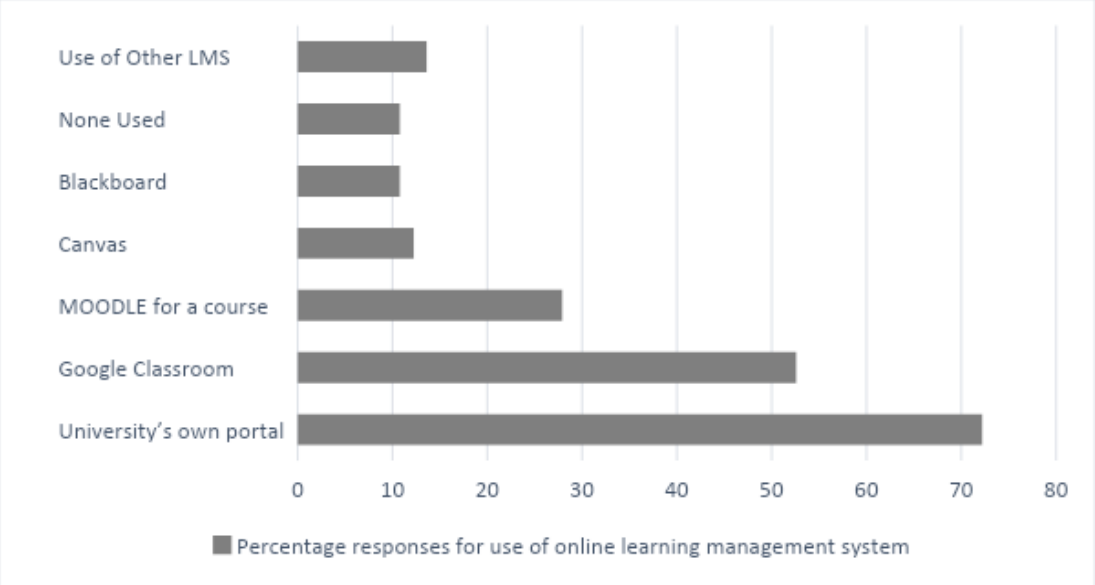

Figure 4: Percentage responses for use of online learning management

Table 3 represents comparison of responses for use of online learning among medical teachers and medical students. Regarding types of learning management systems used, teachers mentioned using university's learning management system and Google Classroom the most; the same learning management systems were also used by students. 10.7% of students mentioned using no learning management system. (*p=0.0001*).

Regarding online instructional use, both teachers and students quoted using Zoom application for online classes the most, followed by online discussion forum and video links. The difference in types of online educational tools used for both groups were found to be statistically significant (*p=0.0001*). Similarly, online assessment strategies usage showed that quizzes were most popular among both groups followed by case study among teachers and presentations by students. (*p=0.0001*).

Table 3: Online educational practices of study participants

Online education practice	Medical Teachers (n=64)	Medical Students (n=66)	*p-value*
Types of Learning Management Systems used			
University's own portal	23(35.9)	24((36.3)	
Google Classroom	22(34.4)	12(18.18)	
MOODLE for a course	12(18.8)	6(9.11)	
Canvas	3(4.67)	5(7.57)	*p=0.0001*
Blackboard	4 (6.23)	3(4.54)	
None Used		7(10.7)	

Use of Other LMS		9(13.6)	
Online Instructional Tools used. (Multiple options selected)	N=207	N=178	
Zoom	55(26.61)	63(35.42)	
Google Meet	24(11.62)	12(6.75)	
Padlet	7(3.381)	0	
Whiteboard use	3(1.44)	9(5.06)	*p=0.0001*
Online Discussion forums	29(14.0)	30(16.8)	
Online live chatting	15(7.2)	6(3.37)	
Online video links	27(13.04)	22(12.4)	
Online audio links	17(8.21)	6(3.4)	
Online group work (Collaborative tasks)	30 ((14.49)	30(16.8)	
Online Assessment Strategies used (multiple options selected)	N=213	N=193	
Quizzes (MCQ, SEQ)	54(25.3)	54(27.9)	
Case Study	20(9.39)	18(9.32)	
Simulation/Animation	8(3.76)	-	
Interactive Videos	22(10.32)	6(3.11)	
Reflective journal	7(3.29)	3(1.7)	*p=0.0001*
Virtual lab/game	4(1.88)	5(2.6)	
Project	9(4.22)	12(6.21)	
Portfolio	7(3.29)	3(1.7)	
Presentation	38(17.8)	38(19.7)	
Open Book Assessment	12(5.63)	15(7.8)	
Oral Viva Discussion	32(15.02)	39(20.2)	

*c. **Extent of usage of various modalities in online learning environments***

Participants rated using various online modalities up to their maximum potential. The participants rated use of online class tools, assessment tools, resource sites and learning management systems up to 51-75% of their stated potential. Regarding the provision of support services, participants rated it being provided in at 26-50% potential whereas social media sites for learning were used from 26–75 % of their stated potential. There was a statistically significant difference between the ratings provided by teachers and students for the learning management system being used up to its stated potential (p= 0.03) (Table 4).

Table 4 Perceived extent of use of various online modalities up to their stated potential

	Medical Teachers (n=64)	Medical Students (n=66)	*p-value*
Online Class tools			
Mostly Used (76-100%)	12	6	
Frequently Used (51-75%)_	30	36	*p=0.30*
Slightly Used (26- 50 %)	19	18	
Rarely Used (0-49%)	3	6	
Online Class assessments tools			
Mostly Used (76-100%)	12	12	
Frequently Used (51-75%)_	20	27	*p=0.69*
Slightly Used (26- 50 %)	22	18	
Rarely Used (0-49%)	10	9	
Online Learning resource sites			
Mostly Used (76-100%)	8	9	
Frequently Used (51-75%)_	28	21	
Slightly Used (26- 50 %)	22	33	*p=0.24*
Rarely Used (0-49%)	6	3	
Online Learning Management System			
Mostly Used (76-100%)	11	3	
Frequently Used (51-75%)_	23	33	*p=0.003*
Slightly Used (26- 50 %)	17	24	
Rarely Used (0-49%)	13	3	
Online Support Provision			
Mostly Used (76-100%)	2	3	
Frequently Used (51-75%)_	17	15	*p=0.14*
Slightly Used (26- 50 %)	27	39	
Rarely Used (0-49%)	18	9	
Social media sites for education			
Mostly Used (76-100%)	5	6	*p=0.27*
Frequently Used (51-75%)_	22	33	
Slightly Used (26- 50 %)	26	18	
Rarely Used (0-49%)	11	9	

*d. **Perceived expertise in online education***

Regarding perceived expertise over use of online learning modalities, both groups rated scale of 3/5 followed by rating of 4. (Figure 5). There was a statistical difference in perceived expertise as rated by teachers and students.

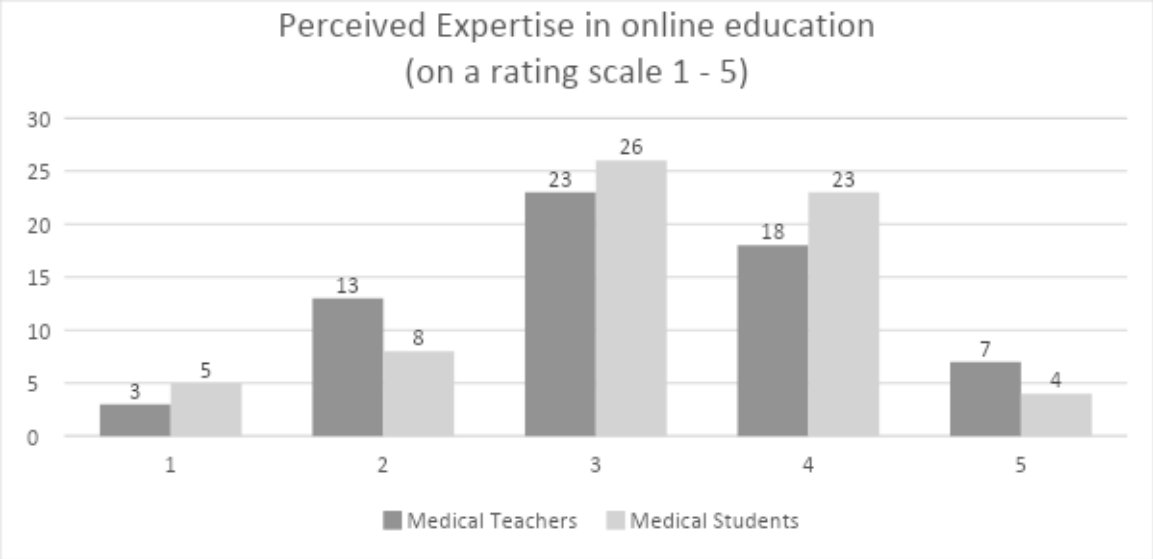

Figure 5: Perceived Expertise in online education (on a rating scale 1 - 5) (*p=1.00*)

2. Focus group interviews.

A total of 12 participants participated in 2 focus groups (6 students and 6 teachers) over online meetings after checking the availability of the participants. Following is the distribution of participants in focus group interviews.

Table 5: Demographic Characteristics of study participants in focus group interviews

Demographic Characteristics	Medical Teachers (n=6)	Medical Students (n=6)
Gender		
Male	3	3
Female	3	3
Age		
21- 25 years	-	5
26-30 years	1	1
31-35 years	2	-
36- 40 years	3	-
Academic Level		
Undergraduate	4	5
Postgraduate	2	1
Institution		
Public Sector	4	3
Private Sector	2	3

a. Enablers of learning in online learning environments: Factors creating Buzz.

Total of twenty-seven enablers were identified among the nine main components of the TELEMED framework. Both facilitators and students identified multiple factors that enabled them to have a positive experience in online learning environments. “Ease for use” was the

most cited enabler for a productive online learning environment by both groups. This was followed by "Organization of learning" among teachers and "feedback provision" among the students. Table 6 shows identified enablers with representative quotes in each domain of online learning environments in medical education.

Table 6: Enablers of learning in online learning environments

Component of online learning environment	Identified enablers	Representative quote(s) Medical Teacher: MT; Medical Student: MS
Cognitive Enhancement	Flexibility of learning	**MS5: "***For me, it was great to allow me to choose time, and place to do online learning. It allowed me to manage my routine according to how I wanted! Of course, I made sure I didn't miss any deadlines."*
	Interactive content	**MT2:** "*Students enjoy when we gamify the content via different instructional tools in online class."*
Content Curation	Careful content selection	**MT3:** *"Online learning requires careful selection of content. Heavy content will only scare students away."*
	Data exploration from different sources(s)	**MS6:** *"Best thing about online learning is availability of different types of resources for learning. We can have videos, handouts, audio, and also read from website links provided by our teachers."*
	Clear Learning outcomes	**MS2:** *"Transparent learning outcomes should be clearly mentioned and at the end students reflect and provide evidence of their progress. The learners should know what, how and when the course is going to be completed."*
Learner Characteristics	Motivation to learn	**MT3:** *"Students who are internally motivated make use of online learning more, and for the rest, it is up to the teachers to provide external motivation in form of incentives."*
	Self-regulation	**MS2:** *"I need to manage my routine, and study schedules by myself in online learning environments."*
Cybergogical Practices	Organized learning	**MT5:** *"Online learning environment best works when learning is organized. Teachers can display schedule, put in announcement, lessons, discussion platform and assignment in a pattern which students can then follow."*
	Use of interactive tools	**MS6: "***We enjoy interactive tools like Mentimeter, kahoot, they keep us involved like we are doing activity in physical class."*
	Convenience of auto grading	**MT4:** *"Online learning environment provides opportunity to teachers to grade student quiz automatically and saves a lot of time."*
	Instantaneous result	**MS1:** *"I like that our quiz results are announced at once and we can also see feedback written by teacher in wrong answer."*
	Record Maintenance	**MT1:** *"We can keep long term record of all students till the end of session, so all work, tests and record are at one place with all timelines maintained"*
		MS1: *"In the start, there was no training for students or*

Digital Capability	Supportive training	*teachers for online learning, which left us frustrated. It's important to build skills to use online learning environments to avoid negative feelings."*
	Time Management	**MS4:** *"If we are able to manage time in online learning, only then we can save ourselves from being anxious."*
Platform utility	Accessibility	**MT6:** *"Learning platform should be available both in laptops as well as mobile."*
	Convenience	**MS1:** *"The learning platform should be convenient to use for all the students regardless of the place where they live."*
	Ease of use	**MT4:** *"Not all the students are digital literate, or even teachers. Hence the online platform should be easy to use."*
	User friendly interface	**MS2:** "If I see a complication website with multiple links, I get confused and waste time. I wish I had spent time on learning instead of figuring out what
Learning Facilitation	Feedback provision	**MT4**: *"Effective feedback will help to know how you teach and students understand the topic or not"*
	Answering queries online	**MS5:** *"We can ask questions over points we do not understand in online class in chat box. The teachers can answer those questions to aid out learning."*
Social Representation	Information sharing	**MT2:** *"Online platforms can used for information sharing including learning objectives, handouts, rules and regulation etc. all at one place."*
	Communication	**MS4:** *"I can contact my teachers in private message as well as communicate with fellow students online. This helps me clarify any concept and not feel lonely."*
	Academic discourse	**MT1:** *"Online Discussion boards provide great way to encourage students to involve in academic discussion and enhance learning."*
	Interaction	**MT5**: *"...as we can't see the students, need more activities that we can interact with them."*
Institutional Support	Rules and regulations	**MS6:** "*Students need to be clear on what is expected from them in learning as well as online behaviors. The institutions should provide us with rules and regulations regarding using online platforms."*
	Training Programs	**MT2: "***Training on using online platforms should be provided by college's IT department."*
	Technical support	**MS6:** *"I wish I was given support when I had issue in submitting my assignment online. Those were our summer vacations and deadline was near. I lost interest!"*

b. Barriers of learning in online learning environments: Factors creating Fuss.

Total of twenty-three barriers were identified among the nine main components of the TELEMED framework. Both students and teachers talked about "feelings of isolation in online learning environments as the main barrier to learning. Additionally, "distractions" were quoted as second important barriers to learning in online platforms by students while teachers discussed the demonstration of "lack academic honesty" in online learning

environments. Table 7 shows identified barriers with representative quotes in each domain of online learning environments in medical education.

Table 7: Barriers of learning in online learning environments

Component of online learning environment	Identified Barriers	Representative quote(s) Medical Teacher: MT; Medical Student: MS
Cognitive Enhancement	Distractions	**MS1:** *"I got distracted learning online; it was easy to move from one browser to another. Only if the session was interesting, I could keep my focus on online platform."*
Content Curation	Lack of Content development	**MS2:** *"I wish teachers could give us meaningful content after development. They seem to use same material for traditional classes, which was very monotonous and rather boring."*
	Heavy cognitive load	**MS3:** *"The online handouts were duplicate of books, with so much content. We are already struggling to focus in online learning, we need learning to be easy, not difficult."*
Learner Characteristics	Frustration	**MS5:** *"I feel frustrated in learning online when I cannot submit my assignment online, I keep trying and failing. Next time, I do not bother to make a good assignment."*
	Lack of Student responsibility	**MS3:** *"I agree that students should be responsible for his learning, but there should be gradual release of responsibility."*
Cybergogical Practices	Time demanding	**MT4:** *"Preparation of online session demands more time and preparation, which is added load on us."*
	Lack of assessment for practical skills	**MS2:** *"No matter how well online learning is, we suffered in Covid times due to lack of learning practical skills; this gap will always exist."*
	Strategy for Subjective paper	**MT6:** *"It's tough to assess students for assessment strategies which will come in their final exams. e.g. short essay question. Here checking becomes hectic but we are bound to assess this as the university demands."*
Digital Capability	Lack of basic skills	**MS1:** *"We see our teachers struggling with basic computer skills. At times we help them out but that wastes time and attention."*
	Online fatigue	**MS4:** *"Long lectures on Zoom…that's so tiring, I feel I have had enough for that day and can't study on my own later."*
	Academic dishonesty	**MT2:** *"Everything aside, the biggest challenge is issue of students copy-pasting each other's work and even cheating in exams. The purpose of learning finishes here."*
	Online security	**MT3:** *"My online account got hacked and the tests leaked once. I was wondering whether these platforms are really safe and secure for teachers and students?"*
Platform utility	Tiresome interface	**MS2:** *"Cluttered website with multiple links…that's so displeasing. I would not want to learn from there."*
	Insufficient	**MS6:** *"Often we are left stranded alone to deal with IT*

	user support	*issues like unable to submit our work etc. That's demotivating."*
	Technical Issues	**MT5:** *"The platform keeps updating and hanging. There is a need to monitor the platform vigilantly to avoid such issue."*
Learning Facilitation	Old teaching practice	**MS3:** *"Teachers should realise that they should apply different methods of teaching in online platform. We want to learn, but if they use the same traditional way, we only attend classes but not learn."*
Social Representation	Feeling of loneliness	**MS3:** *"No matter what, I often feel isolated, working in silo in online platforms. Wish there was ore of group work to make me feel part of the group."*
	Lack of interaction	**MS4:** *"I feel like there is an empty place in front of me during online class. So most of the time, I am quiet and do not interact."*
	Patchy student involvement	**MT1:** *"Some students do not interact and act passive in online environment, these are the ones who need maximum support. It is a recurring challenge"*
Institutional Support	Poor Internet connectivity	**MS1:** *"If the basic internet facility is not optimum, the whole learning process is impeded."*
	Lack of training	**MT2***: "Being a teacher for so long, I need training in building skills for using online platforms. That is where I lag behind and I see it can be one factor effecting students' learning online."*
	Lack of sufficient resource provision	**MS2:** *"Limited number of students allowed in online class by the institutional account provided. They should upgrade to allow all students to enter class."*
	Lack of guidelines for online learning	**MS6: "***Online learning was new for us too, we needed clear guidelines for using online platform to its maximum potential so we can learn. We felt confused when no guideline was given"*

DISCUSSION

Our cross-sectional survey had a response rate of 81.25% which is congruent to acceptable range of response rate in online surveys (7). Similar to suggestions given by meta-analysis by Wu et al (7), our high response rates in online surveys were possible after carefully selecting appropriate WhatsApp and Facebook groups and also sending reminders in groups requesting to fill the form which would only take 10 minutes of the participants' time. Additionally making sure that the researchers respect the time and privacy of the participants supported participants to help decide taking online surveys.

This cross-sectional survey had a diverse group of participants from various institutions which helped us generalize the findings instead of exploring the experiences of participants from a single university. There were representations from both the private and public sectors

as well as from undergraduate and postgraduate levels, although representation of postgraduate faculty and students was less than that of undergraduate participants. The mean experience of online learning was 2.188 $\pm$ 1.361 years and 1.881 $\pm$ 1.145 years for medical teachers and students respectively. This corresponds to the time of Covid-19 pandemic which was a tipping point for initiating online education all over the world (8,9).

An interesting observation in our study was regarding use of online instructional tools. Medical teachers reported using online sessions (Zoom and Google Meet) most frequently. Among medical students, Zoom was the most used online instructional tool followed by online video links. This demonstrates students' inclination towards using videos for learning purposes which is related to the "content curation" component of TELEMED model. It is important that the teachers carefully select the content for online learning as well as provide diverse options for content (textual, handouts, audio, video etc.) to ensure student engagement in online learning environments (10). This observation can also imply that students use video links on their own for online learning, hence they are personalizing their learning. This can lead to self-regulation among students which is one of known "learner characteristics" for promoting online learning(11).

Participants also rated various online modalities being used up to their stated potential. This question was put forward to understand whether these online tools (LMS, instructional and assessment tools) are being used to their full potential or not. Our group of participants perceived these modalities to be used only at 51-75% of the potential. The resource provision was perceived to be slightly used (26-50%). This highlights an important issue for need of appropriate resource provision by the institutions as recommended in various studies(12,13). While these online modalities have significant potential, their maximum utilization depends on various factors, including effective instructional design, integration with in-person learning experiences, faculty training, technological infrastructure, and student support services (14,15). Additionally, ongoing research and evaluation are necessary to identify best practices and refine these modalities to optimize their impact on medical education.

Our qualitative study threw light on the enabling and inhibiting factors in online learning environments for medical education (Figure 6). One of the most appreciated factors was "organized learning". Online learning environments has opened new avenues of possible remote teaching thus reducing resource-burdening travel expenses and easing time management for medical teachers (16). The added ease in previously cumbersome administrative tasks like attendance documentation, course design, course management, report generation and deadline reminders enhanced instructor productivity and resulted in easy centralized learning based on a rather simplified process (17).

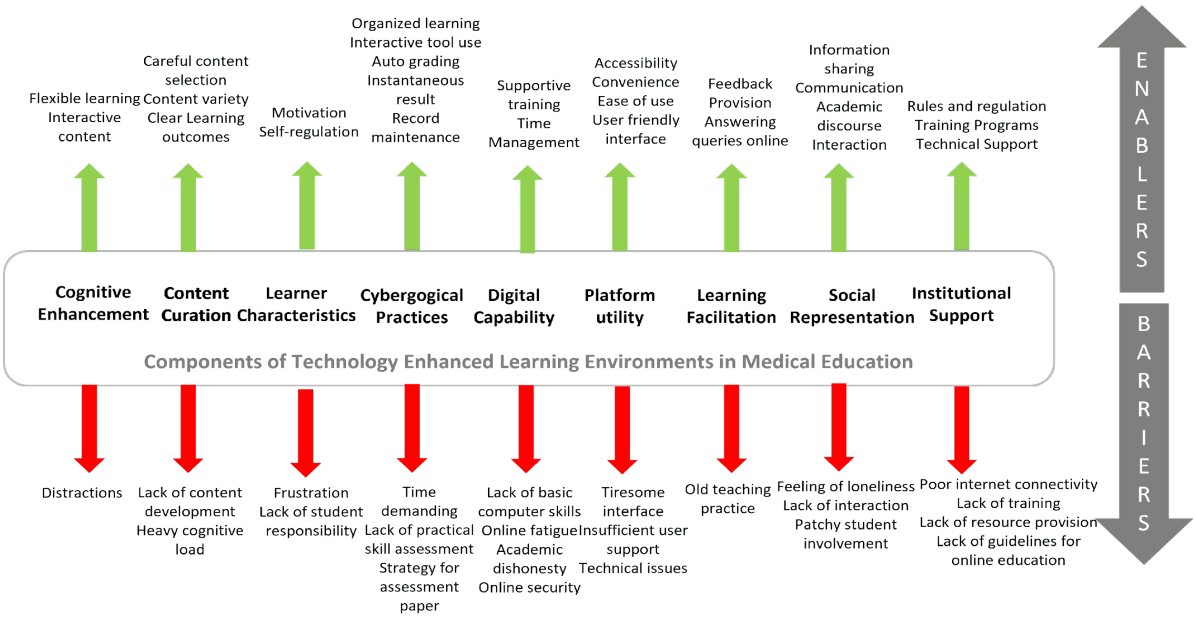

Figure 6: Conceptual Model for enablers and barriers of effective online learning environments.

The significance of an individualized learning environment should not be underestimated, as the one-on-one interaction in an online system provides a distinct advantage compared to the traditional classroom setting. In a traditional classroom, simultaneous communication can often be overwhelming and less conducive to productivity(18). Also, the students are motivated to use online learning environments as it enables them to manage time productively due to which their ability to do other non-academic tasks is enhanced, eventually leading to fulfillment of individual goals (19). The whole outlook of accessibility and flexibility greatly attracts them to prefer this mode of learning over conventional live learning (20). Self-regulation has been a major driving force behind the success of the online learning environment which goes hand in hand with effective communication and interaction in three key areas: among learners, between learners and instructors and between learners and content (21).

On the other hand, multiple barriers of online learning leads to poor student experience. First, the lack of ability to provide practical, hands-on training. Our Medical education requires hands-on training, however online learning modalities cannot fully overcome the barriers to such type of learning (22). Another barrier to online learning was academic dishonesty which was discussed both by the teachers as well as students. The inherent nature of online environments, with reduced supervision and increased opportunities for remote collaboration, presents unique challenges in maintaining academic integrity(23). With time, this challenge has brought attention to administrators and teachers with emergence of policies regarding online proctoring, checking plagiarism to reduce academic misconduct(24). Those two points alone are enough to give one pause before shifting medical education to an online environment (outside of the necessity of a global pandemic).

Students also reported ‘feelings of isolation’ as an inhibiting factor for successful online learning. There is undoubtedly obvious scarcity of personal contact among peers and among learners and teachers and thus the element of community ownership is challenged to be

eliminated from online learning(25). This has detrimental effect on the establishment of healthy teacher-student relationships as this interaction is the cornerstone in academic excellence regardless of mode of teaching (21). Another challenge for online learning is difficulty in maintaining motivation to learn amongst students during this online experience, the lack of which leads to decline in successful outcomes as compared to their constantly motivated counterparts (26). Online learning makes it hard for offers of clarifications, explanations and interpretations to take place effectively as opposed to traditional classroom learning as barriers like language, time, good web connection do exist and make face to face encounters in such circumstances invaluable (27).

Limitations and Future Directions

Having participants from a vast background has given this study to investigate the diverse perspectives of both medical teachers and medical students, who are important stakeholders in online education. However, still this study was limited by a lower number of audiences who were invited via social media groups from Pakistan; hence only those participants were included in the study who had access to social media and were present in the groups where an invitation was sent. Institutional invitation was purposefully avoided to allow diverse participants with varied experiences. Also, this study involved a very small number of postgraduate students in both quantitative and qualitative studies, hence findings cannot be generalized for the context of postgraduate education. The qualitative study involved a lower number of interviewees, hence detailed insights can be given in future studies with cohorts with larger numbers.

Considering the inclusion of participants from different institutions, the next direction could be to investigate institution-based case studies to analyse individual schools' online learning environments based on this study's key findings. This study combined the perspectives of both the students and the teachers. Separate studies for each group can further help in exploring the subject in detail.

CONCLUSION

This study has shed light on the enablers and barriers of learning in online learning environments in medical education. By leveraging innovative instructional strategies, integrating emerging technologies with training, and promoting inclusive practices, medical institutions can create engaging and effective online learning environments. Additionally, policymakers and administrators play a crucial role in ensuring equitable access to technology and connectivity, fostering collaboration, and allocating resources to support the development of comprehensive online learning ecosystems. As the landscape of online medical education continues to evolve, continuous research, adaptation, and collaboration will be key to realizing the full potential of online learning and its ability to shape the future of education.

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