



## Teaching Clinical Skills Using Online Modality through Modified Peyton's Framework: An Experience from a Medical University in Pakistan

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### Abstract

**Introduction:** Medical institutions worldwide faced an unprecedented situation during COVID-19 of identifying alternative strategies to sustain the continuum of learning process. This led to several innovations in the traditional medical curriculum. This study explored the effectiveness and feasibility of using the Peyton's framework modified for a virtual platform (Microsoft Teams) for teaching clinical skills to first and second-year medical students at The Aga Khan University, Karachi, Pakistan.

**Methods:** In 2020-2021, the modified Peyton's framework was integrated in the clinical skills (CS) curriculum for all first- and second-year students (N=200). For evaluation, a mixed-method design was used, with pre-and post-session questionnaires. Students' satisfaction was obtained through the standard session evaluation tool of the university. For the qualitative arm, to explore the instructors' experiences, purposive sampling was used (n=8) and a focused group discussion (FGD) was conducted. Finally, performance of the students at the end of year summative Objective Structured Clinical Examination (OSCE) was compared with the students of previous year. Quantitative data were analysed using STATA® version 15.1, using paired t-test to compare the differences in OSCE scores in selected CS stations. A p-value of <0.05 was considered significant for all tests. The FGD was transcribed and analysed through manual content analysis.

**Results:** Nine clinical skills (that included history and examination skills) were taught using the virtual platform. There was a significant improvement in post-session questionnaires in seven of these skills (P<0.01). Session evaluations showed that most students were satisfied with the learning experience. The instructors showed that the online teaching offered a promising platform for teaching history taking skills. The OSCE scores showed mixed results, with significant improvement in two out of four repeated stations by using paired t-test [abdominal exam (87.33±8.99, <0.001); and precordial examination (88.45±8.36, 0.001)].

**Conclusions:** Modifying Peyton's framework to a virtual platform allowed us to sustain the continuum of clinical education during the COVID-19 pandemic. The results support the use of a blended learning environment for teaching clinical skills.

**Keywords:** Clinical skills, Covid-19, Medical students, Teaching

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Please cite this paper as:  
Saeed S, Kashif U, Zaki S, Samad K, Yousuf MZ, Raza M, Jabbar S, Khan UI. Teaching Clinical Skills Using Online Modality through Modified Peyton's Framework: An Experience from a Medical University in Pakistan. J Adv Med Educ Prof. 2023;11(1):15-23. DOI: 10.30476/JAMP.2022.95986.1669.

**Received:** 29 June 2022  
**Accepted:** 22 October 2022

## Introduction

In undergraduate medical education, the Clinical Skills (CS) course in pre-clerkship years, initiates the development and refinement of basic clinical skills that are essential for students to develop mastery in clinical years. The literal meaning of the term 'clinical skills' is "actions performed by a healthcare worker that involves or impact direct patient care." This includes history-taking, physical examination, clinical investigations, using diagnostic reasoning, procedural perfection, effective communication, teamwork, and professionalism (1). The theoretical underpinnings of clinical skills teaching are embedded in theories of behaviourism, constructivism, and experiential learning theory. Several teaching models have been devised to facilitate the learning of these skills (2). Medical colleges utilize various instructional strategies to enhance the learning of clinical skills including skills lab, simulation-based teaching, role-plays, bedside demonstration, etc. One of the most popular methods of teaching clinical skills is Peyton's method (3-7). It is a four-step model which includes 1) demonstration (demonstration of the skill by the instructor); 2) deconstruction (the demonstration by the instructor with commentary); 3) comprehension (the demonstration by the instructor but prompted by students); and 4) execution (the students' demonstration with commentary). The approach suggests that learning is enhanced when observation of skill (constructivism) is linked with the opportunity to do repeated practice (behaviour) and feedback (3).

In the year 2020, the COVID-19 pandemic disrupted the conventional process of teaching and learning in educational institutions across the world. The challenge was greater for medical schools that had to ensure a safe and suitable environment for the teaching and learning of clinical skills to medical students during frequent lockdowns. While teaching, learning, and assessing the theoretical knowledge were converted to online platforms, the challenge was greater for teaching clinical skills (CS) and ensuring that appropriate outcomes are attained by the medical students by using a virtual learning environment (VLE) (8-13). There is limited literature available which highlights the evolving pedagogical framework for teaching clinical skills using a virtual platform (11-13).

This study explored the effectiveness and feasibility of using Peyton's framework modified for a virtual platform (Microsoft Teams) for teaching clinical skills to first- and second-year medical students at The Aga Khan University, Karachi, Pakistan.

## Methods

### *Study design*

We used a mixed-method study design. The quantitative arm was based on quasi-experimental approach which was meant to ascertain the effectiveness of the pedagogical framework on CS learning in a VLE. To explore the feasibility of this approach, we conducted an FGD with the instructors, who are teaching associates (TAs) at the medical college. Ethical approval was obtained through the Ethical Review Committee of The Aga Khan University (2020-5294-14171). At the beginning of this activity, students were clearly informed that the voluntary submission of the online questionnaire indicated their consent to participate in the anonymized survey. Throughout the study, anonymity was maintained by treating the data with strict confidentiality, and participants' identifying information was not used in reporting the research.

### *Setting and participants*

The Aga Khan University, Karachi, Pakistan offers a five-year Bachelor of Medicine, Bachelor of Surgery (MBBS) program which consists of the initial two years as pre-clinical years followed by three clinical (clerkship) years. The spiral curriculum allows the integration of basic and clinical sciences. Synchronized with the basic sciences modules in the pre-clinical years, students complete a robust CS course, which includes history taking, examination, basic procedural skills, and communication skills, to prepare them for clinical encounters during clerkships. These skills are assessed through an end- of-year Objective Structured Clinical Exam (OSCE). The CS team includes clinical faculty from multiple disciplines and educational faculty. The CS team is responsible for creating the curriculum, training of instructors, and assessing students through the end-of-year summative OSCE. Before the COVID-19 pandemic, CS course was taught by clinical instructors who were trained by CS faculty. They taught clinical skills in small, in-person groups, using a standardized instructor manual, mannequins, and standardized patients. Students were provided with checklists to ensure the understanding of proper order of clinical skills. These checklists were also used for revision and peer-to-peer assessments.

In 2020-2021, during the COVID-19 pandemic, when all didactic teaching moved to a virtual learning environment, the CS team gathered to create a practical and effective framework for teaching history taking and examination skills (data gathering skills) in a safe learning environment. The Peyton's framework

was modified to a virtual learning environment and integrated into the CS curriculum for year I and II students. Students of academic batch 2023 and 2024 (n=200) who attended all the clinical skills virtual sessions and provided consent were included in this study through convenient sampling. Students were informed of this study, and all students provided verbal consent to participate (n=200). Due to integration of the intervention within the curriculum and uncertainties related to COVID lockdown, it was not possible to identify the control within the same group; hence, previous preclinical batches, who were taught through traditional methods, were used for comparison. (n=200). This makes the total sample of four hundred to address one of the study objectives, i.e., to evaluate the effectiveness of using Peyton's framework modified for a virtual platform for teaching clinical skills to first and second-year medical students.

### *Online Clinical Skills Curriculum*

#### *Planning of teaching sessions*

Members of the CS committee reviewed the year I and II curriculum to identify clinical skills to be taught on a virtual platform. Clinical skills that provided a synchronous learning experience with the ongoing theoretical modules were selected. These included four history-taking skills (history of chest pain, cough, flank pain, and menstruation), four examination skills (examination of the precordium, the respiratory system, thyroid, and abdomen), and Basic Life Support (BLS).

A customized space was created in the University VLE to add lesson plans. For each history and examination session, instructor guides were revised, and examination checklists were reviewed for students to be used during and after the sessions. For examination sessions, examination videos developed at AKU, and free YouTube resources were reviewed and approved by the CS committee. Wherever online resources were considered inadequate, the CS committee created new videos for history and examination skills. Microsoft Teams was used as the online platform for teaching the Clinical Skills sessions. Twenty small groups, comprising of ten students each, were created to optimize the interaction of individual students with the TA and ensure students' engagement in the process of learning

#### *Training of Instructors and Standardized Patients*

Instructors were trained by the medical educationist and the subject expert, who were part of CS committee, for each clinical skills session.

Scripts were prepared in the local language, and standardized patients were also trained.

#### *Briefing to medical students*

Medical students were oriented to this new mode of teaching. They were also briefed about the key expectations, the grouping, mode of teaching, peer to peer learning and feedback, mode of assessments, and rules for online teaching. They were also introduced to the instructors.

#### *Framework for online teaching of Clinical Skills - Year I and II*

The teaching plan comprised of synchronous and asynchronous learning experience in the form of pre-class, in-class, and post-class activities. The total duration of each session (in-class activities) was one hour and thirty minutes. The details are mentioned below.

#### *Pre-class (asynchronous component)*

Before each session, students were expected to view relevant learning resources (videos for examination skills and handouts/chapters for history-taking skills), followed by completion of a self-assessment (ten one-best-choice questions). These assessments also had an additional item for the students to rate their confidence on a 5-point scale (0: no confidence, 5: most confident) in performing the relevant history/examination skill (Pre-session assessment). The learning resources and assessment were uploaded three days before each session on VLE.

#### *In-class (synchronous)*

Considering the effectiveness of Peyton's model for teaching clinical skills, as reported in the literature (2, 3, 7), the committee unanimously decided to utilize it for this project; however, its implementation on an online platform was a challenge. Hence, certain adaptations were made to fit this pedagogical approach to meet the project requirement. The details are mentioned below.

1) Discussion: To link the asynchronous learning with the in-class (synchronous) experience devised for students, the instructor discussed the key principles embedded in the skill (history/examination) and encouraged clarification and questions by students.

2) Demonstration/Deconstruction: This is the core of the session where the instructor demonstrated the relevant skill. For history taking skills (e.g., history of chest pain) instructors worked with a standardized patient (SP). For examination skills, the instructor deconstructed



the examination videos in small bits (play & pause strategy) and explained each step with underlying rationale.

3) Re-demonstration: To provide students with the opportunity to practice and redemonstrate those skills, students were provided with skill-specific checklists and were divided into pairs using Microsoft (MS) Teams channels. Peer-assisted learning was used in the channel space where one student performed the relevant skills and other students functioned as the assessor and vice-versa. Instructors randomly checked each online channel to ensure that the students were able to utilize the checklists effectively for peer-assisted learning and clarify the concepts where necessary. After peer-assisted learning, students were redirected to the main room after fifteen minutes, where the instructors randomly assigned the students to interact with the SP to redemonstrate one component of history. For examination skills, the expectations are to facilitate the understanding of the examination checklist in the channels. The instructor enquired about the examination steps by pause-play video, randomly from each student in the main room.

4) Summary and Feedback: At the end of each CS session, the instructors would ask the students to summarize the learning, provide verbal feedback to the group, and address the students' questions.

#### *Post-class*

The student's knowledge of the skill was re-evaluated using the same post-test questionnaire. They also shared their feedback through the standard university session evaluation form.

#### *Data collection and analysis*

##### *Pre-Post Questionnaire:*

For each clinical skill session, knowledge assessment was carried out through similar one best questions (ten questions). These questions were developed by the clinical content expert, relevant to each topic and reviewed on their structure and format by medical educationist. Questionnaires were piloted on a group of students, who were not part of the study, and necessary adjustments were made before final implementation. These questionnaires also had an additional item for the students to rate their confidence on a 5-point scale (0: no confidence, 5: most confident) in performing the relevant history/examination skill.

##### *Session Evaluation*

Student's feedback was obtained using standard session evaluation form of the university.

The students rated their experience on a 6-point Likert scale (1: strongly disagree, 6: strongly agree).

#### *Objective Structured Clinical Examination (OSCE) scores*

The OSCE scores of classes of 2020-21 (taught by using online pedagogy) were compared to the OSCE scores with the previous batch of 2019-20 (taught through face-face traditional skills lab). The OSCE exam took place in-person with strict observation of COVID standardized operating procedures (SOP). The scores of those stations which were taught and assessed in both the groups were used.

Quantitative data are expressed as means and standard deviation for continuous variables, while categorical variables are expressed as frequency and percentages. To confirm the fidelity of the scores, we applied paired t-test to compare individual-level results. A P value of <0.05 was considered and reported as significant. Data were analysed using STATA® version 15.1.

To assess the feasibility of utilizing the online clinical skills framework, we conducted an FGD with instructors. The FGD guide comprised of eight open-ended questions. Relevant probes were used to explore each aspect in detail. The questions explored the instructors' experiences about the lesson plan, learning medium, strengths, limitations, future implications, and the online clinical skills framework usability. All instructors (n=8) were invited for voluntary participation in this process. One whole sentence was used as a meaningful unit. The transcription was completed within 24-48 hours of data collection. Coding was done independently by two researchers to ensure trustworthiness. Data were subjected to condensation and abstraction to develop the codes which were clumped together to yield categories or subcategories. Emerging themes were identified by reviewing the coded data for areas of similarity and overlap between the codes.

## **Results**

A total of two hundred students (Year I: 101 and Year II: 99) participated in online Clinical Skills sessions. Of these 106 (53%) were male.

#### *Quantitative results*

##### *Pre-and post-test scores*

Table 1 shows the change in knowledge of clinical skills by comparing the pre-and post-test questionnaire. There was significant improvement in knowledge in all sessions, except menstrual history and abdominal examination.

**Table 1:** Change in knowledge on pre-post session questionnaires

Session	Average pre-test scores (Mean±SD)	Average post-test scores (Mean±SD)	P**
Menstrual History	6.67±0.54	6.7±0.86	0.19
Basic Life Support	8.14±3.04	11.4±3.19	<0.001
History of Cough	5.4±1.9	6.7±1.6	0.001
Respiratory examination	7.09±1.8	8.29±1.8	<0.001
Thyroid examination	1.35±0.91	2.77±1.14	<0.001
History of chest pain	5.05±1.63	6.13±1.56	<0.001
Precordium examination	4.77±2.11	7.75±1.74	<0.001
History of flank pain	3.91±1.43	4.63±1.17	<0.001
Abdominal examination	4.45±1.53	4.85±1.49	0.25

\*\* : Paired t-test for within group differences; P-value of <0.05 was considered significant.

**Table 2:** Students' confidence in demonstration of clinical skills (scale 0-5)\*

Sessions	Pre-session score (Mean±SD)	Post-session score (Mean±SD)	P**
Menstrual History	2.44±1.11	4.28±0.48	0.02
Basic Life Support (BLS)	1.88±0.21	3.92±0.88	<0.01
History of Cough	1.72±1.3	3.17±1.34	<0.01
Respiratory Examination	1.31±1.28	3.35±0.93	<0.01
Thyroid Examination	1.78±1.41	3.84±0.88	0.01
History of Chest Pain	1.49±0.91	3.63±0.60	<0.01
Precordium Examination	2.4±1.23	3.75±0.72	0.05
History of Flank Pain	1.26±1.05	3.75±1.02	0.02
Abdominal Examination	1.95±1.16	3.66±0.94	0.03

\*5-point scale (0: no confidence, 5: most confident) was used to examine change in confidence in demonstrating the specific skills; \*\*: Paired t-test for within group differences; P-value of <0.05 was considered significant.

**Table 3:** Change in OSCE\* scores

OSCE station name	Present Class (Mean±SD)	Previous Class (Mean±SD)	P**
Abdominal Exam	87.33±8.99	71.40±10.5	<0.001
Menstrual history	70.34±16.49	72.08±9.5	0.369
Basic Life Support	81.48±4.73	81.55±12.02	0.95
Precordium examination	88.45±8.36	74.51±9.76	<0.001

\*OSCE: Objective Structured Clinical Examination; \*\*: Two-group mean comparison t-test. A P-value of <0.05 is considered significant.

Students also rated their confidence pre- and post-session in the demonstration of the nine skills on a 5-point scale (0= no confidence, 5= most confident). There was a significant improvement in the students' rating of their confidence in the demonstration of most of the skills as shown in Table 2.

#### OSCE scores

The OSCE scores of the present classes (2020-21) were compared with the pre-pandemic (2019-20) exam. Four stations included clinical skills that had been taught online to the class of 2020-21 and in-person to the class of 2019-20. A significant improvement (P<0.05) in scores was observed in two skills: abdominal examination and precordium examination (Table 3).

In the session evaluation, students reported their satisfaction on a 6-point Likert scale (1:

strongly disagree and 6: strongly agree) about the structure of the session, facilitation skills of instructors and appropriateness of pre-session learning material. For most sessions, students rated the sessions to be effective and helpful (mean satisfaction more than 4). While most felt engaged during the sessions (mean satisfaction of 4.57 and above) and were satisfied with the instructors (mean satisfaction of 4.86 and above), they did not agree much with using online modality as a long-term solution to teach the clinical skill (lowest reported Mean±SD=3.21±1.15) (Table 4).

#### Qualitative results

Four key themes emerged from the FGD with instructor.

*Theme 1: Use of technology in maintaining the continuity of learning*

**Table 4:** Session Evaluation (scale 1-6)\*

	Items	Session with highest (Mean±SD)	Session with lowest (Mean±SD)
4.	Helped learn how to interact with patients.	History of cough 5.06±0.86	Thyroid examination 4.37±1.61
5.	Ample opportunities for interaction with faculty.	History of cough 5.44±0.69	BLS 4.67±1.22
6.	Felt engaged during the session.	History of cough 5.22±0.76	BLS 4.57±1.28
7.	Online modality can be used for teaching these skills.	History of cough 4.69±1.09	Thyroid examination 3.21±1.75
8.	Well-planned for delivery of relevant skills.	History of cough 5.25±0.65	Abdominal examination 4.45±1.74
9.	Facilitators were well prepared to deliver content.	Thyroid examination 5.37±1.21	Abdominal examination 4.86±1.70
11.	VLE resources helped optimize in-session learning.	BLS 4.89±1.25	Abdominal examination 3.55±1.9

\*: 6-point Likert scale (1: strongly disagree, 6: strongly agree); BLS: Basic Life Support; VLE: Virtual Learning Environment.

The instructors believed the online clinical skills to be a great innovation to continue the students' learning that was halted by the pandemic. They commented it is 'well-structured' and applauded the thought and research that formed the curriculum. They also appreciated the institution's rapid utilization of alternative instructional methods and recognized that technology served as the quickest solution to bridge the anticipated gaps in learning.

One of the instructors said, "It was thrilling to be a part of this as we were the first people who did this in our country."

They also appreciated that it was an excellent opportunity to learn simultaneously and gain new skills and confidence in their teaching abilities by using online mediums to teach clinical skills.

One of them quoted: "We were not only interacting with them, but also judging our ability to multitask and monitor the level of participation by each student at the same time, which we had never faced before."

### Theme 2: Role of facilitation during online learning

When asked about engaging students as well as conducting the sessions according to the framework provided, all the instructors agreed that being familiar with all the resources seemed necessary for effective facilitation. This was especially important during online teaching and learning, where both instructors and students were remotely connected.

One of the instructors stated, "We were not only delivering the online content, but also striving to optimize the learning environment whereby we keep our learners engaged in the learning process."

Some of the instructors also stated that, at times, it became overwhelming as there was an

internal desire to complete the given content. However, keeping connected and ascertaining that the information is transmitted and assimilated by each student is by far the greatest job. Interestingly, the instructors considered this as a learning opportunity for them. They mentioned that while the pandemic had negatively impacted almost all life avenues, sometimes it seemed like a blessing in disguise. The instructors claimed that without the pandemic, they would not be having this uniquely designed experience which they quoted as «the art of facilitating through an online medium.» They commented on the initial discomfort with this new medium of instruction and how they adapted to it. There came an essential aspect of the learning curve, which the instructors quoted as "It was difficult to adjust initially, but then soon things were running smoothly because of the flexibility of the lesson plan and the ability to improvise, and soon it became the new norm."

One participant said: "This was probably the best way it could have happened in an online setting."

### Theme 3: Strengths of the learning framework

The instructors mentioned that students gave them personalized feedback about how much the sessions were helping with their learning. Peer-to-peer learning and feedback during the breakout channels were something that the students appreciated a lot. The instructors appreciated the use of pre-assessments and found them useful in identifying the gaps in knowledge beforehand.

One of them quoted, "It was so assuring to see the escalating scores of the students in the post-test; it seemed that we did some justice to our job." They also expressed their feeling about how some aspects of this online session were better than in-person due to time efficiency and the students were more attentive in the lessons.

One instructor shared, *“the framework provided a better opportunity of learning than a physical session; for example, the students had a checklist in their hand, practiced on each other, and almost everybody did practice, while in physical session only 20- 30% of people practiced.”*

#### *Theme 4: Challenges and future utilization of online teaching*

The biggest challenge faced during facilitation was connection issues on the Internet with students or the SPs. The students were connected from various cities within Pakistan and abroad, where high-quality bandwidth was not always available. The intermittent disruption led to a decrease in engagement in the learning process.

Another emerging theme was the etiquettes of online learning. Instructors mentioned the difficulty in creating a good learning environment. One instructor commented, *“Many a times students wouldn't turn on their videos or mute their microphone when they were not interacting in the class, and then it was difficult for us to continue with the process.”*

The timing of sessions was also discussed. Instructors suggested running clinical sessions earlier in the day when the students were more attentive. Another suggestion was to develop the clinical skill videos that focus on one relevant examination skill to be taught in each session (For example, the video for precordial examination may not have detailed peripheral vascular examination). According to the instructors, this will help better connect the video demonstration to in-class teaching of those skills.

There was an interesting perspective which the instructors shared regarding using available resources for explaining specific skills, for example, the use of *“pillows”* to demonstrate the placement of hands during chest percussion.

One instructor said, *“Apart from videos, we can have some drawings, images, or sketches and share with them while sharing our screen.”*

They all agreed that online teaching of history-taking skills was better than/or equivalent to face-to-face learning. This component should be retained in the curriculum definitively. However, examination skills for the pre-clinical years would attain a degree of realism to the clinical sessions using simulators during the sessions.

One of them quoted, *“It may be used even after coming back in person”*, while another said that *«it can be part of a revision session and would be very effective in revising many histories in a 2-hour session. It can be made a part of the overall module.»*

## **Discussion**

The COVID-19 pandemic has prompted the use of online modalities in teaching and learning, and ample research has been generated on the use of online platforms for medical education. Our study aimed to add practical evidence of using modified Peyton's framework to teach clinical skills to medical students in the pre-clinical years and explore the views of the students and instructors regarding this new method of learning and teaching, respectively.

Shifting medical education to an online system is not an entirely new concept. Similar transitions were noted during the severe acute respiratory syndrome (SARS) outbreak of the early 2000s that forced medical school closures (14, 15). At that time, many medical schools successfully transitioned to videotaped vignettes, audiotaped recordings, and/or online chat rooms and webcasting to replace clinical experiences (16, 17). Similar initiatives have been seen in institutions across the United States, Canada, and United Kingdom during the COVID-19 pandemic to ensure continuity of medical education (18). This study reports the transition in a low-middle income country where, to our knowledge, such a modality has not been utilized prior to the COVID-19 pandemic (19-21).

The stepwise approach of Peyton's framework is adaptable to teaching of technical skills in various disciplines and has been modified to address the emerging needs (5, 11). In our study, the key challenge was change in the medium of delivery, i.e., in-person setting to virtual setting; hence, the framework was modified to maximize the learning experience on an online platform.

Even though we were sceptical about teaching practical skills through online platform, the results of the study showed good buy-in from the facilitators and students. Most of them agreed to learn new knowledge and skills, while being satisfied with the interaction, instructor's preparation, peer-to-peer learning, and online resources. Encouraging responses were received from students regarding the use of modified Peyton's framework. Similarly, the instructor supported using this framework for teaching history taking and communication skills. However, the lack of fidelity and realism with virtual learning methods has been identified as a limitation to teaching psychomotor skills on an online platform (22). Our study corroborates these findings, as the students' feedback, when asked if they *“feel the online modality can be used for teaching the skills”*, showed lower scores in particular in examination skills. Thus, building students' confidence in learning skills online



can only be achieved with time and practice and utilizing technology and simulations to the fullest.

The students' experience interpretation also revealed that they appreciated the interaction with the faculty and their peers, as well as the availability of learning resources and videos on VLE. A similar study which explored the nursing students' experience of online clinical skills showed anecdotal findings that suggested that the video resources met the learning needs, and the increased time with VLE teachers online could be used across the curriculum to teach a variety of practical skills in a better manner (23). An online video of skills is becoming an adjunct to good instruction of clinical skills sessions and improves the students' assessment results and satisfaction ratings (24).

Our study is one of the few that takes the students' and teachers' perspectives on online learning into account. Many authors argue that the online environment promotes a more learner-centred instructional approach that the faculty need to adapt their teaching strategies (24-26). Similarly, while the instructors in the CS sessions were eager to adopt this teaching method, they acknowledged that it took time to adjust to it and discussed the challenges they faced in teaching and engaging the students on a virtual platform. This feedback provides valuable insight that can help enhance the online learning and teaching environment.

Finally, another strength of our study is that we were able to assess the impact of online teaching by comparing the results of a summative OSCE on stations taught through the traditional program in the pre-COVID era and on the virtual platform during the pandemic. An OSCE is a performance-based evaluation tool for examining the students during undergraduate years in most medical schools across the globe (27). The OSCE scores showed that students from this year performed better on two out of four stations that were repeated from the previous year with more than a 10% increase in scores.

One limitation of our study was that we were unable to randomize the students for online versus face-to-face training due to ongoing teaching and learning. Using two different cohorts for group-based performance comparison in OSCE exam could be a potential confounder in the study (baseline knowledge, prior performance, etc.). However, the analysis yielded an insignificant difference in half of the compared OSCE stations that may point towards true inference of our study.

## Conclusion

Our study shows that online clinical skills

sessions for medical students in pre-clinical years can offer a good platform for teaching and learning. Students' improvement in knowledge scores after each session, improvement in confidence and satisfaction with the online format, and an improvement in summative assessments all support an online platform that provided a safe learning environment and led to minimizing disruption in the medical students' curriculum. Our study adds to the literature by reporting the instructors' overall satisfaction and challenges to which the virtual platform is faced, which will have to be addressed to move to a blended-learning course for clinical skills in the future.

## Acknowledgements

The authors would like to acknowledge the support of Drs. Sadaf Khan, Associate Dean for undergraduate curriculum, Kulsoom Ghias, (Chair, Department of Biological and Biomedical Sciences) for support, the teaching associates (Drs. Syed Mujtaba Baqir, Amna Afzal Saeed, Fatima Mustansir, Chaudhry Ahmed Zafar Cheema, Mohammad Ahmed Ansari, Alishah Akbar Ali, Muhammad Bilal Ibrahim & Mishka Ahmed) and the administrative support from UGME office, Mr. Hassan Ali.

## Authors' Contribution

S.S, U.K, S.Z, Kh.S, M.Z.Y, M.R, Sh.J, U.I.Kh contributed to the conception and design of the work; the acquisition, analysis, or interpretation of data for the work. All Authors contributed in drafting and revising the manuscript critically for important intellectual content. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

**Conflict of Interest:** None declared.

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