

# Practical Strategies for Designing and Facilitating Teleconferences in Medical Education

Courtney M Queen<sup>1</sup>, Michele C Williams<sup>2</sup>

## ABSTRACT

Teleconferences played and continue to play an important role in medical education and the clinical encounters for ensuring distancing during the pandemic. The teleconferencing tools provide interactivity features that when leveraged properly can facilitate active learning and increase participant engagement. This article provides the teleconference tools that can facilitate active learning and increase participants' engagement.

**Keywords:** Distance education, Engagement strategies, Interactivity tools, Medical education, Remote active learning, Teleconferencing, Videoconferencing, Virtual session design.

*Donald School Journal of Ultrasound in Obstetrics and Gynecology* (2021): 10.5005/jp-journals-10009-1806

## INTRODUCTION

During the spring of 2020, institutions of higher education were forced to rapidly de-densify educational spaces to prevent the transmission of COVID-19. The process of de-densifying required a quick effort to position staff, faculty, and students for remote work and shift the delivery of educational programming to emergency remote teaching<sup>1</sup> via teleconferencing. Health sciences centers and the delivery of medical education also required a systematic repositioning for the delivery of educational and clinical training to reduce transmission of COVID-19 but to also keep practitioners, patients, and students safe.

To decrease the risk of transmission, the need to limit exposure to others during the pandemic also included the need to limit patient contact. This need prompted the adoption of solutions involving the practice of telehealth in the place of a traditional clinical encounter, but also teleconferencing as a primary modality for communicating with both colleagues and patients. Specifically, video or teleconferencing systems provide the virtual spaces and real-time interactivity tools essential for the delivery of educational and clinical training, at a distance. Moreover, with the enhancement of technology and internet protocols robust enough for two-way point-to-point and multipoint videoconferencing, teleconferencing is key to telehealth and therefore is a critical component for medical education curriculum and as a valuable educational tool.<sup>2</sup>

However, and even before COVID-19, higher education had already begun a slow transition to distance and remote education<sup>3-7</sup> through the increase of hybrid and online course offerings, and simulation in medical education.<sup>8</sup> This shift is even more apparent when considering the increasing opportunities for teaching medical procedures remotely using ultrasound,<sup>9</sup> and the adoption of augmented and virtual reality that is a common practice in the field of interventional radiology,<sup>8</sup> as well as other areas of telemedicine include telesurgery, telerehabilitation, and teleintensive care.<sup>8</sup>

The role of technology in medical education has increased in use and is seen as engaging and useful to students.<sup>10</sup> With a technology-based curriculum seen as more effective than the traditional approach to medical education,<sup>11</sup> the use of tele-ultrasound in training and preclinical application is an example

---

<sup>1</sup>Department of Public Health, Graduate School of Biomedical Sciences, Texas Tech University Health Sciences Center, Abilene, Texas, USA

<sup>2</sup>Academic, Curricular and Assessment Support, Office of Academic Affairs, Texas Tech University Health Sciences Center, El Paso, Texas, USA

**Corresponding Author:** Courtney M Queen, Department of Public Health, Graduate School of Biomedical Sciences, Texas Tech University Health Sciences Center, 1650 Pine Street, Abilene, Texas, USA, Phone: +1-325-696-0654, e-mail: Courtney.m.queen@ttuhsc.edu

**How to cite this article:** Queen CM, Williams MC. Practical Strategies for Designing and Facilitating Teleconferences in Medical Education. *Donald School J Ultrasound Obstet Gynecol* 2021;15(4):365-370.

**Source of support:** Nil

**Conflict of interest:** None

---

of the trend to support learning through innovation to further support a future that includes technology-enabled medicine.<sup>9</sup> For instance, point-of-care ultrasound (POCUS) is widely used in many disciplines of medicine including "internal medicine, emergency medicine, obstetrics, critical care, sports medicine, surgery, and rheumatology."<sup>10</sup> Drake et al.<sup>10</sup> cite that there is no statistically significant difference between instruction delivered using tele-ultrasound and instruction offered using in-person methods. These findings are useful to support the growing need to train for using technology-enabled diagnostic and procedural techniques but also training for the growing need for communicating effectively across platforms.

In addition to tele-ultrasound education and training, remote simulation is another example of technology-enabled training in medical education that has shown to be both feasible and effective. Findings presented by Pennington et al.<sup>12</sup>, show that virtual simulation training, even over a very long distance, and across languages, can improve team performance during a simulated patient crisis. Utilizing the TEAM metric, Team Emergency Assessment Measure, nine teams were evaluated pre- and post-CERTAIN trailing simulation for improvements in the team composure and control during a simulated crisis, the ability to complete tasks on time, and communication effectiveness

by the team leaders. Upon completion of the training and subsequent assessment, six of the nine teams showed performance improvements, with a greater need to focus on the primary language of communication and the need to focus on training with the technology before the meeting. Similarly, a study by Arya et al.<sup>13</sup> reported overall positive findings using ultrasound simulation citing improvements in postsimulation knowledge and performance for key features of utilizing the technology with proficiency including: “hand-eye coordination, transvaginal probe manipulation, and on-site image interpretation”.<sup>13</sup> Evidence supports remote training in medical simulation in the transition from in-person to meeting virtually and by teleconference. Furthermore, there is a growing body of evidence to inform the development and assessment of medical education in the future.

This article aims to connect the research-based practices with recommendations for transitioning from in-person to virtual meetings while prioritizing participant engagement. Lessons learned during the transition from in-person to emergency remote learning during the pandemic informs the delivery of educational programming for future pandemics, but more importantly, is valuable to enhance a future that is moving toward more technology-enabled medicine.

## STRATEGIES FOR FACILITATING TELECONFERENCES

The digital transformation of clinical care is seen as a necessity for modernizing and optimizing health care. Effective communication through teleconference requires the careful design and planning of the encounters so that communication and learner activities support participant engagement. Recognizing this trend of increased opportunities for remote education, there is an equal need to consider the need to promote participant engagement and ensure the effectiveness of communication during the encounter. Cited by Pennington et al.<sup>12</sup> and Arya et al.<sup>13</sup> and supported by O’Conner,<sup>14</sup> effective communication should remain as a point of focus as clinicians not only just read images, but also need to provide interpretation, “protocol examinations, communicate with technologists, and work with on-site review committees,”<sup>14</sup> and can do so remotely. Drawing from adult learning theory, this article provides the best practices in communication strategies for the more effective delivery of educational teleconferences.

Videoconferencing is referred to as a synchronous channel of communication that supports the transformation of interactive voice, video, and data between two or more groups of people.<sup>7</sup> Videoconferences, teleconferences, web chats, or virtual meetings, refer to live interactions between participants from remote locations using audio and video signals. Since the 1990s, teleconferencing technology has been used in higher education primarily for small group tutorials, to increase access to remote experts, to engage in role-play and simulations, and to observe student teaching in remote locations.<sup>3</sup> In a scoping review of the different types of teleconferencing systems and technical configurations used in higher education, Al-Samarraie<sup>4</sup> identified web videoconferencing tools as the most promising in the academic setting, because of their accessibility, ease of use, and ability to provide instructor–learner and learner–learner interactions.<sup>4</sup> Besides exchanging audio and video signals using web-based videoconferencing, participants can also share documents, annotate in those documents, share screens with running applications, and record their sessions. These features,

which differ depending on the product brand, when used properly, can significantly expand opportunities in the didactic and clinical settings.

### Utilizing Educational Theory to Support Participant Engagement

Active learning occurs when cooperative and collaborative learning strategies are employed during instruction, or an encounter, and which heavily promote learner engagement<sup>15,16</sup> to improve learning outcomes. Participants must interact with the content, instructors, and especially others to solve problems. These active learning strategies are easily adaptable to distance medical education using teleconferencing.<sup>17,18</sup> For example, during the pandemic, in-person rounds were substituted by virtual rounds and supported by teleconferencing for an Internal Medicine clerkship.<sup>18</sup> These virtual rounds had three curricular components: (1) virtual prrounding for students to access patient records, remotely; (2) formulating a SOAP (subjective, objective, assessment, plan) oral presentation on assigned patients; and (3) giving a SOAP presentation to a small group with subsequent feedback and clinical teaching, using teleconferences and tele-instructors.<sup>18</sup> In this example, the clinical faculty relied on teleconferencing and adjusted the active learning opportunities for students to have the clinical experiences, solve problems, participate in small group discussions, and received instructor feedback.

Anchored in constructivist learning theory, active learning in medical education relies on the careful planning and design of instructional sessions with clearly defined objectives, measurable outcomes, varied learning activities, pauses for reflections, and various forms of assessments.<sup>19,20</sup> Andragogy, Knowles’ adult learning theory,<sup>19</sup> claims that adults learn best when they actively engage with content and each other, such as in solving problems connected to their professional and personal interests. Knowles recommends that adult learners solve authentic problems and with the right level of challenge: enough to increase their cognitive engagement, but not too difficult that they give up before trying.<sup>19</sup> The learning outcomes improve as the level of learner activity and engagement increases. In addition, and relying on the student engagement core model,<sup>17</sup> engagement is more than just participation or involvement: engagement includes feelings, sense-making, and activity.<sup>16</sup> Fredricks et al., drawing on Bloom,<sup>21</sup> identified three dimensions to student engagement: behavioral, emotional, and cognitive. Behavioral engagement is evident as students comply with norms, such as attendance and involvement, and would not be disruptive or show negative behavior. Emotional engagement refers to a student’s affective reactions such as interest, enjoyment, or a sense of belonging. Cognitive engagement is demonstrated as students are invested in their learning, go beyond requirements, and relish challenges.<sup>16,19</sup> The overall learner engagement is then determined by a blend of the behavioral, emotional, and cognitive engagement dimensions.

In the virtual rounds example, anonymous student surveys revealed that using the virtual rounds, most students improved their prrounding abilities (86%), oral presentation abilities (93%), and clinical reasoning skills (62%), and found the small group discussions useful.<sup>18</sup> Additionally, several studies performed at schools of pharmacy in the United States suggest that teaching using teleconferencing to students did not adversely affect their academic performance.<sup>22</sup> In a qualitative study, graduate nursing students reported that the use of teleconferences made their learning the same or better than face-to-face.<sup>23</sup> The introduction

of new teaching strategies includes problem-based learning, virtual grand rounds, and flipped and hybrid-type lectures have made learning more active and enjoyable.<sup>18</sup> Accordingly, designing teleconference sessions according to adult learning theory encourages engagement and interactivity.<sup>15-19</sup> Examples of the application of teleconferencing tools for specific instructional methods that support active engagement in medical education include the following:

### Lectures, Grand Rounds, and Large Group Discussions

- Webinar or Meeting Modes: Based on the level of control needed, use webinar mode (participants have less control of features and their microphones are muted) or meeting mode (participants have more control to turn on/off their microphones and cameras).
- Chat: The facilitator may ask a question and instruct participants to use the chat feature and provide about a minute to answer. Then read out loud some answers and provide feedback. Also, participants can add commentary without interrupting the speaker, as well as communicate with specific participants, privately.
- Q&A: This feature is typically a direct and private chat channel for participants to ask questions to the facilitators. When permissible, a moderator responds and also the one to voice the unanswered questions to the speaker, when planned pauses come up.
- Raise Hand: Participants may raise their digital hand as a response, or request to speak.
- Polling: Most teleconferencing technology tools have yes/no responses ready to go for a quick verbal poll. Even for large groups, in less than a minute, a facilitator can assess engagement, check for understanding, and receive feedback. Polling applications can be incorporated in to the session and even into the slide presentation. Various types of questions can be weaved seamlessly throughout the slides, and participant responses can be immediately recalled and displayed in aggregate form, while also saved for later analysis. Polling applications are ideal to pause and capture participant reflections.

### Ward (Virtual) Rounds

- Share screen to show access to patient records.
- Record live SOAP presentations.
- Provide feedback in small group discussions<sup>11</sup>—see below.

### Small Group Discussions, Case-based Instruction, Journal Club, and Concept Mapping

- Share screen, applications, or various types of files, such as documents, images, and videos.
- Annotation: Use the annotate functions to underline, highlight, and write-on file pages for emphasis.
- Whiteboard: Prepare concept maps or sketches in shared whiteboards.
- Chat: Use the Chat feature to share links, ask questions, or provide commentary without interrupting.
- Reactions: Participants can display their feelings and reactions using emoticons.

### Team-based Learning (TBL)

- Breakout sessions: Most teleconference tools include the ability to group participants and send them to a separate

virtual room (breakout feature) for a predetermined time, and facilitators can join in and out of those virtual spaces. Within these spaces, participants can share applications, documents, make annotations, watch a video, solve problems, and other tasks assigned to them.

### Practical Strategies for Designing Teleconferences that Encourage Engagement

Effectively engaging participants in a teleconference involves the careful design guided by the tenants of adult learning theory, but also a familiarity with the technology. Keeping participants engaged relies on careful planning around navigating the technical components of the hardware and software. While teleconferencing applications have vastly improved recently, and more features become available, various features, like breakout rooms, file sharing, screen sharing, whiteboards, electronic polling, participant rosters, and the multiple configurations will continue to provide a remote, safe, and convenient platform to meet, teach students, and even care for patients. Common advice for teleconferencing is not that dissimilar to in-person environments, including making eye contact, showing interest in the participants' comments, and employing general active listening cues such as head nodding, and smiling.<sup>24</sup>

A few general tips for ensuring smooth facilitation include entering the virtual meeting space at least 5–15 minutes early to greet participants and handle any last-minute technical difficulties. During this time open all documents and applications needed for the session and make sure to close those applications that are not central to supporting the teleconference. Also use this time to make sure that you are facing the camera, that your light is focused on your face, and that you have a neutral and quiet background. Most importantly, remember to follow the active learning plan so that participants can engage with the facilitator, the content, and with each other.

### Recommendations for Designing and Facilitating Engaging Virtual Sessions

- Prepare a session plan with key elements: This plan or agenda will facilitate your time management in meeting session goals:
  - Include goals, planned activities, and reminders (to record).
  - Indicate starting times of each activity for a quick reference.
  - Program short pauses, as short as 1–3 minutes, for reflection and checks for understanding, by using polls, discussions, and Q&A, after about 10 minutes of content presentation. Well-programmed breaks will seem naturally timely.
  - Consider providing information in sets of three. Most people can remember three things, so structure the session with three objectives and three outcomes. By creating a pattern of threes, learners get the impression of completeness.<sup>25</sup>
  - Plan for every minute of your time and include time for unanticipated events. Be ready to use your time wisely, so that session goals are fulfilled.
- Consider recording the session: This will provide feedback on your facilitation performance, time management, content delivery, and can be made available to absent participants. In addition, while your platform may announce that the session is now being recorded, as a courtesy you could also inform the learners/attendees verbally or *via* a message in the chat box that the session is being recorded.

- Prepare and distribute session guidelines in advance: Your participants and guest speakers can greatly benefit from a “tech check” on their own devices, instructions on technical settings, and how to use the communication and document sharing features of the teleconference platform, at least 24 hours in advance.
- Technical help: Designate someone to assist with technical difficulties and especially during the session.
- Prepare digital learning material.
- Write a script, based on your session plan, that includes time indicators and:
  - Initial, probing, or follow-up questions.
  - Include names of guest speakers, credentials, and an introduction script.
  - Highlight keywords for quick reference, as you should not be reading the script!
  - Use a copy of the script and structure it to allow for notetaking to capture valuable points made by participants and follow-up tasks.
- A revised script can serve as a session transcript to better accommodate participants.
- Consider the use of slides with images and key points to guide your presentation.
- Consider the embedding of polling within your slides or include the prompt in the slide with the instructions on how to answer to poll features.
- Consider asking participants for their take-away lessons, at end of the session.
- Avoid playing videos during the session: If you must, include captions. The speed and quality of the video will depend on participants’ devices and connections.
- Distribute any materials in advance, as needed.
- Carefully review accessibility guidelines of materials used and accommodate as needed.
- Consider inviting subject-matter experts to the session and communicate the session plan, and how they will be contributing to the session. Include any questions and activities into your session script for the subject matter expert.
- Create a situational context to include contextual factors that support an open and inclusive environment.
- Consider flexibility while staying on track: Anticipate conversational tangents, overtalkers, and differences in perspectives. Stay flexible to accommodate enriching discussions but must carefully moderate deviations from your session plan.
- Reduce the opportunity for uncertainty by anticipating the dialogue of the discussion. Guard and protect the space for conversations that matter.
- Consider writing into your script three sentences that you can rely on if needed to deal with difficult situations and can be used to bring the discussion back within the scope and while keeping time commitments. While probably never used, these prompts can be extremely valuable if you are caught off-guard, are distracted, or become flustered by an event. Relying on these sentences will help you maintain composure in a potentially difficult situation.
- Have a backup: Plan for technical difficulties. Designate someone as your backup and share your session plan and script. A smartphone can serve as a connectivity backup device. A seamless transition will keep the momentum of the session.
- Prepare a strong closing: Sum up the key points for participants.

Communication of scientific information as part of the remote delivery of educational programming, or in a remote clinical encounter can be greatly enhanced by incorporating teleconference tools and the practice of these strategies for more effective learning. For those facilitating teleconferences, it is important to understand how adult learners engage in medical education then carefully design and plan around active learning opportunities to leverage engagement.<sup>16,17,19,20</sup> Similarly, it is important to practice using the teleconference platform tools, until you become proficient in their use. Do not overlook the value of providing a powerful summary based on notes from the teleconferencing session and do not forget to thank participants and recognize those making valuable comments and contributions. When appropriate, offer copies of the transcript and recording of the teleconference. Finally, follow-up with any unanswered questions that remain pending from the session.

## DISCUSSION

Clinical disciplines had already adopted technology-enabled educational delivery, and are growing increasingly comfortable with technology as a normal part of the practice, and with the clinical encounter. Regardless of the preferred term for remote conferences, or whether a laptop, desktop, tablet, or smartphone is used, or even the brand of the web-based videoconferencing tool, such as Zoom, Skype, WebEx, or Microsoft Teams, the lessons learned from implementing teleconferencing and its features during the pandemic, will facilitate education in future pandemics, and more importantly enhance or supplement in-person education in general. Requirements to support this movement are already common practice in ultrasound education and includes: (1) the equipment, including a camera and microphone, which with the current power of mobile technologies, can take place on mobile devices such as tablets or smartphones; (2) software, which already exists to support the clinical application; and (3) connectivity to the Internet for effective transmission.

The promise of telemedicine and tele-education is supported by advances in teleconferencing hardware and software. The capacity for augmented and virtual reality allows for the exchange of high-resolution images and videos, including the annotation of images that support effective teaching and demonstration. This type of imaging allows for increased training opportunities for interpretation and communication that is accomplished entirely in a remote setting. Ultrasound education, specifically, lends well to remote delivery using teleconference because it relies entirely on visually analyzing images and videos, while augmented and virtual reality improves on this technology of sharing images through the development of training procedures that allow for a student, or participant, to experience a surgery from the view of the surgeon and with a 360-view of the field.<sup>14</sup> O’Conner<sup>14</sup> cites that interventional radiology is developing virtual reality for simulation as a teaching tool so to allow some of the most difficult surgeries such as the trans-jugular intrahepatic portosystemic shunt (TIPS) placement surgery to be shared and studied beyond the traditional shadowing approach. These types of advancements greatly benefit not only medical education but especially the quality of patient care.

## CLINICAL AND EDUCATIONAL SIGNIFICANCE

Teleconferences are very useful in the practice of medicine and in teaching medicine. The medical education curriculum must include proficiency in the use of teleconference tools and features, as well as how to effectively facilitate teleconference sessions.



There are many advantages to incorporating teleconferencing beyond the pandemic. Travel time and costs are significantly reduced when inviting experts *via* teleconferences. Medical education and patient care can easily be enriched with collaboration and virtual exchanges from other medical centers globally.<sup>6</sup> Recordings of teleconference sessions can be analyzed, edited, and reused. Technologies for imaging, virtual reality, and simulation can be shared and experienced using teleconference platforms, and no longer bound by location. The opportunities are endless.

## CONCLUSION

This article provides practical strategies for the design and delivery of educational virtual meetings or teleconferences and outlines educational theories that support participant engagement to improve learning outcomes. While teleconferences are not new to health care or medical education, there has been an increase in use due to the required distancing. The use of teleconferences will continue to increase because there are many advantages in medical education, and telehealth. These advantages include, but are not limited to higher access to the best educational resources and expertise without the limitations of distance or time<sup>25</sup>; enrich the medical curriculum with global experiences and exchanges; easily record sessions for a video library or reference; provide a platform for experiencing virtual reality, simulations, and imaging applications; increase accessibility with the use of smart mobile devices; and easily account for attendance and engagement by effectively manipulating interactivity tools. For instance, and even before the COVID-19 pandemic, the movement to transition from in-person to virtual meetings was already evident in the classroom and the clinical encounter. Meeting virtually saves on both costs and time, and, with the right tools, is as effective for learning as in-person instruction.<sup>22,23</sup> In fact, by employing the right strategies, instruction *via* teleconference can also be interactive and effective.<sup>2,5</sup>

Post-COVID medical education will continue to expand with the use of emergent technology-orientated innovations, such as artificial intelligence for adaptive learning, virtual simulation, and telehealth as indispensable components.<sup>11</sup> Telemedicine-specific educational goals are already included in curricula and integrated with existing clinical experiences to provide students with core telemedicine and clinical skills to prepare them for a smoother transition in current and future pandemics.<sup>2,18</sup> For instance, even mental telehealth services are founded on expert consensus, research evidence, and patient needs.<sup>26</sup> Additionally, telemedicine has increased access and quality of care, and there is evidence that in certain settings. Mental telehealth is found more effective than treatment delivered in-person.<sup>26</sup> With the recommendations provided in this article, medical educators may enhance their current practices by strategically utilizing teleconference technology and incorporating additional planning and communication strategies to improve interactivity during the virtual learning experience to then ensure participant engagement. The increased use of emergent technologies to deal with remote education and medical practice during the pandemic accelerated the inevitable technology-based education trends. The use of teleconferencing tools and features have a place in tele-health practice and therefore must be included in the medical education curriculum.

This guide for planning and facilitating educational sessions using teleconferencing tools and features was anchored in sound

educational theory and is carefully framed to provide practical advice for developing effective communication strategies for the delivery of scientific and educational content in a remote and virtual setting. The advantages of teleconferencing in medical education far outweigh the pitfalls.<sup>25</sup> The COVID-19 pandemic contributed toward the expansion of educational opportunities for knowledge sharing through web-based technology, but also accelerated the use of teleconferencing platforms for clinical encounters such as telehealth. The ability for the instructor, facilitator, or leader to effectively deliver educational content in a virtual setting requires an active retooling of one's skillset from the in-person environment to a virtual setting, and developing the skills requires deliberate practice.

## REFERENCES

1. Queen C. From face-to-face to remote education: opportunities and challenges of the COVID era [Panel Discussion]. Texas Tech University Health Sciences Center, Institutional Faculty Development Program. 27th January 2021.
2. Jumreornvong O, Yang E, Race J, et al. Telemedicine and medical education in the age of COVID-19. *Acad Med* 2020;95(12):1838–1843. DOI: 10.1097/ACM.0000000000003711.
3. Lawson T, Comber C, Gage J, et al. Images of the future for education? Videoconferencing: a literature review. *Technol Pedagog Education* 2010;19(3):295–314. DOI: 10.1080/1475939X.2010.513761
4. Al-Samarraie H. A scoping review of videoconferencing systems in higher education: learning paradigms, opportunities, and challenges. *Int Rev Res Open Distrib Learn* 2019;20(3). DOI: 10.19173/irrodl.v20i4.4037
5. Lamba P. Teleconferencing in medical education: a useful tool. *Australas Med J* 2011;4(8):442. DOI: 10.4066/AMJ.2011.823
6. Li CH, Rajamohan AG, Acharya PT, et al. Virtual read-out: radiology education for the 21st century during the COVID-19 pandemic. *Acad Radiol* 2020;27(6):872–881. DOI: 10.1016/j.acra.2020.04.028
7. Gough M. Video conferencing over IP: configure, secure, and troubleshoot. Elsevier; 2006. New Delhi, India
8. Makary MS, Alexander J. Augmented and virtual reality – radiology at the center of medical technology. *Diagnostic Imaging*. 2020. Available from: <https://www.diagnosticimaging.com/view/augmented-and-virtual-reality-radiology-center-medical-technology>. Accessed 22 May 2021.
9. Winn S, McKeown P, Lotfipour S, et al. Remote, synchronous, hands-on ultrasound education. *Telemed e-Health* 2015;21(7):593–597. DOI: 10.1089/tmj.2014.0050
10. Drake AE, Hy J, MacDougall GA, et al. Innovations with tele-ultrasound in education sonography: the use of tele-ultrasound to train novice scanners. *Ultrasound J* 2021;13(1):6. DOI: 10.1186/s13089-021-00210-0
11. Gaur U, Majumder M, Sa B, et al. Challenges and opportunities of preclinical medical education: COVID-19 crisis and beyond. *SN Compr Clin Med* 2020;1–6. DOI: 10.1007/s42399-020-00528-1
12. Pennington KM, Dong Y, Coville HH, et al. Evaluation of TEAM dynamics before and after remote simulation training utilizing CERTAIN platform. *Med Educ Online* 2018;23(1):1485431. DOI: 10.1080/108723(1):1485431.2981.2018.1485431
13. Arya S, Mulla ZD, Kupescic Plavsic S. Role of pelvic ultrasound simulation. *Clin Teach* 2018;15(6):457–461. DOI: 10.1111/tct.12714.
14. O'Conner, M. Remote reading is here to stay: how radiology can prepare for a virtual future. *Health Imaging: insights in Imaging and Informatics*. 2020. Available from: <https://www.healthimaging.com/topics/conferences/remote-reading-here-stay-how-radiology-can-prepare-virtual-future>. Accessed 22 May 2021.
15. Prince M. Does active learning work? A review of the research. *J Eng Educ* 2004;93(3):223–231. DOI: 10.1002/j.2168-9830.2004.tb00809.x
16. Fredricks JA, Blumenfeld PC, Paris AH. School engagement: potential of the concept, state of the evidence. *Rev Educ Res* 2004;74(1):59–109. DOI: 10.3102/00346543074001059

17. Corso MJ, Bundick MJ, Quaglia RJ, et al. Where student, teacher, and content meet: student engagement in the secondary schoolclassroom. *Am Second Educ* 2013;50–61. Available from: <https://www.jstor.org/stable/43694167>; Accessed on June 25, 2021.
18. Sukumar S, Zakaria A, Lai CJ, et al. Designing and implementing a novel virtual rounds curriculum for medical students' internal medicine clerkship during the COVID-19 pandemic. *MedEd PORTAL* 2021;17:11106. DOI: 10.15766/mep\_2374-8265.11106
19. Knowles MS. *Andragogy*. NETCHE; 1972.
20. Graffam B. Active learning in medical education: strategies for beginning implementation. *Med Teach* 2007;29(1):38–42. DOI: 10.1080/01421590601176398
21. Bloom BS. *Taxonomy of Educational Objectives*. Vol. 1: Cognitive Domain. New York: McKay. 1956;20:24
22. Klibanov OM, Dolder C, Anderson K, et al. Impact of distance education via interactive videoconferencing on students' course performance and satisfaction. *Adv Physiol Educ* 2018;42(1):21–25. DOI: 10.1152/advan.00113.2016
23. Foronda C, Lippincott C. Graduate nursing students' experience with synchronous, interactive videoconferencing within online courses. *Quart RevDistance Educ* 2014;15(2):1. ISSN 1528-3518
24. Kalia V, Srinivasan A, Wilkins L, et al. Adapting scientific conferences to the realities imposed by COVID-19. *RadiologyImaging Cancer* 2020;2(4):e204020. DOI: 10.1148/rycan.2020204020
25. Antonakis J, Fenley M, Liechti S. Leadership development: learning charisma. *Harvard Business Rev* 2012;127–130. Available from: <https://hbr.org/2012/06/learning-charisma-2>. Accessed 11 May 2021.
26. Shore JH, Yellowlees P, Caudill R, et al. Best practices in videoconferencing-based telemental health April 2018. *Telemedicine and e-Health*. 2018;24(11):827-832. Available from: <https://doi.org/10.1089/tmj.2018.0237>; Accessed on November 1, 2021.

