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Author: Triemstra Justin D. MD; Haas Mary R.C. MD; Bhavsar-Burke Indira MD; Gottlieb-Smith Rachel MD; Wolff Margaret MD, MHPE; Shelgikar Anita V. MD, MHPE; Samala Renato V. MD, MHPE; Ruff Allison L. MD; Kuo Kevin MD, MHPE; Tam Marty MD; Gupta Amit MD; Stojan Jennifer MD, MHPE; Gruppen Larry PhD,; Ellinas Herodotos MD, MHPE

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Impact of the COVID-19 Pandemic on the Clinical Learning Environment: Addressing Identified Gaps and Seizing Opportunities

Justin D. Triemstra, MD, Mary R.C. Haas, MD, Indira Bhavsar-Burke, MD, Rachel Gottlieb-Smith, MD, Margaret Wolff, MD, MHPE, Anita V. Shelgikar, MD, MHPE, Renato V. Samala, MD, MHPE, Allison L. Ruff, MD, Kevin Kuo, MD, MHPE, Marty Tam, MD, Amit Gupta, MD, Jennifer Stojan, MD, MHPE, Larry Gruppen, PhD, and Herodotos Ellinas, MD, MHPE

J.D. Triemstra is assistant professor of pediatrics and human development and associate program director, Pediatric Residency Program, Department of Pediatrics and Human Development, Helen DeVos Children's Hospital, Spectrum Health, Michigan State University College of Human Medicine, Grand Rapids, Michigan; ORCID: https://orcid.org/0000-0001-9860-8628.

M.R.C. Haas is clinical instructor of emergency medicine and assistant program director, Department of Emergency Medicine, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: https://orcid.org/0000-0002-9506-5928.

I. Bhavsar-Burke is clinical reasoning director, Medical Student Education, Division of Gastroenterology and Hepatology, Department of Internal Medicine, Indiana University School of Medicine, Indianapolis, Indiana; ORCID: https://orcid.org/0000-0002-9438-2067.

R. Gottlieb-Smith is clinical assistant professor, Department of Pediatrics, Division of Pediatric Neurology, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: https://orcid.org/0000-0002-6066-5966.

M. Wolff is associate professor, Departments of Emergency Medicine, Pediatric Emergency Medicine, and Pediatrics, University of Michigan Medical School, Ann Arbor, Michigan.

A.V. Shelgikar is clinical associate professor of neurology and director, Sleep Medicine Fellowship, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: https://orcid.org/0000-0002-3629-0084.

R.V. Samala is assistant professor of medicine, Cleveland Clinic Lerner College of Medicine, and staff physician, Department of Palliative and Supportive Care, Cleveland Clinic, Cleveland, Ohio; ORCID: https://orcid.org/0000-0002-2950-7708.

A.L. Ruff is clinical assistant professor, Division of General Medicine, Department of Internal Medicine, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: https://orcid.org/0000-0002-1381-755X.

K. Kuo is clinical assistant professor of pediatrics, program director, Pediatric Critical Care Medicine Fellowship, and associate program director, Pediatric Residency Program, Department of Pediatrics, Stanford University, Palo Alto, California; ORCID: https://orcid.org/0000-0002-9124-147X.

M. Tam is assistant professor and associate program director, Advanced Heart Failure and Transplant Cardiology Fellowship Program, Division of Cardiovascular Medicine, University of Michigan Medical School, Ann Arbor, Michigan; ORCID: https://orcid.org/0000-0002-5826-1727.

A. Gupta is assistant professor of medicine, Department of Medicine, Division of Gastroenterology and Hepatology, University of North Carolina School of Medicine, Chapel Hill, North Carolina; ORCID: https://orcid.org/0000-0001-6468-1472.

J. Stojan is associate professor of internal medicine and pediatrics, University of Michigan Medical School, Ann Arbor, Michigan.

L. Gruppen is professor of learning health sciences and director, Master of Health Professions

Education Program, University of Michigan Medical School, Ann Arbor, Michigan; ORCID:

https://orcid.org/0000-0002-2107-0126.

H. Ellinas is associate professor, Department of Anesthesiology, Division of Pediatric

Anesthesia, Medical College of Wisconsin, Milwaukee, Wisconsin; ORCID:

https://orcid.org/0000-0003-0803-809X.

Correspondence should be addressed to Justin D. Triemstra, 100 Michigan St., MC 013, Grand

Rapids, MI 49503; telephone: (616) 391-2123; email: Justin.triemstra@helendevoschildrens.org;

Twitter: @JTriemstraMD.

Abstract

The clinical learning environment (CLE) encompasses the learner's personal characteristics and experiences, social relationships, organizational culture, and the institution's physical and virtual infrastructure. During the COVID-19 pandemic, all four of these parts of the CLE have undergone a massive and rapid disruption. Personal and social communications have been limited to virtual interactions or shifted to unfamiliar clinical spaces because of redeployment. Rapid changes to the organizational culture required prompt adaptations from learners and educators in their complex organizational systems yet caused increased confusion and anxiety among them. A traditional reliance on a physical infrastructure for classical educational practices in the CLE was challenged when all institutions had to undergo a major transition to a virtual learning environment.

However, disruptions spurred exciting innovations in the CLE. An entire cohort of physicians and learners underwent swift adjustments in their personal and professional development and identity as they rose to meet the clinical and educational challenges they faced due to COVID-19. Social networks and collaborations were expanded beyond traditional institutional walls and previously held international boundaries within multiple specialties. Specific aspects of the organizational and educational culture, including epidemiology, public health, and medical ethics, were brought to the forefront in health professions education, while the physical learning environment underwent a rapid transition to a virtual learning space. As health professions education continues in the era of COVID-19 and into a new era, educators must take advantage of these dynamic systems to identify additional gaps and implement meaningful change. In this article, health professions educators and learners from multiple institutions and specialties discuss the gaps and weaknesses exposed, opportunities revealed, and strategies developed for optimizing the CLE in the post–COVID-19 world.

The COVID-19 global pandemic has had a dramatic impact on every aspect of medical education,[1,2] including the clinical learning environment (CLE). The CLE is described as the environment in which learning is experienced in the clinical context.[3,4] A CLE is formed through the learner's personal characteristics and experiences, social relationships, organizational culture, and the institution's physical and virtual infrastructure.[3,5] These components allow the learner to develop a professional identity and engage with others while learning and working in an organizational structure that is specific and unique to the institution.[6,7]

The rapid changes to institutional priorities, dramatic adjustments in patient volumes and acuity, cancellation of elective procedures, and personal protective equipment (PPE) shortages brought about by the pandemic have led to daunting challenges for health care workers and to catastrophic financial consequences for the health care industry.[8,9] All of these factors, along with the psychosocial stressors on the health care team, have directly affected the CLE.[10] In response, rapid adaptations and innovations have occurred in the ambulatory and inpatient settings, in both undergraduate medical education (UME) and graduate medical education (GME), and across the entire educational continuum.[11]

The authors of this article—a geographically diverse, multispecialty group of faculty mentors and learners from the University of Michigan's Master of Health Professions Education Program—convened to evaluate and analyze the impact of COVID-19 on the CLE. Based on our diverse experiences and shared judgment, we recognized that this pandemic has uncovered gaps in our current health professions educational environments and has simultaneously paved the way for novel and potentially improved approaches to overseeing educational activities in the CLE. Here, we describe our insights into the impact of COVID-19 on the CLE, focusing on the gaps and weaknesses exposed, the opportunities revealed, and strategies for optimizing the CLE in the post–COVID-19 world.

Gaps and Weaknesses

The COVID-19 pandemic has revealed significant gaps and weaknesses in the current educational system. The CLE model described by Gruppen et al[3] groups these into personal, social, organizational, and physical and virtual spaces.

Personal space

Learning occurs through personal growth and direction of the learner toward an educational goal, focusing on professional identity formation and the emergence of autonomy, in both UME and GME.[3] As many institutions launched virtual outpatient visits and created faculty-predominant hospital teams (intensive care unit, rapid response, endoscopy, surgical, and airway management teams), UME and GME trainees were marginalized or even eliminated from direct patient care activities. When significant portions of the CLE shifted from a physical space to a virtual one, learners lost the human connections, contextual cues, and clinical skill development associated with direct patient care. Similarly, educators lost opportunities to provide the individualized learner-centered education characteristic of teaching through direct, face-to-face patient care. Learners attempted to maintain their autonomy by engaging virtually with other learners and seeking meaningful learning opportunities within a mutual context. However, some educators, faced with long work hours or isolation from others, PPE shortages, and limited testing capabilities, veered away from education and focused on self-preservation and their own well-being.

Social space

The social space of the learning environment varies widely by institutional culture and specialty; however, it is classically formed through the interactions of learners and faculty, peer-to-peer relationships, and learner-to-patient contacts.[3] These essential interactions with patients, peers, and faculty members shape learners' perceptions and their engagement with the learning

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environment. Due to decreased non–COVID-19 clinical volume, the need to limit exposure to the coronavirus, and surges in COVID-19 clinical volume, UME and GME learners were displaced to virtual learning environments and/or redeployed to unfamiliar clinical teams to address COVID-19 care needs.[12] Social interactions were severely hindered with the implementation of distance learning or had to be quickly reestablished when learners found themselves in unfamiliar locations. The disruption of existing relationships and the need to adjust to unfamiliar educators have likely affected learners' ability to learn, their well-being, and the continued formation of their professional identity.

Organizational space

A learner navigates the learning environment within the boundaries of a complex organizational system, which includes the learner's institution, the medical school, the residency or fellowship program, and accrediting and licensing bodies. Learners rely on these organizations for structure and guidance and to support their education.[3] At the start of the pandemic, it appeared that this complex organizational system providing learner oversight lacked coordination across the educational continuum. Then, on March 13, 2020, the Accreditation Council for Graduate Medical Education (ACGME) posted specific COVID-19–related considerations for residency and fellowship training and provided multiple communications thereafter to outline provisions for the CLE.[13] Similarly, on March 17, 2020, the Association of American Medical Colleges (AAMC) mandated that students step away from patient care activities but made gradual adjustments to its guidelines throughout 2020.[14] Although the authors support these decisions by the ACGME, the AAMC, and subspecialty boards, it is clear that, initially, students, residents, and fellows suffered from the lack of a coordinated response across the multiple organizational components of their CLE, likely increasing anxiety and confusion among learners and educators alike.

Physical and virtual spaces

The global pandemic has demonstrated to both learners and educators the reliance of the health professions education system on in-person activities to educate trainees. These activities take place in campus buildings, hospital operating rooms, inpatient wards, clinic rooms, sites in the local community, team-based learning hubs, and small conference rooms.[3] Social distancing and mask requirements, however, have disrupted long-standing educational and clinical practices, such as in-person lectures, team- and family-centered rounds, interdisciplinary meetings, family meetings, and case discussions.

In addition, UME and GME learners and educators have historically augmented direct patient care with in-person didactic education in classroom settings. Because of concerns that such in-person activities present a high risk for the spread of infection, most supplementary learning opportunities, including lectures, small-group activities, and simulations, were halted at the start of the pandemic. The cessation of these activities has translated to lost opportunities for experiential learning through direct patient care and didactic education until institutions are able to adapt to the new CLE.

Opportunities Identified

Although the COVID-19 pandemic has exposed gaps and weaknesses in the CLE, the stress on the health professions education system has also spurred innovations to meet these challenges.

Opportunities for personal spaces

The pandemic has necessitated and accelerated personal growth in key areas of learners' and educators' professional identity. Residents, fellows, and attending physicians have had to confront their own fears of illness and death, put aside concerns over the well-being of their loved ones, and remain in the forefront managing critically ill patients. In certain geographical clinical settings, health care workers, including trainees, have risen to the occasion to care for

novel coronavirus–positive patients in unfamiliar settings.[15] Clinician–educators and physician–scientists, if not heavily involved in inpatient care, have had the opportunity to complete unfinished projects and submit for publication manuscripts on COVID-19–related topics with a fast turnaround time. Like past pandemics,[16] the COVID-19 pandemic has affected an entire cohort of physicians-in-training, contributing to their professional identity formation and expanding their understanding of the importance of public health and its role in society.[17,18]

Opportunities for social spaces

The transition into virtual spaces and the need to rapidly share information and best practices across the world have facilitated the development of larger social networks and expanded the social space of the CLE, which now transcends traditional geographical boundaries. Medical students have created response teams to mobilize interested students to participate in initiatives to support their own learning and the broader community of health care workers and patients.[19] Educators from different institutions have met virtually to crowdsource ideas, troubleshoot challenges, and even share educational conferences with outside learners and training programs. For example, the International PICU COVID-19 Collaborative has organized conference calls with more than 300 pediatric intensivists throughout the world in which leading experts shared their experiences, the latest data, and best practices.[20] In addition, anesthesiologists worldwide have communicated their challenges with PPE during airway management and with ventilator management for COVID-19 patients to help their counterparts do better. This article illustrates how individuals from different disciplines and institutions have come together to share their perspectives on how this pandemic has affected particular areas, such as medical education.

Opportunities for organizational spaces

Despite the complex and interwoven system described above, national associations and accreditation bodies adapted quickly to provide oversight early in the COVID-19 pandemic.[13,14] The AAMC has kept the health and safety of medical students at the forefront, and some students viewed the initial removal of in-person education as an opportunity to contribute to "flattening the curve."[21] Many accreditation-related activities have been suspended to allow greater flexibility in patient care and in recognition of alternative forms of education during the pandemic.[13] National organizations, such as the American Medical Association (AMA) and the AAMC, have hosted webinars to share resources and experiences across institutions. Individual institutions have taken on the task of adapting UME and GME, often forming smaller committees to enact more rapid change. Health systems scientists, epidemiologists, public health officials, and medical ethics professionals have been brought to the forefront, with a focus on education and implementation of value-based care.

Opportunities for physical and virtual spaces

In this era of social distancing, the virtual space of the CLE has had to support or replace parts of the physical CLE.[22–24] The plasticity of the information technology infrastructure has been essential for conducting remote educational sessions, meetings, and patient care visits using a virtual platform.

Medical educators have adapted their conventional educational formats, modifying traditional pedagogy to better fit the virtual space and utilizing innovative technology to enhance interactions with UME and GME learners.[23] Although this shift has not been without its challenges, it has led to certain improvements in CLEs. For instance, remote learning solves traditional problems, such as long commutes, limited parking and conference room space, and the logistical challenges of uniting learners and educators scattered across various sites.

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Furthermore, the use of telehealth for patient care visits has allowed health care providers to more easily complete direct observations of patient care visits with learners that are often difficult to achieve in a traditional, physical learning environment.[25]

Educators have adapted quickly to best practices on virtual platforms and have found these platforms to have benefits.[2] A virtual lecture may increase the ability for immediate feedback and engagement through features such as interactive rating and chat functions. The digital back channel available during these virtual interactions can facilitate online discussions among learners and further promote active participation by allowing learners to informally question the educator.[26–28] More educational sessions are now recorded, simplifying asynchronous distance learning so that it may be undertaken at times convenient for the learner, thus allowing improved flexibility and, possibly, increased learner wellness. Furthermore, by eliminating the need for travel, remote learning formats have augmented the ability of national experts to speak at multiple institutions and share best practices. This virtual venue may provide institutions that have fewer financial resources with a less costly way to invite experts to discuss a variety of topics and expand the CLE. This transition will leave a lasting adjustment, one that, we hope, will provide significant improvements.

Strategies for Moving Forward

The COVID-19 pandemic has drastically accelerated organizational changes within the current health professions education system, as discussed above. Now, as educators, we must take advantage of these dynamic systems to institutionalize effective innovations, continue to identify gaps, and implement meaningful changes.

Personal space

Virtual education empowers learners to take more ownership of their education, providing them with more flexibility and the ability to personalize their time management.[29] This flexibility and personalization are central tenets to the success of adult learners, cultivate personal growth, and improve wellness and satisfaction.[30,31] Educational programs will, however, need to develop mechanisms to ensure that all learners are accessing the core content, receiving robust feedback and assessments, and sufficiently meeting core competencies, as previous research has shown that the rates of successful completion of the curriculum vary between virtual and in-person learning.[30,32] Yet, the virtual spaces that have been added to curricula during the pandemic should remain beyond it, blending the return of in-person education and virtual learning to allow continued personal growth and flexibility. Finally, curricula that train master adaptive learners should be developed.[33] These learners, who manage change effectively and can rapidly adapt to changing environments, will then be able to respond effectively and efficiently during times of uncertainty throughout their careers.

Social space

The development of robust virtual communities of practice and harnessing of the power of collaborative networks will be imperative for adapting the CLE to dynamic regulations about social distancing.[34] For instance, the current environment has motivated educators to develop and share multi-institutional curricula to more efficiently address similar problems. Such collaborations may encourage the development of a standardized approach to medical education among various governing bodies that has not previously been achieved. Although remote activities may enhance learner and educator well-being by increasing scheduling flexibility, they may also impair well-being by resulting in isolation.[35] The leveraging of social enterprise networks, such as Slack, Microsoft Teams, and Basecamp, may facilitate and encourage more

frequent social interactions and engagement among learners and contribute to community building.[36–38] Educators should frequently check in with and continually seek input from learners to optimize the balance of remote versus in-person activities for learner well-being.

Organizational space

The changes that have been made during the pandemic to support new curricular resources and the online infrastructure have made apparent gaps in existing technological and institutional frameworks. Institutions should continue to financially support these online resources, with the understanding that health systems are encountering new budgetary restraints that will require repeated analysis and adaptation, in response to user feedback, to maintain their durability and continued success. Learners should be engaged in the remodeling of the virtual curriculum, which should include robust training in epidemiology, public health,[17] and medical ethics, so that these adaptations meet true educational needs and not just institutional and regulatory requirements. As institutions make changes that affect workflows and financial and other organizational endeavors, careful consideration should be taken to safeguard learners' needs. Institutions need to be mindful of their clinical volumes as trainees reintegrate into clinical environments and ensure that preceptors have the capacity to incorporate learners back into already stressed environments. Furthermore, the improved and increased communication efforts by national associations and accrediting organizations during the COVID-19 pandemic should remain in place in some capacity after the pandemic recedes.

Physical and virtual spaces

The adequacy of physical and virtual learning spaces will depend on iterative modifications to online resources to ensure their continued success. The reallocation of physical work spaces should be done with Liaison Committee on Medical Education and ACGME requirements in mind. Virtual spaces should be crafted to make sure that all learners have equal access to high-

speed, secure internet, professional backgrounds for video meetings, and devices with adequate processing speeds and security features. To maintain compliance with the Health Insurance Portability and Accountability Act of 1996,[39] physical spaces within the CLE will need to accommodate UME and GME learners who do not have access to private work spaces in their personal residences to maintain equity in health professions education for all. Finally, adhering to guidelines on the use of masks and physical distancing in the CLE will help maintain safe conditions for patients, learners, and all members of the health care team.

Conclusions and Recommendations

The COVID-19 pandemic has forced learners and educators to rapidly adapt within their altered CLEs. Personal separation, social distancing, organizational changes, and the shift from physical to virtual learning environments have significantly disrupted the status quo. Although the pandemic revealed gaps and weaknesses, opportunities for innovation and growth were simultaneously identified across the continuum of medical education. Moving forward, individual learners, educators, institutions, and governing bodies will have the opportunity to enhance and expand the CLE. We conclude with the following recommendations:

- *Personal space.* Although rapid personal growth has been observed during the pandemic, institutions must continue to prioritize workplace safety and monitor physician and learner well-being. Access to and the correct fitting of PPE, work space decontamination, testing of personnel for infection, and a plan for return to work with social distancing are a few of the processes that should be addressed to protect faculty, staff, and learners alike.

- *Social space.* Institutions should promote multidisciplinary teams that cultivate collaboration across settings and disciplines to allow learners and clinical staff to maintain the social interactions so desperately needed during this pandemic. The creation

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of virtual learning communities and virtual social connections should be encouraged to stimulate meaningful relationships that sustain teaching activities and facilitate patient care.

- *Organizational space.* National associations and accrediting organizations must continue to guide institutions in the development of action plans during the pandemic through the use of various methods of frequent communication (e.g., webinars, email correspondence, and town halls). Institutions' action plans must adhere to accrediting organization requirements, such as the adequate supervision of learners and duty-hours limitations, yet allow flexibility and local decision making for the adequate distribution of cases, experiential learning, and safe patient care. In addition, online resources should remain available, and financial support for educators should be guaranteed for further development and implementation of curricula.

- *Physical and virtual spaces*. Blended learning is the future of health professions education. Virtual educational activities permit learner and faculty flexibility (e.g., decreased commute times and global availability), whereas face-to-face interactions ensure social interactions and assessments of learners' direct patient care skills. Institutions must collaborate with software developers to design secure online applications and with internet providers to ensure high-speed access for all involved.

Educators and learners have come a long way from the initial shock they experienced at the start of the COVID-19 pandemic. By harnessing the opportunities for innovation provided by the pandemic and solidifying successful strategies, we can achieve a new and improved CLE in the post–COVID-19 era.

References

1. Liang ZC, Ooi SBS, Wang W. Pandemics and their impact on medical training: Lessons from Singapore. Acad Med. 2020;95(9):1359–1361. doi:10.1097/ACM.0000000000003441.

2. Hall AK, Nousiainen MT, Campisi P, et al. Training disrupted: Practical tips for supporting competency-based medical education during the COVID-19 pandemic. Med Teach. 2020;42:756-761. doi:10.1080/0142159X.2020.1766669.

3. Gruppen LD, Irby DM, Durning SJ, Maggio LA. Conceptualizing learning environments in the health professions. Acad Med. 2019;94(7):969-974. doi:10.1097/ACM.0000000000002702.

4. Gruppen L, Irby DM, Durning SJ, Maggio LA. Interventions designed to improve the learning environment in the health professions: A scoping review. MedEdPublish. 2018;7. doi:10.15694/mep.2018.0000211.1.

5. Nordquist J, Hall J, Caverzagie K, et al. The clinical learning environment. Med Teach. 2019;41(4):366-372. doi:10.1080/0142159X.2019.1566601.

6. Wong A, Trollope-Kumar K. Reflections: An inquiry into medical students' professional identity formation. Med Educ. 2014;48(5):489-501. doi:10.1111/medu.12382.

7. Wald HS. Professional identity (trans)formation in medical education: Reflection, relationship, resilience. Acad Med. 2015;90(6):701-706. doi:10.1097/ACM.0000000000000731.

8. Colenda CC, Applegate WB, Reifler BV, Blazer DGI. COVID-19: Financial stress test for academic medical centers. Acad Med. 2020;95(8):1143-1145. doi:10.1097/ACM.0000000000003418.

9.   Kim CS, Lynch JB, Cohen S, et al. One academic health system's early (and ongoing) experience responding to COVID-19: Recommendations from the initial epicenter of the pandemic in the United States. Acad Med. 2020;95(8)1146–1148. doi:10.1097/ACM.0000000000003410.

10. Ripp J, Peccoralo L, Charney D. Attending to the emotional well-being of the health care workforce in a New York City health system during the COVID-19 pandemic. Acad Med. 2020;95(8):1136-1139. doi:10.1097/ACM.0000000000003414.

11. Woolliscroft JO. Innovation in response to the COVID-19 pandemic crisis. Acad Med. 2020;95(8):1140-1142. doi:10.1097/ACM.0000000000003402.

12. Bakewell Z, Davies D, Allanby L, Dhonye Y. Pandemically challenged: Developing a ward-based cross-skilling programme [published online ahead of print May 21, 2020]. Med Educ. doi:10.1111/medu.14252.

13. Accreditation Council for Graduate Medical Education. ACGME response to pandemic crisis. https://www.acgme.org/covid-19. Accessed January 26, 2021.

14. Whelan A, Prescott J, Young G, Catanese VM, McKinney R. Guidance on medical students' participation in direct in-person patient contact activities. Washington, DC: Association of American Medical Colleges. https://www.aamc.org/media/43311/download. Published August 14, 2020. Accessed January 26, 2021.

15. Ammar A, Stock AD, Holland R, Gelfand Y, Altschul D. Managing a specialty service during the COVID-19 crisis: Lessons from a New York City health system. Acad Med. 2020;95(10):1495-1498. doi:10.1097/ACM.0000000000003440.

16.   Sherbino J, Atzema C. "SARS-Ed": Severe acute respiratory syndrome and the impact

       on medical education. Ann Emerg Med. 2004;44(3):229-231.

       doi:10.1016/j.annemergmed.2004.05.021.

17.   Maeshiro R, Carney JK. Public health is essential: COVID-19's learnable moment for

       medical education. Acad Med. 2020;95(12):1799–1801.

       doi:10.1097/ACM.0000000000003517.

18.   Rosen K. The COVID-19 curriculum. Acad Med. 2020;95(9):1311.

       doi:10.1097/ACM.00000000000035.

19.   Soled D, Goel S, Barry D, et al. Medical student mobilization during a crisis: Lessons

       from a COVID-19 medical student response team. Acad Med. 2020;95(9):1384-1387.

       doi:10.1097/ACM.0000000000003401.

20.   Shekerdemian LS, Mahmood NR, Wolfe KK, et al. Characteristics and outcomes of

       children with coronavirus disease 2019 (COVID-19) infection admitted to US and

       Canadian pediatric intensive care units. JAMA Pediatr. 2020;174(9):868-873.

       doi:10.1001/jamapediatrics.2020.1948.

21.   Menon A, Klein EJ, Kollars K, Kleinhenz ALW. Medical students are not essential

       workers: Examining institutional responsibility during the COVID-19 pandemic. Acad

       Med. 2020;95(8):1149-1151. doi:10.1097/ACM.0000000000003478.

22.   Chick RC, Clifton GT, Peace KM, et al. Using technology to maintain the education of

       residents during the COVID-19 pandemic. J Surg Educ. 2020;77(4):729-732.

       doi:10.1016/j.jsurg.2020.03.018.

23.   He S, Lai D, Mott S, et al. Remote e-work and distance learning for academic medicine:

       Best practices and opportunities for the future. J Grad Med Educ. 2020;12(3):256–263.

       doi:10.4300/JGME-D-20-00242.1.

24. Morawo A, Sun C, Lowden M. Enhancing engagement during live virtual learning using interactive quizzes. Med Educ. 2020;54(12):1188. doi:10.1111/medu.14253.

25. Biery N, Bond W, Smith AB, LeClair M, Foster E. Using telemedicine technology to assess physician outpatient teaching. Fam Med. 2015;47(10):807-810.

26. Rose C, Mott S, Alvarez A, Lin M. Physically distant, educationally connected: Interactive conferencing in the era of COVID-19. Med Educ. 2020;54(8):758-759. doi:10.1111/medu.14192.

27. Kimmons R, Veletsianos G. Education scholars' evolving uses of Twitter as a conference backchannel and social commentary platform. Br J Educ Technol. 2016;47(3):445-464. doi:10.1111/bjet.12428.

28. Yates K, Birks M, Woods C, Hitchins M. #Learning: The use of back channel technology in multi-campus nursing education. Nurse Educ Today. 2015;35(9):e65–e69. doi:10.1016/j.nedt.2015.06.013.

29. Regmi K, Jones L. A systematic review of the factors—enablers and barriers—affecting e-learning in health sciences education. BMC Med Educ. 2020;20(1):91. doi:10.1186/s12909-020-02007-6.

30. She T, Shin-Kim J, Lee H, Li T, Steinberg E. Creating an asynchronous curriculum for your emergency medicine residency. MedEdPublish. 2019;8. doi:10.15694/mep.2019.000090.1.

31. Sadeghi R, Sedaghat MM, Sha Ahmadi F. Comparison of the effect of lecture and blended teaching methods on students' learning and satisfaction. J Adv Med Educ Prof. 2014;2(4):146-150.

32. Lew EK, Nordquist EK. Asynchronous learning: Student utilization out of sync with their preference. Med Educ Online. 2016;21:30587. doi:10.3402/meo.v21.30587.

33. Cutrer WB, Miller B, Pusic MV, et al. Fostering the development of master adaptive learners: A conceptual model to guide skill acquisition in medical education. Acad Med. 2017;92(1):70-75. doi:10.1097/ACM.0000000000001323.

34. Yarris LM, Chan TM, Gottlieb M, Juve AM. Finding your people in the digital age: Virtual communities of practice to promote education scholarship. J Grad Med Educ. 2019;11(1):1-5. doi:10.4300/JGME-D-18-01093.1.

35. Croft N, Dalton A, Grant M. Overcoming isolation in distance learning: Building a learning community through time and space. J Educ Built Environ. 2010;5(1):27-64. doi:10.11120/jebe.2010.05010027.

36. Huls TA, McLean ME, Park JC, Anana MC, Klein MR, Kulkami ML. Implementing a social media-based curriculum for newly-matched interns. West J Emerg Med 2019;20(Suppl):S12–S13. https://escholarship.org/uc/item/4fm3w3ff. Accessed January 26, 2021.

37. Hill J, LaFollette R, Grosso R, Axelson D, Hart K, McDonough E. Using slack to facilitate virtual small groups for individualized interactive instruction. AEM Educ Train. 2019;3(1):92-95. doi:10.1002/aet2.10201.

38. Chan TM, Gottlieb M, Sherbino J, et al. The ALiEM faculty incubator: A novel online approach to faculty development in education scholarship. Acad Med. 2018;93(10):1497-1502. doi:10.1097/ACM.0000000000002309.

39. Centers for Disease Control and Prevention. Health Insurance Portability and Accountability Act of 1996. https://www.cdc.gov/phlp/publications/topic/hipaa.html. Accessed January 26, 2021.