



Mindful Medical Education Online

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Abstract

The COVID-19 pandemic disrupted medical education. In-person classes and clinical rotations were urgently canceled, followed by a historic and unprecedented migration to online teaching. Most medical school courses were not designed to be fully online, and faculty and students are novices in the process. The purpose of this article is to provide recommendations for educators to optimize their approach to online curricular transformation. Mindful teaching online creates presences that set climate and support discourse, establish routines that build practice, model professional expectations, and challenge but support learners.

Keywords Online · Learning · Teaching · Medicine · Teaching presence · Community of inquiry

Introduction

The COVID-19 pandemic fundamentally and rapidly disrupted medical education. In-person classes and clinical rotations were urgently canceled, necessitating historic and unprecedented migration to online teaching. It remains unknown whether this is simply a temporary disruption or an opportunity to catalyze disruptive innovation in medical education. Winston Churchill is credited as saying, “Never let a good crisis go to waste,” and as such, medical schools must find the opportunity in this moment to transition to online learning to deliver needed curriculum to meet educational objectives, keeping students on track for graduation and residency application. Said differently, can we not only do things differently but do them better?

Most medical school courses are not designed to be fully (or even partially) online. The amount of dedication, ingenuity, and hard work needed to migrate curricula appropriately to online environments has been enormous and reflects the commitment and skill of educators and tenacity of students. However, many, if not most, educators and students in medical and other health professional schools are novices

when it comes to effective online teaching and learning. The approaches taken have varied from merely posting previous lectures online to a complete reengineering of courses to make these more appropriate for the virtual environment. No matter the direction of COVID-19, it is important to identify opportunities from this time of online educational transformation in medical and health sciences education that can be continued in the post-COVID era. The pandemic likely has unknown (if unintended) consequences for medical education.

Online teaching skills differ from face-to-face teaching skills, requiring outsized attention to structure (form) and learning dynamics [1–3]. Blended and online learning environments are notoriously complex to produce [4]. Face-to-face (traditional) classrooms are afforded the relative luxury for example, of nonverbal communication, whereas such interactions must be intentionally (if artificially) built into the online course. However, intentional focus on learning in online environments pays dividends. Ithaka S&R, in a 2018 white paper on institutional returns on student learning, found that “blended” course redesign (converting face-to-face to hybrid environments) uniquely contributed to instructional reform success [5]. By migrating traditional courses to new, remote environments, the older courses are invariably seen with fresh eyes, making us reckon with what is, and is not, actually present in the redesigned courses.

In general, self-directed learners—those who can manage their time and set learning goals for themselves—do better in online environments, while those struggling in person

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struggle more online [6]. However, evidence-based strategies are available to keep learners engaged and to deliver effective curricula that maximize learning for everyone.

Quality online courses should be student-centered [7]; purposefully designed and follow a framework using evidence-based standards [8–11]; have measurable learning objectives that align with instructional materials, learning activities, assessments, and technology tools [12]; structure student engagement and active learning [7]; consider accessibility and usability; and, finally, embody continuous quality improvement [8]. No online technology can make up for poor in-person curricula, and poor online design and execution will inhibit the delivery of good curricula.

The purpose of this article is to provide recommendations for educators to optimize their approach to curricular transformation to create mindful learning online. The term mindful is meant to convey “intentional,” “carefully constructed,” and with “self-awareness” which is a critical concept underlying the recommendations in this article [13, 14]. Although these recommendations are most applicable to didactic-based courses, the applicability to clinical education will also be discussed.

Recommendations for Mindful Online Learning

Establish a Framework for Effective Online Learning

Excellent medical teaching is supportive, inspiring, communicative, and active [15]. These affective (non-cognitive) qualities must be intentionally structured into an online course to resonate with students. Online learning must go beyond content and technological execution to be effective. Learning is highly social [16], and thus, community must be established for students. Additionally, perception that the instructor is vital to the online course is associated with students’ sense of learning in that community [17].

A useful and well-known theoretical framework to structure meaningful interactions online is the Community of Inquiry (CoI) model [18, 19]. This model describes how learning takes place at the intersection of teaching, social, and cognitive presence (Fig. 1). The goal of the CoI model is to foster a meaningful learning experience for a group of learners through the development of learning communities. Teaching and social presence in online environments are especially important given the inherent distance common in virtual settings [20]. Each of these dimensions of presence is described in the next three subheadings. For a truly complete learning experience online, all three types of presence are needed (5).

Build Teaching Presence into the Online Environment

Most medical educators can recall a teacher they had with effective teaching presence. Great teachers have an authentic presence that draws learners in [21, 22]. Curriculum is meant to be a collaboration between teacher and learner, not something to be consumed by a learner. Sharing information about your research program or clinical practice will inform students of who you are and what is important to you. Teaching presence (facilitated leadership) should occur in a predictable manner and can be established by scheduled course announcements (e.g., every Monday by 5 PM) and specific feedback schedules for submitted work (e.g., every other Thursday by 8 P.M.). Teachers should respond to student postings, encourage participation, address misconceptions, and establish linkages for students.

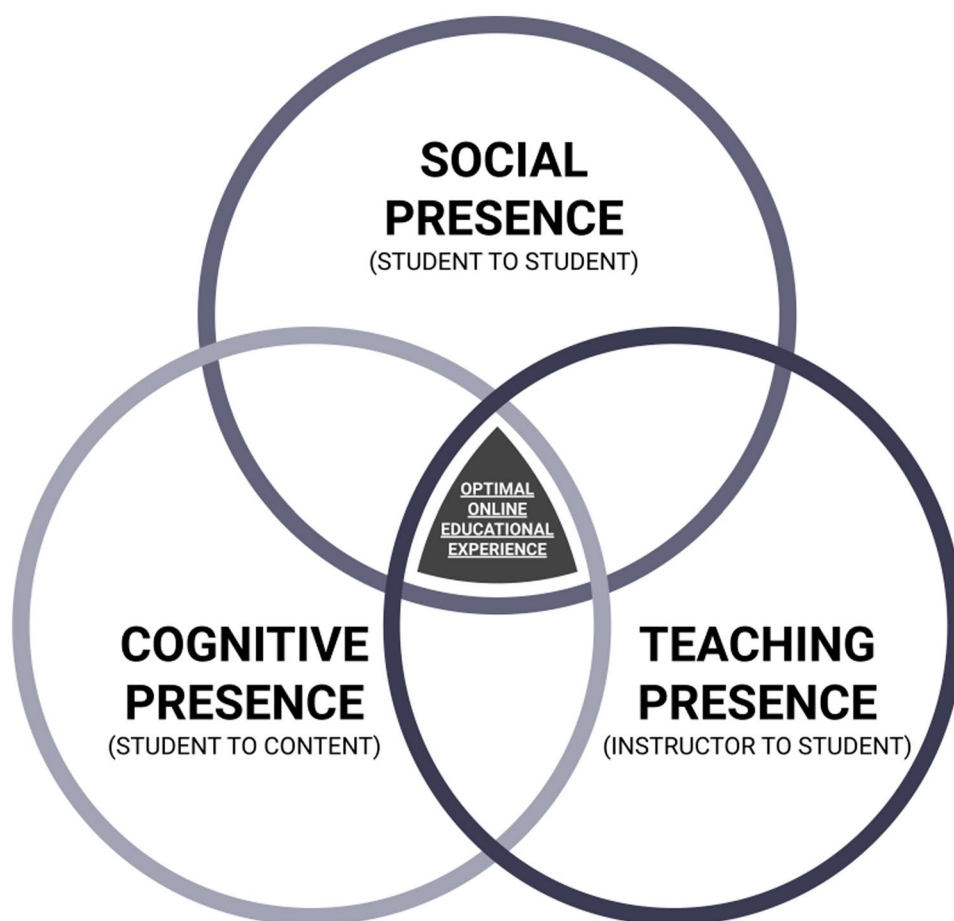
It is important to communicate regularly with learners and to do so in an affirming, empathetic, and responsive way, much like an educator would do during a period of clinical service or small group teaching with a learner. Ensure you are facile with the technology and have realistic expectations for learner participation. Learners should be surveyed to monitor how they are doing with the course and to identify any issues that can be addressed either with the way the course is being presented or with the course content. In courses with multiple instructors, be transparent and inform students about this at the start of the course. One instructor should be the master instructor (coordinator) who may introduce topics, display and emphasize organization of content, establish clear grading criteria, and provide timely feedback.

Build Social Presence into the Online Environment

Social presence is the degree to which students feel connected to their instructor and to one another online [21] [22]. All good online courses foster such community. Social presence posits that the online classroom is still a society of learners who are real people [23], and the instructor maintains a real presence in the class, even if asynchronously. Students’ perceptions of their instructor’s social presence strongly correlate with task satisfaction and reports of learning [21, 24].

Social presence can occur in multiple ways: via sharing of personal stories and experiences, prompt (formative) feedback, and consistent conversation [25]. Medical teachers can create community and increase their course presence by establishing safe, comfortable ways for students to communicate with each other. These include personalization (modeling professional communications, calling students by their correct names and gender pronouns, introducing themselves in video), constructing activities that encourage collaboration, and allowing for dialogue that is relation-building.

Fig. 1 The Community of Inquiry (COI) model describes learning that takes place at the intersection of social, cognitive and teaching presence



Adapted from Garrison, Anderson & Archer, 2000

Professionalism expectations for online behavior should be set and modeled early in the course. An important strategy is to establish a “community agreement” that is developed by students with added rules from the instructor. The agreement describes “rules of engagement” to prevent one person from dominating, to encourage participation from quieter students, and to set expectations that maintain student privacy, respect personal topics, and avoid embarrassment. In many ways, such “ground rules” would make in-person learning more effective as well. Keeping one’s camera on during the session is an important way to keep learners engaged and to allow for non-verbal cues, even online. Social presence also means professional interactions are modeled and students connect by adding a photo/bio to their online profiles.

The course should start with an introductory forum so students can begin to know one another. A backchannel (real-time online conversations that co-occur in or outside of class) can be added to the learning management system as a place for students to ask you or their peers questions and have discussions. Backchannels are analogous to the group study room or student/resident workroom in the clinic

or hospital where learners pre-round or debrief after more formal interactions with their preceptor.

Build Cognitive Presence into the Online Environment

Cognitive presence as defined by Garrison and colleagues is the “extent to which learners are able to construct and confirm meaning through sustained reflection and discourse” [19]. Critical thinking is at the heart of cognitive presence and is fundamental to medicine given the rapid growth of new knowledge [26]. It is just not possible for all information on a given subject or clinical area of medicine to be absorbed by learners. Instead, a focus on higher-order thinking processes—for which reflection is fundamental—is needed. Cognitive presence reflects the quality and quantity of this reasoning. This is very similar to how a learner learns about a clinical problem—one must develop an approach to a given clinical condition (e.g., acute kidney injury) to be able to effectively categorize the massive amount of information available about its causes.

Establishing cognitive presence begins with a triggering event in which the importance of the topic is described, and learner interest is generated (see below) [27, 28]. An effective trigger can provide structure to the topic and helps direct the activity of learners. This is followed by the exploration phase where learners access different sources of information, ask questions, and discuss the issues. In the integration phase, learners link ideas as they come up with solutions. In the final resolution phase, learners apply the knowledge they have acquired to new situations and test and defend their solutions. Often, these various phases are intertwined as learners develop higher-order thinking skills. Divergent thinking and the development of multiple perspectives should be encouraged—just like in the clinical environment when working through a challenging case from multiple points of view.

To optimize cognitive presence, it is important for the teacher to chunk content, engage others to present some of the content, and check frequently for comprehension. This, of course, is the same advice that should be followed when teaching on the wards or in small groups. One should think outside of the “PowerPoint box” and use online videos, simulations, images and illustrations, charts and graphs, news articles and library resources, podcasts and audio recordings. Online environments uniquely support multiple modalities for instructional materials (images, sound, text).

Use Engagement Triggers that Bring Learners to the “Now” of Learning

Engaging learners is an important first step for mindful learning online [29]. This, of course, is different from “satisfying” learners—as with all pedagogy, desirable difficulty is superior to pedantry. The course and topic need to be put into the proper context and the learner informed why it is important; this is especially true when online learning replaces a clinical experience. It must be clear that the learning is real and relevant to learners’ future practice, not simply “make work.” Engagement triggers get the attention of learners and compel curiosity, bringing learners to the now of learning.

Triggers have been long-used for in-person medical education in the form of cases. Medicine is learned through a specific type of story: case presentations [30]. Such stories are forms of analogical reasoning that help the learner look for structural similarities between disparate things, a process that is fundamental to learning [31]. As unique proxies for experience, case presentations can serve as a “hook” for engaging in knowledge transfer and are fundamental for developing and reorganizing pieces of information into coherent illness scripts for future practice.

Case-based clinical reasoning education is well-supported in the medical education literature; educators must now embrace case-based learning in online settings. Clinical reasoning education depends heavily on case-based learning and the organization (and continuous reorganization) of vast knowledge networks into clinical syndromes [30, 32]. Clinical relevance in medical education is associated with improved learner retention of knowledge and clinical performance [33–35].

Establish Routines that Build Practice

Establishing and maintaining routines throughout any course reduces the complexity of the learning environment [36] and helps establish structure. These routines can start with mapping predictable and consistent places for learners to go to access learning resources to prepare for the course, the entry and exit of learners into the online environment, rules of engagement during the course (such as raising a virtual hand, use of the chat box and classroom polls), and the presentation of online material. Course content should be organized in a consistent manner throughout the course. Learners need to be informed about what to expect in each session.

Practice-retrieval routines that reinforce memory are essential to learning and can be structured into the learning management system to provide spaced retrieval practice [37]. Routines that allow learners to meaningfully practice memory retrieval include low- or no-stakes online quizzes [38], concept mapping [39], student response systems (clickers), and self-testing. For example, a weekly online routine could include (1) completing a reading, (2) applying the reading to a related scenario (annotating a collaborative document, critiquing a video simulation, answering guided questions), and then (3) completing a reading quiz (Reading-Annotation-Quiz). The goal is to build retrieval practice.

Concept maps [40] that apprise learners “where they are at” in learning a complex field such as cardiac physiology or anemia can help maintain focus and perspective. Karpicke and Blunt address concept maps as an excellent retrieval practice [39]. Concept maps require learners to think about and connect the relational and organizational structures of ideas/concepts/materials. Learners who can assign meaning and organize materials make learning their own. There has been a proliferation of the clinical equivalent of concept maps (schema) in medical education of late (@CPSolvers, Twitter). Other routines include how to submit work and obtain feedback, the structure and timing of assessments, establishing formal office hours to engage with the instructor, and online forums for learners to interact with each other.

Use Both Low and High Bandwidth Strategies

Online courses should utilize a range of activities, where both internet bandwidth and time exert an influence over learning (Fig. 2). Bandwidth here refers to the volume of information that can be sent over an internet connection in a given amount of time. Asynchronous or synchronous delivery refers to whether learner(s) and instructor(s) need to be in the same place at the same time in order for learning to take place. A live (synchronous) lecture would take up the most bandwidth, requiring the instructor and students to be present simultaneously (see Fig. 2, upper right panel). While synchronous learning trended in 2020 [41], likely as a pragmatic pandemic survival strategy for faculty used to delivering live lectures, much remote instruction was conducted asynchronously prior to the pandemic [42].

A mix of asynchronous and synchronous activities is considered best practice; both have their advantages and disadvantages and act as structural complements to one another [43]. Live environments create community, but streaming and connection issues also bedevil the online classroom. Synchronous environments are furthermore problematical for equity and access as not all students have the same access to high bandwidth [44]. “Zoom fatigue” makes high-bandwidth, synchronous environments hard to sustain [45]. Alternatively, asynchronous environments allow students to go at their own pace and may provide more time for reflection [44] but can increase transactional distance and inhibit community formation unless done well. By their nature, asynchronous environments require greater design effort. The upside is that quality asynchronous design affords students a commanding structural sense of the course that may be

missing from even face-to-face courses, while synchronous instruction can give back missing community.

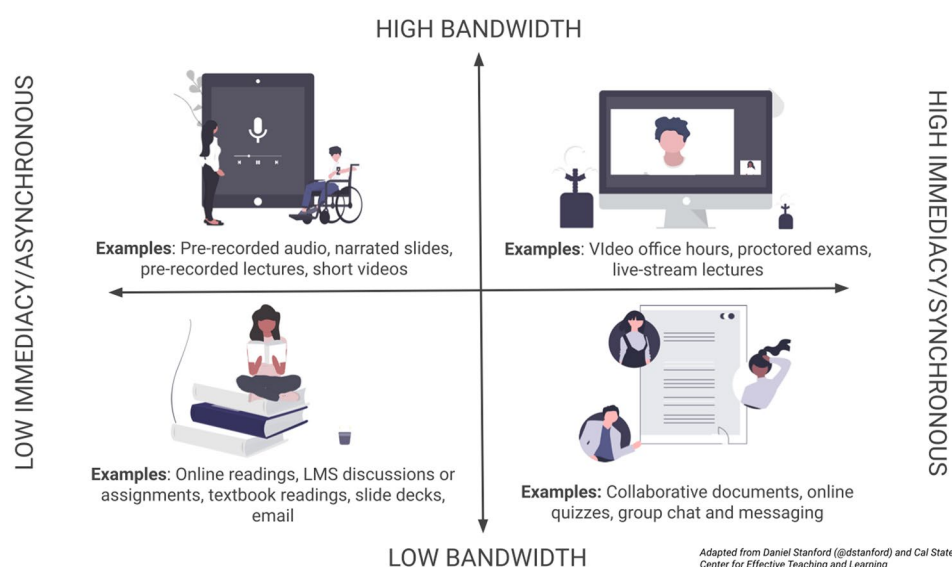
It is important to pay attention to the role that reading will play online—there is more of it. Unsupervised reading (a low-bandwidth activity) is critical in the online environment and an important life-long skill for the developing professional. Help learners unpack reading by establishing routines and rubrics that provide a structure for readings [46], such as knowledge checks (i.e., quizzes) prior to a discussion.

Ensure “Threshold Concepts” are Transparent

Think about the learner—what do they know and not yet know? What can they do and what can they not do yet? It is important to acknowledge that students are novices, not experts (yet); learners should be challenged but supported. When thinking about the learner, keep in mind the idea of threshold concepts in our discipline. Meyer and Land, who pioneered the term in their work with economists [47], describe threshold concepts as liminal and a rite of passage where once stepped over, there is no going back. A threshold concept is a transformative idea found in a discipline that defines that discipline’s key preoccupations, and that once understood propels the learner to deeper understanding.

In medicine, one of the most important threshold concepts to consider is clinical reasoning: the ability to synthesize clinical information together with pre-existing knowledge to make diagnostic, therapeutic, and prognostic decisions [48, 49]. Clinical reasoning is very much a threshold skill; before a medical student has crossed this threshold, s/he is not able to synthesize complex information in a specific case context to arrive at a diagnosis; after the threshold is crossed, learners are able to internalize (and refine) this skill. Given

Fig. 2 Low and high bandwidth and asynchronous and synchronous learning activities should be built into every online course



that clinical reasoning is key to medical outcomes, online coursework should support this concept through consistent routines that allow the learner to see worked examples and then practice their clinical reasoning.

Threshold concepts undergird all disciplines, but we do not always explain what these are to students, and why they matter. Online environments may (ironically) have an advantage over face-to-face learning for structuring such awareness of threshold concepts. As long as faculty are willing to make space to structure curriculum around the concept of threshold concepts (by allowing students to consistently practice a threshold concept, by using adaptive learning, or not allowing students to progress through a module online until they have mastered a concept), students could conceivably have an easier time working through difficult concepts online.

Teach Students to Ask Good Questions

The ability to ask good questions is a critical skill of any learner but is especially important in teaching, learning, and practicing medicine. With the explosion of health information, it is impossible for the learner (or their teachers) to know everything. One of the most important models of learning in medical education that has emerged in recent years is self-regulated learning [50, 51]. This model describes a cycle of learning by which learners are equipped to become adaptive lifelong learners by identifying and rectifying their own knowledge gaps based on what they encounter in the clinical environment. Since the pace of knowledge expansion and revision continues to accelerate, information learned during one's period of formal education will likely be irrelevant and/or even incorrect when an individual enters and remains in practice [52]. Thus, it is fundamental that one be able to ask and answer questions encountered in the course of clinical care in order to provide high-quality, evidence-based care. Asking good questions has emerged as a key activity of the master adaptive learner, an aspirational goal of medical education programs [53].

As Rothstein highlights [54], asking good questions can stimulate new ways of thinking about problems and identifying knowledge gaps. Asking questions encourages divergent, convergent, and metacognitive thinking (“thinking about your thinking”) and leads to more curious and engaged learners. It must be noted that explicit exposition of questions by medical teachers that allow learners to see into their teachers’ uncertainty has substantial benefits for learners and patients [55].

The online environment is conducive to deliberately teaching question-asking skills using the Question Formulation Technique developed by Rothstein and colleagues [54]. The first step is to design a question focus. In medicine, this is often an aspect of the clinical presentation of

a patient. Presenting rules for developing questions is the next step and includes asking as many questions as you can; not stopping to answer, judge, or discuss questions; writing down every question exactly as stated; and changing any statements into both open- and close-ended questions. Producing questions can stimulate divergent thinking. The next step is to prioritize questions, a form of convergent thinking. The process for answering questions can be discussed followed by reflection on how the questions were used for learning, a form of metacognitive thinking. These steps can be implemented as a series of online discussion postings which allow thinking processes to surface (and capture diverse thought) in perhaps more meaningful ways than a live discussion.

Medical students are conditioned, especially in the early years of medical school, to be answer-focused, but learning can be greatly enhanced by changing the focus and teaching the skill of asking good questions.

Align Measurable Learning Objectives with Instructional Materials, Learning Activities, Assessment, and Technology Tools

As with any curriculum, it is important in the online environment to align learning objectives with instructional materials, learning activities, assessment strategies, and technology tools. The desired outcomes of the session and course should determine the curriculum delivered. Having educational outcomes define the curriculum and assessment strategies is the fundamental principle underlying the competency-based medical education (CBME) framework and is relevant in both the online and in-person environment [56]. This approach contrasts with a more traditional approach in which the curriculum determines the educational objectives and assessment methods. The most compelling feature of CBME is its focus on outcomes and not process or time.

An outcomes-based approach starts with writing learning objectives that are active, specific, and measurable. The learning objectives should provide a clear statement of what the student can accomplish following course completion in terms of a specific change in competence, performance, or patient outcomes. Measuring course outcomes is critical in the evaluation of the effectiveness of the course.

There are many resources to help faculty align objectives, activities, and assessment. Quality Matters (QM) [57] is the industry standard. A faculty-led, peer review rubric that assesses and ensures quality in online and blended courses based on instructional design principles, QM is organized around eight categories—course overview, learner objectives, assessment and measurement, resources and materials, learner engagement, course technology, learner support, and accessibility (see www.qualitymatters.com).

Use Low-Stakes Assessments as Formative Practice to Enhance Memory

Low-stakes assessments for learning that are aligned with the learning objectives are one of many strategies to use in the online environment to enhance learning. Regular quizzing (as opposed to high stakes tests such as mid-terms or finals) forces the process of effortful retrieving of information from memory which reinforces learning and helps “make it stick” [58–60]. Self-testing is a powerful way for students to recall information [61]. Low-stakes assessments (combined with reflection or goal setting) allow learners to identify learning gaps, enhance their self-efficacy, and provide the teacher a sense of whether learners are understanding the material presented [62].

Regular, low-stakes testing should not be the only type of low-stakes assessment instructors use online. The beauty of the online environment is the way that many types of assessment can be structured so that all students are heard from online: via discussion boards, collaborative text annotation (Google docs, Perusall), breakout rooms, video modeling and critiquing, and others.

Students answer the questions asked by instructors. Time should be taken to write effective (reliable and valid) testing items for frequent low-stakes online tests that align with learning objectives. Assessments can be in the form of problem-solution, a case study, premise-consequence (if this... then this), and analogical reasoning, all representing types of critical thinking used in medicine. The polling function of online tools can be used for these assessments. In keeping with previous tips, teachers should consider making such assessments case-based to enhance not only retrieval but also knowledge reorganization.

Embody Continuous Improvement

As with all courses, a strategy of continuous quality improvement (CQI) mindset should be embodied [63–66]. The instructor should regularly assess the effectiveness of the online course through student feedback, peer review, and critical self-assessment. Be adaptable and be prepared to change what is not working. Learn from what is effective in other online courses. Try new approaches and continuously assess their effectiveness.

As part of CQI, faculty can perform item analysis on quizzes, identifying which questions students are likely to get wrong. A strength of a learning management system is that it tracks learner analytics including performance on specific questions. Various options are available when seeking statistical information about quiz performance. Faculty can use these data to inform the time the teacher spends on a given topic, and future versions of a test.

It is important to continually develop your skills as an online educator through reading, workshops, and peer review. Seek consultation with your teaching and learning center (instructional designers and academic technologists) and take advantage of their expertise designing online. Some resources available to build online teaching skills are through Quality Matters workshops, EDUCAUSE (www.educause.edu), and other professional organizations like National Education Association (www.nea.org) or Association of College and University Educators (www.acue.org).

It is the duty of medical educators, just like health care professionals, to continually seek to improve their educational and clinical practices [66]. There has been a convergent evolution between medical education and clinical practice with respect to CQI [67], and some of this may be related to the increasing inclusion of quality improvement and patient safety and their attendant methods in medical education programs [68].

Relevance to Clinical Education

Application of the above recommendations could also substantially improve education in the clinical phase of medical training. Until the last year, in-person clinical educational experiences had changed relatively little over the last many decades, remaining largely of an apprenticeship nature. These time-honored (sometimes time-worn) experiences would benefit from mindful design. Clinical encounters are by their very nature engaging, yet are (appropriately) usually not learner-centered. Health care environments are typified by chaos and time pressure, making intentional teaching and learning challenging.

Teaching presence is fundamental for effective clinical teaching, especially considering that clinical teachers must balance patient care and education by “making room” for teaching and learning in the midst of health care delivery. Clinical education is increasingly incorporating online and/or virtual experiences to supplement and complement clinical experiences [69]. The online environment can also be leveraged to include the teaching and assessment of physical examinations and the conducting of procedures. This includes the use of online standardized patients, virtual Objective Structured Clinical Examinations (OSCEs), and crowd-sourced assessment of technical skills (C-SATS) such as surgical procedures [70–73]. These recommendations are also relevant to telemedicine which is often taught online [74].

Online experiences designed to supplement traditional clinical experiences must be well-designed to be effective. Students must not view these experiences as something to be done simply because there is not capacity at a clinical site due to the pandemic, but instead as valuable and engaging educational experiences. Time will tell whether such hybrid approaches to clinical education remain after the pandemic,

but applying these strategies will help ensure that truly worthy innovations are not lost and that we return not to normal, but to better.

Conclusions

The Covid-19 pandemic has changed the way medical education is being delivered. It is unknown whether this is simply a temporary disruption or an opportunity to catalyze disruptive innovation in medical education. Medical teachers should avoid making inferior comparisons of online courses with their former face-to-face iterations as the two modalities vary greatly in context and delivery and offer different advantages. The historic migration of coursework to remote environments during the 2020 pandemic has offered a once-in-a-lifetime opportunity to reframe all of our courses.

This paper makes a practical contribution to medical education by identifying possible improvements to original course design via renewed and careful attention to online course structure, design, activities, and delivery. Almost all the techniques we identify as helpful to structuring an online course such as frequent low-stakes assessment, threshold concepts, transparency, item analysis, collaboration, asking better questions, can be employed in a face-to-face classroom.

Online courses take more time and attention than their traditional counterparts; an asynchronous discussion involves more planning than the usual classroom interactions [75]. The benefits are, however, a nearly universal form of feedback in which the instructor hears from all students and can make lively and robust connections for them. Such conditions are not always present in the physical classroom [76].

Despite a terrible pandemic which has unleashed both chaos and creative disruption, different components of online learning could work together with face-to-face environments to achieve a superior educational experience for medical students when we all “return.”

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