Abstract
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The COVID-19 pandemic has had innumerable profound impacts, many of which have resulted in irrevocable changes to both the practice of medicine and the teaching of medicine. Medical educators have adapted to the need for social distancing by providing virtual educational opportunities for their learners, often without training or experience in online teaching. Because these educators require both professional development and technical support for their online teaching to be sustainable and effective, departments need to provide immediate help and support. These twelve tips are designed for those in leadership roles who have recognized the need for investment in online education and are interested in strategies to ensure the success of their educational programs.

Keywords
medical education, online learning, COVID-19, virtual education, leadership

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Introduction
In response to the COVID-19 pandemic, medical educators around the world have suddenly found themselves moving educational activities online (Bao, 2020; Wolanskyj-Spinner, 2020), from virtual rounding (Dedeilia et al., 2020; Hofmann et al., 2020) to morning report and case discussions (Kondziolka, Couldwell and Rutka, 2020), to journal clubs (Codispoti et al., 2020; Tomlinson, Hendricks and Cohen-Gadol, 2020) and even full-length courses (Ferrel and Ryan, 2020). They have often moved rapidly, with little preparation, and minimal institutional support (Anderson, 2020; Kamenetz, 2020). Medical educators have embraced the charge bravely, rising to the challenge of transitioning their teaching content and interaction with their learners online while also adapting to unfamiliar formats. However, they are often underprepared, as many faculty members lack formal training in the delivery of online courses, and many more may struggle with the technology required to get connected.

Recent articles have described the effects of this shift on medical education (Parisi et al., 2020; Rose, 2020; Sandhu and de Wolf, 2020; Wayne, Green and Neilson, 2020; Weiner, 2020), discussed student and faculty responses to online learning (Agarwal and Kaushik, 2020; Muflih et al., 2020), provided case studies of specific teaching approaches (Chick et al., 2020; Parisi et al., 2020; Zhou et al., 2020), and offered tips for faculty making this transition (Gewin, 2020; Reyna, 2020). However, little advice has been delineated for institutional leadership and departments to support their teaching faculty under these challenging circumstances.

Many administrators are eager to support their educators but are unsure about how or where to start. Thus, we wrote the following twelve tips to provide tangible and actionable ways for department leadership to assist faculty as they transition to online education. Given the urgent and unexpected nature of the transition to the virtual space, the majority of these tips are designed to address immediate needs. However, the consequences of the pandemic and the shift to online education are likely to be long-lasting (Branswell, 2020; Razavi, 2020; Rose, 2020). Thus, the last tip provides advice on building institutional capacity in anticipation of a sustained investment in online education.

1. **Ensure faculty have the necessary hardware**
A recent report shows that large percentages of faculty do not have access to an institutionally provided laptop (45%) or desktop (40%) (Brooks and Grajek, 2020). Many institutions expect that faculty will use their own computers for online instruction. However, their personal devices may be outdated or not configured to run the latest versions of the applications required for online teaching. Faculty may be connecting from areas without reliable internet access (McMurtrie, 2020), which can result in inconsistent streaming. Moreover, faculty may have to share these personal computers with other family members working from home. As a result, there can be gaps “between the work faculty are being asked to do post-COVID and the tools that are being provided to conduct that work” (Brooks and Grajek, 2020). To address and mitigate these gaps, survey your faculty members to determine what hardware (i.e., laptop, desktop, tablet) and equipment (i.e., headset, microphone, webcam) they have and what technology they still need. Ask about the status of their internet connectivity. Make sure faculty know what tools they will need to teach online and be prepared to fill any gaps.

2. **Familiarize faculty with their Learning Management System**
Faculty at all major universities have access to a learning management system (LMS), for example Canvas (Instructure, Salt Lake City UT), Blackboard (Blackboard, Inc, Washington DC), or Moodle (Moodle Pty Ltd, West Perth, Australia). Yet some faculty (particularly clinical faculty) may not know that these platforms exist. Others may be unfamiliar with the full capabilities of the LMS, particularly those functions that promote interaction in online teaching sessions (e.g., discussion boards, wikis, plug-ins to tools such as VoiceThread (VoiceThread LLC, Boca Raton FL) (Brooks and Grajek, 2020). These skill gaps limit their ability to teach effectively online. Thus, one of the simplest things departments can do to help faculty get up to speed online is to offer LMS training, focusing both on basic features (e.g., how to add, delete and edit content, how to use the gradebook) and on the features that will inspire the most student engagement. This training can often be provided by the university teaching center, if your university has one, or by an experienced staff or faculty member from your department. In a pinch, you can assemble links to resources, such as training videos and technical support, provided by the LMS company itself. Making sure that faculty are facile with the LMS and its tools is likely to instill confidence while also alerting them to forms of online content and interaction they might not otherwise have known. Over time, departments can expose faculty to a wider array of tools to integrate into their courses.

3. **Provide exemplars**
Many faculty members have never taken an online course, let alone taught online. Thus, it may be difficult to imagine what online teaching looks like, or to set appropriate expectations (Schmidt, Tschida, Christina and Hodge, 2016). It is important for faculty to see examples of online courses and modules before they work on their own. There are many examples online; however, they often involve subject matter (e.g., meditation, yoga, guitar) that can be difficult for
faculty in academic medicine to relate to their own teaching practice. They may also represent a different type of online offering altogether (e.g., a self-paced video-based module rather than an instructor-led module with tasks and assignments) thus creating confusion about what, precisely, the final product should be. To find the right kind of model, consider asking your institution’s teaching center to identify and provide guest access to well-designed courses that are similar to those your faculty teach. Request courses that represent like content (e.g., physical exam or procedural skills, research design, medical communication), teaching methods (e.g., problem solving, case-based discussion), student level (e.g., medical student, resident, fellow), and class size. The closer the model is to your own faculty members’ experience, the more likely it will speak to them. If possible, provide a range of models, not just a single example, to illustrate different options and approaches. Consider asking the instructors who developed these courses to attend a faculty meeting or professional development event to talk about the course design process and/or the teaching experience.

4. Arrange for an assistant to support virtual class sessions
As sessions move online, synchronous teaching increasingly takes place in video conferencing platforms such as Zoom (Zoom Video Communications Inc., San Jose, CA), Microsoft Teams (Microsoft Corporation, Redmond, WA), Cisco Webex (Cisco Systems, Milpitas, California), and GoToMeeting (LogMeIn Inc., Boston, MA). These tools create opportunities (for example, the ability for students to participate even when not in the same physical location, the seamless integration of polling, and easy screen sharing capabilities) but also challenges. Instructors must manage new technologies and navigate an unfamiliar set of logistics while also adjusting to a different kind of pedagogy. To help faculty manage the added cognitive burden, consider providing the services of a staff member or teaching assistant who can sit in on virtual class sessions to help monitor the chat window, resolve technical problems for students, moderate breakout rooms, and assist if the instructor encounters challenges. Knowing they have help with technical and logistical issues allows them to focus their energy and creativity on teaching.

5. Consolidate technology tools
Choice is good, but too many choices can be paralyzing. If faculty are relatively new to online teaching, it may be wise not to provide too many choices of tools and technologies. Instead, recommend a small set that come highly recommended and have been well-vetted by people in your field. Make it clear to faculty what each of these tools is for (e.g., housing course materials, hosting synchronous class sessions) and provide robust training and support resources for each. Consider using the same tools for other departmental purposes so that faculty get comfortable using them. For example, you might use Zoom for virtual department meetings while recommending Zoom for teaching as well. Using a limited number of good tools reduces the cognitive burden for faculty while also creating a more consistent and manageable learning experience for students, who must otherwise master different platforms and tools for different training purposes. As faculty become more adept at online teaching, departments can consider purchasing site licenses for additional tools targeting more sophisticated uses, such as the development of interactive video content or enabling media-rich discussions.

6. Use templates and rubrics
Faculty are accustomed to having latitude in how they organize and run their courses, an important facet of academic freedom. However, as instructors are learning how to design and teach online courses, structure and guidance in this context may be appreciated. Departments should consider providing templates and rubrics to guide online course creation. Templates help faculty identify key course components (e.g., course overview, course objectives, modules, synchronous activities, asynchronous activities) as well as the logical steps in course design (Borgemenke, Holt and Fish, 2013). Rubrics, on the other hand, designate the marks of quality in an online course. Two of the most well-known rubrics are the Quality Matters Rubric (QM Higher Education Rubric, 2018) and the Online Learning Consortium’s Quality Score Card (OLC Quality Scorecard, 2018). Templates and rubrics help to develop a base level of standardization across courses, which leads to a shared vocabulary among faculty, while ensuring a more consistent, high-quality experience for learners.

7. Appoint a staff member to oversee course consistency
Most students have taken in-person courses since their elementary school days. They understand what classrooms look like and how these courses generally operate. Online, however, that familiar structure is gone, and students can easily feel disoriented and confused. Dykman and Davis (2018) recommend that all courses in a program have a similar look and feel to make courses easier for students to navigate. To achieve this, it can be beneficial for departments to assign a staff member the job of reviewing courses to ensure consistency. For instance, do all courses have clearly articulated learning objectives? Do they use terminology (e.g., module, session, unit) in consistent ways? Do syllabi reside in a consistent location? Ideally, staff members in this role would have a background in instructional design, but that is not strictly necessary, as long as they are armed with the templates and rubrics described above.
8. Supply relevant resources
Teaching online entails a specific set of skills for which few medical educators have had explicit training. Until such training can be provided, consider buying your teaching faculty a small set of helpful books about online teaching. A gift is always appreciated, and this gesture may help to foster good will among faculty who may be feeling overwhelmed. Books provide basic information and advice about designing and teaching online courses which most faculty need. Moreover, the best books ground their advice in research-based learning principles (Ambrose et al., 2010; Brown, Roediger and McDaniel, 2014) which are a necessary foundation for teachers working in any modality. Finally, a shared set of books helps to foster a vocabulary among the faculty, making communication more streamlined and effective. Books we recommend include: Small Teaching Online: Applying Learning Science to Online Classes by Darby and Lang (2019) and The Online Teaching Survival Guide by Boettcher and Conrad (2016).

9. Capitalize on existing professional development
Copious research points to the necessity of providing robust professional development to faculty new to teaching online (Shelton et al., 2014; Vaill and Testori, 2012; Mohr and Shelton, 2017; Hampton et al., 2020). Your medical school may have its own teaching center or faculty development unit. If so, explore whether it offers workshops and trainings on online teaching for your faculty. If not, your university’s teaching center may be able to provide programming on online course design and teaching (independent of the platform-specific training mentioned above in #2), customized with examples from your field. If these are not options, your department may be able to purchase a group subscription to a seminar series focused on online teaching (e.g., Magna Online Seminar Series, Magna Publications, Madison, WI) or simply assemble a set of useful resources from professional organizations like the Online Learning Consortium (Online Learning Consortium, Boston MA) and Educause (Educause, Louisville, CO): focused on online and technology-enhanced education. Consider asking a graduate student to assemble a set of recommended sources.

10. Create a forum for faculty to share tips and ideas
Faculty often learn best from one another. Thus, it can be helpful to provide a forum for faculty to compare notes, share ideas, and learn from one another. Forums such as these already exist; for instance, a number of national Facebook groups were created after institutions moved online in response to COVID-19. One called “Pandemic Pedagogy” seems to have gained considerable momentum (Pandemic Pedagogy for Visual Arts Professors, 2020), splitting into discipline-specific subgroups. There is even one group called “STEM Faculty Blundering Through Remote Teaching in a Pandemic” (STEM faculty blundering through remote teaching in a pandemic, 2020). However, because national groups on social media can be large and overwhelming, it may best to see if there is an existing group at your institution or to create (or encourage faculty to create) a forum of their own using social media and collaboration tools, e.g., Slack (Slack Technologies, San Francisco CA) or Microsoft Teams (Microsoft Inc, Redmond WA).

11. Hire a student or staff member to organize a repository of online content
Many faculty developing online courses believe that they must record all their lectures as videos, a daunting task in the best of times (Norman, 2017). However, there are other options, including using materials that already exist in the public sphere: TEDMed talks, podcasts, NIH-produced video, even whole curricula. Open Educational Resources Commons (OER Commons, 2020), for example, provides free educational materials from a wide range of subjects and learner levels. While busy faculty may not have the time to search for these materials, it is a perfect job for a staff member or graduate student in your department - someone familiar with the types of courses your faculty teach and knowledgeable enough to evaluate the quality of the content. Hiring such a person to find, organize, and catalog a set of department-relevant multimedia materials can be a wise investment. To make sure the repository they assemble is as useful as possible to faculty, ensure that the materials are systematically organized and indexed by topic, source, length, and content type (e.g., video, podcast, curriculum), and include a brief description.

12. Invest in staffing and resources to provide sustained support
In anticipation of a world where online and hybrid medical education are increasingly common, there is an undisputed need to offer robust, long-term support for faculty teaching online, and thus the need to build the capacity necessary to do so. There are multiple layers involved. First, a mechanism must be in place to provide ongoing faculty development, preferably within your own School of Medicine or School of Health Sciences. Second, you should consider hiring an instructional designer. Instructional designers (IDs) are trained to work closely with faculty to develop instructional materials, often enlisting technology tools. A good ID combines pedagogical know-how and keen design aesthetic with technical expertise, making him or her a valuable asset to a department. Third, consider hiring a video producer to record and edit video and audio to create high-quality multimedia materials. Finally, consider building a video and audio recording studio. This does not have to be an expensive venture. For example, Pennsylvania State University pioneered the “One Button Studio,” designed to allow faculty to record lecture video themselves, but with professional lighting and backdrops (Welcome to the One Button Studio, 2020). It may also be possible to share studio facilities between several
departments and programs. While the aforementioned steps are more involved and require an investment of time and financial support, they have the potential to create lasting and impactful opportunities for medical educators to thrive in the online space.

Conclusion
Though the rapid transition to online teaching has been sparked by the novel coronavirus pandemic, it is likely that online and hybrid education will become mainstays in medical education in the future. We hope these tips can assist institutions to manage this transition with greater purpose and focus. We recognize that many of these aforementioned tips require an investment (some financial, most with at least time and energy), which may seem daunting at first. It would be reasonable to approach this list in a stepwise fashion, allocating resources to the earlier tips first before tackling the later ones. Both the quantity and quality of online teaching may become a discerning factor for students applying to medical education programs. Thus, those programs that are proactive in their approach could attract higher quality matriculants and expect to produce higher quality graduates. In the end, we anticipate that institutional leaders who make progress through these suggestions may experience a competitive advantage in the medical education marketplace for years to come.

Take Home Messages
- The consequences of the COVID19 pandemic are likely to be long-lasting, underscoring the importance of sustainable online learning experiences for educators and learners.
- Medical educators are in need of professional development opportunities and institutional technical support to assist in this period of transition.
- By leveraging existing resources and capitalizing on the benefits of technology, departmental leadership can provide assistance to educators as they adapt their pedagogy to the online space.
- Timely investments to optimize the online learning experience will have lasting effects for both educators and learners alike.

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Declarations
The author has declared the conflicts of interest below.
Dr. Marie Norman has received honoraria in the past for presenting for Magna Online Seminars. Otherwise, the authors have no conflicts of interest or potential declarations of interest to disclose.

Ethics Statement
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Samar Aboulsoud
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This review has been migrated. The reviewer awarded 5 stars out of 5

Dear Authors, Thank you for giving me the opportunity to review this interesting article. I strongly agree with you on the importance of the topic and the themes you included in the paper. In my opinion, one of the “positive” effects of the COVID 19 era is that it stimulates innovational thinking and creative solutions in order to address current challenges and issues that are not essentially handled by traditional methods. I think you nicely summarized and listed the important supportive elements and skills that can ensure an effective transition to virtual learning. I believe this is a door opener for further research in other e-learning related domains e.g., the effect of cultural variations on e-learning, addressing e-learning challenges in resource restricted environments and e-learning management throughout the medical education continuum (UG, PG, CPD). One final thought; while we mostly focus on the technical aspects of e-learning, however, I believe that it is crucial to reinforce its educational aspects and models. In other words, it is imperative to ensure that faculty members are capable of transferring the full classroom learning experience to a virtual learning space that is effective and measurable. This includes, but is not limited to, mastering interactive small and large group teaching and discussions; secure & reliable assessment methods and virtual mentorship. Thank you again for a great article.

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Mary Higgins
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This review has been migrated. The reviewer awarded 4 stars out of 5

Thank you for this very practical and well referenced paper. I cannot agree more with Subha about the concept of cognitive overload for clinician educators, and while the idea of offering books for reading is laudable, I think what would be preferable would be to have a technician who can help. That, or the ABC of technology enhanced/provided learning. I would have also been grateful to have some tips on how to use technology to return students to more clinical placements, as at some point this will need to happen. Who better to learn from but from the patient themselves, in this situation using technology?

Competing Interests: No conflicts of interest were disclosed.

Helena Filipe
Hospital of the Armed Forces/PL-EMGFA

This review has been migrated. The reviewer awarded 4 stars out of 5

Thank you for the opportunity to review this useful and interesting paper. Distance as a “new” safety measure has been a ubiquitous word since the pandemic started. I would choose to say physical distance instead of social distance as we always have devised a way including now, to feed our social nature. Lately synchronous social interaction became more than ever one of the most effective means to get in touch within our communities. I appreciated the emphasis on the critical need for medical education departments’ leadership to support a consistent and robust online learning plan. Completely agree when the Authors underline the thought of continuity of such development and implementation efforts to include the experience in future programs. Inasmuch, the pandemic may well imprint a longer lasting need for a sustained elearning methodology or at least the need for hybrid models. Authors provide us with good guidelines full of pragmatic measures to implement and draw our attention to the importance of adaptation of online programs in accordance with the learning environment culture and resources, faculty and learner specific needs. For instance, providing coached training opportunities for faculty to try online tools and platforms looks thoughtful, feasible and allowing for much better outcomes. Appreciated tip 10 mentioning the importance of networking with educators experienced with online teaching and providing faculty with hands-on training opportunities on online tools and resources. Already widely used...
for personal and practical purposes, friendly-user social networks can be adapted for medical education as local facebook groups may be an example. These can work to straighten personal and professional members' bonds and allow for developing new learning in a collaborative manner. We are happy to share our insight on Filipe HP, Mack HG. Teaching through social media. Ann Eye Sci 2019; 4:28. Either face to face or online, learning experiences will be better if unfolding in a supportive and trustful environment where the learning group, the learning community members can feel openness to share their views, experience, concerns and aspirations, learn and grow. The learning community will progress with a constructive impact in the organization. The importance of planning and constant improving by piloting and iteration is focused. The updated bibliography will be very helpful to the medical education community in general. Would like to mention a related recent paper published in MedEdPublish: Mealey E, 2019, 'Developing an online continuing professional development course for busy healthcare professionals: 12 tips for course developers', MedEdPublish, 8, [3], 21 Thank you for sharing your experience and insight forward in your paper.

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Subha Ramani
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This review has been migrated. The reviewer awarded 4 stars out of 5

The ongoing pandemic has made online teaching and learning mandatory. I agree with the authors that this mode of education is likely to persist beyond the pandemic. Despite the challenges that have forced the change, educators, institutions and organizations have discovered the benefits of virtual education and the lessons learned will be very relevant in the future. For eg, there are amazing educational conferences organized all around the world and it is impossible for faculty or learners to just travel to several to attend in person. The virtual environment has widened access, facilitated global conversations in a way that was not possible in the past, stimulated cross cultural networking and collaboration. The 12 tips paper is well written, well referenced and quite concise and to the point. I agree with the tips that have been emphasized. My one concern is adding to the burden of faculty whose education provided them expertise in their discipline and are not being asked to also be technology experts. The cognitive load is real and could impair their well being. I would recommend that institutional leaders do their due diligence by hiring educational technologists to help the teacher design online curricula, manage the LMS and also have staff with technology expertise ready to help during synchronous sessions. Another aspect
of virtual teaching and learning is the physical space where the teaching is done. Institutions could have experts in space design advise and even provide equipment that would be ergonomic for those with a large online teaching burden. The physical effects of long hours of virtual teaching are only beginning to be described and these are real. All health professions educational leaders could find this article useful.

**Competing Interests:** No conflicts of interest were disclosed.