

Announcer: Welcome to Mayo Clinic's ECG segment Making Waves Continuing medical education podcast. Join us for a lively discussion on the latest and greatest in the field of Electrocardiography. We'll discuss some of the exciting and innovative work happening at Mayo Clinic and beyond with the most brilliant minds in the space, and provide valuable insights that can be directly applied to your practice.

Dr. Anthony Kashou: Welcome to Mayo Clinic's ECG segment making waves. Today we're diving into an exciting and growing world of online learning for healthcare professionals. We'll navigate the current landscape, comparing it to the traditional classroom settings. We'll explore the advantages of flexibility and accessibility that online learning offers delve into its impact on learning outcomes and tackle the challenges and limitations head on. We're fortunate to have an exceptional educator with us today, Dr. Nandan Anavekar. Dr. Anavekar is a professor of medicine and consultant in the cardiovascular and radiology departments at the Mayo Clinic in Rochester, Minnesota. He currently serves as the program director for the Adult Cardiovascular Diseases Fellowship program. He's board certified in cardiology and has completed additional fellowship training in echocardiography and advanced cardiac imaging. Dr. Anavekar has special interest in cardiac CT and MRI in congenital heart disease and cardiovascular physiology with a particular interest in hemodynamics. His main clinical interest is in the management of diseases of the pericardium diseases of the aorta and critical care cardiology. Dr. Anavekar thank you so much for making time to join us today.

Dr. Nandan Anavekar: Oh, absolutely. I'm, I'm thrilled to be here, Anthony, and thank you for the invitation.

Dr. Anthony Kashou: Well, no better person to talk about education than you currently my program director and someone I look up to and just seeing how this whole landscape is changing, and I know you've thought a lot about this, we've talked a lot about it, but maybe you could describe where do you see the current landscape of online learning today, that environment, and how does that compare to, you know, the traditional classroom approach that, you know, we grew up with?

Dr. Nandan Anavekar: Yeah, again, thanks for the invitation, Anthony, and, and thanks for the question, which I believe, you know, has quite a lot of interacting factors to consider. So let's first consider the ideal learning environment, and then we can compare that to the traditional classroom setting, followed by a comparison to the current landscape, as you put it, of the electronic learning environments. So when we consider the ideal learning environment, this really requires several important components. First, there must be a qualified teacher. Now, a qualified teacher does not need to be a world expert on a topic, but must have the expertise or mastery over this subject matter, at least enough to teach. A qualified teacher must be able to deliver a lesson in an organized manner, and the lesson must be internally consistent, meaning that any questions raised during the lesson should be answered, keeping in line with the reasoning provided in the lesson. Second, the optimal learning environment requires a qualified learner. Now, a qualified learner is one who values that, which is being taught and one who arrives at the lesson with the requisite preparation. And what do I mean by preparation as part of the qualification?

Well, for example, let's take a person who's signing up for a course in advanced mathematics. It's important for that learner to have at least completed the basic topics in mathematics as part of their preparation. So this is what it means to be a qualified learner. Third and most crucial, it's important to understand that ideally a subject matter is taught following which a learner can then supplement the lesson with reading. Independent reading assumes that a learner knows how to read and understands the written word in exactly the manner in which the author meant it to be understood. With this point, I hope that you and, and our audience can see that there is quite a scope for misunderstanding or wrong understanding to take place. Therefore, there is a crucial fundamental and essential need for a teacher to explain a given topic before one dives deep into the written literature. Next, the ideal learning environment is one that delivers lessons systematically and consistently over time. And I think that the latter is key. And I believe this actually was born out in the findings of the educate trial, which you ran. And this trial, as you well know, was looking into outcomes of different learning styles when interpreting electrocardiograms. In fact, those learners, if I, and correct me if I'm wrong, but those learners who had a regularity to their learning with a systematic approach tended to do better on metrics of performance. Now that we have delineated the optimal learning environment, we should consider the traditional classroom. And for me, the traditional classroom reminds me of my time in high school where learning for me was actually the most effective. Having a predefined physical area where learners gather led by a teacher and with a robust schedule provided systematic and consistent teaching. Over the course of time, learners were given provisions for different abilities, and teachers provided customized lessons that adapted to our needs. Now, the traditional classroom, as I experienced it in high school, was absolutely amazing. But in the postgraduate medical education space, most of the learning appears to be, in my opinion, achieved independently. And if you are fortunate, you have access to some guidance from some clinical masters. As you're well aware, in the past two decades, especially in the context of the emphasis on independent learning, electronic learning environments have evolved, and there are just so many resources to choose from. Each platform has their advantages and disadvantages, but the common missing ingredient in all electronic platforms that I have utilized in my time is the absence of a teacher to date. My impression is that the technology, I will, as the technology continues to evolve, the educational platforms will continue to try to achieve knowledge transfer in the absence of a teacher and the student positive feedback system. Now again, I would reiterate that there is a crucial fundamental and essential need for a teacher to explain a given topic before one can truly take an independent deeper dive into the topic. The teacher also provides a strategy to approach a topic or a group of topics, and therefore, in my opinion, although the electronic environment is impressive, it'll remain the second choice when compared to a more traditional learning paradigm that includes the presence of a teacher for the electronic environment to transcend its current position in, in my opinion, it really has to evolve to integrate a master educator into the interface. Having said that, these are my personal opinions, and I understand that others may feel differently.

Dr. Anthony Kashou: It's really fascinating and I love how you describe that ideal learning environment of the teacher, the learner, you know, being, having to be taught, and then doing that before your independent reading. And then really the consistent, the regular systematic approach in learning, which you're right, we did find that to be effective, but there is that missing of those, that ideal learning environment as, as you mentioned, the teacher was a core component. And so if that's missing, it's like how do we fill in that gap? And so I would agree with you, we need to, to find a way to bring that master

educator or someone there to ensure that the knowledge transfer is also understood. Now, keeping that in mind, you know, let's, let's say we come across that we find a way to integrate that. Where do you see, just at this point, the primary advantages of just like online learning environments and how that may actually help in the postgraduate education?

Dr. Nandan Anavekar: Yeah. Well, I think the, in, in terms of the electronic environment, I think the, the primary advantages is really gonna be their accessibility, their ease of use and, and, and flexibility. And it really wasn't that long ago, and definitely during my time in high school and medical school where accessing information really required one to go to a physical library, we had to know how to find the resources on the shelf utilizing the paper index and cataloging system. And then once we found the resources, we, we had to figure a way to digest the material to supplement the ethical activities in the classroom. Now, now looking back on this, it was a very time consuming endeavor, but having said that, for me anyway, there was sort of a, always a charm to visiting the library, finding the right resources or books, and then sitting down and going through the content and coupling that with, you know, the sort of the, the, the group learning or, you know, discussing with friends when we were all on the same journey. Now, I think that such an experience was special and, and it was meaningful for me, but now we're in the age of the electronic learning environment, and the electronic learning environments have really changed the paradigm, and to a great extent has leveled the playing field. It really allows anyone with an internet connection to access a vast ocean of content anywhere in the world. Now this access to information, no doubt, is a great boon for learners and educators alike. However, the one word of caution I think that I hope you, you would agree is that in contrast to the physical library, the electronic environment needs extra attention on the part of the learner to ensure that the quality of the content being reviewed is, is satisfactory now in the, in the medical field. And, and for the most part in the sciences in general, this is largely circumvented since there's rigorous peer review. But still, it is something to be aware of, especially since the medical literature appears to be growing exponentially over time. Now, beyond the ability to reach a vast array of content, the electronic environment also offers a variety of interfaces that caters to the variety of learners out there. Now, the aesthetics of the interface and the intuitiveness of navigating through the electronic environment is one of the greatest appeals of several of the current electronic curricula. But in addition, it is also worthwhile to mention that the electronic environment is no longer tethered to the historic desktop or even the cumbersome laptop. Instead, we can experience the environment utilizing tablets and even smartphones. And I suspect that with integration of more interactive features in the future, this will further enhance the experience. Indeed, both the accessibility and flexibility of the electronic interface has really been the primary advantage of the electronic learning environment. And I believe with integration of artificial intelligence or AI into these environments, this may further customize the experience for the user at large.

Dr. Anthony Kashou: So certainly a lot of advantages that transcend the traditional of, you know, the accessibility, ease of use and flexibility and really of great educators can transcend of someone in a single classroom or university. But even beyond, you know, our, our institutions and even worldwide, you could see that, and as you mentioned, the, the vast amount of content certainly has to be reviewed ensuring that, especially in the medical field, that this content is relayed accurately because that can certainly

affect how indirectly some of the patient care and certainly lots of things coming about. Now, aside from those advantages, where do you see are some of like the most significant challenges and limitations in this space, particularly in this online ecosystem, this learning environment?

Dr. Nandan Anavekar: Yeah, it's a great question, Anthony, and, and thanks again. And in fact, I, I would argue that that question becomes a seed for potentially a seminar. So when I consider that this, this, the, the challenges limitations and, and when I consider this question, I think we really need to take it from the lens of the learner and educator who are the primary consumer of these electronic learning platforms. Now, first and perhaps the elephant in the room is the question of time to learn. You know, we are all aware and sensitive to the fact that the postgraduate medical trainee is pulled in, you know, a hundred different directions and has to focus on providing service to patients to be technically proficient in their practice, to engage in research and to, and then really to balance all of that with family and social obligations. So I, I think the elephant in the room is where is the time to study? And in this regard, I, I personally feel now with my, the, the program director hat that it is incumbent upon training programs to firstly endorse the importance of developing a consistent and systematic study plan. And two, to have the provisions within the structure of the program to allow for consistent and systematic study. I think this is the greatest hurdle for any postgraduate medical professional, and this is beyond whether it's a in-person traditional paradigm or an electronic interface. Now, if we are able to get past this hurdle, then we can critically appraise the specific challenges and limitations associated with electronic learning. First, it is very challenging to appraise the efficacy of any given platform. And, and I may be entirely wrong, and if I'm, please excuse me, and maybe I'm not completely informed, but to my knowledge, the efficacy of an electronic platform to date is really based on endorsements from those who contribute to the platform, as well as aggressive marketing strategies, therefore is extremely challenging to gauge how a specific learning platform will improve my personal intellectual growth. Now, every platform makes a promise to deliver a unique learning experience. And I personally, and it's just me feel that this is a bit of a stretch. The second challenge with the electronic learning environment is the primary goal of many of these environments to push the learner to achieve a specific outcome, typically to cross some form of exam, a board exam, for example, and therefore the utility of many of these platforms are going to be to a specific group of learners in a specific time of their career. Now, having said all of that, I do concede that there are a number of online resources that are now evolving with the spirit of emphasizing lifelong learning. And I think this is amazing to see, and I hope that this becomes congruent with the vision of continuous medical education, and that is a vision where we are continually learning on a daily basis every moment that we are engaged in our professional activities. Now, crucial limitation of all the electronic learning platforms that I've interacted with and which I've alluded to earlier, is the absence of the teacher. The platforms all have a broad and deep array of content, but a necessity for an effective learning experience, in my opinion, is the presence of a teacher to explain the content and to be available to answer questions as they arise. Now, I could imagine that with the emergence of ai, that learning platforms will have their own virtual teaching assistant to help answer questions as they arise. However, until that technology really becomes more broadly available, and until that technology really matures, I do think it remains a major limitation of the electronic environment in, in, in terms of them not having a physical teacher to help navigate the content. Finally, and very importantly, there is currently a paucity of studies regarding educational outcomes which utilize electronic learning platforms. Now, I think this is a good moment to shine, again, some light on you, and I know it makes you a little bit

uncomfortable, but really we must applaud your efforts in terms of what you've accomplished with the Educate trial. To this end, the findings of the educate trial are really going to inform how we approach teaching in the postgraduate medical education space. It's important that those who have passion for education out there in our professional community really be part of the research in defining the optimal educational methods. We cannot just sit on our laurels and think that because we believe it works, that it's going to work. This is a critical, yet exciting time for our profession, and I hope that you know, the work you've done and others will really motivate and as and and inspire us to keep moving forward in the education research space.

Dr. Anthony Kashou: Yeah, and I mean, there's clear challenges and limitations and you very nicely laid them out and, you know, how do we gauge the efficacy of these platforms? You know, we attempted to, but we also noticed that, you know, there was no real time teacher, as you mentioned, there was areas that yes, we saw improvement, but it wasn't, there was also room for even more growth, you know, so how do we fill those gaps? And I, I think we have a lot to learn and, you know, ongoing research is gonna be important to, you know, navigate this, but also to ensure the way we deliver, you know, education is effective. Now, just kind of building on that, you know, how do you see this online learning affecting the learning outcomes and competence of healthcare professionals compared to say, more traditional methods?

Dr. Nandan Anavekar: Yeah, I, again, I think, I think this gets back to just what we have spoken about, and it really gets at the fact that we as a profession really need to apply rigorous methods and we need to have clear definitions of education based outcomes. And I, I personally don't think we are there yet, only with precise definitions and measures of these outcomes, will we, will we be in a position to test the efficacy of one educational strategy over another? Now, profession has evolved from anecdotal based medicine to evidence-based medicine with the latter really cultivated through the application of rigorous clinical trials. And I think that we can apply the same discipline to the education space. I, I don't think that we are too far that we can't achieve this now. Only when we can do this, can we give more robust appraisal of how the electronic learning approach affects learning outcomes and competence of our healthcare professionals. Me included. Now, going back to the educate trial, it was a really well-designed trial with different arms of learning styles. This design provided a balanced appraisal of methods of delivery of education that could be undertaken. Now, I believe that the educate trial represents the initial steps towards evidence-based education, and I feel that this will be necessary, especially in the era of exponentially expanding knowledge in all our respective fields of practice. Now, having said that, the educate trial looked only at electro at looking at learning of electrocardiograms, but remember the entire field of medicine and surgery is so extremely vast and the educational needs of one area of practice will be starkly or strikingly different from another area of practice. The educational needs of an internist will be different from that of a cardiologist, which will be different from that of a surgeon. And as you well know, you know, in the midst of your training within cardiology, the educational needs of the imaging specialist will be different from that of the interventionalist proceduralist, which will be different to that of the electrophysiologist proceduralist. Therefore, although I believe that the electronic learning interfaces will impact learning outcomes and competence of healthcare professionals, I think it needs to be studied. I think it would be most reasonable to also concede that the electronic learning environment

should, at this stage and in the foreseeable future, be viewed as a compliment and not as a replacement to the in-person learning environment and apprenticeship.

Dr. Anthony Kashou: Yeah, and I think you hit it to right outta the park in terms of we do need more evidence, we need to even refine, you know, we did our best with kind of putting our step first foot forward, but there's probably areas that we can improve that, but we need to assess this. And as you mentioned, until we could really bring that teacher into this online environment, and not probably an AI tool, but a real teacher that can ensure understanding we should use this as, you know, not so much a replacement, but as a valuable adjunct to it. And I think that's the same way we use a lot of these AI tools in medicine today or any other diagnostic method. Now, I can go on and on, but you know, the final question I have for you today, and we'll have to have you back to kind of continue with this discussion, but in what ways do you see that these technological advancements have kind of transformed this learning environment for healthcare education and mostly, you know, postgraduate education? Where do you see foresee it going in the future?

Dr. Nandan Anavekar: Yeah, I mean, I think that's a, I think again, a, a another great question, and I think that it, we would all agree that technological advancements have, have really transformed the learning platforms into fast, easily accessible instruments with an interface that enhances the experience of the user. I suspect that the greatest innovation that I foresee will be the integration of AI into the interface to further customize the experience, to help the learner understand the gaps so that they can have a more focused approach to their education, meaning focusing on areas that they need to master in order to practice proficiently rather than generically covering all topics with equal emphasis. Now, I think that having an interface that directly meets the unique needs of each unique user, in my opinion, should be the goal. And I genuinely believe that integration of AI into these electronic environments will bring us closer to that goal. I mean, imagine, you know, if, if, if I have a refined practice and, and I work mostly in the pericardial disease area, aortic disease area, and infective endocarditis, and if, if this is really gonna be the bulk of of patients that I'm gonna be looking after, I would be thrilled if I could have a unique educational experience that keeps me up to date in these areas of my practice so that I can always bring the, the frontier of my practice to my patients. And I, I think that makes it a practical educational experience. But having said that, again, that's, that's my opinion. I, I think that education should always be practical and usable and its usability should be in real time. I, I think we should move away from the concept of preparing for a test and being, having encyclopedic knowledge at the time of a test and then being certified for x number of years after that. I, I think that, that our education should be interwoven and integrated into our daily lives without being onerous or cumbersome. And I'm hoping that, that with these electronic interfaces, that that, that, especially with integration of ai, that this can be truly and genuinely a part of our daily work routine.

Dr. Anthony Kashou: Wow. And you know, well said and you just kinda showed there's so much room, but I think, you know, we could see the vision. It's just a matter of us getting there. And thank you so much. Now, today we really navigated this growing world of online learning, this e-learning environment. We explored the accessibility, the flexibility, the impact on healthcare professionals. We focused on the

postgraduate education and area that still has a lot of areas to grow from. We looked at the challenges and limitations, but also glimpse that exciting future that is certainly gonna be there as we end this episode. The message is clear. Online learning is a powerful wave, transforming healthcare education, offering opportunities for continuous learning and the ability to improve our patient care and continue to stay up to date. A sincere thank you to Dr. Anavekar someone I look forward to speaking to, I grow a lot from, thank you for joining us again. I hope we'll have you back and continue this discussion as we navigate this transformative landscape.

Dr. Nandan Anavekar: Thanks so much, Anthony, for the chance. And again, you know, I working with you, you know, you, you, you and I have a long history and passion for education. I am inspired by everything that you do. I dunno where you get the time to do everything that you do. And again, to, to all the learners out there, just, you know, we we're all part of the same group and, and community and I look forward to, you know, reaching out and, and and corresponding with you too.

Dr. Anthony Kashou: Thank you so much.

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