



A Special Podcast from *Clinical Chemistry*:
Adaptive learning and medical education.

Guest:

Dr. Ulrik Juul Christensen is the Chairman of the Board of Area9 Learning, and a member of the Executive Management Team of McGraw-Hill Education.

Bob Barrett:

This is a special podcast from *Clinical Chemistry*, sponsored by the Department of Laboratory Medicine at Boston Children's Hospital. I am Bob Barrett.

Recently, the *New England Journal of Medicine* partnered with Area9 Learning, a physician-led pioneer in adaptive learning, to create a platform with smart technology that adapts to clinicians' learning goals and knowledge gaps to deliver the information they need to know.

Dr. Ulrik Juul Christensen is the Chairman of the Board of Area9 Learning, and a member of the Executive Management Team of McGraw-Hill Education. In addition to being trained as a physician, he is an expert in learning technology, having pioneered advancements in adaptive learning, data-driven content development, computer simulation, and debriefing technologies. He is our guest in this special podcast from *Clinical Chemistry*.

Doctor, what trends do you see that will change medical education in the coming decade?

Dr. Ulrik Juul Christensen:

So over the last 20 years or so we have been looking at how education could interact with avoiding human errors. And I think that we are finally beginning to see some major trends that could impact that. And a lot of it is rooted in very fundamental education that goes way back into pre-graduate education.

Bob Barrett:

Given your background in medicine and medical education, what can be learned from the research you've done in these and in other areas of interest?

Dr. Ulrik Juul Christensen:

I think there are a number of different things. The first one is that--what I sometimes refer to the mountain of stuff, so all the -- just the sheer amount of stuff that we are trying to teach people and we as individuals and professionals try to learn, is often getting in the way of storing it in an efficient way.

So both when we're originally trying to learn it but also when we are designing curricula for people who are to learn it, we have to be more mindful or we can probably benefit from being more mindful about the fact that there is a limited absorption capacity or a limited pace by which we can learn. And I think one of the most important things we've seen over the last years is that we're not very realistic about what we are capable of accomplishing in the educational system.

Bob Barrett: What about technology, what is its role in medical education moving forward?

Dr. Ulrik Juul Christensen: So the biggest advances we've made have actually been right before we reach medical education. So in higher education we've transformed, with technology, a lot of educational programs through growing, through introducing adaptive learning, that is able to filter out some of the unnecessary practice, focusing learners who are not very good at deciding what they should focus on, where they should spend their efforts, and we've also found that we, with advanced technology, are capable of making them better learners.

Bob Barrett: How far down that path have we already traveled?

Dr. Ulrik Juul Christensen: In terms of medicine, we're not very far. We are further with the foundation subjects like microbiology, biology, physiology, anatomy and that kind of things, we're quite far there.

In terms of the more specialized medical areas we are not that far. The only example of adaptive learning in medicine currently is *New England Journal of Medicine's* new Maintenance of Certification credit platform called Knowledge +. That one was quite an ambitious project when they started out, but it has turned out to be a much greater success than even I hoped.

Bob Barrett: Doctor, what are the biggest barriers to more efficient learning?

Dr. Ulrik Juul Christensen: That's actually a really good question. The most important one, I think, is the ability to filter between important and unimportant, but that has a number of different faces that shows each of their ugly heads at different phases of learning.

So when you learn something the first time, it's great if you are capable of soon figuring out, what I am

reading right now and I have seen for the first time, "this is probably not very important," or "now this is really important, I really have to fit that in to the semantic framework in my head so I can find it later when I need it."

But two weeks or four weeks later it's also really important to be able to have that -- the technical term is metacognitive skill--to be able to look back and say, this thing back there, I really didn't get but I could really benefit from looking at this again now. I am trying to understand that, or comprehend that at even deeper level, because of what I'm doing now I could really benefit from it.

Great learners are really good at this, weaker learners or slower learners, are not very good at it. The technical term is deliberate practice, or it's been proposed to look at this as a matter of deliberate practice. How good are you at practicing the things you do not yet master?

Bob Barrett:

As we move forward, what will the costs be? What costs are involved, and will advanced tools eventually pay for themselves?

Dr. Ulrik Juul Christensen:

I think it depends on how you look at it. But I think there is a resounding yes, but it depends on what you count in as "paying for it."

So if you look at it from an individual learner's perspective, of some of the advanced technologies that we have done research in and pioneered over the last years definitely brings an enormous efficiency to learning something, particularly if it's larger areas like it is in medicine.

So the amount of time you save, if you factor that in, yes, they will pay for themselves. If you think your time is free, they don't necessarily, not straight away at least.

If you look at it from an educational system perspective, we know already now that they more than pay off, or pay for themselves, simply because of the reduction of failure rates, or people who don't learn as they need to.

So we know in higher education we can reduce the failure rates by about one-third, which is a massive impact, that means that in two or three decades if we did this throughout the entire educational system

we could probably address the fundamental problem of 1.3, 1.4 trillion dollars of educational debt.

So in terms of the economics of this, if you just factor in the appropriate contributions to value, I am absolutely convinced that they can pay for themselves simply because they are capable of using some relatively -- or some time that is not used very efficiently today and use that in a highly, highly efficient way.

Bob Barrett: Preventing errors in medicine and the laboratory in particular is an ongoing endeavor. Are there any effects of more efficient learning on human factors or human errors?

Dr. Ulrik Juul Christensen: That's interesting, that's where we started 20 years ago. We were thinking that we should look at this as a "human factors" problem not as an educational problem. What became clear over the following decade was that it was a combination of things. It was both the human factors and human errors as basically we know from aviation where it's really, really important that you collaborate with your teammates, that you build checklists, that you think about the world as something where we're not perfect and we will make errors and we have to be tolerant to human errors.

But it also became clear through trying to address all these issues that there was a very, very big educational component of this, where we were building simulation environments where doctors and nurses, OR teams, ER teams, military, emergency medicine, response teams, they were practicing how to become better teams. We can also see how much of the time we were spending on knowledge.

So we actually got into all the advanced technologies that are currently changing K through 16 or 17, how they changing that world of education, they came out of trying to understand how do we get people to post-gradually improve, and the key to this is education. It has changed the way we learn things in the first place, it is to make people better learners or students better learners, help them navigate through the mountain of stuff. All these things we throw at them, that where they get lost and they don't know what's up.

Bob Barrett: What would be the best way to improve someone as a learner, teaching them to get to the top of that

mountain of stuff, or teaching them how to cut it down to size so it's not so big?

Dr. Ulrik Juul Christensen: That's a simple answer. The most important single factor you can improve is getting better at knowing what you don't know.

So, a very concrete example is that in the adaptive systems we invented about a decade ago, we introduced the concept of asking you how certain you are about your answers. This simple thing of constantly figuring out, do I really know this or am I guessing or am I like in that unknown territory?

If we can -- we know now that we can, but we thought back then, if we could make them better and faster at figuring out that they don't know this, we've actually moved them from being unconsciously incompetent which is pretty dangerous, into at least a zone of being consciously incompetent, so that they are in the learning zone where they are able to improve.

That thing alone, of being consciously incompetent knowing that I still need to learn something and it's *this* I need to learn, is really, really powerful.

Bob Barrett: Finally doctor, I am going to bring it back to us: how can a journal like *Clinical Chemistry* contribute best to the next generation of medical education?

Dr. Ulrik Juul Christensen: I think it's very important for all of us who are involved in delivering information, and thus contributing to the mountain of stuff, that we see it as part of our responsibility to help students and learners integrate this into the rest of their world.

So I think a journal like *Clinical Chemistry* and the societies around it are able to contribute and help all the stakeholders, if you take a more active, or if you are assuming more active role, in not only communicating this one-way, in other words in the classic publishing paradigm that you put things on print then you send it out in an envelope and hope people will absorb it, but actually take responsibility for doing close loop and make sure that people actually are capable of learning and storing and ultimately retrieving the important things that a journal like *Clinical Chemistry* is bringing in every issue.

Bob Barrett: Dr. Ulrik Juul Christensen is the Chairman of the Board of Area9 Learning, and a member of the

Executive Management Team of McGraw-Hill
Education.

He has been our guest in this special podcast from
Clinical Chemistry on adaptive learning.

I am Bob Barrett. Thanks for listening!