



## Forging Effective Learning with Bror Saxberg

### Leading Learning Podcast Transcript for Episode 343

**Bror Saxberg:** [00:00:00] The way motivation was defined was do people start, persist, and put in mental effort? And it's important to highlight the word "like" does not appear in that set of things, right? Often, people think motivating somebody is about getting them to like what they're doing. In fact, no, that's actually not connected to learning.

**Celisa Steele:** [00:00:26] I'm Celisa Steele.

**Jeff Cobbs:** [00:00:27] I'm Jeff Cobb, and this is the Leading Learning Podcast. Welcome to episode 343, which features a conversation with Dr. Bror Saxberg. Bror is passionate about learning engineering and focuses on applying what's known about learning science and learning measurement at scale to the practical business of making effective, efficient, usable, and graceful learning environments that get learners the outcomes they need to be successful. Bror is richly and wonderfully experienced in the world of learning, having served as the chief learning officer and co-founder of K12 Inc., the chief learning officer of Kaplan, and the head of learning sciences at the Chan Zuckerberg Initiative. Most recently, he's the founder of LearningForge, a learning engineering consultancy that helps organizations think creatively about applying learning development and motivation science to their products, services, and strategies. Bror and Celisa talk about learning engineering, the components of expertise, cognitive task analysis, a model of motivation, evidence-centered design, and more. They spoke in November 2022.

**Celisa Steele:** [00:01:50] Reading up a little bit about your background, I was struck by the fact that you're a doctor doctor. Is that right?

**Bror Saxberg:** [00:01:57] Yes. Well, this is because I began life as a pure researcher. I'm an MD PhD. I used to do human and machine vision research at MIT's Artificial Intelligence Laboratory back in the 1980s, "before fire, before the iPhone," as my daughter likes to say. She's never sure which came first. But it was a long time ago, let's put it that way. And I am an engineer. And so, over time, I just got really interested in that question of—how do you use

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what we know about human minds, human learning to do something real at scale? And that's really what I've been about ever since then. The fact that I'm an M.D., it's interesting. Medicine, if you like, is an engineering branch of human biological sciences. It's amazing how much we've learned about human disease, human biology, and all that. But medicine is the effort to use that in ways that create practical solutions at scale. And so, there are decades-long series of research articles in journals like the *Journal of the American Medical Association* or *The New England Journal of Medicine*, which are basically bedside research. It's not laboratory petri dish research. It's actually work at the bedside to see—does this insight from the sciences lead to something valuable at the bedside? And, in fact, we don't have that much of that going on in learning where there are journals and professionals who are literally looking at evidence-gathering and checking closely at what works for whom and when, when we're applying an education intervention, whether it's a technology-based intervention or whether it's just simply a change in practice to try to help teach kids how to add fractions like denominators, or how to become kids who are excited by mathematics, or for adults. As many of your listeners are thinking about, you know, how do you help adults begin to recognize that they can become something different? They should have those aspirations. And how do you give them the right sets of skills and attitudes to become top performers in the fields they want to enter, not just simply average performers?

**Celisa Steele:** [00:04:11] That might that be a good place to then talk about expertise because I know that's an area that you've given some focus in your work, and you really point to that importance of understanding expertise and then feeding that understanding into how we design and develop learning environments and learning experiences. So would you just share a little bit about the components of expertise, and how we can go about defining expertise?

**Bror Saxberg:** [00:04:37] Yes, happy to. It's one of the more remarkable results of a lot of cognitive science research over the last, honestly, 50 years now, maybe more; is how expert minds seem to be organized. And it's not the way most of us think. And it's a real problem actually for learners, but also developers. The way this came about was in the 1960s; people were starting to create expert systems, and there were some being created in the world of medicine. Things like, "Hey, let's create an expert system that can diagnose infectious diseases. How hard can this be, right? We get some infectious disease experts. We sit them down. They describe how they do their work. We code that up. And look at that—we've altered human health for the rest of history. Whoo-hoo! Our work will be done. We can go for lunch." Well, what they discovered as they had these experts, you know, supposedly unspooled how their expertise works is experts didn't actually have a very good verbal understanding of how they made decisions. Now, at first blush, it's like, "Wait, these people don't know what they're

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doing; what's going on?" But, in fact, that's not the case that their minds as a bag of neurons, having become expert, have a huge amount of patterns, processes, and signal detection things that are hardwired into long-term memory.

**Bror Saxberg:** [00:05:57] But it basically disappeared from verbal awareness. So their brains nudge them, show them, and get them to do the next thing. And they don't necessarily know that that's what's happening in a verbal way because our verbal capacities tend to be in what's called "working memory," which is the part of our minds that does very complex problem-solving, uses language. It's quite slow, but it is the most creative part that we need to use for hard problems and such. Long-term memory, which is where expertise gets stashed as you do repeated practice and feedback, is very fast, can do multiple things in parallel compared to working memory, but it's not verbally very accessible at all. What this means is that you have to do real work to unpack how top performers decide and do what they do. And real work does not mean just give them a pen or a keyboard and ask them to start typing lessons. Now, I have to say that an awful lot of teaching and training materials and training environments are basically created by trusting that all we need are experts, and then they will figure it out, and we don't do the next step. And that's where the cognitive scientists from the '60s forward figured out they had to do some really careful interviewing work and watching experts actually make decisions and think aloud as they did them to unpack a lot more of what a top-performing mind does.

**Bror Saxberg:** [00:07:29] There's a collection of approaches to this called "cognitive task analysis" that people like Richard Clark have spent decades perfecting and using in many circumstances. That helps you get sort of 70 to 80 percent of what a top performer's mind is doing, compared to less than 30 percent that's just letting a top performer talk or teach actually uncovers. So you can make dramatic performance improvements that way. And there have been empirical studies of this showing really major changes in the outcomes of training for that. What does this mean for folks who are interested in trying to help learners switch careers, get better at their own careers, and so forth? It means you have to actually be a bit humble about how you're coming up with the outcomes you're after, and you have to have a bit of a wide lens for this. If you're trying to do your best work, meaning, help your learners accelerate the most in their careers after your training program, you should not restrict yourself to textbooks or to standardized curriculum and just digitizing those things because those were not built by deeply understanding what top performers decide and do. And that's both within the domain.

**Bror Saxberg:** [00:08:43] But also, top performers often have a range of time management and communication skills that are not well-articulated within the domain-centric training manuals

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and training books that have already been created. And yet, that ability to manage time to communicate with a wide array of different professionals in the workforce, that can be just as important to a professional success as anything that they have in long-term memory about their domain expertise. So it really means one way or the other—either going all the way to doing cognitive task analyzes, which are pretty intense and take a lot of effort on top performers' parts, and so forth. But again, I'm an engineer, right? So if you can't do that, can you back off and, at least, engage well-trained instructional designers in talking with top performers to understand—why did you do this and why that—as opposed to just assuming that they've already described everything there is to know about it? So that's kind of how you think about expertise. And it is the starting point. If you don't have the outcomes you want laid out, what do you want learners to decide and do at the end of this that will lead them forward to the goals they aspire to?

**Bror Saxberg:** [00:09:58] Well, then, all the rest of it—the evidence-gathering, the practice and feedback, the work examples—you're going to miss your target even if you do good design for the rest of it. So outcomes are really important. I don't think we spend enough time on doing that. And the last piece on this is that expertise is changing faster and faster. In the Middle Ages, if you were lucky enough to become a grandparent and you handed your stone masonry tools off to your grandkids, they were grateful because they were the same tools that you used, and you have the same tools they're using. And they could use that to continue building the same cathedral you've been working on for a hundred years. Well, these days you go a couple of years and there are new tools, new technologies, and new pieces of software that top performers actually need and are using to do even better work, which means you can't just train in your 20s to be good at something and then rely on that for 40 years and retire. You've got to be in a continuous improvement model. So how are we providing the right continuous improvement? Well, we've got to figure out what is the latest work that top performers are doing and then build that into our continuous training environments.

**Celisa Steele:** [00:11:18] I really appreciate those last couple of points. One around how expertise is evolving more than ever. And, also, the point around that cognitive task analysis, which is so expensive in terms of time and money, and just the effort involved. And so, I think you began to get at it a little bit, but maybe just talk for a minute about—when does it make sense to do cognitive task analysis versus when would you potentially try to take a lighter and, perhaps, more agile approach to understanding expertise in a particular domain?

**Bror Saxberg:** [00:11:52] This is where learning engineering is a design exercise. There is a certain amount of art and intuition that you have to bring to bear to try and solve real-world

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problems and decide which are the right techniques and how many resources to apply to different things. To me, at one level, it's not that hard. You know, what's not going well? Talk to employers, talk to employees who've now just left. If you have existing training programs or any existing training programs, and ask them—what was the hardest thing in your first year on the job? And it's a way of unpacking, even at top level, what there is. When I was at Kaplan, we did a cognitive task analysis of paralegals. We didn't go all the way through the detailed parts of it, but we did enough to see that something like half of the things that top-performing paralegals did in their jobs were not at all trained on in standard textbook materials that were used in the paralegal training community. This is true in all kinds of professions and explains why for nurses, lawyers, paralegals, and all kinds of people—when they move from their training program into a job—it's often a very bumpy first year.

**Bror Saxberg:** [00:13:10] And the reason is because they weren't actually trained to do the current job. Some healthcare environments find themselves spending an enormous amount of resources retraining healthcare workers who are trained on ways to do healthcare that are 10 years old. And so, when they come in, they're not clueless but helpless in the sense of, "Wait, what's all this?" Now it's the companies that have to engage in major retraining of these folks. So that's what I would do, I would look to see what are the hardest, most important things that seem to be missing. And then those are the ones that you would go deeper on in terms of, "Okay, now wait a minute, how do top performers handle this piece, this outcome, this kind of decision?" And I would actually use that same kind of reasoning all the way through a learning engineering process where you're trying to think through, "Okay, how much effort do I put into designing, practice, and feedback?" "Do I actually go all the way to making a simulation for this thing?" "Or can I get away with a bit of a lecture, a couple of quiz questions, and move on?" And it's the same kind of thinking, which is, "Well, wait, what are the hardest, most important things?" And for that, call it 20 percent or whatever number you wish for that 10 percent of those outcomes.

**Bror Saxberg:** [00:14:25] Then go deep on really using learning science and the best methods you can come up with to do the practice, feedback, work examples, and all the rest. And then other parts that are easier to learn. It's okay; it's a tradeoff. Then you can use lighter-weight approaches to those. And then the last thing about this is you want to iterate. So we used to say this at Kaplan, "We want to celebrate success, but we're going to instrument for failure." So you want to instrument your learning environment so that you can find out—where is it not going well, and why? What part of the learning process did not go as intended? Because if there was something about where the software tools broke, that's very different than that the method wasn't a good method. And so, you want information about—what was the learner experience

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like in those places that didn't go well? And again, that's where you then bring in more of the learning science, more of the investment in doing this as well as you possibly can once you discover what's actually broken.

**Jeff Cobb:** [00:15:33] We're grateful to WBT Systems for sponsoring the Leading Learning Podcast. TopClass LMS provides the tools for you to become the preferred provider in your market, delivering value to learners at every stage of their working lives. WBT Systems' award-winning learning system enables delivery of impactful continuing education, professional development, and certification programs. The TopClass LMS team supports learning businesses in using integrated learning technology to gain greater understanding of learners' needs and behaviors, enhance engagement, aid recruitment and retention, and create and grow non-dues revenue streams. WBT Systems will work with you to truly understand your preferences, needs, and challenges to ensure that your experience with TopClass LMS is as easy and problem-free as possible. Visit [leadinglearning.com/topclass](http://leadinglearning.com/topclass) to learn how to generate value and growth for your learning business and to request a demo.

**Celisa Steele:** [00:16:33] I know motivation is another area where you've focused some effort. What is it that we know, at this point, about how motivation impacts learning?

**Bror Saxberg:** [00:16:45] Yes. Richard Clark was a very good cognitive scientist. As I mentioned before, he did a survey of a wide range of research literature to try to uncover what is it that causes people to not be motivated. And in this search, the way motivation was defined was do people start, persist, and put in mental effort? And it's important to highlight the word "like" does not appear in that set of things, right? Often, people think motivating somebody is about getting to like what they're doing. In fact, no, that's actually not connected to learning. In a way, the analogy is like working out on the weights or something, doing scales, or working at the bar as a dancer. You gain benefits whether you like doing that or not. The point is, are you starting, persisting, and putting in effort into a well-designed program? And you can hate the weights all you want, but by doing that, you are changing your muscles in that case. Well, it turns out learning is a bit the same way, which is, if you have a well-designed program, if you start, persist, and put in mental effort, you don't have to like every single part of it. Liking is one of the reasons to do it, but it's not the only reason.

**Bror Saxberg:** [00:18:04] So that's what he then did, was to have a good, long look at behavioral psychology, motivational psychology, cognitive psychology, behavioral economics, and some other areas. And your listeners can find this article by looking up Clark and Saxberg and Motivation. And he ended up with a really nice four-part model of what makes a difference to

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people's willingness to start, persist, and put in mental effort. So the first one is—do you value what you're doing and how you're doing it? If you're a dancer in an algebra class, you're thinking about Swan Lake. It's really tough to get your head around the algebra stuff. So what do you do in that case, if that's the problem? Well, there, you want to connect something that's exciting to you as a dancer with algebra, with what you're trying to learn. Is it a dance foundation? How much money does it need, modeling over time, and all that? So now you're doing algebra, and now you see the point. It really makes a difference. The second thing that goes wrong is that you just think you can't do it. Now, I'm another dancer in the same algebra class, but I'm no good at math. That's it. So if the math professor comes bustling up to me with dance foundations and all this, you're just making me miserable.

**Bror Saxberg:** [00:19:20] I know how important it is, but I can't do it. So, there, you need a different solution. You need to do things like show how you've already learned things that are not that different from this kind of math. Hear stories from others who, just like you, thought they couldn't do it, had your same background, and they did it. And how did they do it? That kind of thing. And then, make a plan. There may well be cognitive things that are missing that you need to get back to, to master in order to make progress, make a plan, and keep going from there. So that's the second thing that goes wrong. The third thing that goes wrong is you blame something in your environment. "My teacher hates me." "I can't understand this textbook." "Have you looked at this?" "I don't have any space to work." And the one that professionals love the most is "I don't have time." "Oh, it's valuable." "Oh, I could do it, but I just don't have time, so I don't start." "I don't persist." "I don't put in mental effort." Totally different, again, from the first two. And again, it's about helping to problem-solve around that, to say, let's look at your schedule in the case of a time thing, or let's look at what other spaces we might be able to find for you in a library, at home, or somewhere else.

**Bror Saxberg:** [00:20:31] And let's find other resources if the teacher is not a good one or the text is not a good one. So it's about showing there is a solution to this. The fourth category that he came up with out of his literature review, different completely than these other three, is probably the hardest to resolve, but it's really important, especially in these pandemic times, which is negative emotional states. If you're angry, scared, or grieving, it's really hard to start, persist, and put in mental effort into something that's challenging. Even if it's incredibly well designed, it's still hard to do. So you've got to kind of diagnose those four different things and then figure out—how can you help your learning environment, including teachers, trainers, software whatever, to help them diagnose and potentially intervene? So one of the ways—if you backup all the way back up again—what we really need to be doing is two kinds of design simultaneously for learning environments. One is cognitive design, and that's where you want

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to use learning sciences and understand—what is the research we have about specific outcomes or kinds of outcomes, the use of multimedia?

**Bror Saxberg:** [00:21:44] There are some great syntheses in places like Clark and Mayer's *e-Learning and the Science of Instruction* that show what are different research pieces that can guide you as an instructional design, to get the best cognitive design for learning. Yes, you want to do that and the outcomes design we talked about. But the other side is motivation design, and that involves—how do you detect that someone's having trouble not because of a cognitive issue but also because of a motivation issue? They just don't see the point, or they think they can't do it, or they think something's in their way, or they're just really bummed out for some reason. And so, the motivation design is just as important as cognitive design, in fact. That's what I think about motivation. And because it's the fuel for learning, you know, starting, persisting, and putting in mental effort—it is key. It's a really important part of design that is usually underappreciated by professionals and so forth. And one of the things that I find so encouraging out of the learning sciences as a whole is how optimistic it is. The evidence shows that brains change all through life and can be made to change dramatically. And so, we have this myth of talent where we think, "Oh, you know, I wish I were a good writer." "Oh, I wish I were good at math; it would make such a difference."

**Bror Saxberg:** [00:23:14] But aside from a few neurological issues around dyslexia, or dyscalculia, or some organic things; for the most part, if you can start, persist, and put in mental effort into a well-designed learning program that starts from where you are and heads to important outcomes, you can get there. Now, some folks may take a lot of repetitions to get there, and some folks may take fewer repetitions to get there, but you can actually get there. This is one of the funny things thinking about this as an adult is, you know, the evidence says instead of saying, "Oh, I wish I were a good X," whether that is a writer, a singer, or whatever it is, you've got to look yourself in the mirror in the morning and ask the question, "How come I don't care enough to become a good X?" Whatever that X is. Because you've got the machinery; if you will start, persist, put in the mental effort, and find a good learning environment that actually matches where you are and what you're trying to get to.

**Celisa Steele:** [00:24:26] I think that's fascinating. And, as you said yourself, it does seem like the motivation side really does tend to be neglected. And yet, it's incredibly powerful because, as you're saying, you can have this well-designed learning environment, learning experience. But if the learner doesn't have the motivation, they're not going to start, or they're not going to persist, or they're not going to put in the mental effort, and then it's sort of all for naught. So really beginning to think about what you, as a learning business, can do to support the

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motivation for learners seems incredibly valuable, incredibly important. So I'm glad you impact that for us.

**Bror Saxberg:** [00:25:01] I'd also say there's another piece of this where cognition and motivation do intersect. Definitely. And one of the areas is if you're getting a learner to start something that's new and complicated, that is really new to them, like learning to write persuasively, let's say, and they've never mastered that, right? It's very important, both for motivation reasons as well as cognitive reasons, to try to draw on contexts that are highly familiar and highly valued from a motivation standpoint. I know I need to write persuasively about this thing because I care a lot about it and I see the problem. So that's the motivation side. But it's also a cognition side. In other words, if it's an area I care a lot about and know a lot about, then a lot of the information about the situation is already in long-term memory, which means—and this is one of these cognitive science things that's surprising—it's essentially free. That is, things that are in long-term memory do not feel like effort at all to use; what's effortful is working memories trying to create or learn something new or wrap its little narrow mind around—"How do I write persuasively about this thing that I know a lot about?" And what I think we often miss when we're designing learning environments—especially when we're trying to get people to switch careers, change gears, and so forth—is that if you can give them context to get started with that's highly familiar, then they only have one thing they're trying to do, which is "I got to learn to write persuasively, and that's really hard, and I need a lot of practice and feedback."

**Bror Saxberg:** [00:26:38] If you give that same context to somebody who knows nothing about the context, you've given them two hard problems to solve in one narrow working memory. And so, you want to try to get the context to match the learners more. And this, to me, is part of where technology may have a nice role, which is to understand different learners' contexts, their interests. Use those as the starting points, the springboards for mastering complex cognitive skills. And once you start to master those complex cognitive skills, now you can use those to probe new contexts. So you kind of go back and forth between these two different sides—familiar contexts, unfamiliar skills—and then use the familiar skills to explore unfamiliar contexts. And off you go.

**Celisa Steele:** [00:27:23] I think that's a great point. Because, as you're saying, if you can just focus on one new task, then you're limiting that extraneous cognitive load, which is helping on one side. And then you're also tapping into the motivation piece because you're tapping into something they already know and care about. So that makes a lot of sense. I know that you wrote the preface for the *Learning Engineering Toolkit*. And so, in that preface that you wrote --

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and I had the good fortune of getting to talk with Jim Goodell for the podcast earlier, but I know that you assert that learning engineering should be guided but not limited to research and practice. So I was just hoping to get you to talk a little bit about—what, beyond research and practice, should be guiding our use of learning engineering and how we're designing experiences?

**Bror Saxberg:** [00:28:15] Yes, a couple of things. In a sense, the best engineering is always standing on the shoulders of prior practice and prior research, but you have to look at the exact context you're in and what's going on now in this environment to get the best kind of solution. And sometimes you're just going to have to make a bit of a leap. And it has more to do with kind of design and creation consistent with prior practice and prior research, but maybe not ever done like that before. Again, this is true in all kinds of design and engineering work. You really need to design inclusively. In other words, work with the folks who are going to be the most affected by what you're putting together. Don't sit in your conference room and imagine what it's like to be a learner who's working full-time, has a family, and is now trying to change jobs. It's like, let's get some of those in the room before we even start and begin to understand, okay, what is their context? What are they most worried about as you begin the design process? And it is amazing how much you learn from that. Same thing with teachers, trainers, and professionals. If you've got humans in the loop as well, you want them in that same room early on, listening to learners because, often, teachers, professors, and trainers just do that. They may not have listened deeply to their learners, maybe ever. And in some of the inclusive design processes I've been involved in, it is a surprise to all the professionals in the room—whether they're instructional designers or teachers—what they hear from the actual learners about what works and doesn't work, what excites them and what they hate about learning experiences. And that productive conversation where you then share, also, the learning sciences and motivation sciences, you share it with everyone so that everyone begins to have all the pieces on the table.

**Bror Saxberg:** [00:30:15] And then you begin to say, now, what, then, could be practical solutions that you all really feel like you could actually dig into, you could implement in your world? You'd enjoy all that, and then you begin to pilot. You begin to rapidly pilot and iterate in these kinds of agile ways that you do things. You're not copying and pasting from a previous exercise. In fact, I think about learning engineering, you know, a lot of learning work. I think too much has drawn on a kind of software engineering model where the goal is to make a great training program, a great textbook, or a great media experience, and then copy the heck out of it and get everyone to use it. And that works for Excel. It works for Facebook. It works for Google. It works for all kinds of software tools. But there's another engineering tradition that's really

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different; it's the civil engineering tradition. If I'm going to build a bridge across the Potomac River, I do not copy and paste a bridge across the Thames. That doesn't make any sense. That's total malpractice. What do you do as a civil engineer? Well, you go to the Potomac River and bring with you a toolkit of context variables that you're after—the soil structure, the water levels, and, of course, the usage.

**Bror Saxberg:** [00:31:32] Who's going to be on this bridge? What times of day, and all that? And it's not just on the day you visit; it's for the next 20 years. How does it vary? 30 years. How does it vary, and all that? Once you have all that context, you can now begin to design the bridge. But one interesting thing about this is that you don't have to put a steel forge onto the bank of the Potomac and start producing new steel. You don't have to do that. What you know how to do is create specifications of the steel you need, the shapes you need, and you can then start to make your design and assemble your design, mostly from parts that exist and that you can then pull in. Now you still have to do some custom stuff. You always have to pour your own footings for the bridge. That's custom work. But a lot of the rest of it is putting together pieces that you understand how they fit into this context. And so, to me, that's part of what we need to be doing is thinking about the context in which learners work and then start to assemble parts of solutions based on where have they worked before. So all of this ends up being more than just copying and pasting a single solution from one place to another. It is about being informed by what's happened before, including the parts and pieces. But then you have to do your own work in that context.

**Celisa Steele:** [00:32:51] And you've mentioned it a couple of times, the importance of iteration in the learning engineering process. And so what do you see as being the effective parts of iterating well?

**Bror Saxberg:** [00:33:03] Well, a couple of things. One is just where we started from, which is, have you even clearly defined the outcomes you're after? Do you actually properly have a clue of whether or not you're going to achieve what you're after? And it is surprising how often outcomes are either backward, mapped to a textbook or something else, or they are poorly framed in the sense that the student should know X, Y, or Z. Well, that's not objective. You can't tell what that means. And so, the first step is do you have your outcomes laid out in a way that is about what students can decide and do. That, then, naturally leads you to evidence-gathering, where you can then look to see, well, they decided to do these things. And like I said before, you really want an instrument for failure, meaning not just, "Nope, they can't do algebra." It's like, "Wait, wait, wait. That's not helpful. I can't iterate based on that, even though that's what a lot of test scores will do." I need to know which parts of this and where are their failures that

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are happening along the way. Is it failures of reasoning? Is it failures of calculation or computation? Is it time issues? Is this something completely outside the academic piece where they're just totally distracted or depressed, as we talked about earlier, and so they can't get their work done, right? And so, you need multiple sources of evidence connected to your outcomes, connected to motivation, to then be able to look to see, for whom is this going well?

**Bror Saxberg:** [00:34:35] And I say that because, often, in the learning world, we tend to kind of group everyone together and ask, "Did it work?" It's like, "No, who did it work for," and when? is a much better context-framed question. You don't want to lose the fact that it did work for a subset of users, because then it's like, wait, wait, don't throw the baby out with the bathwater. Keep that. Then you want to look at the ones who did not succeed and try to figure out, okay, what's up with that? What is it about them—their experience, even their background, or their motivation? And that's where you then start to do interventions. And now you are measuring and iterating on a subset because you've already found folks who are actually doing fine, and you don't need to mess with that success. So that notion of taking apart the context in which learning is happening, having good enough evidence, and then being willing to make evidence-based changes, and then see if that's actually helping it both on a cognitive side and a motivation side.

**Celisa Steele:** [00:35:35] This just reminded me of the success case method, and we were lucky to have Rob Brinkerhoff on the podcast earlier as well. But that idea of looking at who is it working for, and what does that tell you? And then, also, looking at who is it not working for? Rather than having this monolithic approach to outcomes and how it's working or not.

**Bror Saxberg:** [00:35:55] I'd add one more thing to that. Just it's too easy, I think, also, to focus on the learner as if the learner is the only important thing in this whole situation. So what's wrong with the learner? What's happening with the learner? In fact, context can be way more than the learner. It's like, where is this learner learning? Who else is there? What are the trainers like? What are their peers like? What are those interactions like? There could be things that are outside the learner that are just as powerful to help the learner if you make changes to them as things that are, somehow, targeting directly to the learner. So you actually want to think about this context as more than just variables from the learner. It's also, what's around that learner? What's the whole learning environment that the learner is experiencing?

**Celisa Steele:** [00:36:51] Big picture, when you think about the current state of learning ecosystems, how would you describe the current state—what's working well, what isn't working well, or what is still poorly understood or misunderstood at this point?

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**Bror Saxberg:** [00:37:06] I'll offer a couple of thoughts here, and I'll start that all these learning and training ecosystems worldwide, really, honestly, from pre-K all the way up, maybe postmortem training is working okay, you know. Basically, all of it has this same problem, which is that it's not evidence-grounded. And whether you're an investor, a teacher, a parent, a learner, him or herself, an administrator, or a trainer, people just don't have evidence-based groundings on how learning and motivation work. As I mentioned, I'm an MD PhD, so let's compare and contrast with the situation in medicine. The pandemic is a really nice forcing function. I use the term "force" advisedly. Everyone got kicked off the cliff on multiple directions, right? Well, what's interesting is that on the healthcare side, it's total disaster in many ways. But all the solution-making and efforts forward—almost all of them—were inside the guardrails of evidence-based practice. I don't know about you or your listeners, but I heard nobody demanding a return to animal sacrifices. Those were the good old days. Can we start doing randomized controlled trials on animal sacrifices? Because that's how we used to do all these things. No, that's ridiculous. Even vaccine deniers were typically working on the same mythology.

**Bror Saxberg:** [00:38:37] The story of the immune system is, "Hey, I got invisible attackers; I've got invisible defenders in my body, but they're not able to do it on their own. I've got to inject some invisible help to help those invisible defenders against the invisible attackers." Will you, Celisa, give me four billion dollars for a story like that? It just sounds dumb when you put it that way, right? It actually does echo the evidence of how this all works. And so, even vaccine deniers, for the most part, would be saying things like, "I don't think this has been tested long enough" or "I want to inject other invisible things." But they stayed inside these guardrails of a story. You could call it a mythology, but call it a story of healthcare that's grounded in evidence. Now, look at the education training pandemic, everyone gets kicked off the cliff into virtual learning. But there were no evidence-based guardrails. So people just did all kinds of things in lots of videos, or maybe it's just talk rooms and we talk to each other. Or maybe I can just duplicate my lectures online. And none of it was grounded in evidence. Even what we've been talking about on this podcast about how learning works—working memory and long-term memory, and the practice and feedback needed to move things into long-term memory or motivation.

**Bror Saxberg:** [00:39:57] Motivation was a huge failure point for all of this education pandemic. So, to me, that's one of the biggest issues with our ecosystem right now, which is that we don't have a shared story of learning that is optimistic and positive; like I talked about earlier, that suggests if you want to get there, you probably can. You just need to sweat like crazy and you

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need to find the learning environments that will get you there, but you can get there. And then, what is a good learning environment for you? Well, okay, we have none of those stories, and the same thing—investors, publishers, and all these other folks—they don't start from learning engineering; they don't start from a deep understanding of how learning works. Imagine if our entire healthcare apparatus was still built on the four humors. We had all this research sitting everywhere about bugs, viruses, degenerative diseases, and molecular biology. But, no. Medical schools, we do the four humors. That's what we do. Can you imagine what kind of decision-making there would be? Because those are the people who go out and make decisions. The researchers are off in their labs doing stuff, but you need an engineering wing that is grounded on the research in some ways, and that can also help teach venture capitalists, managers, and teachers this common grounding.

**Bror Saxberg:** [00:41:30] This is a joke: A neurosurgeon and a psychiatrist walk into a bar, okay? I'm not going to complete the joke. But the point is that they can talk about medicine because they actually have a shared story of how human bodies function, molecular biology, disease, cancer, and all kinds of things. Now, each of them has deep specialties that the other one isn't going to understand. But, boy, there's a really rich common layer that they can use to learn about each other's work or to talk about a different health issue that's going on. We do not have that kind of evidence-grounded layer for the whole ecosystem. I think another thing that is missing in ecosystems as a whole is not doing what I said earlier, which is deeply instrumenting and iterating, you know, being very careful about multiple lines of evidence. I think people are beginning to understand this, but over time, there was too much emphasis on trying to build the one perfect assessment, the one perfect way to tell if somebody is good at this thing. And, in fact, that's not how this can work at all.

**Bror Saxberg:** [00:42:39] Bob Mislevy from ETS and some colleagues created a whole way of thinking about measuring learning that's called "evidence-centered design." And what they pointed out is that if you have an invisible, complex cognitive structure that you're trying to probe, you need to use multiple lines of evidence in order to see—is this brain actually different in the way we hoped it would be? That a single line of evidence is very likely to lead you astray. Because then, people will just manipulate that one line of evidence. If you look at near-term outcomes, but also longer-term outcomes and multiple kinds, if this brain were good at this thing, what should be happening in the workplace? What tasks should be different, and how would we know? How would other colleagues react to them? When you put together multiple lines of evidence, now you can begin to get information relevant to that construct, and you're less likely to make the mistake of pushing on just one line of evidence and not realizing we missed some of the most important things. And so, I think people are not thinking holistically

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enough about the evidence that they should be gathering. The third thing relates to what we talked about before; I think we have underinvested in understanding motivation. And, to me, that ties into issues of identity, issues of long-term memory and context, and all kinds of things that connect up to cognition.

**Bror Saxberg:** [00:44:08] But just also that notion, we need to get all our citizens around the globe, at all ages, to get excited about starting, persisting, and putting in mental effort into new things that they want to do, as opposed to feeling like, “I can’t do that.” “I’m too old.” “I’m not smart enough.” Or, “I wish I could, but I can’t.” We need that fuel as well as better learning environments to actually power us forward as humanity, especially as things like artificial intelligence and various technologies begin to snap up what used to be simple, still complex, but relatively simple cognitive tasks, which we should no longer have people doing. So we’ve got to get people more things that they need to do. The research suggests it takes about ten years of really intense, deliberate practice—you’ve probably heard about the 10-year rule—in order to become world-class. And there are many examples of that in many different careers. So that’s cool. Now we’re all going to live to be 80, 90, or 100 years old. So if we start, let’s say, at 20—don’t even start at 10, start at 20. That means each person could build six or seven world-class competencies.

**Bror Saxberg:** [00:45:25] Now, you could spend it all on one, but what’s interesting to me is the combination. So here we go. You start, and you’re a gardener, and so you build competence as a gardener. At the same time, you’re taking classes in robotics. So, now, you start to build a robotics expertise. Now you can start doing robotic gardening, right? At the same time, you start to build business expertise, and now you can put together one of the world’s best robotic gardening businesses, lower variable costs, and all that. And finally, because some robots are going to use shears to hurt somebody, you’re going to need some real expertise in law. So you build the legal expertise to create the defense that you need, and so forth. For expertise, it will take you 40 years. But think about it; you’re unique. You are not replaceable by an AI. And do the combinatorics; there are hundreds of expertise. Just multiply hundreds times hundreds. You’ve got a unique fingerprint of expertise for each human being on the planet. That’s only a thought experiment. But it’s a way forward to explain why we need to get better at being able to change our competencies. We need to have the motivation to do that throughout life, and then we can start to create really interesting career paths and progressions for each of us over the long term.

**Celisa Steele:** [00:46:47] Well, that is fascinating, and I do love that idea of the different combinations, the potential to develop expertise in these multiple areas, develop this unique

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fingerprint of expertise, and that when you pair that or perhaps put it up against AI, it gives a compelling reason for why humans can continue to do certain things.

**Bror Saxberg:** [00:47:07] I think your word “pairing” is exactly right because that’s how this technology always is going to work; it’s going to be people using technology for what it’s really good at, but then doing something new with that. And that’s where these multiple expertizes crashing together inside a single human brain can begin to create new opportunities and new ways of making use of the technologies as they continue to expand.

**Jeff Cobb:** [00:47:39] Bror Saxberg is the founder of LearningForge, a learning engineering consultancy. You’ll find a link to the LearningForge Web site in the show notes for this episode at [leadinglearning.com/episode343](http://leadinglearning.com/episode343).

**Celisa Steele:** [00:47:53] If you enjoyed this episode or the podcast in general, we’d be grateful if you would take a moment to rate the Leading Learning Podcast on Apple Podcasts or wherever you listen. Jeff and I would personally appreciate it, and reviews and ratings help others find this show. Go to [leadinglearning.com/apple](http://leadinglearning.com/apple) to leave a rating.

**Jeff Cobb:** [00:48:11] And please spread the word about Leading Learning. You can do that in a one-on-one conversation with a colleague or a personal note, or you can do it through social media. In the show notes at [leadinglearning.com/episode343](http://leadinglearning.com/episode343), you’ll find links to connect with us on Twitter, LinkedIn, and Facebook.

**Celisa Steele:** [00:48:28] Thanks for listening, and see you next time on the Leading Learning Podcast.

*[music for this episode by DanoSongs, [www.danosongs.com](http://www.danosongs.com)]*

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