Learning Engineering with Jim Goodell

Leading Learning Podcast Transcript for Episode 331

Jim Goodell: [00:00:00] There are so many learning sciences discoveries that just aren't being applied at scale. And that's really what learning engineering tries to do, is to move from the science of learning to scale the implementation of those findings.

Celisa Steele: [00:00:23] I'm Celisa Steele.

Jeff Cobb: [00:00:25] I'm Jeff Cobb, and this is the Leading Learning Podcast.

Celisa Steele: [00:00:33] Welcome to episode 331, which features a conversation with Jim Goodell. Jim is the director of innovation at Quality Information Partners, and he chairs the Learning Technology Standards Committee at the IEEE Standards Association and the IEEE Consortium on Learning Engineering, also known as ICICLE. Jim is the coeditor of *Learning Engineering Toolkit: Evidence-Based Practices from the Learning Sciences, Instructional Design, and Beyond*. Jim and I talked mostly about the *Learning Engineering Toolkit*, what prompted the book, how it took shape, what learning engineering is, the relationship between learning engineering and learning science, and how learning engineering can be used to design and improve learning experiences. Jim is a passionate proponent of learning engineering, and he brings deep understanding of and much experience with learning engineering to our conversation. His hope is that you, dear listener, will consider turning your learning business into a learning engineering business. I spoke with Jim in September 2022.

Celisa Steele: [00:01:47] I think we should start first by a definition of "learning engineering." So how do you define "learning engineering," and how do you distinguish it from something like "learning design," which might perhaps be a more familiar term to listeners?

Jim Goodell: [00:02:03] Learning engineering is a process and a practice that applies the learning sciences using human-centered engineering design methodologies and data-informed decision-making to support learners in their development. And you don't have to take my word for that because the IEEE Standards Association and ICICLE organization under IEEE

developed that definition. And your listeners may be wondering, hmm, IEEE that sounds familiar. Well, you may not recognize IEEE, but you do recognize Wi-Fi and Bluetooth, and IEEE was the standards organization that developed the standards behind those technologies.

Celisa Steele: [00:02:57] And so when you think about learning engineering, given that definition that comes from the IEEE and the work that they have done, how do you distinguish it from something like learning design?

Jim Goodell: [00:03:09] Yes. So learning design overlaps with learning engineering. And listeners who consider themselves learning designers may already be doing learning engineering. So you think about that definition, those parts: applying the learning sciences, using human-centered design, using engineering mindsets and data-informed decision-making. So, if what you do involves those ingredients, then you might be doing learning engineering and data-informed decision-making. Sure, there are different levels of fidelity in learning engineering. We consider both the data instrumentation side of data and the analytic side of data, and the learning engineering process is an iterative process. So we assume that data collected in one iteration is going to inform improvement of the next iteration of a product.

Celisa Steele: [00:04:09] So you have just put out this book, the *Learning Engineering Toolkit*. I'm curious to know what prompted the book, and why do you feel like the book is needed now? Why is this the right moment for it?

Jim Goodell: [00:04:22] So I guess I'll go back to it started as a personal journey because over a decade ago I was working for an organization, the Center for Educational Leadership and Technology, and a mentor who worked with the Detroit Public Schools pointed me to some learning science research discoveries, and I was astonished by some of the things that I was learning about how people learn. And I made it a quest to learn as much as I could about what we can know about how people learn. And what I discovered in that process was there are so many learning sciences discoveries that just aren't being applied at scale. And that's really what learning engineering tries to do, is to move from the science of learning to scaled implementation of those findings. And, during this process, I learned that there was an organization called ICICLE, the IEEE IC Consortium for Learning Engineering, that was starting in 2017, and this group was meeting and having debates about the definition of "learning engineering." And we weren't really getting to a clear definition, but I had heard that the term "learning engineering" was over 50 years old. Over 50 years ago, a guy named Herb Simon, who's a Nobel laureate and was at Carnegie Mellon University, coined this term, and I knew about some learning businesses that had spun out of Carnegie Mellon University that were

doing learning engineering. And I wanted to learn more. So I took some vacation time, took a few vacation days, used some frequent flier miles, flew down to Pittsburgh, and visited with a whole bunch of people and interviewed them about their understanding of what this thing called "learning engineering" means. And I was with Mark Lee, and Jodi Lis joined me for some of the interviews, but we interviewed a whole bunch of people at Carnegie Mellon and outside of Carnegie Mellon at businesses like Acrobatic, Carnegie Learning, and Duolingo and heard their take on what learning engineering is. And that trip really was the beginning of the development of this book.

Celisa Steele: [00:07:06] Well, thanks for sharing that, that it began as this personal journey, and I'm sure it must be very satisfying to now have the book in your hands and to know that it's come to this fruition, where all that you've learned can then be helpful—and all that the other collaborators and contributors have learned, can share and now others can apply it. I want to go back to the definition that you shared of "learning engineering" because I think that definition points pretty clearly to the connection between learning engineering and learning science. You just also talked about that connection in sharing your personal journey. And so I think that one of the things that you talk about and point to is that there have been all these discoveries that come out of learning science—some of them are surprising, surprised you ten years ago—but that they aren't necessarily being applied at scale, as you explained there, and that that being what learning engineering can hopefully do is help apply those at scale. But would you talk about what you see as the reasons why those discoveries from learning science haven't been applied? What's preventing that from happening? And then how can learning engineering help us overcome those obstacles that learning science has maybe faced in the past?

Jim Goodell: [00:08:21] Sure. Learning is a complex endeavor, but there are other areas of engineering, other domains of engineering, that have addressed complex endeavors. Part of what's holding us back is we're using processes that are more an art than science and engineering. Part of it is we're stuck in often being constrained in ways that we really just need to get something out the door. So we use a learning design process like ADDIE that can often be used as—it could be used as an iterative process, but often the constraints force us to do a one-and-done kind of design development. So learning engineering is in its infancy, and, like other areas of engineering, the benefits are going to grow over time. So I think of an area like electronics engineering, and back in the 1950s there were some components that electronics engineers standardized on—things like resistors and capacitors and inductors and then transistors. And those parts had tolerances, so the electronics engineers knew that they could buy some parts. They were reusable parts, but they could be used to develop different kinds of electronics—radios and televisions or whatever was being developed. But, as the profession and

the technology got better, they could start packing more and more of the transistors onto integrated circuits. But those integrated circuits also had tolerances, so they knew that they could use them not just for one time building of an electronics device, but they can manufacture millions of those devices, and they know that the parts are going to do the job that they're meant to do. So there's a real opportunity for learning engineering over time to develop into a set of reusable practices and components that can allow us to do much more with the resources we have and create better learning for everyone.

Jeff Cobb: [00:10:49] At Tagoras, we're experts in the global business of lifelong learning, and we use our expertise to help clients better understand their markets, connect with new customers, make the right investment decisions, and grow their learning businesses. We achieve these goals through expert market assessment, strategy formulation, and platform selection services. If you're looking for a partner to help your learning business achieve greater reach, revenue, and impact, learn more at tagoras.com/services.

Celisa Steele: [00:11:20] So maybe we can get a little bit into how learning engineering works. And I'm thinking in particular that maybe you can give us an overview of the learning engineering process model and walk us through that, at least a high level.

Jim Goodell: [00:11:34] Sure, we can provide this in the podcast notes.

Celisa Steele: [00:11:39] Yes. Yes, absolutely. We'll make sure to include a diagram there. So thank you for that, Jim. But, yes, listeners can go there, and so they'll be able to see what you're describing verbally here.

Jim Goodell: [00:11:49] Okay. So, at the center of the process diagram for learning engineering is a circle that has the word "challenge" in it, and that's the starting place. We start with a challenge. We always want to, as much as possible, understand the challenge or the problem we're trying to solve. And that challenge doesn't exist in a vacuum. It exists within a context. So the context includes the learners that we're designing for or solving a problem for. It includes the team that is developing the solution. It includes environmental factors and cultural factors, motivational aspects, everything that has to do with whatever the challenge is. Now where we go next—the learning engineering process is an iterative process, but the challenge defines where we go next. So it may be moving out to the creation phase. The creation phase is not just about designing. It's about designing and developing iteratively. And it involves creating not just learning experiences but also implementation plans and data instrumentation, or the means by which we're going to collect data so that we can inform better learning and better iterations

of the next product. So the challenge might also lead us directly to implementation. Maybe we already have a product, and we want to implement it in a new way or collect additional data so we'll better understand how to improve the product. And then we move into investigation. Investigation is where we look at the data, and we figure out what it tells us about how we can improve the product in the next iteration cycle.

Celisa Steele: [00:13:47] And so I know you've stressed a couple of times there, but I will stress it as well. So the idea is that this is a continual, iterative process. You're always taking what you learn at any phase, feeding it back in, so that you're having this continuous improvement, right?

Jim Goodell: [00:14:03] That's right. And ideally it would involve some experimentation, some A/B testing. So, when we implement, we may implement two different variations of a learning solution and use the data collected to figure out which of those implementations work best for which kinds of learners.

Celisa Steele: [00:14:23] I know that one of the points that comes across very clearly in the toolkit is that learning engineering is not only about technology. Technology can certainly be a part of it but learning engineering can be applied beyond e-learning or technology-enhanced learning. And so could you talk about how learning engineering can be used in all situations where learning happens, and maybe give us an example or two of what learning engineering might be focused on if it's not dealing with technology?

Jim Goodell: [00:14:58] Yes, that's a great question. And that also goes into the difference between learning design and learning engineering because there are cases where learning engineering is trying to solve different kinds of problems than learning designers might think are in the scope of what they do. And one example that we used in the book that addresses both the technology side—or lack of technology—and lack of a learning experience design is a story about the West African country of the Gambia, and their challenge was just getting kids to school. The government had eliminated fees for schooling and had built more schools, but kids just weren't getting to school, and so they needed to find out why. So they did some surveys, collected some data, and they found that parents of young children weren't comfortable with having their kids walk to school for three kilometers or more. So the solution turned out to be donkey carts. So it wasn't anything to do with learning experience design. It wasn't anything to do with high technology. It was donkey carts. And you might wonder, well, how is this learning engineering? Did they iterate on this? Well, they did. They found the first version 1.0 of the donkey carts were too heavy and didn't have some safety features, so they built a version 2.0 using local materials, lighter donkey carts with seatbelts and gates, and they found that the

older students could drive the donkey carts and bring the younger students to school. And that was a learning engineering solution.

Celisa Steele: [00:17:00] I do love that example because, as you pointed out, it does make this distinction between learning engineering and learning design a little bit clearer. And I think it's also perhaps an exciting area for learning businesses to explore, this idea of what are the obstacles that are preventing learners from engaging with resources you already have out there? And maybe it is the cost or the time involved in traveling to a place-based event, for example. So what can you do to potentially provide the donkey-cart equivalent to your learners to help get them there?

Jim Goodell: [00:17:36] Yeah, that's right. Often the challenge is not about the learning experience itself. It's about these external factors such as organizational culture, and human performance is impacted by assumptions built into organizational culture or social and cultural factors. One example that I'm aware of is that, in certain cultures, parents feel more or less comfortable communicating with staff from schools. And so one school district decided that it was best, rather than to bring in parents to parents' nights in the school building, they went out to the community, and so they found a solution to that challenge. But there are similar kinds of things in terms of learning businesses where something just like mindsets might be the barrier to the learning that needs to take place.

Celisa Steele: [00:18:42] I know that you make the argument that ethics and values play a role in learning engineering. And, in fact, there's a whole chapter in the toolkit called "Learning Engineering Is Ethical." Would you unpack for us a little bit that assertion and explain some of the ethical considerations that we need to take into account when engineering learning?

Jim Goodell: [00:19:05] Sure. One of the big ones is the collection of data and how we're going to use those data. Most of the most valuable learning data has personally identifiable information when it's collected, and we should be protecting the privacy of our learners. And there's ways of doing that to maintain the richness of the data, even at the clickstream data level, which is really where it's really valuable, while protecting the privacy of the learners. There are some other areas. One example story used in the book had to do with giving credit where it's due, and there was a university that the professors had to grapple with the idea that when they had a new discovery that really came from some students and they wrote about it in academic papers, they should credit the students even though they weren't at the same academic level or considered faculty. So there are a lot of cases like that where in actually each stage of the learning engineering process has ethical considerations that the book goes into.

Celisa Steele: [00:20:33] So in terms of trying to make this even more practical for our listeners—I think there's already a lot of ideas and nuggets in here—but for a learning business that wants to adopt a learning engineering approach, what are some of the actions you would recommend that they take to get started down that road?

Jim Goodell: [00:20:53] Probably a good place to start is to look at the learning engineering process and look at the definition. Compare that to what you're already doing and see if there are some low-hanging fruit where you can add a little bit of learning engineering to what you're already doing. So it might be, well, maybe we can add one cycle of iteration if we do some rapid development and get the product or content in front of real learners sooner, and then, by our deadline of actually delivering this product, we'll have improved upon just doing a one-off. Looking at the learning engineering definition, applying the learning sciences, using human-centered engineering design methodologies, data-informed decision-making, how can we better apply the learning sciences? Can we use a checklist with our next project to see are we considering the right scientific discoveries and incorporate them into our design? How can we instrument data so that we have that feedback loop that we need?

Celisa Steele: [00:22:08] Well, I like this recommendation of first assessing what you're already doing. And, to your point, even if the term is new, organizations may already be doing a fair amount of learning engineering. So perhaps just becoming conscious of what they're already doing, and then looking at some of the gaps and where they can potentially add in more. And then, going back to that definition and thinking about the human-centered design, the emphasis on data, all of that makes a lot of sense. So thank you for those suggestions.

Celisa Steele: [00:22:36] Since this is the Leading Learning Podcast, I do always like to ask guests about their own learning, and so I'm curious to know how you approach your own lifelong learning. And, given what we're talking about, I'm also curious to know if you are approaching your own lifelong learning through a learning engineering lens. Are you trying to engineer what you're doing with your own lifelong learning?

Jim Goodell: [00:22:58] Yes, absolutely. So my earlier example of wanting to discover about learning sciences was one example. Probably a better example is, during the production of the book, I realized that I had a real gap on the learning analytics side. The book defines data-informed decision-making in two parts. We actually broke it into two chapters because it was so important. The first part is data instrumentation, and that is designing and developing how we're going to collect data about learning experiences. I know on an earlier podcast you had

Megan Torrance talking about xAPI, and that is a great tool for doing standardized way of doing data instrumentation. I knew a lot about the instrumentation side. I did not know, or I realized that I had gaps on the analytic side. So I did some research, and I was aware of one of the pioneers in the field of education data mining and learning analytics was Ryan Baker, and he had published what he calls a MOOT, a massively open online textbook, for learning and analytics. And it's actually a series of videos. It's called the textbook, but it's a series of videos. So I took the time to go through that series of videos and with the practical lens of how can I use this knowledge not only for myself but for the book. And I realized, like the learning engineering process, that the first time I learned something like that, it would not be complete or 100-percent correct. So I reached out to some other authors like Steve Ritter, and Steve and I worked together on taking the information from Ryan's course and turning it into a process model that can be used by everyone that has the book now. And then I also realized that, even though Steve was an expert, it could be even better if we ran it by Ryan Baker. So Ryan Baker is at the University of Pennsylvania, and you can look up his online MOOT for learning analytics and education data mining. And Ryan gave us some additional feedback to make the model even better. And that's what is in the book now.

Celisa Steele: [00:25:35] I'm curious to know how you went about structuring the book and whether you had the topics in mind and then went out and sought contributors and collaborators—it reads like this who's who of learning when you look at the table of contents—or did you go to those people, those connections in your personal network, and say, "I'm thinking about this. What do you think we should write about?" Was it people or ideas first, or is it hard to say?

Jim Goodell: [00:26:03] It was a little bit of both. So the organization of the first half of the book, the foundations chapters, is based on the definition of learning engineering. So the first chapter is "Learning engineering Is a Process." The second chapter is "Learning Engineering Applies the Learning Sciences." This, I bet, sounds familiar because it comes directly from the definition. The third chapter is "Learning Engineering Is Engineering," and it talks about how the other fields of engineering have some common concepts that apply to all fields of engineering and how can we look at learning through that lens, etc., etc. But it was also the networks, and I encourage listeners to join IEEE ICICLE. You can go to ieeeicicle.org and find out more because a lot of the authors were part of that community, and you can interact directly with many of the authors and the experts in learning engineering by joining that community.

Celisa Steele: [00:27:19] Jim Goodell is coeditor of *Learning Engineering Toolkit: Evidence-Based Practices from the Learning Sciences, Instructional Design, and Beyond*. In the show notes for this

episode at leadinglearning.com/episode331, you'll find the visual of the learning engineering process that Jim explained. You'll also find links to the toolkit, ICICLE's Web presence, and Jim's Twitter profile, as well as other resources related to our conversation.

Celisa Steele: [00:27:46] At leadinglearning.com/episode331, you'll have options for subscribing to the podcast, and we would be grateful if you would subscribe if you haven't yet. Subscriptions give us some data on the impact of the podcast. We'd also love for you to rate us on Apple Podcasts or wherever you listen, especially if you enjoy the show. A quick rating doesn't take long, but it's very valuable because reviews and ratings help the podcast show up when people search for content on leading a learning business.

Celisa Steele: [00:28:17] Finally, we hope you'll spread the word about Leading Learning. At leadinglearning.com/episode331, there are links to find us on Twitter, LinkedIn, and Facebook. Thanks again, and see you next time on the Leading Learning Podcast.

[music for this episode by DanoSongs, www.danosongs.com]