



AI Workforce Development

Featuring Rachel Dzombak and Jay Palat

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Rachel Dzombak: Hi, everyone, and welcome to the SEI Podcast Series. My name is Rachel Dzombak. I am the digital transformation lead at SEI's Emerging Technology Center. Today, I am so excited to be joined by my colleague, Jay Palat, to have a discussion about AI [[artificial intelligence](#)] workforce development. Welcome, Jay.

Jay Palat: Good morning, Rachel. Good to be here.

Rachel: Excited to have this discussion. Why don't we start off by telling our audience a little bit about ourselves and the work that we do here at the SEI? I can start with that as a means of jumping in. My background is in engineering systems and human-centered design. Before joining the SEI, I was an innovation fellow and on the faculty at UC [University of California] Berkeley where I helped to [grow and define the field of development engineering](#). Here at the SEI, I am helping our partners to think about what is needed from an organizational standpoint to adopt new technologies. What does that really look like, what it means to be in place for organizations to bring new technologies in, as well as helping to lead our AI engineering efforts.

Jay: I am Jay Palat. I am a senior engineer at the SEI. I've been in the industry for about 20 years doing a variety of roles, leading companies at the Fortune 500 level all the way down to alpha-level startups. My goal is to help build things and help create better technologies. And at the SEI, I am helping to build AI products.

Rachel: Great. Thanks so much, Jay. Today we're going to have a conversation about workforce development. I think it's going to hit on both of our backgrounds, pulling in what is happening in industry, what's happening in the education sector, and how do we bring those together to really support this work of AI engineering that we find important. And don't worry, I'm sure we will get to defining AI engineering a little bit later in our conversation. Let's start our conversation today with something that is front-of-mind for many.



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Recently, the [National Security Commission on Artificial Intelligence released this major report](#), the work of several years, that was focused on many different aspects about the adoption of [artificial intelligence](#). But a big piece of it was workforce, and they talked about how there is a gap right now in the workforce in the government to really support AI and AI-adoption efforts. And so why don't we start off by talking a little bit about AI workforce development, both in government and industry? And Jay, maybe you can start us off by talking a little bit about the trends you're seeing as industry is trying to adopt AI.

Jay: Sure. Where we are right now is, there's been an explosion of people trying to build new capabilities of AI. We have seen a lot of really interesting innovations coming out of academia and then moved into industry and being adopted in a radical way. We have large companies, the unicorns—the Amazons, the Googles, the Microsofts—building AI-first businesses that are leveraging the enormous amounts of compute and talent they have to build new kinds of products that are being adopted at a tremendous rate by the consumer space. What we are seeing in the government space is a desire to build some of those capabilities, but we needed to build more robust versions where it doesn't make a difference as much in the consumer space of if an ad is not as efficient as it could be, although, obviously, everyone strives to be the most effective tools that they can. Questions like safety, robustness are not quite as intrinsic as they are in the government space.

Rachel: Absolutely. I think another thing I would add to that is the government is trying to adopt AI technology much like their industry counterparts, but they are at a disadvantage in terms of accessing talent because of really the crazy amounts of money that you are able to offer talent in the industry. So, there are a couple of things that that leads to. One is that government is having to think about, how do they develop their own workforce, the existing workforce as well as create new pathways for individuals to join that workforce? They are also really having to think about, what does it mean to implement AI in government and why is that different from industry, so that they can start to articulate the skillsets that they really need to recruit. Industry at times can be more...they can experiment a little bit more with who they are hiring and how they're hiring because they don't face the same level of constraints. And really, I think it's also a mindset shift that's needed in government today. That proves to be very challenging also, that there needs to be a mindset shift from, *OK, we need to acquire exactly what is needed, and we know what that is*, because these technologies are evolving so quickly that it is hard to say exactly what is needed. It needs to have a little bit of that experimental mindset in it, and that is not something that the government has done historically. I think one of the challenge points today to think about is how do we move forward, even when we don't have all of the answers that are accessible to us right now?



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Jay: It is definitely a case where, even within industry, it is hard for them to get the talent they need. We have folks who are coming out of prestigious Ph.D. programs who are trying to figure out, where do they fit in industry? Industry is starting to move away from just the pure research portion of it and figuring out how to build these systems to scale. And so there becomes a desire for more engineered...the experience in software engineering is becoming more important. And, at the same time, it's a, *What kind of research are you looking to do? Are you looking to develop new algorithms or to help systems get better?* And, so, applying these to real-world problems and real-world datasets is very different than what we see in the academic world. It's not canned datasets that have a well-understood set of properties. It's applying these things to new datasets, new domains where we're not totally sure we have the right data to make the predictions we want to do. So, how do we start building the systems to make that happen?

Rachel: Absolutely, which is forcing people to step into ambiguity and complexity, and it's really hard to do that. It's also really hard to find the right people who are willing to take those steps and start answering those hard questions, particularly in the government space, where then you are also constrained by where and how data and systems exist, where information is stored, and how you get access to them. That brings us to this point that we'll go to next. Many of the organizations that we work with today are seeking guidance on exactly how to develop that workforce. We talked a little bit about, yes, it can be a struggle to bring talent in. And, so, when it comes to hiring or recruiting candidates, what kinds of skills, traits, experiences should hiring managers be looking for as they are trying to think about growing their AI workforce today?

Jay: I think that a little bit depends on where they are in the journey. In some places, you are going to have people who are starting out. They have a large set of data that they have been collecting over the years. They have been doing analytics against it for their business metrics, but they're now trying to start figuring out how do they want to start making predictions off of it? How can AI help them start solving their business problems? In that case, they are in the beginning phases where it may be they are building a small team, which needs to have a little bit more flexibility. You have some more blending of the roles. You are going to want someone who can help with both the data extraction of finding out what's the right data they need to use to solve the problem. A data scientist and data analyst may be kind of blended in the roles of, someone needs to go over the data to really understand it and then start applying, *What's the right set of hypotheses we're going to test? What's the right kind of experiments we need to do in order to start building the predictions we're trying to do to meet the goals of the business?*

Other organizations are in the places where they have started rolling out these systems. And they are already starting to build predictive pipelines. They are using it in the business, but they're trying to figure out how to apply it more and more. And then the roles become a little bit more defined where people need to get a little bit deeper in their skills.



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So you are going to have data engineers who are going to be experts in how to move the data from the different sources around the enterprise to the destinations they need for building these better systems. You are going to have data analysts who are going to need more domain knowledge and really understand *What's the business trying to do? What is the end goal they are trying to achieve?* And data scientists who can take that input, understand the business, and then figure out what's the right level of theory that can be applied to this. Is it, *We can rely on existing papers, existing material that's already out there? Or do we have to push new domains and figure out what needs to happen to solve these types of problems?* And then finally, getting that into production; so you're going to start building pipelines to actually build these things and then move them into a production setting where users can actually access them. That could be building an app for a phone where the ML [[machine learning](#)] systems can exist on an endpoint on everyone's devices or a service which is in the cloud where it will be accessed via an API.

Rachel: I want to go back to something you said at the start of that around blended roles. I think a lot of our customers as well as a lot of the organizations we work with are at those early stages of starting to think about, *OK, I want to do some work with AI. I want to start growing my teams.* And yes, they're going to be resource-limited and need people who can wear multiple hats. Do you have any strategies or practices you have seen work in terms of finding people who can have more fluidity in their roles? Any things that people should think about?

Jay: I have always found that the attribute that helps people do this is a sense of curiosity, of really wanting to dig in to understand what is going on around them. There is a time and a place for people who can do very deep thinking and focus down and just have the blinders on and focus on a problem and get to great results by diving deep. But in those early days, it is sometimes more helpful to have a little bit more curiosity, a little bit of willingness to try things that are outside their traditional bounds to figure things out. You see this a lot in startup land where people are coming in, and as the business is growing and they are trying to develop it, they have to build the infrastructure they need as they go. And so you end up having to wear a lot of hats and taking on a lot of roles. The way that it is best to get through that is being able to ask questions, to be curious, to be able to go out and read things or talk to people and ask questions about, *Why is this happening? Or, What should I do?* to understand what are the practices that are out there.

Rachel: Yes. I absolutely agree. I think one of the things I've seen from the organizational side is then being willing to also be curious in your interviewing about people who have more varied backgrounds. I think especially with emerging technologies today, there are great articles that laugh at people saying like, *We want someone with four years of experience generating TikTok videos.* And TikTok's only been around for a year and a half, so that would never happen, and instead trying to look at, OK, even if people have experiences that look like they don't



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necessarily all fit together, in many ways, that can be a great sign that someone's able to jump between different fields, domains, ask those questions that you're describing, but also be that person who can start to translate. I think in small teams, one of the challenges is, if you have people with deep domain expertise, they hit a barrier in terms of just language. The way that a data scientist talks about something is really different than an engineer, is really different than a user-experience researcher. And, you need to have people in those small teams who are focused and can serve the role of translating across those different roles. And even that extends too across the journey of where they are in the AI-development pipeline that you described of making sure that you have that at all stages. Or else you can become really siloed in your organization and not actually have a holistic viewpoint on the implementation side of AI systems.

Jay: Absolutely. I think that ability to carry conversations across different types of audiences is super critical, especially in the early days, as everyone is trying to understand *How does this work together?* They each are going to come into it with different concerns, different perspectives, and so being able to bridge that is going to be super critical. Being able to talk to the businesspeople about what the problems are and explain to them what the limits are about the technology you are using is going to be just as critical as being able to talk to the engineering teams about *What are the tradeoffs?* What are the computational costs for doing this work, so you can understand how fast or how hard you can scale these systems?

Rachel: Absolutely. In our current work, Jay and I are both working to help define this field of AI engineering. Again, we will talk about that in more detail a little bit later, but it's a field that's focused on the implementation of AI systems and really thinking about *How do we leverage AI towards mission outcomes?* In that space, you realize that, though we have different expertise, the lines are so blurred in terms of implementation that you actually can't get to implementation unless you as the data engineer are also focused on the user experience or also focused on the infrastructure elements. Because these elements are all so tightly connected that you really need to be paying attention to them simultaneously.

Jay: Right. It's all still in the place where it's [artisan]. We are not in a place where there's well-defined processes, although we're working on getting better at that. But as people are exploring and are learning, you really need to be able to cross the boundaries and talk to each other about what is going on to understand where are the bottlenecks or the stumbling blocks in the system so that you can work together to achieve the goal that you are going for.

Rachel: Absolutely. The last thing I'll add on this is, I'll build on your curiosity comment with also humility, that I think that we're in a space that's changing so quickly that people posturing as though they have all of the answers really is a stopping point for a team because the problems are changing every day. The answers are changing every day. There are always new techniques being rolled out. As you are thinking about who you're bringing in to do this work, it has to be



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people who are both comfortable enough to say, *I don't have all the answers, but I'm going to give my best guess today to move us forward* as well as people who are humble enough to say, *I don't actually know. What else can I do to bring in fresh knowledge to refine my thinking and to push us forward a little bit?*

So, on that, I am going to turn us a little bit to focus on the talent that already exists in organizations. AI has come through, and many organizations are looking for rapid adoption but don't necessarily have the bandwidth to hire, especially in light of the pandemic. So, they are looking at, how do we grow our internal AI talent? What do you think organizations should consider as they look to develop their existing workforce in AI?

Jay: I think it's a mix of things. The plus side of the explosion of AI capability growth is that there's been a ton of resources out there for people to learn. There are Coursera courses. There are online universities. There are more and more academic institutions who are opening up their doors to give people opportunities to learn about this. In my education path, I think the hardest thing I struggled with is trying to figure out what are relevant datasets to work with, or what are the right kind of problems that I should start working on? I think, within the context of a business, it's a little bit easier to say, *Looking at the data that you have, what do you already capture about your customers or about your processes that you want to start making predictions on?* The key to thinking about AI is, it's a prediction game. How can you help the computer guess better? So, looking at the things that if you could have better predictions on or you could take the predictions away from making someone think about that, to have a machine do it for them to make them more efficient is a great place to get started. So, looking at a business problem, what is the concern you're trying to go for, then finding some data that supports that, and then trying to apply things that are available online is a great way to get started.

Rachel: Absolutely. I loved how you thought it reflected on your own journey of saying, it's about figuring out the right questions to ask. Did you have any formative experiences that helped you get into this mindset of *How am I figuring out the next thing I need to know in order to move forward?* or do you think that was something that was more natural to just how you approach problem spaces in general?

Jay: That is a good question. I've been at it for kind of a while, so it's a little bit of a mix. Through my career, I've watched different waves of technology go through. When I was getting started, I was in time for, like, catching the web. I was using the Mozilla tools before they were Mozilla. So, I got to watch the web go through this technology. I got to learn across the path there of *What does it take to be good at a new domain?* Then mobile came through and other things came through, and it's been kind of always a *Let's ask the question, let's try and build something, let's build a little small project to see what we learn from it.* And for me, it's always a



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little bit of *How do I apply some kind of new trick or something I want to learn, find a project that helps me explore it, and understand what makes it hard?*

Rachel: Absolutely. I think I was in a similar space of just being thrown into different domains. I had worked in healthcare, then I switched into climate-science work, and then I switched into innovation work. It was all about, yeah, figuring out *How do you step in and just start with something?* Even if it looks really small, just in doing a bit of applied work. You can study for forever, but until you're actually applying those skills and knowledge that you have, you're not taking it in and figuring out, OK, what's working, what's not? That experimental mindset, I think, is so key to it, of just saying, *I don't know everything, but I'm a learner.*

That is what I was going to add to this notion of developing internal talent. I think more and more, we are going to see that it's really about learning how to learn and helping people learn how to learn. I like to think about this in the education space as, it's moving from...As an instructor, you have to move from being sage on the stage and delivering all of the information that one could ever need through a textbook or through lectures and to instead shifting to be the guide on the side. So, as a manager, if you're trying to develop internal talent, you need to be thinking about *How am I creating opportunities for people to learn and grow? Am I there and present when they have questions about where they go next? How do I guide them along the way, helping them see things they hadn't previously seen, ask new questions, or curate a set of resources?* Like you described, there are so many out there that it could be the just-in-time knowledge they needed to push their understanding forward.

The next thing I want to have us talk a little bit about is the [NSCAI](#). In its final report, they set a really ambitious goal for the Department of Defense and intelligence community to be AI-ready by 2025. What do you think needs to change for that to happen in areas such as education, recruitment, workforce development? Any big factors that you see as needing to change there?

Jay: I think to date, the government has done a lot of work. They have a very strict process of *You have to meet these requirements.* They are used to very cookie-cutter type of role descriptions, and I think we talked about earlier, you need a little bit more of the people who are able to blend things and really to go across domains and pick from different experiences to put together better wholes. When I think about AI, it is a lot of learning by example. And, so, you want to have a diverse set of people to help you look at different examples and to bring different lenses to the problems, so that they can pick better sets of examples to train the AI on. The robustness of the system comes from lots of different perspectives and data. So, having people who come from different backgrounds who can talk to different aspects of the problem can help you choose better datasets.



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Rachel: Absolutely. I think something else I would add that I see needing to change is really thinking about where and how we are sourcing talent. I think there is an assumption that talent in the AI space is only coming from a couple of schools. In fact, that is really not the case. And if we can take a broader view of the skillsets that are needed as you described, we can start to look elsewhere. What's happening at all types of schools—in liberal arts colleges, at really tier-one research institutions. How do we start to piece together, like a puzzle, the talent that we need to grow and develop these systems? And I think that will also help the second piece of the diversity that is needed to really implement these systems. The DoD has a strong point of view of what it means to implement ethical AI, and those are big, hard questions. They are questions that can't be solved by a single discipline. And really, moving forward, we're going to need both diversity in terms of perspectives—which is informed by the cultures people come from, their past experiences, the ways that they see problems and think about the world—as well as diversity and heuristics of ways people solve problems. You can have a really diverse group of people, but if you're all engineers, you're all going to approach that problem space in the same way. So, what is it to partner a philosopher with a policymaker, with an engineer, to think about and triangulate around these systems in a different way? I certainly saw that in the climate-science space be incredibly important because you needed all of those perspectives to push each other's thinking as a means of driving toward solutions that could actually be implementable.

Jay: It is really interesting, right now as we talk about where the roles are, we have an idea of, like, there are data scientists, data engineers and a handful of roles, which are what we think of what we need for AI systems. But that is also going to evolve, and as part of this explosion of growth, we're going to see new roles develop and new things we're going to need. In the beginning of the web, there was a webmaster, and a company would hire a webmaster, and that would take care of their entire web presence, everything from hosting all the way through graphics. Today, there are teams and teams of people working on web products. You have people working on the UX [user experience] side. You have [DevOps](#), you have engineers. You have product specialists. You have a range of different roles that didn't exist 20 years ago, and now there's an explosion of them. We are at the beginning of that explosion for AI. We have a couple of roles: we know that there's a data scientist. We know that there's going to be data engineers, but we don't fully realize what the other roles are going to be. We're going to need to have different understandings of the pieces of the work as they come together so that, as we start building these things, we'll need more than just diversity to talk about it, but the mix of things of it is still kind of happening.

Rachel: I agree. Something I know that we have talked about before is the creativity that is needed and how you're terming roles and what you're writing in terms of job descriptions. We were discussing that there's a role available right now focused on the intersection of machine-learning and user-experience research. That same role can be called many different things at



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many different companies because it's trying to articulate the mix of skillsets that is needed to push this work forward. That is going to be a growing challenge, too, both for the job seeker to think about, *OK, where and how do I fit in? Can I find language that maps to this mix of skillsets that I have?* As well as for the organization that is looking to hire, you know, *How am I bringing in people that can have a perspective on multiple different aspects of the system as a whole?*

Jay: Yes, moving away from...it's difficult, right? But we're very used to kind of a checklist-driven hiring process. *All right, you have x years with this. You have y years of that, and you have these buzzwords on your resume.* We are going to move into a space where it's just like, it's going to be a little bit more complex than that, and it's going to be more on...I hate to call them *soft skills*, but the personal skills of being able to communicate and collaborate to bring these systems together.

Rachel: Absolutely. Yes. I completely agree. I think we're going to see...there's been so many studies. [The World Economic Forum has a great study on the top skills that are needed by 2030.](#) The top of the list is complex problem-solving, and next to it is the ability to work with other people, ability to work in diverse teams. I think that hits home so strongly, which then, speaking about trends, I'm hoping that over time, we are going to see a shift in education, especially technical education, to be a little bit less of...that we need to hit all of these...*You need to go through six math classes in order to be credentialed in that way* and really push for these classes that are honing people's professional skillsets so that they can exist in teams, be comfortable with ambiguity, and figure out, how do you move forward, even as things are changing at a very rapid rate?

So, that brings us to the work that we're doing that I've hyped up so far in our conversation about AI engineering. AI engineering, as we term it today, is a field of research and practice that integrates the principles of software engineering systems, computer science, and human-centered design to operationalize AI systems in accordance with human needs for mission outcomes. And here at the SEI, we are home to a national initiative aimed at establishing and growing this discipline of [AI engineering](#). And, so, I'm curious, just from your perspective, or I'd love for you to tell our audience a little bit about why you think AI engineering is necessary to grow as a discipline.

Jay: I like jumping between lanes for different technologies, but one of the things I look at is kind of...If we look at a mature technology like automotive engineering, everyone's got a car now. They are fairly well-understood systems. We still see incremental improvements. It's not that we have hit the final car and it's good, but it's come a long way from where it started. The original cars were made out of wood. They were highly unsafe. In order to operate them, you really had to be a mechanic. You couldn't just rely on the reliability of the system. You had to know it inside and out. You had to be able to disassemble your engine, reassemble the entire car



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from scratch, and those were the operating parameters that were necessary to make the systems work. In AI, we are in that space right now. We need to have data scientists and engineers who take these bespoke pieces, really craft them to very specific outcomes, and endlessly tune them. What we want to get to is a place where we can build more robust systems to have good principles, to have safe-at-any-speed type AI systems that can be used in a variety of different environments. To get there, you need to come up with the best practices to understand them and share them. Right now, as an industry, we have got them coming up in different places, and every environment which is kind of building AI at scale has developed their own best practice of how to work in their environment. They are starting to share those, but it means that you have to look like their environment to be successful, and that is not always possible for everybody. So, where we are going into for AI engineering is really, *What are the best practices that we can share amongst us? How do we build a set of practices and standards that help us build better tools, better technology, and grow the profession so that we can build a more robust, safe AI systems that we can use in more places?*

Rachel: Yes. Absolutely. It makes me think of a quote I heard once as someone was describing implementing new projects, and they said, *There is no book of spells. There is just magic.* As much as I love that, it really, I think, is not what's helpful right now, where we don't want to think about AI as magic. There actually is a series of steps that are needed to build systems that are human-centered, that are robust and secure, that are scalable. To the extent we can distill what exactly goes into that book of spells, what are all of those different elements, we can get more people doing AI in a way that is rigorous, in a way that adheres to the values that certainly the DoD holds as well as other government partners, as well as getting more people who may or may not think that they are capable of participating in the AI conversation to do so. If we can distill it, we can lower fear factor about *I can't talk about AI. You have to be a genius to talk about it.* And I think that that becomes a big barrier. We need domain experts who know a lot about human-resources systems or healthcare systems to be able to be working with AI system developers so that we can grow implementation and that we can make sure it is done in a way that actually reaches the potential that AI has. Else, we are going to be, like many other technologies, developing these things and crossing our fingers, hoping people adopt them, but they won't actually achieve the potential that they have.

Jay: Yes. I think the beautiful potential of AI is that it is one of those transformative technologies that can help us in so many different ways, but it can't do that if it's just bound up with a few people. To your point of wizards and spells, it can't be the wizard on the mountain in the tower that is just casting these amazing magical things. It has got to be a part of everyday life. It has got to be something that people have as something that's accessible that they can use on a daily basis and find and understand in a way that helps them make it effective. And that means making the tools available to everyone, which requires better sets of tooling. It used to be



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like computers were built in warehouses and only accessible by a few people or a few universities. When we moved to a place where everyone has one in their phone, and they can use them and make them more effective in their lives. We want AI to do the same. To do that, we need to be able to scale the technology, build it more robustly and securely, and make sure that people really have the ability to work with it and make it accessible.

Rachel: Agreed. On that note of giving people the resources that they need, if I am an organization seeking to develop my AI workforce, are there any resources that you would recommend to watch, to listen, or where to go to learn more?

Jay: I have been a fan of the Coursera courses. I think they have done a wonderful job of giving a good introduction. While they include the math in there, they also tell you which parts are optional and which parts are not. They give you a chance to run through it, build examples, and do things. I found the [TWIML AI podcast](#) to be super helpful to understand what is happening in the industry and get expert opinions talking about what they are doing, what they find is relevant work and where it fits in the context of the world of what we are doing today. And that branches from what's in academia all the way through to what's the latest things in industry.

Rachel: I would definitely second your recommendation for some of the Coursera courses. [Andrew Ng's AI for Everyone](#) is a great starting point to build literacy amongst nontechnical audiences, which I think is so important if we are going to actually enable these AI systems. And the other thing that we are doing that I think everybody in this nascent field of AI engineering should be doing is going out and talking to people. We're in a conversation mode right now talking to our partners about *Where do good examples of AI systems exist? What should we be looking to? Who should we be learning from?* I think even as people who are involved in growing this discipline of AI engineering, being disciplined about going and having those conversations, learning from our partners, making sure we are tracking the state of the art is so important so that we stay as a learning organization as well and are making sure we are pushing our thinking. And so that's less of a recommendation for a resource but more of an action, that I think trying to solve all or answer all of the questions yourselves in this emergent field is too difficult. And I think that it is something that we are really trying to embody in our work also is making sure that we're learning from our peers who are doing amazing work in this space as well.

Jay: I think the cool part of where we are right now is, everybody has questions. No one has [said], *We have solved it. It's good. AI is done.* Everyone is happy to have the conversation because everyone needs to learn, and everyone knows that there is more out there that they could be learning about, and having those discussions helps everyone.



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Rachel: I definitely agree. Well, thank you so much for being here today, Jay, to talk with me about the AI workforce. And to our listeners, thank you for being along for the journey as well. Hopefully, this podcast was helpful for you to think a little bit about how to grow the AI workforce in your own organization or just things you need to think about as you are trying to grow AI projects in specific domains. We will include links in our transcript to all resources mentioned in this podcast. And as always, if you have any questions, please don't hesitate to email us at info@sei.cmu.edu. Thank you so much.

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