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Mike: From the Center for Occupational Research and Development welcome to Preparing Technicians for the Future Of Work. I'm your host Michael Lesiecki. In each podcast we'll reach out to the people who are actually on the frontline of the future of work and hear what they have to say. That means interviews with industry leaders, working technicians, and forward thinkers in the field. In every episode we will suggest action that you could take. We want to inspire you to take that action. This podcast is brought to you by the Center for Occupational Research and Development, known as CORD, with financial support by a grant from the National Science Foundation's Advanced Technological Education program. Opinions expressed in the podcast do not necessarily represent those of the National Science Foundation. You can find out more about our project and our approach at "preparing technicians"—all one word—dot org. Our topic today is Digital Twins. Let's get right to the interview.

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We're very pleased to have with us today Gerry Deren. He's the Vice President for Academic Enablement at Siemens. Gerry that's a fascinating title: Academic Enablement. What does it mean? What do you actually do?

Gerry: So Mike, one of the things that we have found as a company is: a real challenge and a trend in the industry today, where companies are really trying to fill the gap that's being left, by what they call the "gray tsunami." Meaning: a lot of people who are in the ages of over 50 years old—retiring. Their huge need for talent to come up and fill a lot of those slots. And with the direction of competition, companies just can't wait to go through the normal chain. So, they've looked out to us to help train them in technologies perspective, in order to help get them ready and capable and connected to the industry so that they can get jobs much quicker.

Mike: How long have you been at Siemens, Gerry? Something like 20 years right?

Gerry: Yeah, it's a little more than that. 23 years coming up here in about a month.

Mike: All right. Let's get started with our topic for today. I was at a meeting recently and Gerry, I swear, nine of the ten people were unfamiliar with the concept of the digital twin. So, I thought maybe we could start and have you give us an overview of "What is a digital twin? How is it used? What is this thing?"

Gerry: So, that's a great question, Mike. And by the way, that's a comment that I hear a lot also. There's a couple of different terms that actually come up with digital twin. You'll hear digital thread, digitalization, and digital transformation. But what it really comes down to is this: and I'll start by giving you the Wikipedia definition, but it says that "a digital twin is a digital replica of a living or nonliving physical entity." Probably a better way to look at it is this: If you were to look at a mirror, that mirror image is something which should be an exact duplicate. Granted, you have the right kind of a mirror. We're talking about a real part that was developed using CAD tools or visualization tools. So, you may have seen some pictures on TV, or in different places, where you have a wireframe model of an airplane, or a car, or a medical device of sort. And right next to it is the real part. So, technology has allowed people who are building and developing things to do it in virtual space, the digital space, and then be able to take from that exact duplicate and build the part. That's basically the premise and the foundation of the digital twin.

Mike: Interesting! What motivates this? I know Siemens and other companies are really into it. What's the driver behind doing this?

Gerry: That's another good question. I did recently come out of a role that was business development, where I was an engineer turned "bean counter." And what "bean counter" meant was companies themselves are looking for ways to get a competitive advantage. Things like improving end-to-end information flow and teamwork. The "time to market" is an example, when I worked in automotive many, many years ago. It was close to six years. Today it's a little bit more than a year. So, that's cycle time reduction. They're

looking to reduce cost. They're trying to impact the bottom line from an ROI perspective.

But more importantly, in a lot of cases with technology today, and the complexity, you only get one chance to do it right. And so, quality is a big, big issue for them. So, really there's a number of business issues that companies are going through. And they see the ability to save a lot of money by not building the prototypes of old. But also, being able to share information from the beginning of the design cycle all the way through manufacturing, and actually putting a product to bed when it's done with its use time.

Mike: That just made me think of something, Gerry. Do you ever share the twin with your customers?

Gerry: All the time! As a matter of fact, one of the things that the digital world has brought us is the ability to get online, and take a look at neutral renderings, and being able to share, and have multiple customers all looking at something or pieces and parts all at the same time.

As I mentioned, I came out of automotive. And, years ago, we call those design reviews. Today, with the digital twin, they're able to put it up on a screen, stay home, a cross the world, different global entities, and see if it's right. More importantly, when you start looking again downstream into the manufacturing parts, you can now simulate the manufacturing of that part, make a change, and see what conflict it might have. So, now the collaboration between manufacturing engineering has actually gotten a lot better, too.

Mike: Interesting. I want to make sure I've got this right. Many of us are familiar with, as you mentioned, CAD drawings, wireframe things. But this is more than that, right? It actually simulates the performance of the part that we're doing. That's, as I understand it, one of the unique aspects.

Gerry: That's exactly right. Our perspective in looking at the digital twin, and again, you hear a lot of different people talk about it, digital twin is not just design. Digital twin in our world is manufacturing. It's performance. It's taking a look at the specification or the requirements of the product that you're trying to build. It's modeling it in that CAD tool. But also I'll use the word "annotating," or actually "making definition" to meet the requirements

and the execution of that product when it's into its useful life.

So, if you're taking a look at a car, and I like to pick on salespeople sometimes, I'll say when you're driving that Ferrari, is it really going 150 miles an hour like the specification said? And how would you know that? So, in today's technology, not only the modeling and the development of this digital twin, but the ability to analyze and simulate using those types of requirements is really what the digital twin brings into the table also. So, now you can actually see what happens to a vehicle, as an example, if it hits a wall. Or an airplane, if it's low on fuel.

One of the things that a lot of the people who are in aero and auto are looking at is weight. And weight plays a huge role. So, they're able to simulate those types of things now. And that all comes back to how they define the definition of what that digital twin is all about, and what it's supposed to do.

Mike: Interesting. Where in the product lifecycle does the digital twin appear? Or is it just at the design phase? Or early manufacturing? Where does it appear throughout the product life cycle?

Gerry: Actually, it appears throughout the entire life cycle. And again, I mentioned "digital thread" earlier. When you start to define a product through, we'll call it a value chain, which is something I learned many, many years ago, you come up with a concept. And then you get the feasibility, design, test, manufacture. That representation in the digital format is used from the beginning of life and should be used as a check-and-balance all the way through manufacturing. So, are we manufacturing, in that we designed the product properly, to manufacture it properly? So, it's actually relevant throughout the entire lifecycle, from beginning to end.

Actually, you bring up a good point. Because many people think it's in a silo in design. And then, you know, you throw it over the wall, and manufacturing... And actually, that's not true. People re-engineer, redesign. They may not be up to date on the latest version or change that was made. And even manufacturing change that they make, did it ever get reflected back into the design cycle? So,

"prolific and throughout the entire lifecycle" is probably the best answer.

Mike: You know, Gerry I was doing some background reading. I think the building industry uses this thing as well, don't they?

Gerry: Absolutely. They have gone through a great element of, I'll say, "maturing." Probably a good word for it. And, that part of it is by seeing and trying to begin to simulate and model in virtual space their buildings: running routes, such as piping for HVAC, running different things like security systems, and whatever. It's really, if you think about most any product, you can apply the digital twin to just about everything, including glue. Ha! So, yes, they've picked it up and they're running with it. And they can simulate a building and they don't have to worry about all the inspections. In fact, some have even gone to having inspections done for the actual CAD and from some of the certified documentation that's the output of the digital twin.

Mike: I suppose, I'm just thinking out loud, as you come out with the next version of whatever product it is, the twin will help you decide the best way of doing that as well, I guess.

Mike: That's true. You're still gonna have tooling. You're still gonna have machine tools and different things that are going to help you with that new product. But the question is, "Is it a new generation of something that you're modifying? Or is it really something that's brand new?" The world, okay, and again, I've been at it for quite a few years, is really all about improving on something that you've had before—even when you start from a scratch piece of paper. So, a lot of people will talk about a brand-new design. They'll talk about something that's a brand-new feature. Well, but they're typically putting on something old. So, reuse of something old, but being able to test it virtually, test it multiple times without building any prototypes—which is a very time-consuming and costly endeavor—really, really helps them out.

So, yeah moving into the future you're gonna see more and more. And we believe we're just scratching the surface. We're taking a look at the way people are starting to develop things and their expectations, the families of

things, trying to elongate life, personal life, as well as the life of a product. And that plays a big role in this.

Mike: Interesting. Fascinating stuff, Gerry. In our project we're focused on preparing technicians for the future of work. So, what do technicians need to know now, and in the near future, about digital twins? How do they prepare for that workplace that they're entering soon?

Gerry: Most of today's kids, and most of the people moving into this are not afraid of technology. So, I think the first thing I would suggest is, not be afraid of technology, because it *IS* the future. It's the current, and it's going to be even more into the future. So, being able to look at digital and understand what digital means: that's very important. The old world and there's a lot of companies struggling with this digital transformation—they're moving from paper to digital—but digital is where it's at. So, if you look at an iPad, you take a look at a tablet, a CAD system, most everything—even your watch today is all digital. So, understand what that really means.

Then, kind of start opening your mind up to: how can I define that digital object, be it a watch. Most watches today are basically smartphones to some extent. They have got all kinds of things on them: that allow you to watch your heartbeat, take a look at your blood pressure, do all kinds of things. Those are all defining elements within a digital world on that watch. And so, when you think about a technician, and you think about the work they're gonna need to do in the shop, be it on a shop floor, be it in a machine, whatever. How was the product they're working on really defined? And what information can be gained from that digital object? Well, that will help them do their job better. So, that's one part of just understanding the digital. Understand how you can leverage it, and move forward.

But there's another thing that I think is important also: how do you then take and look for ways of improvement? Everybody wants to improve. Companies are really looking for—getting, again, that next competitive advantage. Technicians are critical to the element. They're critical to the design, and to the product development lifecycle. And if they come across and have better ideas, inventions, innovations, and things like that, that's another piece of it. So, learn it. Embrace it. And really help them grow with it and leverage it. If I were to coach a number of

people who were technicians, I would really kind of give them that direction.

Mike: That's good advice, Gerry. What happens if they don't do this? Is there gonna be a place for them in the workforce?

Gerry: The answer is "No." Not as a technician anyway. And not in a growing company. There are people who are always going to be laborers that, I'll say, probably are non-educated, and people will fall into that like. When they try to interview for a job at any company today in the direction that's going into, digital capability, ability to work within—I'll say, even Microsoft tools—is a critical piece, or criteria and a filter, for them to even get selected.

For those that want to stay in the paper-based world, people will have a job, okay? There's going to be food service, and things like that. But, if they want to be a technician and work in an industry where products are growing, in an exciting thing about being innovative, this is absolutely a core competency they're gonna have to get.

Mike: Perfect. So, as I understand what you're saying, I should, number one, not be afraid of the digital aspects of technology—and for many young people, it's just part of their lives, so that's not too difficult. But, number two, as they look at an object, think about it as information they can get from it in a digital sense. And then, number three, be willing to contribute their own ideas to moving concepts like digital twin, moving that forward. I think those are some of the three main things you said, right?

Gerry: That's correct. You said something, Mike, just a second ago, that also triggered another thought. I mentioned STEM earlier. There's a tremendous amount of competitions that are out there today: things like FIRST Robotics. And FIRST Robotics is targeted at junior high and high schools, where these kits on building a robot, encoding it, having it go off and compete with others like, you've probably seen "BattleBots," and whatever. Well, that's a reality. And it's a global competition. There's Future Cities, and these things are looking at how do you design the city of the future.

Now, I only bring those up because you said earlier, you asked about, what if they don't gravitate to it? Well, there's going to be a competition for jobs. And if they don't, these young kids, these high school kids, are the ones that are going to take the job. So, learning from

them, watching from them, learning to be innovative and outgoing, I think is maybe the 3.5 to the three you mentioned, and really having fun with it. But, again, understanding: how can they compete? How can they be better than everybody else? But it's a real thing. It's really out there. And there's a lot of opportunity.

As I mentioned earlier, we're in a negative birthrate here in the United States, as an example. And, with the people who are retiring there's ample amount of jobs in all different pieces and parts. And this happens to be a core element to what people are looking for. So, find a place to fit in. They'll be there!

Mike: Good advice, Gerry. As we wrap up today, I think helping things like this move forward really takes collaboration between the industry side, people like yourself, who are really committed to this, and the academic side, who can think about modifying programs, helping students be aware of these things. So, thank you. I really appreciate your being part of this today.

Gerry: I appreciate it. I had a lot of fun. Got a passion for it. So warm to do it anytime.

Mike: It's clear you do, Gerry. Okay, thank you, again. And I'll talk to you. Bye.

Gerry: Thanks, Mike.

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Mike: Today we discovered a "digital twin" is a virtual model of a part or a process. A model that can be used, not only to design, but also to predict performance, to judge the impact of product changes, and even to discover how a product or a building will perform under different conditions. Here's your action for today. Go home, and at dinner tonight, tell your partner, your friends, your kids, call your mother...whatever you're going to do... Explain to them what a digital twin is. Say, "Here's what I learned today!" You could make a joke to your spouse if you wanted to and say, "Honey, we're having twins!" Sorry for that bad joke. Anyhow. To help your own understanding. We have two web references in the Show Notes. Take the action. Click on those references and discover for yourself. As always find our podcasts on PreparingTechnicians.org, or subscribe on Apple podcast or Google Play. A rating and review are always appreciated. Our series is produced by John

Chamberlain at CORD. Thanks, John. Our project is led by Ann-Claire Anderson at CORD. Thanks, Ann-Claire. And thank you, our listeners, for preparing technicians for the future of work!

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