

TRANSCRIPT

Integrating Emerging and Cross-Cutting Technologies: Edge Computing with Marilyn Barger and Richard Gilbert

23:00

SPEAKERS

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Mike Lesiecki

Our series on the Future of Work is continuing with the focus on integrating emerging and cross cutting technologies. We are hearing from educators on exactly how they are creating changes and new opportunities for learners in partnership with industry. Note that this presentation does not necessarily reflect the views of our sponsor, the National Science Foundation. A video version of this presentation is available on our website, Preparing Technicians dot org. And now let's hear from Maryland. Barger, Maryland personalized yourself to the audience. And tell us a little bit about your role. Oh,

Marilyn Barger

good afternoon, everyone, or good day. I'm Marilyn Barger, I served as the Co-PI the PI of the NSF, ATE Florida Advanced Technological Education center for a number of years, and now serve as its senior educational advisor. So I'm going to give you a little history of the work we did our our center was focused on advanced manufacturing in the state of Florida. And early on, we were looking to, of course, work with industry to make sure the programs that supported manufacturing were as good as they could get and match the industry needs as best as they could. And we did this old old time exercise, looking for common skills in a number of programs that were offered throughout the state that were related to advanced manufacturing. So they were programs in digital design, there were programs in drafting and design, advanced manufacturing, computer aided manufacturing, electronics, technologies, etc. So we took about six of these and we we pasted all of those state frameworks, which are standards and benchmarks for the programs that the colleges must observe, pasted them on the wall and highlighted common skills. So this is, you know exactly what we tried to do to consolidate the programs. And we were also looking for alignment to the MSSC's Certified Production Technician standard skill set for that certification as at that point in time, from around 2005-6 they were just emerging, as was the concept of integrating and aligning programs to industry certifications. So what happened as we worked with the colleges or industry partners, some community organizations, etc. And ended up defining a program that have really three components, the general education, what we ended up calling that at technical core, and then eleven specialization at that time, sorry, three specializations when we started, that really took on the core of their specific technology. So just call your attention to the number two, the ET core technical core. These were cross disciplinary skills. These are skills that we identified in all of those programs I previously mentioned, from electronics, to advanced manufacturing, to drafting, etc. So we were doing some cross disciplinary skills back in the early 2000s, and didn't really even know it. We certainly didn't call it cross disciplinary skills at that time.

But we were looking to increase enrollment to provide multiple entry and exit options to meet our industry needs, of course, remove some duplication in teaching loads for the educators and integrating industry credentials. So on this slide now today, we have over 2000 students and over 20 colleges, starting with three back in 2008. And now we have 11 specializations with where we're moving down to industry 4.0 With this advanced industrial automation, the name might change, but for now it's advanced industrial automation, where we'll capture industry 4.0 skills, it's yet to be approved and finalized. We're working on that right now. Marilyn,

Mike Lesiecki

I had a question for you Marilyn excuse me, fore interrupting, these these specialization tracks are those tracks are those courses.

Marilyn Barger

These are all tracks, they're 24 to 27 credit hours. And they all all require that 18 credits of technical core, okay, same technical core. So the students basically take one whole year of their program, exactly the same the gen ed and their ET core, and then they move into a track different colleges offering different combinations of these different tracks. Okay. Okay, so that's our first alignment to cross disciplinary skills and identifying those. And as Mike is mentioned, and you look at the standard core, you'll see some of these are all of these listed in one of those three buckets. So fast forwarding to recent times with the emergence of industry 4.0, we were funded to look at these skill sets and integrate them into our into our programs, especially advanced manufacturing, so the focus was on one, or is on one of those specializations. And it's the most popular one that most colleges offer that particular specialization. Alright, so we just looked at these lists of skills, there are many different visualizations of industry 4.0 technologies, this was the one we use, they did a lot of work with our industry partners, we surveyed industry, we surveyed educators, we analyzed that data for gaps between the two groups, we then took the data to the two groups and coded it and worked with it, we also eventually aligned it to the existing framework to see how far off we were. So let's move forward the result of those various iterations of just working with the skill sets and the surveys through what we call caucuses, where we talked about them, we ended up with this list of 37 technical skills. They're not in any prioritized order just to make this visually readable, you'll see many things that are in many existing programs, many skills people are already teaching. And what we discovered was 33 of these were covered in our programs already, we've had not too much work to do. And pulling out the ones that were not covered. We see database skills, data integrity, integrating systems, data interpretation, some interdisciplinary concepts, and security requirements. So security requirements implying cybersecurity awareness. So also, you'll see here, these are all in STEM core as well. They just currently aren't addressed in a in a big way in our programs. So this was what we decided to tackle, and figuring out how to integrate them into the program. So we took the that list. And as all of you might know, or might not know, edge computing is also an advanced and emerging technology. And it's used to accumulate data from a variety of devices or equipment locally, and to be analyzed locally, before any of it is sent to the cloud, for storage, or whatever auditing etc. So it's a it's a nice way for companies that are doing things in real time to look at data and make adjustments at a faster time pace than they would if it was all if everything went to the cloud and had to be dealt with at that level. So it's commonly used in manufacturing and production environments. So now I'm going to turn it over to Dr. Gilbert. He's going to give us a little overview of how this works.

Richard Gilbert

The industry 4.0 technology insertion into the manufacturing workplace is placing new skill demands on the operation technology technicians that support this workspace. To support integration of the edge computing skills into Florida's Engineering Technology two year degree program, four community colleges developed an edge computer project. Using an industry based edge interaction device. The LIMS box has manufacturing process sensors and final control elements and acts like an edge computing device that interacts with company owned servers and does not have to interact with the public domain. This allows the company to interact with other equipment in the plant and have no fear of interference from the outside world or a cybersecurity break in. The LIMS box has all of the software necessary to interact with your computer. This software will run all of the equipment, as well as do calculations and graphics with information that can be stored in mass storage devices of your choice. Please note that the company's local area network router has access to the cloud. And this is done when the company wishes to transfer information to the cloud. Several Capstone student projects are also being developed. In this example, the independent variable frequency drives are not performing as expected. The OT technician is assigned to fix the problem. This is the graphic supplied to the students. It has all the information they need for the solution of this challenge. So

Mike Lesiecki

Dr. Gilbert, let me ask you, Richard, let me ask you this question. Many of us are somewhat familiar with edge computing, but take a step back. And what's the difference between OT and IT usually referred to an O as an OT technician, and a lot of us know what IT is. But could you be specific, what's the difference between OT and it, historically,

Richard Gilbert

I believe IT trained people would be involved in this only The problem now, the challenge now, is that in manufacturing facilities, it's usually operation technology technicians who are working in the floor. And the IT person may not even exist there, because they can't afford them, or the IT person is, is off doing other IT things. So it will be certainly the case that operation technology technicians are going to get involved with situations perhaps in the middle of the night, where equipment doesn't seem to be working correctly. In this case, one of the or the independent variable frequency drives, so there is no IT person out there to go to. So we are going to have to put some of the IT skills into the OT person.

Mike Lesiecki

Well, that makes sense. So in other words, they don't just wake up the IT person for in the middle of the night and send them into the plant for that's not what they do.

Marilyn Barger

Right. I think the important thing is the OT person, which is the term sort of new, I guess, or not been seen much is really the manufacturing or production technician, yes, operating equipment, and oftentimes just one piece of equipment at a time. And looking at data and maybe from that piece of the operations, but not necessarily collecting it from multiple machines. So maybe things are running in parallel, and they're trying to look at are they working the same, you know, they're two lines doing the same thing. Maybe they want to compare those two lines and edge computing allows would allow them

to do that. So bring those two data streams together on the floor. And, and therefore the floor technician manufacturing technician, operations tech would need to understand some of those communication skills of getting bringing that data from those two different lines to one one place.

Richard Gilbert

If you check with John Sands, for example, they are very, he is very, very knowledgeable in IT and IT situations and cyber situations. He, he would tell you that what's happening is those three variable frequency drive equipment pieces were just bought, replaced two or three years ago. And they aren't the simple, straightforward, single job tasks masters anymore. That equipment has multiple sensing multiple interactions with multiple equipment. So the IT person won't know exactly which things are important relative to the problem. And it will take the IT person quite a while I go through all of the code to figure out what's going on when in fact something in the other part of the plant is working perfectly fine. So it is the industry 4.0 new equipment that is driving the operation technology technician into this arena. He didn't have to do that, or she didn't have to do that in industry 3.0.

Mike Lesiecki

Marilyn, that brings us to a very interesting point. It's clear now that the skill sets of a manufacturing technician, let's call it a OT technician, as Richard just said, have to include things like networking and these other skills well, how do they get them? Do they take another class from the IT area from the you know, computer technology department at the college or is it integrated in? How does that happen in an actual program like an engineering technology program?

Marilyn Barger

So for us, it happens within the program itself. That may happen too. We do a lot of project based learning in our programs in Florida. So that's one way so Richard mentioned, the kind of case studies and senior projects or capstone projects that students were some students were developing and others would be would be using, as one place where they would integrate this, but I know a lot of the faculty are starting to integrate the networking piece into their PLC courses, especially those that have two PL programs that have two PLC courses like, you know, beginning intermediate kind, of course, they would do that networking piece right within that second course, or the robotics course, if it's after the PLC course. So there's lots of ways the the amount of information that they really need is just, you know, they keep the facility running and their equipment running. So they don't they need to understand how they communicate that they don't need to know everything else that it comes in, that turns into a network problem, the IT people are going to have to come in.

Richard Gilbert

Sure, sure. Sure, it turns out that one of the one of the colleges and happens to be in Palm Beach, is involved directly in building some of these applications for us. And their program is in biomedical technology isn't even manufacturing. So she has already integrated these concepts into her program, because she has the same problem. If there's a new piece of biotech equipment, it's going to be driven by the extra freebies, if you like that come with industry 4.0 new equipment. So her technician, students have to be prepared to deal with that as well. And they she does not do manufacturing, per se in her bio medical program.

Mike Lesiecki

Let me follow up with you, Richard. So a program then ideally would have some sort of edge computing device that a student could get some practical hands on experience with. I mean, do these things cost \$500 \$5,000.

Richard Gilbert

That's a very good point, the actual one that we got, because we got it through SF engineering, we got it through a grant source was a industry based piece of equipment. And I'll just quote 5000. That's not it, however, we are also working on with colleges and part of this project to do a Raspberry Pi and or Arduino. So right now smaller, inexpensive machines that would not be used directly in industry, but can be used in a college environment. And those prices are under 1000. The actual CPUs are, don't quote me to at the grocery store, but the actual CPUs are 100 to \$200. And then the other equipment, depending how exaggerated you want to make your point, could be up to \$1,000. So okay, so there's some options, a Marilyn,

Mike Lesiecki

I'm a faculty member, and I'm just sort of vaguely I'm a manufacturing person. I know about networking, I'm not all that solid in it. And I'm a little intimidated by thinking about bringing something like this into my program. How do I how do I skill up? How do I how do I get myself up to speed my own professional development? How are how to Florida faculty do it?

Marilyn Barger

Well, in Florida, we have a great community of practice of public Engineering Technology forum. And that's a vehicle for professional development for us. We meet twice a year and gather that kind of information, what people need, and hook people together, or connect people, oh, who knows this and who knows that with those who don't. So for example, we just have a two day while we have all semester workshop that culminating at the two days of PLCs with some networking actually, in last Monday and Tuesday at one of the colleges that hosted and also instructed the other faculty. A small group of six I believe we were in attendance and one presenting so that's how we're taking care of ourselves and otherwise I would say reach out into the greater NSF ATE community. Some new resources and workshops coming out of that. We are FLATE is actually hoping to develop the Raspberry Pi idea which we have a pilot of that's work into a workshop that will illustrate the skills and then provide this educational the affordable platform for them to for educators across the country to use some but we might be eight months out from getting that into a workshop kind of area of gotta work on more data to collect and that's where we are right now but we've got currently are working. So the

Richard Gilbert

engineering technology programs around the country, and there's over 200 of them are organizing themselves to be for the support Engineering Technology Center. And with that in mind, it is likely that we will have a professional development workshop at HI-TEC in next year. Well, sorry, this is 2024. So we are looking, this is a national situation. So we're looking to make sure that those national opportunities for professional development

Mike Lesiecki

look good. Thank you, Richard, I'll Richard, Marilyn, and myself, let's work together and put together some show notes with the resources that we have now that we can share with people. So thank you. And thank you both for this because it's such an example of a, I'll use this term in a tongue in cheek manner, using such a cutting edge technology. As an example of integrating cross disciplinary skills. You mentioned the implications of cybersecurity. That's one of the drivers of this. And Richard, you mentioned Dr. Sands, he is also producing a webinar in this series on cybersecurity implications. And I'll make sure that we crosslink to that one as well. As we wrap up today, I'd like to remind you again of our project website, Preparing Technicians all one word dot org, and the tools and resources that you will find there. These include the white paper, a framework for a cross disciplinary STEM core, you can download and share cross disciplinary instructional cards in your class, you can listen to podcasts, or you can share these recorded webinars. Here's some examples of those cross disciplinary instructional cards. They're organized in those three major skill areas. You can see things in the middle of for example, under advanced digital literacy, like network communications, internet of things we heard about that today, automation, robotics, network architecture. So these are small learning activities that you can bring right into your classroom. Also podcasts for example, Episode 37, incorporating the Internet of things, talks about how to take cross disciplinary technology and integrate it into a manufacturing area. And finally, recordings of this webinar series are available at preparingtechnicians.org/webinars Thank you again for joining us today.