Episode 47: Integrating Emerging and Cross-Cutting Technologies: Manufacturing and Data Analytics with Mason Lefler and Scott Danielson

🕐 33:39

SPEAKERS

Mike Lesiecki, Mason Lefler, Scott Danielson

M **Mike Lesiecki** 00:10

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 now it's time to introduce our presenters for today. Mason Leffler Mason, thank you for joining us. I want you to say hello for the audience. And tell us a little bit about yourself. But I know your title is Associate VP for educational innovation. I like that title at Bridgeland Technical College up in Logan, Utah, say hi to everyone. Mason, tell us a little bit about yourself.

M **Mason Lefler** 01:04

Hello, everyone. I come from a background in education. I was inner city, middle school teacher that started doing stuff with technology early on years ago, and then moved up to northern Utah to get a PhD in Instructional Technology and Learning Sciences. And so have shifted into research and in particular with with regards to Tech ED learning management systems. That's what brought me here to Bridgeland. And then had the opportunity to work with awesome teachers like Scott Danielson and work on some of the problems that we have in northern Utah, in leveraging technology to disseminate curriculum, and develop curriculum at the pace of of innovation.

M **Mike Lesiecki** 01:49

Cool. Thank you. Dr. Leffler. Isn't it nice to say that Dr. Leffler isn't a recent PhD? So thank you. So thank you. Very cool. Scott Danielson Associate VP of Instruction for three things right. manufacturing, construction and transportation at least. That's what your title is a bunch of those words, Scott? Well,

Scott Danielson 02:08

sure. Sure. Yeah. So my background is from industry. So for 20 years, I worked in manufacturing plants as a control systems engineer, graduated with an electrical engineering degree in 1991. And the first thing that my first company did was send me to PLC training. And then I never looked back from that, you know, so it was interesting to me that I needed PLC training after college. But I did and but anyway, but then I've used PLCs, and control systems ever since. And then about eight years ago, I started here at Bridgerland. I was teaching and then now I'm in administration. Right, a lot

Mike Lesiecki 02:50

of us out here love PLCs. So we're welcome. And we're happy to have you here, Scott.

Scott Danielson 02:54

Thank you.

Mike Lesiecki 02:56

Okay, Mason, I'm gonna turn it over to I think to give us a sense of manufacturing analytics, from the perspective of data analytics, go ahead and take it over.

Mason Lefler 03:06

So in my position in northern Utah, I'm over grants and curriculum. And so I had the opportunity to sit on advisory boards and sit in on those meetings. And something that started happening earlier, early on, well, at least five to six years ago, as we started hearing a lot of the local companies. And just to understand context, northern Utah is very manufacturing centered. It's like one in four jobs are in manufacturing, and its manufacturing of food and auto parts, and all sorts of stuff. So one thing that started creeping up as we started hearing, not only about the jobs, a tremendous amount of need for technicians in our area, but also data started popping up across a multitude of different departments. And so we actually wrote an in state grant previous to these two ATE grants to start a data analytics program. And more than half of the advisory was manufacturing plants when we started the data analytics certificate. And then after that, wrote the distance enabled industry lead data analytics, technician pathway to work on particular populations, and also this move into manufacturing analytics. So this slide talks about a little bit of those, those things that started bubbling up, and you would go to our IAT advisory and they would be talking well, we need people that data and that you go to manufacturing, like we need people that understand PLCs, but the data side of it, and it just started popping up everywhere. And so that's, that's, that's what our companies locally, are really striving to do. It's like we had the information age, but now everything's interconnected. It's created immense amounts of data. And lots of those companies are figuring out what's the type of technician that we need. And something one thing that I wanted to mention is that as we've been developing that program Each of the companies are dealing with it differently. In some cases, companies are like, well, I need a data technician, that's going to work underneath

my data analyst. And then in other companies, they're saying, we're not going to hire a data tech, we're going to upskill, our controls techs, or our automated manufacturing or our maintenance technicians. And so it's really interesting this, that in some cases, it's becoming a job. And in other cases, it's a it's an additional skill set that's been adding onto a lot of different job titles.

M Mike Lesiecki 05:33

I think that's true for a lot of things across the nation now, isn't it? I mean, there's no single job description anymore that you can, can use. They're all integrated, as you're saying. Yeah.

M Mason Lefler 05:44

Yeah, yeah. And those technicians that sit in the crux of are sitting between IT, and data, and, and controls engineering. From what I've heard, and from what I've heard from, from our local, advisories, they just, most people are worth their weight in gold. So when you're talking about future future proofing? Yeah, that's a great set of skills. It's those people that sit in between those two, are those those certificates, you know, series of knowledge. So,

S Scott Danielson 06:17

yeah, I'd like to kind of interject here, there's one of the interesting things that we learned as we were going down this path. And then I've known from industry as well, as you know, data means a different thing to from, if you're a controls technician, and somebody that's like a data analyst, it depends on how big the company is. But if you're, if you're working at a small company, that may be all pulled into one single person where the one person would be preparing the PLC to be to collect data, and to present the data and then move the data into a database from the PLC, and then actually present the data, you know, collect it, clean it, present it and all those things. You know, in a smaller company, that may be the same person, in a larger company, midsize to large company, those roles might be different. And you actually have what what a data technician would see. And then what a controls technician needs to do to make sure that that person can see are two different roles. And so we started to look at this from those two aspects, you know, so a PLC programmer will need to make sure that the data is collected or presented in a way that the data analyst can pull it. So often, they're given this task of maybe doing a little bit of math or number crunching in the PLC as time rolls on. And then making sure that the data people know the tags that they need to pull in order to see what they want to see.

M Mike Lesiecki 07:50

And I'm sorry to interrupt you, they just dump the data to an Excel spreadsheet and manipulate it,

S Scott Danielson 07:56

well, yeah, it depends on how you want to do it. But yes, so most PLC tools do have a very

well, yeah, it depends on how you want to do it. But yes, so most PLC tools do have a very simple inside the PLC programming software, you can just pull down an Excel spreadsheet, most of them have that capability. But if you want to do it over time, you're going to use a piece of software that will hold the PLC, ask the PLC for data every so often, however, often you may have decided that you need to collect it. And then that piece of software Kepware, as an example of one we'll take, it's basically a middleman between the PLC and it like say an SQL database. So every so often, it'll say, give me this tag, give me this tag, give me this tag, and then it'll throw it into the SQL where your data people in the business office can easily see it. Yeah, so if you wanted like a widget count or something like that, you'll probably program the PLC to keep track of that widget count. And then you present that tag to the data people who will grab it. Like I said, every so often. Okay, that's it. It's an example. Yeah. And then in that previous slide as well, if we go back there for just one second, these are the kinds of problems that I just wanted to mention that that are being solved with data, we have companies in the region that use data to an amazing effect, and then ones that you would call rookies, and they're just starting to do that. But an example would be if you monitor the amps on a motor, and then the motor fails, you've kind of got a view of what a failing motor looks like. And then now you can continue to collect that data for the new motor that you just installed and look for that pattern and be able to predict, hey, we're close to failure here. And that's just an example of the kinds of things that can be done. This

M Mason Lefler 09:51

gives this you know, the the complexity of how, how these of how companies are managing this transition. There's a good example of it on this page, this, this is actually a screenshot of a video that we're that we're developing, to try and communicate to high school students or people that are looking to be hired in the area to kind of tell them that there's these jobs out there. And so in this picture, we have Taylor. And she's an engineer that's that works at Blackbox Engineering. And they're they're, they're a firm, what are they?

S Scott Danielson 10:29

They are, You would call them a systems integrator? Yeah, their system, they do jobs for other companies. Yep.

M Mason Lefler 10:35

But what's interesting is that Taylor's job, so this that the integrator will be hired to like set up a new line or design a new line and that piece, Taylor's a large portion, I think maybe even all of her job at this point from from what was reported in the last time I talked to her is that her sole responsibility is to be hired out by local companies to help them move from non-data to data, which means that she's collecting that data, she's figuring out which reports are going to be generated for all of those different things that Scott had shown on the previous slide. And it was really fun that in the in the, in the timeline of going to visiting this local factory, that's not the that's not Blackbox, that's a picture of a local manufacturing company called Gosnells that produces cheese, just in the time that we went in for the first time to talk to him about producing the video that we came back. And then later, we came back like a year and a half later to look at stuff, you could see their their space transforming the first time we went through, you can see that they had paper printouts of key performance indicators that they

were putting in the site, the line of sight for their technicians, between the night shift and the day shift, which meant that the manager was pulling that data down, cleaning it up, and then going around and taping up stuff. Right, so that the production line could beat what they the night shifted, or they could beat what they did the day previous. It's giving them the scoreboard, right? How much downtime that we had, how long did it take us to get back up again. And then when we came back, they had already been working on this for a while. And all of a sudden they had where those pieces of paper were that somebody had gone around and manually put up. They all of a sudden had a big, big screen right there with a data dashboard that showed those those KPIs. And it was just ongoing data, right. So that it was really interesting to see that transformation firsthand, happen within a span of six months to a year. And that's what they're doing. And it's they're doing that for the oil. Let me let me say this. The other the other piece that's really interesting is that there's multiple people that are involved in this, they use a company called Tetra pack, Tetra pack designs, designs the line and they have a controls engineer, and they have their own proprietary software that tetrapack has, but then they're also hiring Taylor, in this local company to do other pieces of that. And then there at the same time, they're upskilling, somebody that used to work off that was a line operator at one point or a machine operator that's worked his way up. He's now in a position where he's learning these deep data analytic skills to produce all those reports that they that they want to have. So you've got three, at least three different people that are working on transforming this plant into a data driven plant, which is really, really exciting to see that happening firsthand. So I wanted to talk just just really quickly to kind of give you an update of where we're at in the process of our grants, we have those those two grants, and essentially the the automated manufacturing grant around troubleshooting started earlier, or a year prior to the data analytics grant. And so we have a little bit of a jumpstart there. And essentially where we're at on that grant is that we've been developing KSAs, or we've been going through this curriculum review process. And the whole perspective of that piece is that if we want students to be able to if we want, let me do that, again. If we want students to be capable of producing and managing data and understanding that little system, then we've got to develop a trainer that collects data and collects the types of data that local industry is managing. And so you can go to the next slide. And so what we've been developing as we we needed, we needed a trainer to simulate that real life. And we've been working with that, that industry over the past few with our manual local manufacturing industry to develop a trainer where we could produce our own data, and so that the students can be connected because you give them our official data set and they're working against some, some product like ignition, then they're not going to understand where it's coming from or how its generated. And so we wanted to keep that all in one piece and connected. And then the second grant was written a year later, and has been following. And we're, and we're essentially developing curriculum from both angles. So you've got, now that we've got the trainer. And now that we've gone through and designed, what are the features that are going to be there, what's the data is going to be produced, and where's the server going to be held? We, we've been working with local industry to figure out how to develop a Data Analytics course, from the direction of the technician, and the data analytics course, from from the direction of the data tech, or somebody in management that may be, you know, data has now been thrust upon them, there's, they're expected to have that skill set. And all of a sudden, they need to learn Power BI, or Tableau or some manufacturing visualization data. And so we're essentially building curriculum from two different directions, where, where they're meeting in the middle, depending upon which which side you're working on, whether you're on the manufacturing, or the more data, business operation side.

S Scott Danielson 16:11

So here's our trainer. So we talked about I mean, the the data collection is only one aspect of the value of the trainer. And we, we can talk about this some other time. But that's just one of the reasons one of the things that was in our minds as we were developing this trainer with industry. But it's really just a mini process that you would find in a manufacturing plant locally. And nationwide. I would say, Scott,

M   Mike Lesiecki 16:35

I can't help resisting are those light curtains on there? Yes, they are. That's exactly

S   Scott Danielson 16:39

right. Yep. Laying, you know, surrounded by light curtains, we have an Epson robot, and we have a table that turns there in the middle. So parts are presented, and they go through these processes at these little stations as it kind of goes around. And then you know, parts are determined if they're good or bad and end up in different buckets.

M   Mike Lesiecki 16:57

Data data comes out of a sensor somewhere. Well, the sorry to interrupt. You might be going to talk about this, but the students from the data analytics department, are they taking a manufacturing course and the manufacturing, people are taking the Data Analytics course? Is it the same course? Or how does that work?

S   Scott Danielson 17:01

whole system produces data. So you can you can track like widget count, you can track like how many metal pieces do you have versus plastic, you can track the time spent on the on the wheel there. Yeah, there, there are just a number of things. Weight, you know, there's a load cell on there. So we can track weight, you know, weight variation. And we can do some standard deviation based on that. Those kinds of things, typical things that manufacturing plants need to do. Well here that this is showing us the two, the two directions. So we have a data analytics department, which again, which Mason is saying, you know, was a fairly new thing that we started. And then the automation department that has been around us for a while. And one of the things that we've done recently that might be of interest is statewide, we changed the name of the automation department from manufacturing. Let's see, what was it before automated manufacturing? automated manufacturing? So I'm already been shifted. Yeah. Automated. know this? Yeah. I mean, I worked in that department, for heaven's sakes, yeah. But anyway, automated manufacturing. And we change it to automation, because manufacturing is only one aspect of automation now, and one of the things we're doing here in Utah is trying to attract things like the AG sector, all of which is automated. It's incredible how much automation is going on in AG. But you know, when you see automated manufacturing, they don't connect those things is irrelevant. But again, so a data analyst is one side data analysts are learning things like SQL, Tableau, Python, things like that. And but in the automation department, we're learning PLCs, we're learning HMIs, we're learning those kinds of things. So the data problem is a different problem for these two groups. And occasionally, you'll

6

have a person that needs both of those things, right. So a person would go ahead and get their automation certificate, and then come on in and get the data analytics certificate if they need both those things. But as we were developing this data course, we, we said, Okay, well over here on the automation side, we've got PLC people that are producing the data. And again, they know the sample objectives, you know, setting up data transfer, like Kepware is the name of a piece of software that is that bridge between, let's say, a PLC and SQL database, for example, lots of it basically talks to a lot of different things and puts that data in a number of different containers, and then analyzing data. And then, you know, analyzing data in a manufacturing and maintenance scenario. So like that scenario that I mentioned earlier, where maybe we need to monitor the amps on this motor to find out if it's working too hard, and as an indicator of failure. But on the data side, if you have someone that's purely from data analytics, they're not going to know PLC programming and nor do they need to. What they're going to be doing is they're going to be presented with a set of data that has been pulled from a PLC. And we do actually have them connected to a PLC, which they may be asked to do connect to a PLC pull the data from there, and then process that data through an active work environment scenario. So they can do all kinds of data presentation based on data that they've collected, which is normally what they would be asked to do in the workplace. I'm There are actually two two different courses, but very similar. So we basically have a set of problems that we present, you know, and again, I'll just use the example of that. We would call it predictive maintenance. Yeah. Which is, let's detect a motor that's going bad. Well, from the data analytics side, that problem is here is a collection of data that shows a motor failure. Can you look at that data? And perhaps, is there something here that could tell you that is somewhat predictive? You know, can you Is there is there something that occurred before that failure that you could perhaps warn an operator about on the automation side, that problem is in the PLC. You know, so if we want to get those amps, if we, you know, first of all, how do we measure motor amps? How do we get the most motor amps in a place where a data collector can grab it? Those kinds of things. But in the automation department, like you said, you know, can you pull a spreadsheet out of PLC software? Yeah, you absolutely can. And, you know, an automation engineer, or an automation technician, may just use those onboard tools to do that, and to do those analyses, whereas the data analytics folks, you know, could be looking at it from a different perspective. So the answer is, the classes are similar, but we recognize that those are two different groups of people. So in the data analytics department, we do have a manufacturing Analytics course, it's an elective, not everybody has to take it, but it's an elective. And by the time they get there, they've learned SQL, they've learned Python, they've learned Tableau or Power BI, they've learned all those things. And we're leveraging those things. So we're saying, okay, get connected up to a PLC, get a data feed going into your SQL database, and use that to make decisions and show us how you made that decision. Right. But from the automation department, we can't assume any of those things. I can't assume that somebody knows Python, I can't assume that anybody knows how to do a visualization. Right? So from there, the problem is different. You know, how do we do this inside the PLC? How do we look at that data inside the PLC? How do we look at historical data inside a PLC? How do we use like the HMI to do that? How do we use HMI to display some important piece of information like when Mason's said a KPI, some important piece of information that we want them to drive the plant with, you know, here's the number in front of the operator, and we want you to maximize that number. You know, those kinds of things are what we're teaching in the automation side. But they're solving the same problems, right? You know, we give them the list of problems to be solved are very similar. But these are two different groups of people with a different background. Mason, I just love this sort of talk. Your students go home, they sit down at the table with their parents, and they said, What do you do in school today? Oh, I set up a data feed from a PLC into an SQL database and I started analyzing the data. The parents say, just just keep going there. That's good. So

Mason Lefler 23:43

on the right hand side, that's like an early version of an HMI that's being produced to count something on off that trainer. Yeah. And then on left is Ignition, a popular software we asked, you know, which, out of all the visualization software's that you want us to focus on which one locally, and ignition was one that was way up there for our local companies. And that's, that's not something that we've produced, but that's something that they they have, as we've gone through, as our instructors have gone through training, so that but that, but those are the type of representations that the students that would be would be asked to put produce. So

Mike Lesiecki 24:23

you've done all this stuff! You answered a key question, I think for us about, Scott, you mentioned the electives. Right. So I was wondering how this gets integrated into your programs. Mason, what were some of the challenges doing this? Is it administrative? Is it technical, what are the challenges and how did you get over it?

Mason Lefler 24:43

I think, I think that I think the biggest problem is the pace of innovation. Kind of like what you were mentioning in you know some of the objectives that you had for the Future of Work, you know, the pace of innovation within the manufacturing sector. And within data analytics is just light speed and there are certain constraints when you come when you're working within an educational environment, specifically regarding to how do you teach the most up to date, there's a certain amount of developmental burden cost of continuing through that cycle of redeveloping. So I think we're at a good pace, you know, leveraging KSAs. And getting into a rhythm of refinement and development. I think that's been a hurdle to figure out to do that efficiently. It's, and it's never going to, I think I've given up on the belief that, you know, curriculums ever done. Yeah, that's one of the reasons I like being instructional designer that that's just what it's going to be for the for time and eternity is to just continually refine and adapt and pivot to local industry. And I think that's, that's a major challenge, tangential to the pace of innovation is the breadth of the amount of skill sets that you've got to find in an instructor. Yeah, sure. So early on, we were trying to hire a one, a one man, or a one. Actually, these were both one woman bands of our early people that we hired, had been working in industry, but they, when you're trying to have some of this teaching both the manufacturing side, as well as the business side of data analytics, you're not going to find somebody that knows all of that. So that's been a hurdle. Finding people that figuring out how to how to hire adjuncts and how, you know, what's the balance and how to keep those people around, because they're worth their weight in gold. You know, like, the first department I had was, was poached, we hired another person. After a year, we hired another person had them for a year, then they got poached. And so it's just this constant burden of trying to keep people here at a technical college when they're worth that much for local industry.

Mike Lesiecki 26:56

Good point. How the students feel about this, I mean, I wait, I signed up to be an automation

technician, I like fiddling was mechanical, electrical stuff, I manage it and this SQL stuff, are you facing things like that?

S Scott Danielson 27:10

Well, not really, I feel like those that, again, it is an elective, so those that choose to take it and are feeling that they need it. Often, by the time they get to that level in the program, they will often be working at that point. There's, you know, so they're there. They're coming to school at night, and they're seeing what's going on at work and what's needed. That so yeah, so the idea that, you know, that that's something that I feel like we've had questions on in the past is, you know, I've noticed, you know, how does this number appear on the on the HMI? How do they know this number? How is it calculated? What are you using to measure it? Those skills, kinds of things are natural student questions that we have. And they often come from, you know, they'll have a supervisor at work, who may be trying to solve a problem, it's like, you know, I need to make sure that the, whenever this happens, it negatively affects our process, how do I measure that thing, so the operator can see that it's happening, and react, you know, so, you know, that comes in sensors and PLC programming and, and that kind of thing. So often, as an instructor, I would be asked that, they would say, you know, at work, I have this, and we'll talk through that. And often it's data related, at least it has been, you know, it's just become a greater and greater thing. And, and not only that, but in our big plants in our big companies, they may have multiple cells, you know, each cell has a certain function. And then they've got like, this overlord software that's watching the cells operate. And by data collection is able to make decisions on I need to slow this cell down, because this one's not keeping up because it has an issue, or I need, I need to shut this one down, because it has an issue, and therefore I need to redirect the output of this one to that one, you know, I mean, they're they're starting, they've been doing this for a while. It's not brand new, but it's fairly new, you know, you know, 10 years, maybe, but they're making sophisticated decisions based on this data collection now, and they all see that all the students that are working see those things. Yeah, yeah,

M Mike Lesiecki 29:21

yeah. Cool. You know, I want to thank both of you because Bridegerland is really taking a forward look here. I mean, you know, our project, Preparing Technicians for the Future of Work. You're doing it your students, you're working with them with their data literacy or ability to manipulate data. You're folding it into your program in thoughtful ways. you've developed your own trainer, which, which gives us students opportunity to pull data out of it and do something with it. And boy, are you using industry I know you have a strong industry board and you're really using them to help direct the program. I think that gives encouragement to A lot of our folks who are listening online viewing this webinar or listening to our podcasts thinking, you know, I can do something like that at my college to our can they connect back with you guys can can can we do that? Yeah, definitely.

M Mason Lefler 30:13

We've got I was hoping to have a few slides in there that where they can reach out to us.

Mike Lesiecki 30:18

Hopefully they're in the show notes. Mason. Yeah, yeah, we've,

Mason Lefler 30:22

there's a couple of QR codes that we'd love that we we've got the website for the data analytics, or sorry, for the troubleshooting grant. It's a little bit further along, in in terms of sharing our curriculum, we're open to doing all that they're both NSF funded. And we're really interested in sharing and growing, we love the ATE community and how we, we it's, it's a really powerful, professional learning community where we can share curriculum and learn and grow from one another.

Scott Danielson 30:49

Right? So I'm happy for anyone to contact me, anytime.

Mike Lesiecki 30:53

Perfect, Scott, I am going to put both of your connections, I promise not to advertise it on eBay or anything like that. Naw just kidding, we'll make sure you get those in the show notes and links to your program. And you mentioned that video, it's an impressive video, I'm gonna put a link to that as well, the ones that you've used to promote your program, because a good sense of things. Yeah.

Mason Lefler 31:12

Because that will lead them to the website that we've got, we'll have that video and the data analytics one will be up there pretty soon once we get it finished.

Mike Lesiecki 31:19

Perfect. Speaking of websites, I want to direct our audience as we wrap up today to Preparing Technicians all one word, dot org. And what will you find there? Well, we have this white paper. I know everyone wants to sit down to read a white paper, but it's only five or six pages, which is titled a framework for cross disciplinary stem core talks about the genesis of what we're doing here. And it's well referenced and so on. Now, we have something in the second bullet called instructional cards. so faculty can actually take these short form learning activities. Mason, I think you'll like the instructional design of those cards, and use them right in the class, you can listen to our podcast series, I'll talk a little bit more about that and share these recorded webinars that you're viewing today. Here's an example of some of those cards. Let's look at that. The first column data knowledge and analysis, we were focusing on that today. There's cards for data visualization, spreadsheets, analytics tools, you heard a lot of those things today. So we have activities that people can use directly in the classroom. I mentioned podcasts, there's now 44 of them, we're increasing our number of podcasts. A lot of interesting things

there. The number 38, which you see in the upper left is an example of technicians in the new blue economy. Justin is talking about Blue tech. They're just an example of some of the cool things that are going on. And by the way, as we wrap up today, the recordings of this webinar series are on the website, you can access them right there, in addition to additional professional development, and instructional resources for this webinar series are at preparing technicians.org/webinars. That concludes our webinar for today. Scott, Mason, just a pleasure talking to you and hearing about how you did it. I mean, we love to hear stuff like that. So thank you again.

M Mason Lefler 33:16
Thank you. Thank

M Mike Lesiecki 33:17
you. All right. Goodbye, everyone.