Instructional Support Part 2: Engineering and Math

Kate Brunick: Welcome to "Head Start TAlks," where big ideas support your everyday experiences.

Well, hello, everybody. Good morning. Welcome to the "Instructional Support Part 2: Engineering and Math" piece of the ECS podcast. We hope that lots of you have already heard "Part 1" of this two-part series. If you haven't yet, we would love you to go back and listen to Part 1, where we explored some common questions, resources, and effective strategies for helping program leaders really facilitate their effective teaching practices and then support science and technology thinking and learning.

STEAM learning is super important because of each of its components. Science, technology, engineering, arts, and math all promote problem-solving as well as creative and analytical thinking.

Today, in part 2 of the podcast, we're going to focus on how you can support your program leader's understanding of how to use continuous quality improvement cycles to boost effective practices related to engineering and math. That sounds like a mouthful, but we promise we're going to break it down for you today. We're coming to you from our professional development conference for early childhood professionals, so we've got a special episode being recorded live.

Dawson Nichols: On the fly.

Kate: And with me today—Yeah.

Dawson: There we go.

Kate: Ready in the middle of things. So, with me today, I've got Dawson Nichols. He is the outreach specialist for the University of Washington I-LABS, which is the Institute for Learning and Brain Sciences.

Dawson: Yes.

Kate: Welcome, Dawson.

Dawson: Thank you. I was glad to see you and be invited to do this.

Kate: I know. It is exciting to kind of get all of the energy from the conference as part of this today.

Dawson: Yeah, yeah, yeah. So, you've been listening to Kate Brunick, who is the Senior Research Analyst for NCECDTL.

Kate: National Centers!

Dawson: If you didn't recognize her voice.

Kate: Well, it's great to have you here, and I'm really excited today to really focus on the second two parts of STEAM, so we're looking specifically at engineering and math.

Dawson: So, I do want to alert people to the fact that there is another way to get an introduction to this, and that is the 2019–2020 "Teacher Time" series.

Kate: To all those listening, Dawson's a huge fan of that series 'cause he has a nice surprise cameo in there somewhere.

Dawson: Oh, yeah. I have a cameo. That's right.

Kate: Just a little plug.

Dawson: But the series is great because it does focus on three strategies. First, providing engaging environments; second, using nurturing, responsive interactions; and then, finally, third, providing meaningful learning experiences and opportunities.

Kate: Those are three things that we love and three strategies that we're—

Dawson: It's a good tripod, yes.

Kate: Yeah, we're going to come back to those quite a bit today. But I want to start by defining engineering and math in the early years because I think it sounds very high and mighty and we think of engineering as being hard and math as being very advanced, and how do we work on that with infants and toddlers?

Dawson: Right, and it is, at its base, a very simple concept, and it is just this: Engineering is how and why things work.

Kate: Oh, okay.

Dawson: And children begin experimenting with this from the very earliest. They start stacking things, building things, pushing things around, designing things, making constructions, testing them, pushing them down. All of that is engineering, and so they're involved in it from the very earliest, and it's these simple activities that constitute engineering at this early time. When children use materials in new ways, that's creative. We love creativity. There's the "A" in STEAM. [Chuckles]

Kate: [Chuckles]

Dawson: But it is also engineering, and they're dealing with engineering concepts when they're doing that.

Kate: That's—And that's really, really great that it's so accessible. I think when I think "engineering," sometimes I get a little…a little scared or a little, you know, freaked out.

Dawson: I know.

Kate: Like, "Am I able to do this with a child?"

Dawson: Yes, but it is simple.

Kate: But it's really…It's real; I'm hoping math is that way, too. What about math? What do we need to know there?

Dawson: No, totally. No, it's simple, too, and most people will think about math as just counting. It is that, but it is so much more, especially for our youngest learners. Research tells

us that children have the ability to think statistically, probabilistically, from the very earliest. It's how they come to understand the world. They're getting all of this data. How do they make sense of it? They make sense of it mathematically. And then as they grow, the children are exposed to different math concepts: shapes, patterns, musical rhythms, even daily routines that are patterns through time, and children understand that and they can learn to predict and rely on these things. So, again, I want to emphasize it's not just about counting. It is counting, but every day we see children exploring math concepts around, like, number operations, geometry, understanding shapes of things, spatial relationships, measuring things, how far is it from here to there, classifying things into groups and categories. All of that is early mathematical thinking.

Kate: I'm so glad you explained it that way. I really think it's important to know that math and science are super accessible and that all of the parts of STEAM that we sometimes think of as hard to teach, especially to our youngest audiences, are really something that can be taught with everyday experiences.

Dawson: Exactly. They're right there all the time.

Kate: Yeah. So, I'm curious, how are we going to support our grantees? So, we know how to support kids, but I'm interested in what are we going to do to support our grantees to understand the importance of STEAM education and how we can use strategic and intentional sort of scaffolding?

Dawson: Yeah, yeah. They're little learning machines, so how can we optimize those machines and help them in this quest for learning? It's a great question. It's important first to explore whether program leaders understand their professional development system and home-visiting practices. The focus needs to be on supporting them to think about their approach to professional development.

Kate: Yeah, I really agree with you there. I mean, I think program leaders—they're faced with a workforce that has such varied levels of experience, that come from a lot of different places and backgrounds, and I can see how focusing on specifically on professional development as a framework can serve as sort of a roadmap for getting people focused on strengths and supporting knowledge and instructional approaches and things like that.

Dawson: Yeah.

Kate: So, I'm thinking—but it's also probably helpful to encourage program leaders to think not just about their own professional development but also thinking about the PD plans that they have in place for their programs and their individual staff.

Dawson: Yeah.

Kate: So, yeah. Facilitating professional development is really a reflective process, and I think that's one thing I have to constantly remind myself.

Dawson: [Chuckles]

Kate: It's a reflective process. We have to think not only about what the program is trying to accomplish—that's a major goal—but also what changes are needed that will result in improvement and then establishing how you know changing is happening…

Dawson: Yes, yes.

Kate: ...and establishing how you know change is happening. So, what things can you concretely identify that show you that change is indeed coming across in these programs?

Dawson: Mm-hmm.

Kate: So, I think one of the…If we go back to those three strategies that we were talking about earlier—engaging environments, interactions that are nurturing and responsive, and meaningful learning experiences and opportunities—when we think about those three, we can help support the reflective process to determine where the grantees are experiencing gaps.

Dawson: Right.

Kate: So, what data they can pull and what practices are in place—that determines if the environment is engaging and if the supports are there to really support engineering and math components.

Dawson: Yes. Yes. So, again, we want people to think about those three specific things from the "Teacher Time" series, but again here: providing engaging environments, using nurturing, responsive interactions, and providing meaningful learning experiences and opportunities. I like repetition.

Kate: Those are our big three.

Dawson: They're the big three. The big three. And that makes me think about—when I'm listing it out that way, that makes me think about the "plan, do, study, act," the PDSA, cycle, which I know you are familiar with.

Kate: I'm a big fan. I love PDSA. I'm a data nerd, but I also know that the PDSA cycle is super valuable. It'll help a lot.

Dawson: You're shaking your pom-poms—pom-poms.

Kate: Yay, PDSA! So, the PDSA, for everyone out there who's listening and is like, "What are you talking about?" It's a rapid-cycle method designed for quality improvement, so it's a CQI process, and what it does is it identifies and then tries to implement and measure changes that you're working on within a system. It aligns what you've been suggesting as an effective strategy to understand whether or not professional development plans or systems are improving teaching practices related to engineering and math, so...

Dawson: Good, good, good. So, how can an ECS use this process to support professional-development planning that's specific to engineering and math?

Kate: Yeah, and that's the key. It's specific to engineering and math.

Dawson: Yeah.

Kate: So, you first want to focus on the plan portion, the "P" in "PDSA," and here an early childhood specialist might encourage program leaders to use available data resources. Planning is almost always data-based, and what's nice is that there are so many available data resources out there. We've got things like ongoing child assessment data in things that are related to math and science areas. We can look at how many professional development events took place

at a site and who attended. We can look at staff participation and coaching that's related to STEAM topics and STEAM-related instructional support.

Dawson: Mm-hmm.

Kate: And then we can look at other data sets that are also available to us in different places, so things like data-related-to-curriculum fidelity, our favorite, class data—we can look at all those —and we can even look at Environment Rating Scale's data. So, all of these things really tell us a lot about the materials and the interactions that are related to science and math, and that's great because we can see in our programs where we're strong but also where we might need to improve.

Dawson: Yeah, I like that: Identifying the strengths and building on those and then identifying the places where you can improve. Excellent. So, this information will help program leaders identify what's currently in place but also to understand the gaps, and with this information, they can begin to develop a plan and put changes into place that will support improvements and practices in some of these areas.

Kate: Absolutely. That's exactly right, and so here's an example. After, let's say, a program leader reviews their data, they might decide that they need to conduct a coaching needs assessment. And let's say that they find from that coaching needs assessment that lots of their staff identify teaching practices related to STEAM as an area that they need help in, so they want additional support from their program leaders on instructional practices related to STEAM. So, from there, an early childhood specialist might help those program leaders identify an action step, like creating a targeted professional development plan for those folks.

Dawson: Yeah, at which point we're ready to move on to the next step of the cycle: The "Do," right?

Kate: "Do," yes.

Dawson: Right, so, tell us…

Kate: So, "Do" is the action step. Well, really, it's the first action step. There are two action parts of the PDSA cycle. But "Do"—in the "Do" step, what we're going to do is support what we've figured out from the data by testing out a plan, and so in our example that we were just discussing, we might take one classroom or one group of home visitors and implement what we —what we had, you know, seen from the planning cycle, and that will allow us to document any challenges and any successes that we're seeing within the program.

Dawson: Got it. So, you can see the wheels hit the road a little bit, see how it's working.

Kate: Exactly.

Dawson: So, bring that back around to the example that we're talking about with teachers identifying STEAM-related practices.

Kate: Mm-hmm. So, specifically, early childhood specialists at this point would want to work with their program leaders to identify what actions they want to take related to any findings that they had in that small group, be it a classroom or a group of home visitors. So, then the program leaders might identify the appropriate coaching strategy for that group who identified

needing targeted support around STEAM teaching practices. And the coaches would be the ones to implement the plan, but the ECSs are the ones who help them identify how they measure and when they check in on the data.

Dawson: Right.

Kate: And by "check in," this is starting to get to our next step, which is "Study."

Dawson: And this is the iterative process. Right.

Kate: Right.

Dawson: So, now we're in the "Study" portion of the cycle, and an ECS could support a program leader by, for instance, finding out if the professional-development schedule was delivered as intended and exploring whether the coaching strategy was implemented with fidelity. They might also explore whether there were opportunities for action planning and follow-up to identify additional supports or resources that might be needed to support.

Kate: Right, so you're looking back at what you've already seen, and then it sort of culminates, finally, with another action step, which is the "Act" portion.

Dawson: The "Act" portion of the cycle, where an ECS could support the program leaders' continued implementation and continued monitoring of their professional-development plan.

Kate: Absolutely. It's all about continuing the good progress that we've made throughout, you know, this iterative process.

Dawson: And then it would happen again, right?

Kate: Exactly.

Dawson: I mean, you don't just rest on your success.

Kate: You find something else that maybe you want to improve...

Dawson: Exactly.

Kate: ...or another thing that came out of your coaching assessment.

Dawson: Another strength to build on.

Kate: Yeah, exactly.

Dawson: Exactly, yeah. So, this is a great example, and it highlights how ECSs might support program leaders to use this PDSA, "Plan, Do, Study, Act," cycle. It is an effective strategy.

Kate: It really is.

Dawson: And they can use it to improve teaching practices that support engineering and math concepts, many other concepts, as well, but here specifically, math and engineering concepts in the classroom but also in the home...

Kate: Yes.

Dawson: ...and over time.

Kate: And, yeah, it's a…it'll sustain a classroom for a very long time. As long as PDSA is being implemented, you'll be able to see continual change and continuous quality improvement.

Dawson: In my own quest for quality improvement, I need to get to my next session, so, sorry.

Kate: Ah, you're a slave to the conference schedule.

Dawson: So, I'm—I'm so glad to be a part of this, and I hope that the first podcast was listened to and listened to again, and I hope that this one will be successful and helpful for people and provide them with strategies to support, you know, program leaders as they work to improve effective teaching practices, especially related to STEAM.

Kate: Yes, 'cause STEAM is the—the take-home message, and we know that it supports all sorts of great outcomes for children, so if you're looking for more information on the research behind children's development of STEAM knowledge and STEAM skills, make sure to check out our "Research on the Go" podcast, because those are specifically focused on the research surrounding how we know children develop their STEAM skills. So, you can find those and all of our other podcasts—there are so many—on the Head Start TAlks app. It's available in the Google Play store as well as in the Apple store.

Dawson: Nice.

Kate: Dawson, thank you so much for your time today.

Dawson: Hey, thank you. Thanks for having me.

Kate: Thank you for joining "Head Start TAlks." For more information on what you heard today, visit the Early Childhood Learning and Knowledge Center, or ECLKC, at eclkc.ohs.acf.hhs.gov.