Episode 46: Dr. Sam Johnston

**KL:** Katie Linder

**SJ:** Sam Johnston

**KL:** You’re listening to “Research in Action”: episode forty-six.

[*intro music*]

# Segment 1:

**KL:** Welcome to Research in Action, a weekly podcast where you can hear about topics and issues related to research in higher education from experts across a range of disciplines. I’m your host, Dr. Katie Linder, director of research at Oregon State University Ecampus.

On this episode, I am joined by Dr. Sam Johnston, a research scientist with the Center for Applied Special Technology, or CAST. With support of the Gates Foundation’s Open Professionals Education Network, she recently led the development of UDL On Campus—a collection of online resources to aid postsecondary educators in implementing Universal Design for Learning. Currently, Sam works on the National Center on Accessible Educational Materials (AEM) focusing on postsecondary and workforce take-up of AEM. Sam is also a co-principal investigator for a National Science Foundation study on stereotype threat and its impact on inquiry science pedagogy in middle schools. The project has created a prototype web-based professional development course to help middle-school science teachers understand stereotype threat and use UDL to reduce its effects in everyday instruction. Sam’s primary research focus is on the use of networked technology to support peer-to-peer knowledge transfer and she has conducted design-based research in both professional development and formal education settings. Before joining CAST, Sam was a senior associate and distance educator at the Center for Social Innovation, leading the company’s online learning strategy. Sam holds a bachelor’s from McGill University and a master’s degree and doctorate in education from Harvard.

Thanks so much for joining me, Sam.

**SJ:** You’re welcome.

**KL:** So Sam, one of the areas of your research that is very interesting to me, and actually I don’t feel like I know very much about it, is design-based research, and this is something that I’ve been kind of hearing about in various circles and would love to just learn a little bit more about. Can we start just by you describing a little bit about what is design-based research?

**SJ:** Yeah. So design-based research is definitely a form of research that, as education technology has been used much more, has become much more commonplace, much more prevalent in how people do research. But basically what it is is it’s a formative evaluation approach to intervention development, where the primary goal is to take both what we know from research theory—so here, in this case, theory into learning, theory into approaches to learning—based on what the research literature says, but then also to generate useful knowledge to improve practice. So there’s really an emphasis in design-based research on what works in practice, as opposed to just thinking about what works in a sort of lab setting, and bringing practitioners and people who understand the realities on the ground is a very important component of design-based research, because they can help to create knowledge that’s really much more relevant in their settings and improve take-up. So the goal, essentially, with design-based research is to bring theory and practice together and to sort of iterate on design strategies so that people can really see what works in practice. So what you would typically do is iterate on, design things. You bring, potentially, educators in as co-researchers. You’d have them look at design elements. You’d have them think about content’s relevance in their actual setting. You’d release prototypes, small segments, have them test them out on a very small-scale way, before moving to a larger pilot study. So the goal would be by the time you’re actually doing a pilot study, whether it’s a pilot study where you’re designing it as an experimental or quasi-experimental study, that you’d have you best, most relevant, *in vivo*, in-the-real-world product or design or intervention ready to go in your pilot study. As opposed to building everything in a lab separate from the realities and the practical nature of applied interventions, you would go into your pilot testing with your best, most well-informed by those who will ultimately use and hopefully benefit from the intervention with their input from the very outset. So, really working with educators, with co-researchers, is a really important part of design-based research.

**KL:** So, it sounds like two things I’m hearing from you. One is a really foundational component of design-based research is the practical, and then two, another foundational component is that collaborative research relationship with practitioners that can help to inform the kind of practical component. Are there other fundamental things to design-based research besides that, besides the practical and then the collaborative nature?

**SJ:** So, I think those are two key pieces, and a lot of our design-based research that we do at CAST, there’s some element of the intervention that very often includes the development of an early-stage software product. So it might be a supportive reading environment for students, it might be an online course, it might be an online curriculum environment with UDL supports. And so we very often combine design-based research with the Agile software development process, and part of the reasons for that is it really pushes you into iterating pretty quickly, so rather than tinker away on some design elements for forever and ever in your lab and not bring them out in the world, you, with the Agile process, you’re really in a position of having to quickly release things, get feedback, quickly release more things, get feedback. And so it really moves you into this dialogue with hopefully the end users, that’s the product and the intervention, but also your own approach to research, which is taking feedback in from the very outside, as opposed to—the way we often think of some research is we design a huge study, we run that study, we get the results, and that’s our feedback, and with design-based research, the emphasis is you’re getting feedback all along the way that informs what you pilot. And then the other thing I would say is really important is that the goal is to take the results of that research and bring it back into, again, a development cycle or improving the intervention. So, in that way I like to sort of think of design-based research as living and breathing in the world in a way that sometimes—other research may be really critical, but it doesn’t live and breathe in the world in quite the same way, in terms of sort of being something that, hopefully, by the end you hope is sort of owned by the people who should benefit from it. It ends up being really their product and their intervention. So it’s well aligned with things like participatory action research as well, in that way, where you’re really pulling people in who ultimately should benefit from the intervention in a more active role than they might be in a very large scale RCT or something that’s developed in the lab.

**KL:** Absolutely. Well, and one of the things that you mentioned, and I think it’s actually a really important point, is the point you made about time and speed and that you can kind of have research outcomes a little more quickly with design-based research than maybe other kinds of designs. And I’m wondering, based on that, do you often see design-based research happening with smaller populations or smaller samples, because you’re trying to iterate and move relatively quickly, or have you seen it a larger scale? Can you talk a little bit about that?

**SJ:** So definitely both. We have projects here that are very small. We’re dealing with a kind of very specific population in using design-based research, like for example dealing with adjudicated youth that are involved with the justice system where, partially because of some of the logistics of getting access to that population, partly because of the intensity of the work, you’re actually working with a, probably, smaller group of individuals and really trying to actively involve them in prototype feedback, involving them in co-design. You have other projects where you might start out with very small groups, but we have other projects that go all the way out to efficacy trials that are in 40 school districts across the country. So, definitely design-based research is not a matter of scale. It’s not like you can only do this with small populations, but what’s important is that you’re bringing the population in pretty regularly along the way, and often you will start with getting focus groups or smaller-scale experiments to kind of understand your components and understand how they fit together in a more in-depth way, and then move all the way to a larger roll-out of things. So, design-based research is very compatible with even large pilot studies, where you have an experimental and control group. But the key feature of it is that you would have had a formative evaluation approach all along, and by the time you get into that large-scale roll-out—which is still part of your feedback, right, because you’re going to get feedback on how this works as an intervention in X number of classrooms compared to classrooms that didn’t have that intervention—but you’ve gotten a ton of data along the way that probably starts with testing with smaller groups all the way on up to a large RCT.

**KL:** Well, this has been an excellent introduction to design-based research.

We’re going to take a brief break. When we come back, we’ll hear a little bit more from Sam about a specific example of design-based research based on her work at CAST. Back in a moment.

[music]

# Segment 2:

**KL:** So, Sam, one of the projects that you’re currently working on is an NSF-funded research project on stereotype threat, which is a great example of design-based research, so I’d love to talk with you a little bit more about that. First, can you start by just describing the project and a little bit about its scope?

**SJ:** Yeah. So, this is a National Science Foundation Discovery Research in K–12 grant that we have for three years. It’s myself as co-PI and Samantha Daley as the PI, and we nicely kind of brought together our different backgrounds and strengths, and we have in this project a pretty nice research-to-practice loop. So what we did is we took the work on existing research on stereotype threat, which is a pretty-well-looked-at issue, especially—it’s been looked at in classroom settings but also in lab settings. And what stereotype threat is is a feeling that you might confirm a stereotype about a group to which you belong. So, for example—and that feeling ends up intervening with success in things like testing, success in classroom performance, and a lot of this research has been done in STEM. So, for example, the stereotype that girls are bad at math, if that stereotype is primed, so for example, if a female student about to take their math portion of their SATs reads something on the news, like the comments made by the ex-Harvard president ages ago about potentially girls being inherently less good at math than boys, if that female student had heard that segment on the news, let’s say, right before taking her math SATs, she may then be concerned that she’s going to confirm that stereotype, that girls are not as good at math as boys, and her capacity and energy in that math testing situation will be focused on not confirming that stereotype, so, not proving it true, and subsequently her bandwidth to concentrate on the math exam will be smaller, and she’ll do worse. And this has been replicated across the board in a lot, a lot of different studies. When stereotype is primed, the threat that someone experiences of confirming that stereotype makes them disengage, perform worse on academic tasks. And so a lot of this shows up in STEM, and so NSF is very interested in this issue of stereotype threat, and then strategies to reduce its impact, which there are. So we knew from the research that stereotype threat was very real, that it had been mostly tested at the individual level, the impact on an individual student, and also that there were strategies to reduce its impact. And so what we did is we said, “Well let’s look at how it plays out in a classroom where there’s a high expectation for students to be interacting with one another.” So in inquiry science, students have to conduct experiments together, they have to report in on those. Much of the learning is focused on peer-to-peer learning, as opposed to just the teacher lecturing to students and then that’s it. And so we have two parts to the research. The first part is really more basic research where we’re looking at when stereotype threat is primed and the ways that it’s been primed before, so we just replicated strategies for priming stereotype threat that had been used in other studies. What are the impacts at the classroom level, so not just looking at the impact on individuals, because you can’t always tell who’s experiencing stereotype threat or not, but what are the impacts on overall classroom dynamics. So we basically primed stereotype threat, we had one article around gender where we read a small article talking about someone’s perception that girls were not as good at math as boys to prime that stereotype, and then we had the researcher and teacher, who were both blind to whether it was a stereotype threat condition or a non-threat condition, teach their class, and we did an observation protocol on classroom dynamics. It’s something called the RTOP, which is standardly used. We did something similar around priming issues of race, around the achievement gap. There was an article read about the achievement gap or a benign article. There were threat days and non-threat days. And what we found is that on days that stereotype threat was primed, students, the class as a whole, rated their interactions as worse, teachers rated the classroom dynamic as worse, and the day as being a worse day than on days when the threat was not primed.

**KL:** Hmm.

**SJ:** And observers noticed that teachers had to do much more work. There was much heavier lift in teaching the course. So that was the first part of our study, looking at does stereotype threat research has an impact on classroom dynamics as a whole, so, is stereotype threat a problem, much as for individual students, but overall how healthy a classroom is, especially when there’s an expectation that peers are learning from and with one another in a classroom. So that’s where we took what we knew from basic research, and we tried to sort of expand on that theory by looking at the classroom level. But then, in the design-based research frame, what we did is say, “Okay, well now we want to think about, if we know that this is an issue, how do we practically address it?” And so we took some of the mitigation strategies that are used to reduce the impact of stereotype threat, so this also comes from existing research. These are things like reframing tasks, so, making a task seem less threatening to students, doing things like reappraising emotions, so if a student says, “I’m really anxious and it must mean that I’m not going to do well on this test,” you could say, “Well, you know, you’re really anxious, but sometimes a little anxiety is actually good, because it gets you to focus and concentrate.” And just reframing emotions as not necessarily negative and linked to the idea that you will not do well has a real impact on neutralizing the effect of stereotype threat. So, the second half of our work is really focused on piloting and then researching the impact of professional development on stereotype threat mitigation strategies for middle-school science teachers. So, we did all the basic research where we found out that when you prime stereotype threat, it actually has an impact at a classroom level. We did that in middle-school science classrooms. We then brought some of the teachers that were in that experimental study in as co-researchers to help us design our professional development, help us translate the existing stereotype threat mitigation strategies into their inquiry science classrooms, and say, “How’s this going to play out when we think about peer-to-peer learning? How is this going to play out when we think about how you provide instruction in inquiry science, how you provide feedback in inquiry scienc? How do we take these strategies that we know help reduce it and make them relevant in your setting?” So they helped us design the professional development, and then we piloted it with 13 teachers, and we’re just finishing up collecting our data on how that professional development went. So, it is a pretty tight research-to-practice loop as we sort of expanded the basic research, which was how does stereotype threat impact the classroom level and does it dampen the classroom learning for everybody, regardless of whether they’re under threat or not. And then how do we then look at applying the strategies to reduce it to the classroom and research whether or not applying that has any impact or not.

**KL:** This is such a fascinating project, and I love the various levels, that you’re approaching this question in a range of ways.

We’re going to take another quick break. When we come back, we’ll hear a little bit from Sam about working with vendors on research projects. Back in a moment.

[music]

# Segment 3:

**KL:** Sam, as you’ve described design-based research, it seems like this is an excellent approach that would allow for collaboration with vendors, and particularly because of the speed of some of the results. I think that vendors are used to having information about their products more quickly than some research projects might allow. But also this idea of innovating products and being really connected to users and practitioners and stakeholders, so I’m wondering if we can talk a little bit about how you’ve worked with vendors in some of the research projects that you’ve done and some of the benefits you’ve found of those relationships

**SJ:** Yeah, so I think there’s a real need in education research, both in K–12 and higher ed, to have a much closer and more collaborative relationship both with creators of open-source software that gets used in education and commercial software that gets used in education. I think the first reason is vendors are always going to be the people that are able to bring things to scale in a way that’s different than a researcher doing a project, and so they need to be a partner from the start in ensuring that they’re bringing the right things to scale, right? You want to make sure that they’re bringing things to scale that actually work for helping students achieve, as opposed to things that just look good or are attractive or people want to buy. You want to make sure people are buying for reasons that they should be buying, which is that they help improve student outcomes, they help improve student attention, they make faculty jobs, whatever it might be. And so they need to really be brought in as a partner in research. The other reason that I think vendors have such an important role in research is that research often, and a lot of the research that certainly we go after at CAST, is focused on populations that sometimes, their needs are less central because they’re not your average student, they’re not your student that does great in a lecture or can continue to operate with the status quo. So, for example, students with disabilities are often students that need research done on what works and what doesn’t work for them. And so vendors being part of the conversation and part of the research and design-based research around looking at those populations is really key, because otherwise, why would they not just report out aggregate information about here’s our take-up of our product, or here’s the average user and how they did? What you want is to be actually looking at how does your product work with these particular students under these particular conditions, right? And now we have so much data analytics that, theoretically, we should be set up to find those things, but what we found in some of our work, even with very collaborative vendors that really want to partner and want to know these questions around specific populations, like students with disabilities, is that actually linking these sources of data, getting information on specific subpopulations of students, and information on how they use software products, and information on how that links to student-level outcomes, bringing those three things together is actually quite hard in the current climate.

**KL:** Yeah, I feel like the connections—you’re pointing out such an important barrier right now to collaborations with vendors, and I’ve found this as well, that a lot of times, the data that’s being collected by vendors is not set up for research purposes. It’s set up for things like analytics, but to pull it out and use it in a way that could answer a research question is actually significantly more difficult to do, and it sounds like you’re finding that as well.

**SJ:** Definitely, and I think we’re finding that as well, but we’re finding that it’s not the vendors that should be faulted for that. There’s components across the board that are not setting us up to do that well. I mean, I think the status of design-based research is lower than it should be. I think that this is some of the most important research we need to be doing, when we think about education technology. And we need to understand the conditions for everybody to play in design-based research. We need to understand what incentivizes vendors to work on being part of answering research questions and setting up their data in a way that might answer research questions. We need to look at issues like who owns the data. Sometimes the vendor collects the data but the institution they’re selling it to actually owns it, so they don’t actually have the capacity to release that data to researchers. Sometimes people have very real or perceived challenges around data privacy issues, and so they won’t realize any information that’s demographic in nature or linking demographic to usage, to outcome data. Well, we need to get a little bit better about understanding how to be sensible about privacy issues while still making it possible to do research on subpopulations that really need us to understand what works for them and what doesn’t. So think there’s a lot of—you know, we also need to understand the vendor’s perspective of needing to protect their IP. It’s a very competitive world. There’s always two or three other people that are trying to build on your product and build something better, so I think to do this research well, we actually have to go in and say, “What can people provide? How do we incentivize them to provide what they can provide, and how does what they provide, how can it be put in a form that helps us to answer research questions?”

**KL:** It sounds like the more communication, the better, to insure that these diverse stakeholders can collaborate in a way that’s going to be effective for research purposes.

**SJ:** Yeah, and I think funding agencies need to grow in their level of comfort with having vendors be a partner at the research table.

**KL:** Mmm, that’s an excellent point.

**SJ:** Yeah, as opposed to someone to just get something from and go, like, they need to be partners and it needs to be answering questions that are useful to them, too.

**KL:** I think that’s such a great point to bring up, because I think that we do some research here at the Ecampus Research Unit with vendors, and when I talk about it with people, sometimes the immediate response is, “Oh, how do you make sure it’s not biased?” And I think that people automatically assume that if a vendor is a partner in research that that research automatically will have some kind of bias in favor of the vendor, and I think that that’s not necessarily the case. I think there’s a lot of vendors who are very committed to answering research questions that may help their product, but that they honestly want to know what is impacting student learning and what is helping people in the classroom.

**SJ:** I think that’s absolutely true, and I also think that the vendors we’ve had interactions with, they’re very, very interested in subpopulations, partly because that helps their market share. If they have something that works for subpopulation X and they can really demonstrate that with robust research findings, that’s great for them. But I think a lot of people also enter the education technology space and become successful in that space because business as usual was not working, so they’ve actually built products and built innovations that are trying to address what was not working about a kind of traditional, legacy approach to how we do teaching and learning, and they want to know, “Is my best guess, is my theory, is the product that I’ve developed, when tested out at large scale, actually having the impacts for people who maybe were similar to how I felt school was not working, or whatever? Is it actually working for them?” So I think bringing them in as partners and really understanding that many of them have very good intentions in answering real research questions, because that’s why they got in the game in the first place, just from a different angle of solving a problem by creating something, as opposed to solving a problem by just doing research, that actually, often we’re more aligned than we think, and I think the research community and the funding community needs to treat vendors that way.

**KL:** Yeah. Thank you so much for sharing your experience with this. I think this is an area that will certainly continue to grow as more vendors are engaging in research related to their projects, but also related to larger research questions that will allow them to partner with universities and other organizations.

**SJ:** Yeah.

**KL:** Sam, I’m wondering if you can share, are there resources for listeners who may want to learn more about design-based research or about stereotype threat? Are there any things that you might recommend?

**SJ:** Yeah, a couple things. I think on stereotype threat there’s a nice website called stereotypethreat.org [*sic*], I think, that really collates all the research that’s been done on it, which is nice.

**KL:** Great.

**SJ:** In terms of design-based research, I think if you look on our website, [cast.org](http://www.cast.org/), you’ll see most of our projects are design-based research projects, so you’ll see what some of those are. There are sort of some seminal articles, [inaudible] Reeves [?] and Hedberg [?], Leigemann [?], Colin Joseph [?], and [inaudible] are people who’ve written about design-based research and what it is, so those are a few resources I would look to.

**KL:** Excellent. Well we can go ahead and link to those in the show notes for listeners who are interested in learning more. Sam, I want to thank you so much for your time today and for sharing your experience with design-based research and your work with CAST.

**SJ:** You’re welcome! Thanks for asking me.

**KL:** And to our listeners, thanks so much for joining us for this week’s episode of Research in Action. I’m Katie Linder, and we’ll be back next week with a new episode.

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# Bonus Clip #1:

[*intro music*]

**KL:** In this first bonus clip for Episode 46 of the Research in Action podcast, Dr. Sam Johnston discusses basic versus applied research—take a listen.

A couple things that you mentioned—you talked about basic research a few different times versus applied research, and I’m wondering, for our listeners who might be less familiar with those terms, can you describe how would you distinguish between those two things?

**SJ:** Yeah, so I’m definitely an applied researcher, so I probably can’t give as clear a definition on basic research, but basic research is sort of fundamental research, it’s really scientific research that’s kind of aimed to improve scientific theories, to improve our understanding, our capacity to predict phenomena. So, for example, this phenomenon of stereotype threat, right, is impacting probably at the level of our physiology, right, and then having these downstream effects on performance. You know, our goal was to sort of expand that initial theory, which is just looking at the impact on individuals and looking at does that then spill over to people because they’re enmeshed in these ways, they’re learning from one another as peers, right? So does the fact that someone may be experiencing that physiological response that’s impacting their performance actually spill over to the—[*inaudible*] performance of the class as a whole, so we sort of expanded on that basic research that’s being done around stereotype threat and its impact on individuals to looking at does this extend to the experience of other students in the class that may not be under threat but that are interacting with someone who is, as well as the teacher, who’s interacting with kids that are under threat and kids that aren’t, depending on what’s been primed. And then applied research basically takes these scientific theories or ideas to look at how do we then intervene, how do we build technology or techniques or strategies to kind of alter this phenomenon. So, if stereotype threat is a phenomenon that impacts individual students’ physiology then impacts their performance in classrooms where they’re tangled up with other students in all these ways, then spills over to impacting the class as a whole, how do we then build something to help teachers not have this be such a prevalent thing in their classrooms? So, sure, you could say, “We’re going to have stereotype threat police and make sure no kids are even under stereotype threat,” but that’s almost impossible. Stereotype threat can happen just when female students are taking an exam and there’s more male students present in that exam than female students. So you can’t control all the conditions that create stereotype threat, but you can do this other work, looking at mitigation strategies and bringing them into teachers’ classrooms in an applied, practical way. So applied research really says, “If we know this phenomenon exists and we want this phenomenon to not shake out the way it is, how do we build an intervention to dampen its effects?” So that’s sort of what we did in this study is we had the basic research component and the applied research, and they actually fit really nicely, because we can bring the basic research of our findings of priming stereotype threat into the middle-school classroom, to the teachers that were in the PD pilot study, and it also made it much more relevant to them, because they were like, “Oh, you’re actually studying how this phenomenon operates in my type of classroom. I can see myself in this. You’re looking at how it impacts classroom dynamics. That’s something I have to worry about every day in inquiry science.” So that’s how the two sides fit together.

**KL:** Thank you for explaining that. That’s very helpful.

You’ve just heard a bonus clip from episode 46 of the “Research in Action” podcast with Dr. Sam Johnston discusses basic versus applied research—thanks for listening!

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# Bonus Clip #2:

[*intro music*]

**KL:** In this second bonus clip for Episode 46 of the Research in Action podcast, Dr. Sam Johnston shares more about expanding design-based research into higher education—take a listen.

I know that one of the areas for this research for you, you’re thinking of maybe expanding it into higher education. Can you talk a little bit about that?

**SJ:** Yeah. So we have a proposal pending in this area, and if we don’t get that, we’ll look at other ways to do this work, but higher-education classrooms are changing pretty dramatically. They’re aware of and reliant on peer-to-peer learning in a way that they perhaps weren’t so much in the past, when it was acceptable to sort of lecture and leave. For a lot of reasons now, teachers are sort of flipping their classrooms. They’re much more focused on active learning. This happens especially in science. It happens in a lot of classrooms, but certainly in science classrooms, often teachers will put the emphasis of the classroom, face-to-face classroom time, on having students interact with one another, conduct lab experiments together, discuss, debrief, engage in peer-to-peer learning. And so we felt that this concept, that probably looking at whether or not stereotype threat impacts classroom dynamics in these sort of more active-learning, flipped higher-ed classrooms, was important to look at too, just the way we looked at this in middle school. So we would again try—with some differences, but—replicate similar priming, where we probably prime around gender and prime around race by reading an article that primed stereotype threat and then having other days where it wasn’t primed, where the articles were just benign, like robots and science, or germs on cell phones. See if again there’s the same sort of effect at the classroom level, like when some students are under threat, is it making active-learning or flipped classrooms less productive than they might be otherwise? And then, again, move into what kind of mitigation strategies, borrowing from the literature, borrowing from what we would find in experimental study, make sense for a faculty member teaching in biology or chemistry, for actually having some fairly simple interventions they can use in their classroom that aren’t intrusive on teaching, that don’t feel like a heavy lift, how do we build that into their professional development. So what would be different in higher is looking at what mitigation strategies make sense, how to package them for higher-ed faculty, which is different than K–12 teachers, and also the nature of professional development. So, faculty professional development often tends to take place as sort of lunchtime meetings, as opposed to maybe a 10-week online course, which is how we did it with the middle-school teachers. So that’s sort of our goal, and we’ll see if what we have out there gets funded, and if not, look to some other sources to understand how stereotype threat plays out in higher ed, but also how to reduce its impact. And then our preliminary work in partnering with higher-education institutions interested in this week, both two-year and four-year. There’s a very strong sense of this is absolutely at play in the classrooms, and they’re quite concerned about it, in terms of, you know, female students disengaging from science, or students from under-represented groups disengaging from science. And a lot of the data in higher ed shows that these students do, the further they move along, get more and more disengaged and don’t end up in STEM careers, so there’s certainly an impetus to intervene.

**KL:** Well, I wish you luck with this funding. It sounds like a fascinating project, and I would love to see it expanded into the higher ed environment.

You’ve just heard a bonus clip from episode 46 of the Research in Action podcast with Dr. Sam Johnston sharing about expanding design-based research into higher education—thanks for listening!

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