What is STEM Interest?

An Interview with Robert Tai

On April 9, 2018, [Tina Philips](#), Research and Evaluation Manager at the Cornell Lab of Ornithology, interviewed [Robert Tai](#), to understand his thinking and work on the topic of STEM interest. Dr.Tai is an Associate Professor in the Curry School of Education and Human Development at the University of Virginia in Charlottesville. A video of Dr. Tai's interview, as well as interviews of other researchers, is available at [InformalScience.org/interest](#).

What is your working definition of interest?

I see it as specific topics in science. I actually have avoided using the term interest in my work; I use the term preference. In my research, I've chosen to look at the kinds of activities that kids like to do. Do they like figuring things out? Do they like making things? Do they like working with other kids, or would they rather work by themselves? What I found is that the interest of young people can be a bit more plastic than that of older people. When you're young, there are things that grab your attention, and there are things that you like to do, and sometimes those two come together and overlap. You spend more time on the things that overlap. So when we're trying to engage kids and develop their interests, I think it's important to see not just a topic that the kids want to get involved in but to look at the kinds of activities they like to do. We should look at how we can develop or incorporate different ways of putting those activities into the teaching and learning of different science topics. That way, it draws the kids in.

So how do you measure or assess interest in your work, and are there any trade-offs in your approach?

I don't specifically look at interest. I specifically look at the kinds of activities that people like to do. I have an instrument that I've been developing over the past several years and that we've used with different organizations. It's being used right now with organizations that engage children through different activities and programs. The instrument that I developed is actually a survey that asks kids what kinds of activities they like and don't like to do. It measures how they feel about seven different categories of types of learning activities: collaboration, competition, caretaking, creating/making, discovering, teaching/tutoring, and performing. Now there are two sides to this coin. For the activities that kids like to do, you can say, "Wow, we should develop a program that incorporates these things, because that way we can attract these children to it." For the activities that they don't like, you can say, "Wow, these kids don't

like doing this." Now what do you do with that information? Well, you try to change the way they see those activities. You pay attention to them during those activities, make sure that they're getting a good experience from that type of activity, and potentially change the way they see that activity impacting them. It turns out that performing is one of the least liked of all the different learning activities. Kids say that it makes them uncomfortable. But there are some kids who love that kind of thing. By taking that information and knowing the children's specific preferences, we have a way of understanding which children we need to pay more attention to if a program involves that kind of activity.

How do you see identity, motivation, or attitudes connecting with interest, and how do you distinguish science interest from these other concepts?

It's an excellent question and to some degree I fear it, because there are so many potential landmines in discussing this. What I mean by landmines is disagreements about how to interpret these things. For example, interest and identity are associated with this notion that somehow who you see yourself as is going to spark what you want to do in the world. We clearly see this happen for many, many people. But it always leaves me wondering whether that outcome is true to the individual or is that person looking for a way of belonging to a larger group, and taking on that identity as a way of connecting to the larger group. For example, if you identify with a particular ethnic group or social group, you could say that interest grows from that kind of connection. It makes me wonder, is that actual interest that you have, or are you just really looking for a connection to other people? But of course it's possible for identity—in terms of what you like and who it is that you are, to have the potential for strong connection to interest. The topic of identity is very messy for me.

Motivation and attitudes are very, very broad as well. There are whole books written on how these ideas and concepts overlap. Motivation itself,

understanding what gets people up and out of their seats and moving into a particular direction or having a particular attitude, in terms of how they feel about something or how they want to engage with something, and how motivation and attitudes overlap with interest, is broadly understood. Personally, I believe that all these different topics are really important to understanding how they engage with science or how they overlap with science learning. I really focus on different kinds of activities that people like to do. There are these conceptual strands of what people like to do that run through different topics, social connotations, and cultural boundaries that might exist for individuals. I want to look specifically at things like collaboration, because regardless of what your motivation, attitude, or identity might be, collaboration in and of itself is relevant to you in some way. It matters, whether you do or don't like to do activities, and how much you need to do those kinds of things. So the reason that I've chosen to look at these seven different types of learning activities is that they overlap with so many of these different areas and are clearly informed by these areas, but they are not necessarily bound to them. We can take these ideas of different activities and use them across different programs and social settings and use that as a jumping off point, a framework to build our larger ideas on.

What advice would you give practitioners who are trying to integrate your findings about interest into their work?

My work has focused on looking at different learning activities that children may or may not want to engage in. If you look at the seven different learning activities—again, they're collaboration, competition, caretaking, creating/making, discovering, teaching/tutoring, and performing— through different programs or classroom activities, you'll notice that some activities, programs, or curricula include two or three of them, and others only include one. Most of the time it's two or three, and maybe up to all seven of these kinds of activities. That gives a teacher, an out-of-school time program facilitator, or someone who is

developing curricula or developing programs some idea of which students are connecting with what they're doing, and which students may not be connecting. There are two different ways to look at this information. One way is to focus on the students who are connecting and getting a lot from it. It's important to understand where kids stand when they come into your program. You might give them a pre-program survey to get an idea of where they stand when they walk in, and a post-program survey when they leave to understand how they might have changed, and link those two to see the differences, the shifts in how they feel and think about things. That information will give teachers and out-of-school time facilitators an idea of how what they did with the kids impacted them and what different areas they might need to pay attention to. We're working with school teachers who are implementing science curricula. When we initially survey the students, we analyze that information and share it with the teachers. It's important for the teachers to look not just at the students who score really high in various categories of learning activities, meaning that they're really interested and really want to get involved with those kinds of things. Those are actually the students you don't need to worry about. The ones you most need to worry about are the ones who say "You know what? I don't like doing these activities." And you see them very easily in the classroom when the activity is underway, but as a program facilitator and as a teacher it is a distinct advantage to know ahead of time which ones they could potentially be before you even begin. That way you know, "Okay, I really need to pay specific attention to these kids." It gives the instructors and facilitators a leg up on what they might be confronting when their activity is happening in a learning setting. Then when you give the post-program survey for the instrument that I've developed, it allows you to see whether or not the students have shifted in some way, whether they have become more comfortable or more engaged or developed a stronger preference for certain types of learning activities. Ideally, what we'd like to see, as educators, is all students liking to engage in all the types of learning activities that we put out there. What I've learned from my own teaching is that

that's not the case. It's not even close. You get different types of attitudes, motivations, and interests in kids, and it's important to understand who they are as individuals. In many ways, the work I'm doing is asking students before we teach them how they like to learn.

Do you recommend that different curricula provide all seven of these kinds of activities, so that kids can find something they have a preference for? Or if that's too taxing on the system, is it better to focus on the three things that most kids like?

The framework that I'm using is intended to help educators understand what they're doing with the students. It's not a checklist. That's one of the most important things for everyone to understand. When you teach kids and you create a curriculum or a program, you can try to put everything and the kitchen sink into it, but you probably won't get something good. These seven different kinds of learning activities that I'm talking about are not check-off items on a list so you can make sure that you're covering all seven of them. It's actually quite the opposite. You develop your curriculum, or your program, the way that you want to. Once you've developed it, take the framework and analyze what you've developed according to the framework, so that you can understand, "We have collaboration here, and competition here, and some caretaking here, and some creating/making here. We don't have any teaching/tutoring and we don't have any performing or discovering." Knowing what you do and don't have is important, because when you survey the students, you know that the students who are not interested prefer not to engage in certain kinds of activities. If you don't have those activities in that list, well that's just one item to check off your concern list. "We don't really have them doing any performing here. These kids don't like to perform, so we wouldn't expect them to change their preference for engaging in performing-related activities. It isn't part of what we're doing here." The conceptual framework is a way of looking at what you're doing and understanding how you're attempting to engage kids. It is not a

checklist. It's not something that educators should look to somehow make sure they cover all of these. Also, it really shouldn't be used as a way of judging how well you've done. This is not a summative type of approach to things. Whether kids like or don't like certain activities may not depend on what you did with them with that specific activity. But if you see them shift to a more positive attitude toward certain kinds of activities, you have an inkling right there that, "Hey, maybe this is having a really positive effect, let's try this again with another group of kids and see if the same thing happens." You get a better sense of what kind of impact it's having on your students, and if it doesn't have an impact, then you really need to look at what you're doing and see if you need to adjust those kinds of activities. Maybe the collaboration activities aren't working out so well, or the discovering activities are not working out so well. Now you know what part of your program to adjust, rather than saying, "Well the program didn't seem to work."

What do you see as the big questions in informal or formal science education for the next five to 10 years regarding interest?

For me, one of the most important questions is, what kind of long-term impact does engaging in certain kinds of out-of-school time activities actually have on students? And how important is it to engage students in science-related activities? And what kinds of science-related activities do the students need to be engaged in, in order to develop a long-term connection to science as individuals? I know that seems really difficult to get a hold of, and obviously it involves a longitudinal study of some kind. I'm interested in doing work in that area, connecting the experiences that people have with long-term outcomes, outcomes that stick with them over time. I realize that there's been a tremendous amount of focus, especially in federal funding, in terms of scientific workforce development. But I think that as a field we need to cast our net broader than that. It's not just, "Can we get more scientists?" because there are actually only so many science jobs out there, to be honest with you. While it is important to have young people engaged in

doing science so they will be able to go into those fields, I think that as educators it's vital that we engage directly with making sure that we have a scientifically literate and a scientifically engaged public. We need people to see science as something they want to know about and that they feel they need to know about, because it's important to what they do on a daily basis.

So are you planning to do a longitudinal study?

We produced a series of papers on it that we're putting out for review right now. That project is actually winding down, and we're potentially moving into another project, another longitudinal study that we'll be doing. We haven't been funded on that yet, but I'm hopeful. We'll be implementing these surveys with the students that are engaging in their program.

Is there anything else about interest and science learning that you want to share that we didn't cover?

I really think that it's important to take a long hard look at how science is taught, how science is put out there and portrayed for people—and I don't mean just school children, I'm talking about parents and the public writ large. How is it offered as a topic, as an area of potential interest? I think that's really critical. We're seeing right now a backlash against scientific anything in a lot of different areas. Quite frankly, it's absolutely bone-chilling. People who are climate deniers are in positions of power. People who don't believe and don't use scientific information and actually actively ignore it are in positions of power. There are people in the public who accept this view, and I think that's fundamentally dangerous, as a society, especially given what science has unleashed for us as humanity. We have at our fingertips immense power and immense ability to do really good things, as well as potentially doing really bad things. So I think it's even more critical, as more and more scientific discoveries are made, for the public to understand at a greater depth what this all might mean to them and why they need to have a clear understanding of

what's going on. I think engaging in broad science or STEM education for the public—making it accessible, making it interesting, making it something that they want to be a part of and feel they can participate in—is really critical to the work we do in the end.