

# What is STEM Interest?

## An Interview with Scott Pattison

On April 9, 2018, [Kelly Riedinger](#), Senior Researcher at Oregon State University's Center for Research on Lifelong STEM Learning, interviewed [Scott Pattison](#), to understand his thinking and work on the topic of STEM interest. Dr. Pattison is Director of Research at the Institute for Learning Innovation in Portland, Oregon, and a Research Scientist with Cambridge, Massachusetts-based TERC (Technical Education Research Centers). A video of Dr. Pattison's interview, as well as interviews of other researchers, is available at [InformalScience.org/interest](http://InformalScience.org/interest).



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### *What led you to study interest?*

When I started working on my dissertation, I was initially focused on identity in preschool children and science identity. I got a lot of pushback about whether or not science identities are forming at that early age. And I actually do feel that they are, but it turns out even though interest is quite complex, identity in early childhood is even more complex. So I got inspired to switch to the related construct of interest and think about how that is forming in early childhood. The more I learned about interest, the more I felt like it was a fundamental construct to what we do in informal STEM education, in terms of the potential strengths of an informal learning experience. There's just so much evidence that interest drives human behavior, it drives what we choose to engage in, and it's related to other things like self-efficacy and identity. It really is the key to why people chose to stay engaged with science or why they chose to take another path.

### *What specific projects have you worked on that focused on interest?*

A lot of my work has been focused on how preschool children and their families get interested in science and other related domains like engineering. My [dissertation](#) was with Head Start families. We were looking at science interest and how families develop interest in science outside of school, in science centers, in the home, and in outdoor settings. For the last several years, I've been working on the [Head Start on Engineering Project](#) and we've been focused on Head Start families, which are low-income families, looking at how we can engage them in engineering. We're studying how the kids get interested in that topic and then how those interests extend past the program into kindergarten. I recently partnered with the [Franklin Institute](#) to think about workshops that engage families with young children in both science and literacy, how families spark their interest in science in that way, how that connects to their literacy interests, and what happens after the workshop.

That project's called [Leap Into Science](#). I've also done several projects that looked at the role that informal science educators play in supporting interest for families in museums, national parks, and other settings. A final strand of my work has been around identity, which is so closely related to interest. We're really fascinated with how youth and adults are developing identities related to science and how the interest process plays into that.

### *What are some of the interesting findings from those projects?*

One of the things that surprised me from the beginning with my dissertation is what a profound effect little experiences can have on creating science interest pathways. A fun at-home activity or a really memorable experience at a museum can snowball as a child or as an adult keeps talking about the experience, and then those lead the family to reinvest in that interest to provide more experiences and more resources, and the interest pathway continues from there. We've seen a lot of examples in which really long-term interest was sparked by these experiences. But one of the things our work is emphasizing is that it's not just about the child. We're seeing just as much change happening in the adult or parents as in the child, and as both the adult and child change together, they form this family interest pathway that's sort of self-motivating over time.

### *Can you explain what an "interest pathway" is?*

I think it definitely is jargon, but for us studying interest, it distinguishes between the idea of situational and long-term interest. In the first case, interest is sparked in the moment, and we can see it when someone is excited and engaged. In the second case, people are taking this moment of interest, extending it over time, and finding multiple moments of interest that form a coherent pathway. Someone might enjoy a visit to a science center and really get into an exhibit around birds, and then a couple weeks later maybe they go outside and see some more birds and have a conversation about that. Then they decide to buy some binoculars and

they get into looking at birds with those, and then they join a birding group. That series of experiences forms a coherent pathway. There's ongoing pushback on how much these pathways are domain-specific, how much they're specific to science and how much they're defined by other things like "I just enjoy spending time outdoors with other people with binoculars." It's a hot topic within interest research in STEM, looking at how much of interest we can really define as science-specific. What does that even mean to a learner who might think of their interest as biology or even specifically as birds? Does it matter if they associate their interest with science? Do they need to associate it with science for it to be a science interest, and for it to connect with long-term pathways or careers? So those questions are a hot topic of research.

### *How do you conceptualize or think about interest?*

Like many people in the field, I'm very influenced by the [Four-Phase Model of Interest Development by Hidi and Renninger](#). That model is great because it provides a framework for many of the different areas of interest that we study as a group. In the model, situational interest is often seen as the beginning of the interest development process. We feel a spark of excitement or challenge or motivation in a particular moment with a particular object, topic, or activity that we're engaging with. If that's maintained over time, then the interest extends, but it's still being supported externally by other folks or by experiences. Then as we start to internalize that interest and start being motivated to engage with that topic of focus over and over again, motivated by ourselves, that's called an individual interest and it can extend over time. That's the basic framework. That framework is nice because it shows how interest is a complex construct. It starts with an emotion, but as it develops it begins to bring in things like knowledge and values and self-awareness. All of those things are fed by new interest experiences, and then they remotivate further interest experiences. So that's the framework that a lot of us are using. I often use that

framework, but when we're studying early childhood interest, we're trying to extend it to think not just about the individual but about the whole family system and how to conceptualize interest as developing across both parents and kids. Some aspects of interest, like the emotional feeling we get when we're excited about something, can be felt by both the parent and the child, but some parts of it might be exclusive to the parent, like awareness that some interest is developing. The child might not think "Oh, I'm into birds," but the parent sees that and they say, "Oh, an interest in birds is developing and I'd like to reinforce that." The interest is actually distributed across both parent and child. That's the new framework that we're trying to develop.

### *How does your concept of interest compare and contrast with that of others?*

Well, interest comes out of psychology, and so traditionally it's pretty focused on the individual. We've tried to stretch it to think about interest as a family phenomenon, so that's one way that our view is different. I think it's similar in that we draw on a lot of the same literature in the science education field, like that four-phase model. Another area that is both different and similar in terms of what I've done is that a lot of people have focused on interest in the moment, situational interest. They look at what happens at a museum visit, when someone's doing an activity, or what happens in a classroom when kids are engaging with a particular topic. Meanwhile, we've tried to make sure that we're capturing both those micro-experiences and also the longer term developing interest in that person or that family. That's the key: how can we connect those individual experiences to understand interest development long-term?

### *How and why do you think interest matters for science learning?*

I think interest is a critical, if not the central, motivator of human behavior. When we're talking about learning, or choices about which types of activities to do, which careers to choose, who to talk to, or what experiences to seek out, interest plays a

huge role in how people decide whether or not to do something. That's especially the case when you're talking about noncompulsory experiences. We're forced to do things in school, but what are we going to choose to do outside of school? Even in school, interest really influences what we decide we're going to focus on, what classes we should do, things like that. A lot of the theories of career choice, for example, put interest and self-efficacy as the central predictors of why people choose certain careers.

### *In what ways is interest important at the family level, or are you primarily looking at family ultimately as a driver for individual interest in kids?*

In the STEM education field, there's obviously a lot of pressure to think about the kids and what kids are growing up to do. Are they prepared for school? What do they do outside of school, and how does that lead to lifelong STEM learning or lifelong engagement with STEM careers? Certainly we're interested in the family as a system that supports the kids. But in the modern world, science is central to everything we do. It's central to our democracy, and understanding science is central to our democracy, so we always talk to families about how this engagement with science and engineering is important for school, life, and work. All of those things. We see parents changing their ideas as their children are changing, and we hope that that's providing them with a whole new skillset or a whole new perspective that's going to influence how they engage in their life and everyday experiences and perhaps support them in their work. I think that as interest researchers or practitioners using this lens, it's important for us to remember that there are individual interests and there are family interests, but there are also a lot of social and cultural barriers to engaging with science and accessing science. It's important that we don't forget that. Just because someone's really interested in something doesn't mean the rest of the world is going to support them in that, and I think that's the tension in interest research: yes, it's a driver of human behavior, but there are lots of other things that

constrain human behaviors, especially in our society today.

### *How are you currently measuring or assessing interest in your work?*

Quite a few ways, depending on whether we're looking at the immediate experience, the micro-experience, or the long-term interest pathways, and whether it's the individual or the family system. Like others, I've done a lot of work with surveys, asking people what their interests are. I've also done work to observe interest, especially using reengagement with something as a measure of interest. More recently, we're doing work in national parks, looking at how national park interpreters engage visitor interest. We're trying to understand how visitors and staff control the focus of the conversation and what lens that provides us to understand interest. If a staff member has a certain goal to educate the person they're talking to and they drive that conversation, we're curious why they chose to focus on that and how they keep the focus on that. But some visitors have interests of their own and they bring those into the conversation, so we're trying to understand how the visitors bring out their own interests and then use them to control the topic of the conversation. We use video discourse analysis or video coding. In our work with young children and families, we're trying to operationalize what it means to study the family system, so we have to have multiple lenses on that because it's a whole system. We ask parents questions through surveys both about their changes and about changes they're seeing in their family and their children. Then we try to access that through videotape of parents and children interacting together and journals in which the families are talking about what they're doing together. We also use outside perspectives, like what the preschool teacher reports is happening. That's another tricky thing about measuring interest: interest is both about what you feel and think and also about what you do. We have to have lenses into what people are saying, but we also have to pay a lot of attention to what people choose to do, what they reengage in, and what behaviors they are exhibiting.

### *What is reengagement?*

It's fundamental in the four-phase model of interest development. They actually define interest as both that feeling you get in the moment when you're experiencing that interest, and also your motivation to reengage with that interest. For example, consider a birder. This is very personally relevant because when I traveled to Costa Rica I just couldn't believe how beautiful the birds were, and someone let me borrow a pair of binoculars, so I spent all my time roaming through the trails watching the birds. When I got back to the United States, I chose to reengage in that experience by buying my own binoculars and seeking out opportunities to go bird watching. So that's reengagement. But it can be a lot simpler. When we study families, we give them these activity kits, so reengagement can be as simple as the kid saying, "Let's do that activity again." It can also be more complex when a family says, "Let's do that type of activity again but with a different topic, or let's find a different book about this topic." They're reengaging, but they're starting to reengage with a broader class of interest experiences, not just the particular materials that we might have provided in the program.

### *How do you use journaling to gather data?*

That's something we struggle with, actually. The families we work with are very busy; they have busy lives, and we're trying to help them carve out the space to tell us about their life. The ultimate dataset is life, and with families so much of that happens behind closed doors in their home, so trying to access that is an exciting but daunting challenge. We've done simple things like researchers texting families to give us pictures that they've taken or little snippets of stories. Other researchers have asked families to journal on a regular basis, like once a week, about things their kids have said or things they've done. We haven't had much success with that. Probably the best technique we've tried is just prompting families to keep some memories about what they've done and then trying to regularly meet with them and do in-depth

interviews to capture those memories before they fade.

### *What are some indicators that you focus on to understand how the family system is changing?*

Right now in our research, we're focusing on three areas. One area is the parents specifically, how they're changing their knowledge and awareness and values around this topic area, which in our case is engineering, but it could be science or anything else. In early childhood, a young kid might be doing a lot and might be very interested, but they may not be able to articulate why it's interesting or even what it is. But the parent can, so they're starting to show indicators of, "Oh, I see engineering everywhere, I understand how it's important in my child's life and in my life, and I'm understanding what the engineering process is, so I can start to use it or talk about it with my child." So that's one area. Another area has to do with reengagement. We're always looking for parents and families who are reengaging in the materials and activities that the program has provided them and also switching to a broader class of experiences. They're seeking out new books that have to do with engineering or science to talk about. Or they're seeking out a class; maybe the kid asks if they can build something, and that becomes a family activity that they do together. The last area we're working on is changes in the way the parent and child are interacting together. Do we see them incorporating more of the science or engineering design process into their experiences together? And are parents and kids changing their roles in those experiences? That's something we've noticed. Some of the kids are not just using the engineering design process, they're teaching it to others, including other kids and other adults. Those are some of the things we look for.

### *What are the tradeoffs in your general approach to measuring interest?*

There is always that tradeoff with the micro and the macro. It's amazing how much you can learn when you turn on a video camera and watch a parent and a child or an educator interacting. When a staff

member and a visitor are interacting, you can see how interests are happening in that moment, which interest is sparked, and what strategies are happening. You can get really, really detailed. Also you can give specific guidance on the strategies that an educator or parent might use, and what they might actually say. But that micro lens tells you so little about what happened afterwards, how it related to what happened before, and what might happen in four months. So then we use surveys to understand those longer term pathways, but with surveys we're losing so much about the individual experiences that make up those pathways. That's the tradeoff there. With this new family interest system, it's really nice to be able to understand both what's happening with the parent and child and how those relate, but it makes data collection so much more complex. When we're trying to do it on a scale to really understand how these patterns might exist across many, many families, going to all these families' homes and doing in-depth interviews with all these parents quickly becomes impossible. So trying to figure out how to track interests for a whole family over time is an ongoing issue.

There is a perception that parents are poor reporters of what happens in the family. We've tried to shift that perspective. Parents aren't just reporters of what's happening, they're actually participants. But that means that as they change, their perceptions of what happens also change. They might not have recognized the engineering their kid was doing before and might not have been able to talk about it, but after three months, they suddenly are aware that their kid is doing engineering. So that's not only change in what's happening to the family but change in the way they're experiencing the world. It's hard to parse that out.

### *How does interest connect with other concepts like identity, motivation, or attitudes, and how do you distinguish them from science interest, if at all?*

Part of the answer probably is that there are some real differences, and part of the answer probably is that they're just different researchers using different

names or parsing the world in different ways. I think traditionally we often talk about interest that's specific to a topic, an object, or an activity. In contrast, motivation might be more global, describing a generally curious person or a generally engaged person, but that's not what interest is, at least as we've often defined it in this field—it's, "I'm interested in this particular thing." So that's one way of distinguishing interest from motivation. I think interest is sort of a sub-domain of motivation. It's an important motivator of why people do things. There are other things that motivate human behavior, more fundamental aspects like "I'm hungry," and there are things that aren't topic-specific, like "I'm a curious person." There are also things that connect to interest, like self-efficacy. I may be interested in something, but I may not be that good at it. Or I could be really good at something, but it's not that interesting to me. You actually see those different profiles. There are different things that motivate people, and interest is one of them.

The connection between identity and interest is fascinating, and it's probably something that we need to explore more. Often when interest researchers talk about their work, they talk about interest and how it develops, and then they start waving their hands and say, "then identity happens." There's some idea that as interest becomes more enduring, it becomes an identity, because we become aware of ourselves having that interest. We develop a sense of pride and motivation around being a person who engages in that interest. And that sounds a lot like identity. Different scholars call it different things, and there is some middle point where those concepts are connecting. The last thing I would say is that interest is not just a single construct, it's a constellation of constructs that are connected. If you have a really enduring interest in something like birding, that's connected to a knowledge of birding, it's connected to a value of birding, it's connected to self-efficacy that you are a good birder (at least, you're a person who is good at hanging out with other birders and talking the talk). A lot of those constructs start to connect as you talk to a person who is really engaged in something.

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

For us, thinking about the family in our early childhood work, we really try to stress that you've got to look at both the parent and the child. For practitioners, it's important to see the whole interest system and, if you're designing a program or you're thinking about connecting to a family, to think about how you're supporting the child, how you're supporting the parent, and how those two things interrelate. It changes your perspective on the world, the kind of data you might collect, and the type of program you might create. In our work we've also tried to emphasize that parents aren't just a static factor that you can put into the regression analysis and say, "Hey, look! The parents' attitudes were this, therefore it changed the child this way." The parents are changing in real time too, so over time they might take a different role in the program or the research. We also really suggest that people think about not just how to spark interest but how to support it over time, which is very challenging. It's challenging particularly because we can think about sparking interest in our particular program or our organizational context, but when studying long-term interest means following people outside our doors and into other spaces, which suggests a whole new way of thinking about partners and how to structure programming. It's hard sometimes for educators, myself included, to think beyond our own educational goals, but learners bring their own interests that influence those experiences, so we're trying to find the intersection between the learner's goals and our educational goals. That involves a certain release of power when you're thinking about how you're facilitating their program.

### *What are the big-picture questions in informal science education, science communication, or even formal science education for the next five or 10 years regarding interest?*

One criticism of the four-phase model of interest development is that it talks about phases but not too much about transition points or mechanisms

that help transition people across those phases. In some ways, that's the Holy Grail: understanding better why one person might just be temporarily interested in something and then go about their merry life, while another has an experience that is profound for them and that leads to many other similar experiences. I think that's key. Similarly, I think we need to study what happens over the long-term, not just in a particular setting or in a particular year, and how to connect that to interest. There are a lot of retrospective studies that ask scientists, "When did you become interested in science?" And they say, "Oh, since I was a child. I had this formative experience in this science museum or with a parent or whatever." There are also some prospective studies, starting from the current time and looking forward. Researchers follow the subjects for a couple of years and say, "Oh look, someone had an amazing science experience and now we can see them moving ahead with science—or not, because of these factors." And there's a gray area in between. What happens in between the time that someone starts to be interested, and 20 years later when they're a scientist? How do we understand a decade or more of interest development? That's a key challenge for the field.

*Could a long-term interest be based on one unique experience that sparked it, or do you think people are just not remembering the other factors along the way that continued to support that interest?*

It's probably a combination. One thing we're learning now is that it's a false dichotomy to say that an interest never existed before and then it existed. It's always connected to something before it. There's this other idea that we construct narratives about ourselves that relate to identity. An interest develops, twenty years later we construct an idea about how it happened, and that narrative itself develops through the process of us becoming interested in the topic. In fact, we see this with parents, who are very good at constructing stories, whether or not they're true, about their kids' interests. "My kids always loved swimming, and

then we went to Hawaii and then they really got into fish, so we started reading about fish, and then we went to the aquarium. And then they wanted to be marine biologists." That may or may not be the way it really happened, but it's a compelling story that takes on a life of its own, and it motivates further interests and identity development. There's probably some truth to how people remember those pathways, and there's probably some fabrication that itself is powerful evidence of that interest developing.

*Is there anything else about interest in science learning that you want to share?*

I think all of us, in this particular time and place, have to reflect on why we're all obsessed with interest and whether it's a passing phase. I think probably not, but you never know. There is a fascinating tension between some folks in our field who feel that interest is fundamental, and other people who just aren't convinced that interest is important for motivating people to build knowledge and skills. We have to ask whether interest is really what educators and educational researchers should be focused on. I can't speak for others, but I think that if you looked at the [Next Generation Science Standards \(NGSS\)](#), the ultimate goal has to do with skills and knowledge. They've nuanced that in various ways, and they do talk about attitudes and engagement, but those things are in service to skills and knowledge. I personally believe that skills are an offshoot of interest, and prolonged interest in something will build the knowledge and skills around it that you need to keep pursuing it. So in a way those things are necessary, but they're very secondary. But that view would not make me very popular in some circles.

I've noted that my work focuses on families and early childhood. I'm really curious how a systems perspective on interest might be relevant to other age groups or other contexts. I think it's particularly relevant in early childhood, but no interest happens in isolation, and some folks have done a good job of showing how interest is really fundamental to communities of people or that it's all about the

relationships between people. I'd be curious to see if we could apply that systems perspective to those different settings.

*Is there anything else you want to add about equity?*

Equity issues motivate a lot of my work. I work a lot with low-income families, youth of color or youth from underserved or underresourced backgrounds, and part of the goal is to find ways to support them and their interests around science over time. But it goes back to what I was saying about the tension between interest and culture and

society, the cultural barriers to engaging with science. I think it's disingenuous for us as a community to say that just because you build the interest of a young child from a low-income background, just because they're interested in science, they will now become a scientist. There are so many barriers beyond their control that they have to overcome in order to get there, so I think we have to be attentive to those barriers as well as continuing to improve our understanding through research. Equity requires that just because we think interest is important, we can't think that's the key for everyone from every background to instantly become scientists.



This material is based upon work supported by the National Science Foundation (NSF) under award nos. DRL-0638981, DRL-1212803, and DRL-1612739. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of NSF.

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