

What is STEM Interest?

An Interview with Rena Dorph

On March 16, 2018, [Kevin Crowley](#), Professor of Learning Sciences and Policy at the University of Pittsburgh, interviewed [Rena Dorph](#), to understand her thinking and work on the topic of STEM interest. Dr. Dorph is the Director of the Lawrence Hall of Science at the University of California, Berkeley. She has worked in the field of educational research and evaluation for over 20 years. Her research has focused on the relationship between learning experiences and outcomes, paying consistent attention to issues of equity, access, and impact. A video of Dr. Dorph's interview, as well as interviews of other researchers, is available at InformalScience.org/interest.



What led you to study the concept of interest?

A few things led me to study interest and include it in my work. One had to do with the number of frameworks or research studies that identified interest as an important outcome of science learning experiences. There were frameworks from the National Research Council, frameworks that came out from various task forces, from after-school organizations—there were a lot of places where people were identifying interest as an important outcome. So it was in the air.

Part two is that part of the reason interest ended up in those frameworks was because some research had been done related to the importance of developing interest in science in the early years in order to put kids on trajectories toward science learning and science careers. So there's some research, there's some policy frameworks. Those are two things.

Another set of research was about the decline of interest in the middle school years. Many studies have shown that over the middle school years, kids end up declining in interest, and this often affects underrepresented groups and girls more frequently than people who are already in the pipeline for science. I've always been focused in my work, research and practice, on equity considerations. So to me this question of who becomes interested or stays interested in science has significant equity implications that loop back into those questions about the long-term study of or engagement with science and long-term career possibilities.

What is your definition of interest?

I don't have a particular definition of "interest" per se. I think interest has been overused as kind of a catch-all phrase for too many concepts, some of which are interrelated, but sometimes people mean things that you'd be surprised to hear fall in the interest bucket. I've been studying interest in a lot

of different ways. I'll tell you a few of them, and they have different definitions.

So one part of interest is the degree to which someone is fascinated by natural and physical phenomena, especially when you're talking about science. Do they kind of obsess about it? Are they positively drawn to it? Do they say, "Oh, wow, this is really cool?" Do they want to keep thinking about it after they've seen something? That's what we mean by fascination. Then another part of interest is related to values, the degree to which someone might value science, and the role it plays in their lives or in society. Then some people use the word "interest" to talk about engagement, how much time will a person spend on science and with what affect and with what behaviors and with what attention. That idea of engagement as interest is another way people use "interest." And another way it comes out is in career interest. Are they interested in a future career in science? We've also broken that one up a little bit more to think about career preference. Part of it might be an affinity, part of it might be a certainty about a career. Part of it might be a general feeling, not as specific as "I'm going to be a rocket scientist," but a sense that you want to do something related to science. We've made that category a little bit broader to understand interest with a lot more nuance across a lot more domains.

What are some of the ways that you've been using those understandings of science interest to guide your research and your practice?

I'll start with the first two first, fascination and values. I've been working with a team of people from the [Lawrence Hall of Science](#), from the University of [Pittsburgh Learning Research and Development Center](#) and, over the years, many other researchers from other places. We're working on a concept that we've called [science learning activation](#), or STEM learning activation, or learning activation, depending on which domain we're thinking about more specifically. We think about activation as having four key dimensions, two of which are the ones I mentioned before, fascination and values, and the other two being competency

belief and sense-making, which I won't talk about right now. The idea is that these dimensions of activation, including fascination and values, are a set of dispositions, skills, and knowledge that position young people for success in future learning activities.

When we think about interest in that context, we've been really thinking about the role that these two dimensions, fascination and values, play in setting kids up for success. By success, we mean choice to participate in science learning, engagement in the science learning activities once they're there, the perceived success that they feel when they're in an activity, and the degree to which they actually learn something while they're in there. Both fascination and values have really important roles to play in supporting kids to have those kinds of successes, to actually choose to participate the next time or engage while they're there. So that's one set of studies we've been looking at, studying the relationship between the kinds of ways we think about interest and the kinds of success people have or might have in learning experiences. There's a feedback loop that happens when a person has this set of interests and has some success, and then that feeds back into developing further and further interest, competency belief, et cetera. I'm using "interest" in that context but I'm really referring to fascination and values.

One of the interesting things that we're trying to understand with that set of studies is the relationship between what happens in that feedback loop and the long-term outcomes. So if I'm a kid who has this experience of having fascination and valuing science, and I then experience success, then I have more fascination and value it even more, and I'll experience even more success. Over time this might lead me to have long-term engagement in science learning, to become part of a science community and do ongoing exploration of science as an adult or in a science career.

Another way we've been looking at studying interest is this idea of career interest. We have six ideas or dimensions around what it takes to actually develop

a full-fledged preference for a career. The question is, what's the relationship between activation, success, and then the development of a career preference toward science?

The other place we've used these ideas, both the activation idea and other ways that interest shows up in the field, is in a series of evaluation studies that we do. A client might come to us and say, "I'm really interested in knowing whether my program helps contribute to these kids' interest." So we'll work with a team to figure out what they mean about interest. We have a whole series of different programs for evaluation that have defined it in various ways, and we've done some studies related to those.

What kinds of tools or resources have you developed for evaluation?

I'm so glad you asked that question. We actually have had the opportunity through a [National Science Foundation grant](#) to transform the tools that we use to do this research on activation into an evaluation toolkit, which we call "[ActApp](#)." You get to ActApp online by going to the Activation Lab website and clicking on the ActApp button. Basically it offers you the opportunity to explore all the instruments that we have to measure things like fascination, values, career preference, engagement, and a whole host of other things that people might have put into that interest bucket over time. Then you can use those, either with our help in partnership, or by yourself with your own evaluator, to understand what kind of outcomes you're seeing in your local context. We have a couple of different kinds of instruments in there, including the series of surveys we used in most of our quantitative studies, a few observation tools, and some interview tools. One reason we call this an app is that you actually can generate your own surveys through the system, tailored to whichever dimension you want to measure, and then administer them online or by PDF offline, on a device that will later upload to the mother ship. That makes it really easy to use these instruments. We're really excited about that because we think it will help local programs use

instruments that were developed rigorously and tested, that have all the high-quality, psychometric properties that you might be looking for but not have the capacity to build yourself for outcomes that we know are valuable in the field. You can use those in your context in an easy-to-use and really inexpensive way, which democratizes access to evaluation instruments without a high cost of entry. So have at it!

Can you give us some examples of how you might use an evaluation kit in practice?

We've really been thinking deeply about that here. I span two worlds, as I'm a researcher and I'm also in charge of a science center that does a whole bunch of things, including having a museum. So I've been thinking deeply about integrating this concept and this framework of science learning activation, which includes these ideas about interest, into the design of STEM engagement experiences for young people, their families, and the public. It's important to be intentional in thinking about the design principles, the frameworks, and beliefs about learning and interest that underlie your work. You should think every time you make a design choice, which of those things are you trying to pull in the choice that you make? If you're thinking about a new exhibition, what do you think the outcome should be? How do you think the experience of a young person, their family, or the public in one of these exhibitions or public programs is going to affect them? Are they going to develop fascination, are they going to value science more because of it? Are you hoping they'll do something different because they've had the opportunity to explore some set of concepts or ideas in a way that supports that development of fascination of values?

Another thing we think a lot about is the appropriate level of dosage for each kind of outcome. For example, what can a 2-minute engagement with the whale on the plaza do for someone climbing it, versus a deep dive into a biotech activity that extends over a whole week of summer camp? Those are two very different kinds

of experiences, and they would give you different outcomes and different opportunities in terms of interest. Someone might get a “wow” moment from the size of the whale. And that would give them a moment of fascination, maybe make them wonder about whales more and investigate about them. But if you really wanted to get a more robust set of interests and values for what information, knowledge, and scientific thinking can do, then a moment on the whale won’t do it.

The other piece that has really influenced my thinking is part of the work we’ve done in the study of activation, which is to think about different learner profiles. Say someone comes to the museum and they’re really high on fascination but they’re pretty low on values, and they have a lot of scientific sensemaking ability but no feelings of competency in their own interactions with science learning. That person needs to have a different set of experiences to engage them and to move the needle for them, compared with someone who comes in with a really, really high value for science, a really high competency belief, and less intrinsic fascination for science phenomena. The first person likes the value of science less than the ideas embedded in it. So you’d craft your experiences so that different learners with different kinds of profiles would all find a place to engage and develop.

What do you think might be important in informal learning and science communication five or 10 years from now?

I’ve thought about that from a lot of different perspectives, as a practitioner inside the research community and as the leader of an organization that is involved in both informal learning and science communication. I really think that in this field, we’re reaching the integration of ideas across the research and practice world, which is great. The design of an informal science organization is now both generated from and generative of research in the field. The researchers and practitioners are now sitting side-by-side and doing all their work in collaboration. It’s not the researchers going over to the practitioners and saying, “I really want to use you as guinea pigs or study what you’re doing because I’m really interested in this.” And it’s not the practitioners saying, “Can you give us some research to inform what we’re doing here? Or can you come give a talk or lead a seminar?” Both are sitting down and asking about these problems together, trying to work through solutions and also being really creative about what that means in terms of learning experiences, the kinds of ideas they’re built on, and what they offer to the people who participate in them.



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