caise | center for advancement of informal science education

What is STEM Engagement?

An Interview with Karen Peterman

On August 21, 2018, Mac Cannady, Director of Quantitative Studies at the Lawrence Hall of Science, interviewed Karen Peterman, to understand her thinking on the topic of engagement. Karen Peterman is an evaluator and researcher studying both formal and informal STEM education programs. She originally earned her Ph.D. in experimental psychology and then, in 2002, transitioned to the education field. Since 2010, she has been president of Karen Peterman Consulting, Co., a firm that specializes in the evaluation of STEM education programs and research on evaluation methods. A video of Dr. Peterman's interview, as well as interviews of other researchers, is available at InformalScience.org/engagement.

What led you to study engagement in your work?

I started looking for a tool that I could use years ago. My perspective is that of an evaluation practitioner. I had many clients who came to me and wanted to study engagement, but often they didn't have a good working definition for what that actually meant. So for a long time we floundered. Then several years ago I came across the engagement survey from the Science Learning Activation Lab, and that is what we've been using ever since, at least to start the conversation. If a client says they want to measure engagement and they don't have a definition, then that survey is often what we use to start thinking about it together and deciding whether that's how we want to define engagement or whether they actually have something else in mind.

What specific projects have you done that focus on or include aspects of engagement?

We used the engagement survey most extensively in a collaborative project that focused on science festivals called EvalFest. That project was particularly interesting because it was a very different context and a very different audience than what was originally envisioned in the engagement survey. We worked with Amy Grack Nelson and Mac Cannady to think through whether and how this might work with festivals and to do some additional psychometric testing. The work that I've done with the engagement survey has spanned a lot of different contexts, and that's really become a focal point of how I think about using it and how I think about the strength of the scale itself. We used it as a quick snapshot of how engaging an activity was across a lot of different contexts—and festivals are just one of those.

What is your working definition of engagement?

I think definitions of engagement vary across projects and across the field. In the context of how we've used the engagement survey, I think about the items on that scale as measuring how locked into a learning experience the participant actually is. How are they feeling, how are they thinking, what are they doing during that experience, and is it focused on the activity itself? Their responses to those questions indicate their engagement in that context.

Does your concept of engagement differ from that of other people studying or using it?

I also do some work with AAAS, with their Center for Public Engagement with Science and Technology. I think when people talk about engagement, some people are actually talking about the activity itself, and others are talking about how the participants felt or how locked in they were during that activity. So the way that AAAS defines public engagement with science is really about the interaction and the extent to which that engagement between a scientist and the members of the public was reciprocal and allowed people to learn mutually so that the scientists were learning alongside the public and vice versa. That's how we define engagement with regard to the activity. Then in other instances we've used the term "engagement" to measure how often something happens. If you have the option of continuing to do some sort of informal learning activity over and over again, the number of times you do that and the length of time that you do it can also be called engagement. So there are lots of different ways that the word gets used, and it's not always as a construct that could be considered an outcome of an activity. Sometimes it's about the activity and how much you've done the activity itself.

Given that you work across many different projects and with several different understandings of engagement, how are you thinking about engagement for those particular projects?

It's a little bit need-to-know and a little bit trial by fire. So the lovely thing about the Activation Lab is that it talks about engagement in a much bigger context. You can think about engagement as it's measured by the survey itself, but you can also think about how it plugs into the larger idea of a learner who is continuously engaged in science. I think ideas like that help. For the public engagement with science piece, I was fortunate enough to be involved in some of the early revision of how engagement was defined. AAAS has a theory of change around that; they have a logic model, and they have a typology for public engagement with science. I was involved in little bits and pieces of that work, so I got to watch them ideate around "what is this, how are we going to define it, and how are we going to try to make it concrete enough that people can actually go out into the world and make decisions about whether what they're seeing is public engagement with science or not—and then if it is public engagement with science, how do we begin to evaluate that and study that in a more systematic way?" I think part of the trial by fire is that we didn't necessarily have a good concrete understanding of this in the context of informal interactions or informal learning, so I get to benefit from all the people who really have devoted their lives to it or who come from an entire center that's based on trying to understand this and define it. As an evaluator I'm taking those ideas and thinking about when and how they apply to the work that clients have done, and what they're asking me to help them understand about those particular programs.

How and why do you think engagement matters for science learning?

I think the more engaged you are, the more likely you are to learn. And I don't just mean learning content, but any of the multitude of layers that you can benefit from through that experience. Does it change your behavior, does it change your awareness, does it give you new skills? I think the more engaged you are in the activity itself, the more staying power that activity will have. So it's a measure along the way to some of the larger outcomes that we need to measure often when we're evaluating informal learning.

I know you're currently using the Activation Engagement Survey. What are some other ways that you're measuring engagement, and the tradeoffs, if any, of that approach?

Within the past year, I had a chance to think about all the different ways that we've tried to use the engagement survey and to look across a lot of different projects. What was lovely about doing that is that I could see how well it holds up with different audiences and in different learning contexts. We have used the engagement survey as our starting point when somebody wants to measure engagement. It's tied particularly to an activity and it tends to resonate with clients, so we've used it a lot. When we used it at science festivals, we learned that you need to use it in relation to a particular booth and not to gather reactions to the entire experience overall. I think it's possible to measure engagement in a overall experience like that, but the engagement survey is just not the right tool for doing that. So when we use it at science festivals, we focus on a booth specifically. What was important about that work is that we used it with kids and adults. At science festivals we used it with anybody above the age of 10, which was a span of potential learners there. We also used it with elementary, middle, and high school students who were attending hands-on workshops on a Saturday or in an afterschool context. We also used it to study scientist visits to classrooms, which is a formal education environment, and asked students to rate that experience. What all of those situations have in common is that the client wanted a quick snapshot to understand how things were going. Often it's one snapshot of one program or one learning opportunity that they can then compare to a much larger group of data so they can see where people report their greatest engagements. The experience can be compared across a range of different activities; for example, we can compare one festival booth to another, or we can compare one student workshop to the rest of those in a series. If the content and the team delivering it and all of those other variables are moving around and at play, the tool can help the client make decisions about where they're getting the most value, or where people are finding the most value in the programs that they're offering.

I don't think I've measured something that I've called "engagement" directly using a different tool than the engagement survey in recent years. We often look at engagement in relation to other outcomes that we measure. But I'm not sure if I've measured engagement in other ways, except, for example, by looking at how often a person did something or the length of time they spent on an activity.

What advice would you give to practitioners who want to integrate your findings about engagement into their work?

I gave a presentation at American Evaluation Association (AEA) last fall that talked about off-the-shelf scales that were available and how evaluation practitioners can use those strategically. That was really an opportunity to look at the different ways that I have tried to use the engagement survey and think about how it works with all these different audiences in all these different ways (and think about the one or two places where it's important to be careful). We've learned, for example, that it doesn't work well as a scale, if you have an extended activity that has lots of different moving parts like a science festival or expo. It has been useful at various workshops; I

have used it successfully when it was tied to a particular experience and I asked people to rate that singular experience. So we can use it on a day that involves lots of those experiences. I don't mean that it should be administered to people after every single workshop, if they do a bunch of them. Instead, what we typically do is wait until the last workshop of the day, and everybody rates the last workshop of the day with the engagement survey. That gives us the ability to compare across lots of different learning opportunities. We get data from everybody at the same time, and we focus them on the thing that just happened. If we take the learning from the festival context and then apply it to some of these other opportunities that might benefit from the scale in the same way, those opportunities might also suffer from multiple perspectives that could diffuse whatever they're rating—to the point that the scale doesn't give us the information we want or need. I think that's probably the biggest lesson. Another caveat is more of a measurement lesson overall: You can't assume that just because it works in one context with one audience, it's going to work for you. We look at the metrics; even if it's just basic reliability statistics, we look at those every single time we use it, because we know that for all scales you have to think critically about what you choose and why and whether it's giving you the data that you expected it to, before you can move on to make any claims about how valuable a learning experience was.

What are the big questions in informal science education, formal science education, and science communication for the next five or 10 years regarding engagement?

I have fun trying to think about this, particularly the different ways that people are defining it, from the activity itself to how much you do the activity to the outcome of the activity. I would think and hope that as we learn more about engagement, and as we learn more about the larger concept of science learning activation or other frameworks, of which engagement is just one piece, that we all start to share an understanding about how to talk about that, evaluate it, and study it. Then when clients come to me and want to know how engaging their program is, they know exactly what they're talking about. And they know why it's important, because it's not just a measure of one thing that happened at one time. It is a puzzle piece that lifts up into these larger outcomes that we're all trying to achieve with the programs that we run and evaluate.

Are there any specific people or projects you would recommend practitioners to learn about?

Well, the Science Learning Activation Lab is my first stop every time. I think there has been such a tremendous amount of work done there, and it continues to evolve in ways that help me think about not just the engagement survey but how the engagement survey is positioned in alignment with these larger ideas related to informal STEM learning in particular. I also think that the work that AAAS is doing around public engagement with science, and the level of effort that has gone into their logic model and their theory of change, are interesting contributions to the field around how we think about engagement and interaction. They're working on how to make sure that we move toward something that is reciprocal between scientists and members of the public instead of that sage-on-the-stage model or the deficit model that is still so prevalent in public engagement activities. I'd recommend keeping an eye on that project and how they're trying to help the field reconceive what public engagement should look like and what it will help us all achieve when it happens.

Have you seen a particularly good example of science communication or an informal science learning experience that addresses engagement?

Okay, can I give you a huge sandbox that I think would be fun to play in with regard to engagement? So earlier this week I was at the Science Event Summit, which included people who are really thinking critically about the importance of creating informal learning experiences or even Friday night entertainment that stimulates people's thinking around science and that engage them in being the

activated-science segment of the public. It's difficult thinking about what is important to those people and how to measure engagement in a truly immersive experience that people are doing just for the love of it—difficult but fascinating, because that's where we all want this to go. We want the public to be interested in science and not afraid to admit it, to like seeking it out and engaging with it in all these fascinating ways, and we want to know what each experience was like and what was engaging about it and what wasn't. So finding ways to figure out the real, live choices that people make and the ways that public science is pushing experiences farther away from what we conceive of as our traditional learning institutions is going to be fascinating to watch. It's fascinating to think about, both from a continued engagement perspective and in the sense that these people might be the closest to the ideal of an activated grownup that we can find. How do we get in there and measure and understand their experience in ways that can then fold back into the whole informal learning framework and inform how we think about the work that we're doing?

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.