

What is STEM Engagement?

An Interview with Bruce Lewenstein

On June 20, 2018, [Tina Philips](#), Research and Evaluation Manager at the Cornell Lab of Ornithology, interviewed [Bruce Lewenstein](#), to understand his thinking on the topic of engagement. Dr. Lewenstein is a Professor of Science Communication at Cornell University. His research focuses on the history of public communication of science as well as informal science education. He documents the ways that public communication of science is fundamental to the process of producing reliable knowledge about the natural world. A video of Dr. Lewenstein'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've been studying public understanding of science for more than 30 years. When I started, the idea of "public engagement" was not a term we used in the field. But as we learned that the idea of just delivering information really wasn't going to be changing anything, we started thinking much more about it. [Two-way engagement](#) was an idea that came largely out of some studies in the UK in the 1980s and early 1990s. It became clear that that was a better way of thinking the relationship between the public and science.

What specific projects have you done that focus on engagement?

There have been a lot of them. Here's one I did a long time ago, early in the days of grant-funded citizen science. There were some projects funded by the [Cornell Lab of Ornithology](#), and I got involved in trying to evaluate them. In one of them, called

[Pigeon Watch](#), we were looking at people who lived in cities and therefore didn't have access to the kind of green outdoor spaces where a lot of birdwatching takes place. As we started interacting with those people, what we learned was that just asking them what they had learned didn't really capture what was happening. It didn't capture the kinds of interactions and meanings that people were taking away, the kinds of changes in their attitudes that were relevant, and so on. So we began to start thinking differently about what we meant by attaching an education component to a citizen science data-gathering project. There was an event at the [Franklin Institute](#) in Philadelphia, in which girls and their mothers were coming in on a Saturday morning to do a bunch of science-related activities. Pigeon Watch was one of them, so after they had done a number of things indoors, they went outside to start looking for pigeons. The whole principle of this particular project was, "Let's get the girls and their mothers to interact, to do

these things together.” The title of the project was literally [Parents Involved Pigeons Everywhere](#). As I was observing, what I saw was all of these girls, most of them young adolescents, going off and watching pigeons, and all of the mothers going in the other direction and sitting on a bench and talking to each other. From a pure evaluation point of view, I was looking at this and saying, “We are not getting the kind of parent involvement that we thought we were gonna get, so it looks like it’s a failure.” But I was listening in on the mothers, and they were talking about some things happening in their school district that they never get a chance to talk about because they were all busy. They all had two-career families, and if they have a chance to see each other at all, it’s as they pick up their kids at the end of the school day and then rush off to get the kids to camp or whatever. They were having a good time, and the girls were clearly having a good time, and I suspected that if we went back to them later (which we didn’t actually have a chance to do) and asked them, “What did you think of that day at the museum?” they would all say, “Oh, we had a great time. I had a great time at the museum with my mom.” Therefore we really had to think very differently about what we meant by engagement: what kinds of outcomes we could expect, what would count as success. That was for me one of the real moments of seeing something different about what engagement was.

Another project I’ll tell you about is a project that’s going on right now. It’s called [Guerilla Science](#). It’s run by a group that began in the UK and is now both in the UK and the U.S., and they bring science in various forms to cultural events. It’s not making science itself a cultural event; it’s not like a science festival, more like a music festival or a book festival or a normal café, not a science café. They’re saying, “Let’s bring science there, and let’s study the science of attraction and have people smell each other’s armpits and find out why that leads to sexual attraction. Or do painting with a live model who has anatomical features painted onto them so that you get ideas about anatomy and so forth.” They tend to do these events at music festivals or other kinds of cultural events. Last year they had their

booth at the [Oregon Eclipse music festival](#) that was kind of like the [Burning Man festival](#). It happened to be during the solar eclipse. So I got to participate in a music festival and see a total eclipse and try to figure out how science was happening there. One of the things that particularly struck me, given the culture of music festivals, is that there were parents with kids there, everything from infants up to young adolescents. Given that there’s a fair amount of drugs and nudity and very, very late nights at music festivals, I found this a little intriguing, so I asked people why they were there. What the parents said was, “Look, we met at a festival, we love festivals, we dated at festivals. Now we’ve gotten older, we’ve got kids, and we want our kids to experience the same culture we do, and so we bring them here. However, we are always looking for things to do with our kids, and it’s really nice that there is this science thing that we can do.” And I remember one of my kids was looking over the program and it said something about edible insects, and he said, “We’re going there.” So for them it really was integrating science into a broader cultural moment. That was really interesting.

This weekend there will be another set of Guerilla Science events at an arts and culture festival in New York City on Governors Island. It’s called the [FIGMENT festival](#) and it’s an annual event on Governors Island. It’s not all science—there’s music and there are interactive arts and food vendors. It’s just something to do with your family on a Saturday or a Sunday. It will be much more mainstream than the eclipse festival, I think. So I’m really looking forward to seeing what that means and how the people there think about science: where science fits into their broader cultural landscape. I’m going in my professor evaluator role. I’ll be working with a [team that’s based at Oregon State](#), and they have a team of evaluators who will be there. I’ll be part of that team, both helping to train a bunch of data of observers who will be collecting individualized data and also doing some of the interviews myself.

What is your working definition of “engagement,” and how does your concept of

engagement potentially differ from that of others?

I definitely have a very specific meaning or set of meanings regarding engagement. I think one of the big challenges in our field is that people don't realize that there are multiple meanings. Some people think of engagement in terms of educational engagement: getting people engaged in the material and excited by it, having their attitude change as they interact with the material and so forth. There have been people, especially in the education world, who have really developed that idea of engagement a lot.

A second kind of engagement is democratic engagement. This involves the governance of science: Who decides what counts as an interesting scientific question? Who decides where we allocate resources and what kind of grants we fund? Do we fund space science or medical science? Within medical science, do we fund basic research or applied research? These are critical questions, they're real questions that have to be addressed. Part of the ideal of especially basic science is that it's purely curiosity driven. It's just about where the scientist wants to take the work. That is true for a very small amount of research. Most research that is funded relates to some kind of real-world problem that the scientists are trying to solve. So that means there are decisions about which problems to address. The question is, who should make those decisions? Are those decisions that only scientists should make, or in a democratic society, which many of us believe in despite all of its challenges, should we have more citizens and more people in the overall community participate in governance? That's democratic engagement and policy engagement. It doesn't happen independently of some of kind of personal, individual educational engagement, but it's thinking about engagement very differently. These things were tied together by the Brazilian education philosopher [Paulo Freire](#), who understood education, especially adult education, was not just the conveying of information. He called it a banker's model; people involved in public communication of science often

call it a deficit model. Rather, you need to think about it in terms of empowerment: education is about empowering people, and part of empowerment is having the authority to make decisions. So that ties it to the democratic ideal.

Those are the two big ways of thinking about it. There is a third way, which is institutional engagement. At a practical level, most institutions want people to be engaged with them. So a particular science museum may feel that yes, they want you to learn, and they may articulate that this is all about democracy, but "by the way, would you become a member, and would you please come back three times a year?" That's an institutional engagement. A lot of people who are absolutely committed to the high ideas of the field are also committed to the strength and growth of their own institutions. I don't want to imply that there's something wrong with institutional engagement, I just want to point out that when people talk about engagement, it may not be clear that they have these different meanings. If you go into a meeting of senior museum staff and they start talking about engagement, it's likely that they mean engagement with that institution rather than educational engagement. So when the head of education of that museum says, "Yeah, we work really hard to get people engaged," which meaning is he using? I think it's important to think about those three different kinds of engagement. They can overlap, and the same project can address multiple meanings of engagement, but they are different meanings.

So why do you think engagement matters for science learning or science communication?

I don't like making very strong distinctions between those concepts. I think engagement is important—whether you're thinking about it as educational, democratic, or institutional engagement—for educational purposes. It's clear that people learn more and are more likely to take in information, retain information, and use information if they are motivated and excited, which are two of the components of a formal definition of educational engagement. So I think that there is a critical role

there for motivation. Engagement leads to a couple of outcomes, including changes in attitudes (which is part of the definition of educational engagement) and changes in identity to “someone who can learn science.” What does it mean to learn science? It’s not just learning methods or content or how to do particular things; to learn science is to learn that you *can* learn science. We’ve all been to a party where you’re talking to someone and they say, “What do you do?” And you say, “I’m a scientist.” And they go, “Ah, yeah, um-hum. Last time I took science was in high school and I barely passed with a C, and I’m so glad I never have to take science again.” That’s someone who doesn’t think of themselves as being able to learn science. So part of learning science is getting that identity as a learner.

Why is engagement important in the democratic idea of engagement? Because that’s the whole notion of democracy. If we don’t have everybody engaged and participating, then we don’t have a real democracy; we have some kind of oligarchy or fake democracy. We all need to be engaged. I think the more we can do to get people engaged in the democratic process and in the relationships between democracy and science, the better off we’ll be and the stronger our democracy will be. That includes understanding what counts as good information, what counts as lousy information, how scientists go about judging information, why they can be both tentative and certain at the same time, how they judge uncertainties, all those kinds of things.

An important aspect of democratic engagement is that it’s not just about individuals, it’s also about communities. We talk about community science literacy. When a family goes to a museum or a science festival, they don’t all have the same experience, and when they sit around the dinner table afterward and talk about what they learned at the festival, each of them will bring something different. Collectively they have learned something as a family, because they learn from each other as well, and they collectively hold that information. That’s true at the family level, and it’s true at a community level. Let’s say that a community is facing a water quality problem, and some people

learn how to take water quality measurements, other people learn how to interpret the measurements, some people learn how to recruit others to help, and some people learn how to write up the findings and how to give public statements. Collectively, that group is much more empowered and much more engaged than any individual could be. That kind of community science literacy is where we see engagement happen. Obviously engagement is important for institutions, because institutions do need people to come back and purchase memberships and give donations and to bring their kids and family members and tell their fellow citizens that this is a place where a lot of exciting things are happening. So that sense of engagement with an institution is important for the survival of those institutions.

How do you measure engagement in your work, and what are the tradeoffs of your approach?

One of the challenges in measuring engagement is coming up with some operational definitions of what you’re going to measure. Do you count engagement according to how many times people participate in an activity, what they recall in terms of factual knowledge, whether they show a change in attitudes, or whether they develop facility with certain practices? Each of those can be measured with some kind of scale, and every time you create a scale you have to create an abstraction, which is pulling out some of the meaning. So I tend to get very frustrated with scales. I’m trained as an historian, and I like qualitative data. I think that there’s a lot to be understood by looking in a more holistic way at what people are doing. In the examples I mentioned earlier, when I observed people watching pigeons or doing science events at a music festival, we used scales to measure their engagement. We asked people to rate themselves on certain scales. Yet those scales didn’t capture some of the odd things that we were observing happen. So we had to be willing to step away from our scales and see what was going on that the scales couldn’t measure. And we had to figure out how to ask interesting questions. There are also problems

with scales because people will give you the socially desirable answer. If you're asking them which of these topics they're interested in, they say, "of course, I'm interested in science." But they aren't especially interested in science, not compared with sports or politics. So you have to be a little careful about how you interpret some of the scales. While I do use scales, my goal is to be not so stuck in a scale that I don't step back and say, "What am I now seeing? What's happening here that I didn't think to measure? And what's *not* happening here?" That's a really hard one. It's the classic Sherlock Holmes concept of the dog that did not bark in the night: how do you suddenly notice that you were expecting to see something and it's not there? It's one of those things you have to constantly remind yourself about.

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

I think there are a couple of important things for people to think about engagement. First, engagement is not just another word for delivering information. Some people have said, "Well, we know the [information deficit model](#) is no good, so we're doing public engagement, and here, let me do an engagement exercise where we present you with lots of information." That's not the way to think about engagement. I think practitioners should be thinking instead, "What is my goal? Is my goal individual educational engagement? Is it some kind of democratic empowerment? Is it a stronger connection with my institution?" Each of those is an important and reasonable goal, but it's important to be clear about what your goals are, or if you have multiple goals what the priorities between them are, and which ones you're willing to trade off for the others. Think about some of the blockbuster exhibits that you sometimes see at science museums which don't seem to have a lot of science in them. I'm thinking of the ["Costumes of Star Trek" exhibit](#) that I've seen. But if it gets people to be connected to your institution and to think well about science, maybe that's the goal that you're trying to achieve, especially if it adds to your

bottom line and lets you do the other things that you want to do. That's why I say there's not necessarily a value judgement here, it's just a matter of being clear about what your goals are. I think those would be the two key things I would want people to think about engagement. It's not just another word for delivering information, and you need to be clear about what kind of engagement you're trying to do, whether it's educational engagement or democratic empowerment or institutional connection and identity.

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

I think a critical question is going to be whether any of the kinds of engagement achieve the goals that we think they do. For educational engagement, when we design activities—whether they are science festivals or social media campaigns or whatever—to get people to have educational engagement and learn more individual things, how do we actually measure that? Many of the people who tend to engage in those activities are already fairly high on the knowledge scale or the attitude scale, so it becomes very, very difficult to figure out whether you're changing anything. I think there are some measurement issues there that we have to address.

Secondly, I think we have to really pay a lot of attention to the difference between educational engagement and democratic empowerment. A lot of people use the rhetoric of democratic empowerment, when what they're really doing is educational engagement. That's a problem because a lot of the justification for these activities is the democratic empowerment language, and yet we aren't empowering people. I think there's been some research work that has started to try to disentangle some of those issues, but I don't think we're very far along, and I don't think most practitioners have really had an opportunity to think about those differences very much. It would be really good to bring their voices into these research conversations and think about how we can ask that question

better. We don't necessarily have good ways of measuring democratic engagement, so I think that's a subquestion, but it's one we have to think about.

A third issue that is largely related to the democratic empowerment issue but can be defined as educational engagement as well is community science literacy, which is the term the [National Academy's committee](#) used to describe it a couple of years ago. They stated that when we talk about science literacy, we shouldn't just be talking about individual science literacy; we also should be talking about community science literacy and broad societal literacy. I think this is a critical development in the field. I think it's one of the most exciting developments in the field, and it's new and we don't yet have very good ways of assessing community science literacy or figuring out what its implications are. So that's an area where there are lots of opportunities for really thinking about what it means to engage with people at the community level, how we can assess that, what it achieves, and where we can make it happen.

Is there anything else about engagement, science learning, or science communication that you want to share with this group of practitioners?

This has got to be one of the most exciting areas there is to be practicing or researching. It's just critical for our modern society. It's a place where there are immense challenges. It allows us to be

tremendously supportive of science, in the sense that science produces reliable knowledge, giving people access to that is one of the most important things that we can do, and these activities are the way we can do that. At the same time, we can be critical and say, "But what do we mean by access to reliable information? How does knowledge get produced, who has access to it, what does it mean to have access, and at what level do we want people to have access?" What's exciting for me is that you can be participating in something that's just critical to the future of society—whether we're talking about food, energy, medical developments, or a host of other things that are vital for our survival—and at the same time you can also be critical about what that means. What do we mean by sustainability, what do we mean by good health, what do we mean by having to make choices between energy, independence, and economic development? What do we mean when we want to make choices about food security and the ability of individuals to make their own decisions about food and seed and to know what they're eating and how that connects to health? Those are all critical questions, and being able to think about those questions, as we strive to deliver good information and engage people in conversation, helps us have a more informed, higher capacity discussion. We can think about this as capacity building. We're never going to have all the answers, but the more people who have thought about these issues at a more sophisticated level, the richer and higher-level conversation we can have. So that's what excites me about this field.



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