What is STEM Identity? An Interview with Angela Johnson

On December 13, 2017, Tina Phillips, Research and Evaluation Manager at the Cornell Lab of Ornithology, interviewed Angela Johnson to understand her thinking and work on the topic of STEM identity. Dr. Johnson is a Professor of Educational Studies at St. Mary's College of Maryland. Dr. Phillips conducted the interview as a member of the Center for Advancement of Informal Science Education (CAISE) task force on evaluation and measurement and co-Principal Investigator of CAISE.

A video of Dr. Johnson's interview, as well as interviews of other researchers, is available at InformalScience.org/identity.

Tell us about the projects that you've done that focus on identity.

I've studied the identity of women and girls of color, studying STEM at the K–12 level a little bit but much more at the university level.

Across those projects, how did you define identity?

The way I think about having, for example, a physics identity, right now my own work is more influenced by the way that Zahra Hazari and her colleagues reinterpreted my earlier work. But when I think about a person having a STEM identity of some kind, what I think matters is how they see themselves. Whether they see themselves as having an affinity to the field and what others reflect back to them. So I see whether they recognize themselves as belonging in the field and whether other people recognize them as belonging to the field. And also whether other people recognize them as not belonging and interfere. They don't necessarily affect a person's self-identity as belonging in STEM, but they interfere with the person's actions. They interfere with the ability for the field to embrace them.

So they set up barriers?

Yes. They keep people marginalized and pushed aside. A story that I was told many years ago was about a woman who was working in a lab, just an undergraduate research experience, and while she was in the lab she had to put a Sharpie pen on the neck of some mice and jerk them by the tail to break the neck. It was part of the research protocol. And she said that she got a lot of hassle from other people working in the lab not because she wouldn't kill the mice, because she would, but because she didn't want to kill the mice. She was getting the message that she was too girlie to be there. The ability to kill a mouse, to take a mouse out with your bare hands, is not actually related to whether you can contribute to the STEM field. She had a strong feeling that she belonged there, but she was being pushed aside nonetheless and wasn't able to engage fully in some of the activities that other people expected her to do to show that she belonged because she was doing it in some way they perceived as the wrong way.

A student I interviewed much more recently was also doing an undergraduate research experience. It was in the summer, and she was the only woman in her lab, the only undergraduate, and the only person of color—so she was triply different from anybody else in the lab. One day someone bumped her, and a chemical got spilled. Then somebody in the lab started saying, "We all know who did that." And they turned, invited everyone else in the lab to laugh at her, and then said, "How does it feel to have the boy's club laughing at you?" So although she had a perfectly strong affinity to physics that continued beyond that day, she never could continue to interact in the lab because she was so concerned about being marginalized. She never spoke for the rest of the summer. Her self-identity, her recognition that she belonged there wasn't impacted, but her belonging in that lab setting was impacted in that she could no longer get out of it what she had come there to get, which was to participate in the life of a research group.

I think that identity in the sense of an internally felt process is one thing, but your ability to step in and occupy a legitimate role in a setting is another. It's at that level of identity, of being able to legitimately occupy a role, that other people recognize as important or valuable. That's where problems crop up and where what other people see when they look at you can start affecting whether you can assume the identity of a physics student, let's say. Regardless of what you feel inside.

Those sound like external facts, right?

Yes.

There's the internal piece of what you can occupy and then there are external factors.

Yes. For me, as an anthropologist, I'm interested in the external factors because I think how you feel inside might affect your motivation and your ability to persist in the face of obstacles. I'm more interested in the characteristics of the setting and in determining how to create settings where people's external perceptions of you are

less likely to be able to shove you to the side, or where they're less likely to have damaging external perceptions—literally damaging your career.

Why, and in what ways, do you think identity matters for science learning or science communication? Can you say a little bit more about why you think it matters for science learning and science communication specifically?

There are two senses of identity. One is something that's intrinsically felt. Without an affinity for science, your ability to learn science and communicate about science is going to be affected because you're not going to be very motivated to do it, and you don't care. In terms of the sense of identity being whether other people recognize you as belonging in a setting, if you have to constantly fight to be given legitimacy in your setting, it's harder to learn because you have two tasks. Learning science is hard enough without having to constantly prove to other people that you belong there. This external sense of identity as a role that you can step into easily or with more difficulty has a huge impact on your ability to learn science. It also affects whether you can communicate science. If people don't perceive you as a legitimate member of a science community, they're not going to think you belong. They're not going to buy your communication. They're not going to take your communication seriously if they don't think you're a legitimate communicator, a legitimate member of the community.

There are a lot of ways that people approach identity. How is your approach distinct from other approaches? We've been talking implicitly about science identity, but some people are talking about STEM identity. Do you think there is a STEM identity? How is your approach distinct from other approaches to identity?

I think that often other people think about identity as something internally felt. I'm talking about how people are recognized in a setting as belonging or not belonging and how that recognition affects the kind of actions and opportunities available to them in a setting. I'm talking about the way that powerful figures in a setting may grant a person legitimacy or may marginalize them, regardless of how the student feels on the inside, regardless of how the student identifies in a more psychological sense. I think that the ways that people are or aren't recognized in a setting are intimately tied with their body, with their physical markers of yet another kind of identity, which is the meaning people make of your gender, your race or ethnicity, and other aspects of your appearance.

How do you frame identity in power relationships? Is that the language you would use?

What interests me is the way that power gets divvied up in particular settings. Whether the way power gets distributed within that setting is in alignment with the larger status quo or whether it can run counter to the status quo, and what are characteristics of settings where the way power is distributed runs counter to the

status quo? That's the project I'm working on right now. Looking at physics and math and computer science departments where women of color are finding it easier to thrive and persist in their studies because they are in a setting where they're less marginalized. What are the characteristics of that? What has to happen for that to be the case? I'm really interested right now in what actions professors can take to push their departments toward this counterculture. Toward a culture that runs counter to the larger cultural features.

How are you currently measuring identity in your work?

When I've worked with identity I've always looked at ways that a person can present themselves in a setting that they are celebrated or admired in that setting versus ways of being and acting that are marginalized or less successful in a setting. For instance, in a study I was working on a couple of years ago I interviewed students about what their lives were like while studying physics, math, and computer science. I listened to the kinds of things they said that they and other students did and the behaviors that they told me students engaged in. I attended a lot of classes to see what I could see, and then I interviewed a lot of professors and asked them what they considered to be a good student in their field. From that I was able to sketch out the kinds of students that are considered typical and optimal in these settings. I was studying settings that I had already identified as counterculture. What I found is that the students talked admiringly about people who were friendly, worked together, and worked hard. The professors were saying they liked students who asked good questions and who worked together and helped one another. They were creating an identity of a good physics, math, or computer science student that wasn't based on natural ability or competition; instead it was based on collaboration, hard work, and supporting one another. The word that they used over and over was "friend," "friendly," "friendship." Those three terms came out consistently. I was at the first day of a calculus class, and the professor said everybody's going to make a friend; to get through this class you've got to make a friend. The professor stood there waiting until everybody grudgingly turned around and introduced themselves to other people. The students would say things like, "I really love this major because I have so many friends." And they would say of the professors, "they're so friendly." I was stunned at how often it was coming up. It was a major characteristic of the identity that was celebrated in this setting, and that's what I mean by identity.

So that's a qualitative approach?

Yes.

Is there another methodological subtype of measurement that you would classify that as? Is it phenomenological?

I would just say that my work is ethnographic. I'm an anthropologist, and it's just classic ethnography. Looking at the things people do and say, the things they use and the shared meanings that are attached to those actions, speech, and objects.

Do you think that it's possible to create tools for measuring identity that practitioners or evaluators could easily use?

Sure. I love Zahra Hazari and her many collaborators' work. I think their work is wonderful.

Can you elaborate on that a little bit?

They have a questionnaire that they give to students. They've piloted it on high school students, but they have also used it on college-aged populations. They ask the students questions about whether they recognize themselves as belonging in various STEM fields. They've modified it for different disciplines. They ask students about their experiences that would suggest that other people recognize them as belonging. It's a nice little quick and dirty measure of a student's identity in the sense of self-recognition and recognition by others.

But a tool for the student—you're asking the wrong person. I was astonished when I saw what everybody had done with the ideas that Heidi Carlone and I put forth 10 years ago now. I was astonished they had made that into an instrument that I thought had good face validity.

I started out studying physics, and I ended up studying anthropology because I'm interested in the things that people may know but they don't know that they know, and it's really hard for them to tell you what they don't know that they know. You can only figure that out, it seems to me, by long and thoughtful observation until you start noticing patterns that aren't apparent on the surface.

I don't know how you make a fast instrument to do slow observations. But I think that somebody else might be able to come up with it. That's just not me. That's not my purpose. I wish it were. I would feel really smart if I could both do the long slow work and also the fast clever work.

In your work, do you think about how other identities, for example, gender, race, socioeconomic status, etc., might overlap or intersect with science identities? What role, if at all, does this intersectionality play in your work?

It's the centerpiece of my work. I love science and physics. I love it enough to be very dubious of the pipeline explanation that there are just not enough women interested, and we have to get them interested. I think it's inherently interesting. When you see a subject that is inherently interesting but there's a huge gender imbalance in who's participating, there's something about the culture. Physics is really great and there's got to be a lot of other women who also think physics is really great and who didn't go into it for reasons other than its inherent interest. They were discouraged by something. It's a great field, so if they're not going into it there must be a reason, and it must be some kind of obstacle that is different for men than women. And, yet, you'll go into a classroom and, although you will certainly see occasionally overt discrimination, you mostly see what appears from the outside to be a level playing field. I get really interested in the actions you need to do to be regarded as a good

student in this setting, an important student, a student who's good at physics, or name your STEM field. How are those actions subtly raced and gendered or how are the interactions in the room subtly raced and gendered? Because we've all heard the explanation that the problem is overtly prejudiced people, and we just have to wait for them to die, but that explanation falls apart. There was a study a couple of years ago where physics, chemistry, and bio professors at six different universities all rated the resumes for a prospective lab technician. The resumes were identical except for one was John, and one was Jennifer, and the professors felt that John should make $6,000 more a year and was rated almost a point higher, I think, than Jennifer on a 5-point scale. The women were doing it as much as the men, and the young professors were doing it as much as the older professors. So the problem is not overt prejudice. The problem is some kind of covert discrimination. I think part of the problem is implicit bias, but with implicit bias, it blinds you to its existence. You don't know that you're implicitly biased. What interests me is looking at structures and policies and procedures and celebrated identities in a setting that are easier to access for some kinds of people than others in nonobvious ways.

For example, in a study I did a long time ago, I was looking at the way that at the end of class, or periodically throughout class, professors who were teaching in huge classes, in front of 250 people, were saying, "Does anyone have any questions?" And I thought that was great because with 250 students they couldn't do anything. Your instinct would be to talk as far as you can from beginning to end and hope that you don't lose control, but they were opening up the floor to questions and comments. But not all students were availing themselves of the opportunity, even though the professors didn't say, "okay, now it's time for white men to pose a challenging question and for white women to just ask clarification questions, and for the rest of you to be silent." That's what was happening. So then the question is why did this ostensibly open practice result in disproportionate participation? Why did different kinds of people take it up differently? What looks like a practice that's open to everybody actually plays to the experiences and socialization of certain kinds of people. First of all, women are already socialized to be deferential—to ask easy questions rather than to answer, to not make anybody look bad. So women were very unlikely to ask a question that challenged the professor's knowledge, and they were unlikely to ask a question that would draw undue attention to themselves. The women of color had all told me that as one of the three women of color, let's say, in this whole class, they already felt like there was a giant spotlight on them, and there was no way they were going to ask a question. And so what happened is you had these white men. I saw one guy put his hand up and start a long discussion of something he had just read in *Science* magazine that he felt challenged something the professor had just taught. He's going on and on, and he's perfectly happy to waste everybody's time in class. I saw some white women ask questions about what exactly is going be on the test, and I never saw a person of color speak. And so I think that these larger structures, due to race and gender and other kinds of marginalities, affect people's abilities to access opportunities in classrooms and make ostensibly neutral practices reproduce the status quo.

You don't look at identity in the vacuum of identity.

No, in our hearts we can feel pulled to a discipline, but that doesn't mean we access it in the same ways, and we can't pretend that we have no bodies. We can't pretend that other people don't look at us and see things and that they don't slot us into the social matrix of domination as soon as they take a look at us. That would be naïve, and the only people who could believe that are people whose bodies are so acceptable that they don't realize that they're being slotted into the acceptable slot all the time. The "you belong here" slot.

A lot of people are talking about things like interests, motivation, and attitudes as outcomes for science learning. How do these connect with identity? How do you distinguish science identity from these other concepts, if at all? How do interest, motivation, and attitudes relate to identity for you?

Interest is key. You have to have an affiliation with the field. And the way that I think about identity, if you don't have an affiliation with the field you won't be entering the setting in which you're trying to be accepted as belonging there. But after that, I don't think of identity as residing in a person; I think of it as residing in a setting and who is and isn't regarded by other people in the setting as belonging, being valuable, and being an exemplary member of the setting. I think that if you enter into a setting where you would like to belong and be recognized as belonging, if you are unable to get that recognition in the setting, of course that can affect your attitude and your motivation because it's really discouraging.

But I don't think of identity as attached to the setting and not the person, but a person has motivation and an attitude, so I don't even think of them as relevant except as outcomes of what happens when you try to be accepted as stepping into a particular identity. I know it's really different than the way other people conceptualize these ideas.

We have lots of different perspectives that we want to share, so I don't think anyone has all the answers.

What we're looking for is a bunch of different tools to see what helps a particular person solve a particular problem in a particular setting.

Speaking of tools, what are some examples or resources or tools for measuring or understanding identity that you have found useful, if any? Are there some people or projects that you would recommend?

Well, obviously I would recommend Zahra Hazari's work and her colleagues. I love the work of my long-time collaborator, Heidi Carlone. And, for example, Karen Tonso and Cory Buxton, but the reason I love their work is because they are all coming at identity in this same anthropological way, as something residing in a setting. In terms of theoretical uses of intersectionality, I really like to go back to the source and Patricia

Collins' work because when she talks about identity she also talks about what happens and the characteristics of a setting and not the characteristics of a person and the way that power gets played out in a setting based (I don't even want to say it like this) based on the bodies people bring into the setting. I'm not sure Collins would put it that way, but I like her work because it's about settings and not people.

I think that a lot of people, when they talk about intersectionality, think of it as something attached to a person, and I think of it as something that comes into play the moment you step into a setting. Different aspects of who you are become salient in different settings. Different aspects of what social location you occupy slash into prominence in different settings depending on the setting.

Beginning with the interest, your initial affinity and our interest, right?

Right, because if you don't have affinity you're not going to go there and try to be accepted in the setting.

Unless somebody's forcing you to or something.

Right. Exactly. Like your mama is making you go to med school, and we've all seen that student. And all you want to do is be a sociology major. I had a young woman whose mama was making her major in chemistry, and she was just not feeling it. So she wasn't even bidding to belong in the chemistry setting. She was just sitting in the back drooping and could hardly wait to get to her sociology class.

Anti-identity.

Yes.

Is there anything else about identity and science learning that you would like to share with this group that we haven't touched on?

No, instead I would like to tell you a story about my student who did not want to be a chemistry major. In her dorm, a first-year student was in an apartment with a bunch of other students, and their door was right next to the entry and exit door to the dorm, and he hung a giant Trump flag in the dorm. All the students on the other side of the hall hung rainbow flags, which I thought was funny. But a student put a note up, which I thought maybe this was a little over sensitive, saying, "It makes me kind of uncomfortable for you to put this flag up here because of his support of white supremacy." So then he put a sign up next to that saying, "It's a flag, deal with it." And then the whole campus got into a giant debate about *is it a flag, just deal with it*? All except my little not chemistry major. She put up with it for two days, and then she just got tired of it and started following him all over campus. When he sat down at lunch, she got her tray and sat down in front of him. Everywhere he went, she followed. He tried to lose her, she showed up at his dorm room, and he said, "How'd you get here?" And she said, "Dude, everybody knows where your room is. That's the point." And then he just took the flag down. It only took two hours of a mad black woman to start following him around campus, and he took the flag down.

That's fantastic.

But his principles were really, really strong as long as he didn't have to face a black woman for two hours, and then he found they were not as strong as he had thought.

As long as he didn't have to own up to it, right?

Yes. Exactly. During lunch and stuff. That's just wrong. How could she make him look at her during lunch? That's not fair.

That's great. Thank you for sharing that.

It's been really, really fascinating. I love the perspective of thinking about it through the setting because I have looked at it very marginally, and it's always been from the person internally, so to have this other perspective is really helpful.

But the thing is, regardless of how you feel inside, for those of us who are studying this, we would like to make settings less toxic. We have almost no control over how a person feels inside. All we have control over is the setting. So all this focus on trying to change what's inside of people, to cultivate some kind of identity, well, I guess we could do that, but I think that there are plenty of people who already strongly identify with the field and are being forced out. Why don't we first work on keeping the people who already want to be there? It's very difficult to change another person. As professors, we have a lot of power to change our setting.

The woman who told me the story about the men in her research group asking her how it feels to have the boys club laughing at you was in another setting where she has also done work. I was interviewing and observing there, and I watched faculty members go up and intervene in lab groups where male students were trying to control all of the equipment and say things like, "Everyone needs to touch the equipment. You're monopolizing the equipment. Stop monopolizing the equipment." So they were conveying strongly that in this setting being a good member of the setting means sharing. This same woman in one setting was marginalized and in another setting her professors came in and were deliberately creating an environment where the actions that were appropriate to engage in were actions that were straightforward for her, like collaborating. So I'm much more interested in the actions that professors can take that they have access to. I can't go in and move the levers in somebody's head, but I can demand that students treat one another a certain way and marginalize those whose treatment is marginalizing other students, if that makes sense.