

**HEENA R. LAKHANI:** Hi. Today we're going to be talking about critical and cultural approaches to scientific investigations. So here's our agenda for today. We're going to talk about how to take a critical and cultural stance in scientific investigations and why it's important. We'll actually take a chance to engage in a home science investigation.

We'll put forth some ideas that we have about how to engage students in home science investigations and incorporate them along your existing units. And finally, we'll talk a little bit about developing inquiry cycles into your own practice. So before we begin, let's turn and talk for about two minutes. So here are the questions that you can talk to with your partner.

What everyday materials in your home or your neighborhood do you see that connect to the unit you will be teaching? What types of activities do you and your family engage in that connect to the unit you'll be teaching? So go ahead and pause your video for about two minutes and then we'll come back together.

All right. Welcome back. So as we think about investigations and how they play out in a classroom, they typically have limited connections to home life. So some examples of these investigations include simulations, lab experiments, teacher demos, and guided observations. And today we want to think about investigations in a more expansive way, and think about how can we modify these investigations so that we can leverage what happens at home and to expand our curriculum to actually talk about home science activities that kids do.

And to do this, we are going to be framing it with some of the following ideas here. We're going to be thinking about what it means to critically reflect on our practice, what students' cultural expertise is, and then thinking about what happens when these two dimensions come together. And we're going to call that critical and cultural responsiveness.

So as we're thinking about critical reflections, I want to put this concept of critical consciousness on the table. Critical consciousness is the ability to identify critique and challenge the social forces that produce inequality and oppression. And to do this, we have to develop language of critique. We have to develop some reflection questions that can help us do this work.

Some examples include whose perspectives are reflected in this work, whose are absent, whose interests are served, whose are not, what assumptions are being made, what values are being transmitted, and who has power in this situation, and where does that come from. Now, these are questions we can ask about other aspects of our life. We can even ask them in our classroom and our approach to scientific investigations.

I'm going to take a little bit of time and talk about culture and emphasize that science learning is a cultural process. Human beings, no matter who we are, where we live, or what language we speak at home develop our ways of knowing, talking, valuing, and acting as we live our day-to-day lives inside family and community.

These ways of living are what is now understood as culture. Indeed, across communities, human beings make sense of the world in ways that are both similar and different. And so I want to emphasize that culture is not a trait that some people have and others don't. We are all cultural beings.

And we're all cultural beings because we all have ways in which we engage and make sense of the world as we participate in everyday activities of our communities. So multiple dimensions matter here. Our science knowledge matters. How do we understand or make sense of the natural world. What do we already know about it? Our personal and community history matters. What lived experiences do we bring into our understanding of science? Language and representation matters.

How do students use language to make sense of the world and how do they represent their ideas without words? And race, power, and justice matter because they shape our identities and agency in the world. They will affect how we perceive and make sense of phenomena and science ideas.

And so we're going to ground this back into the framing concepts I had earlier about being critically and culturally responsive. So thinking about the critical reflection piece when it comes to scientific investigations. We can think about how classroom science investigations have traditionally been used in which students are not given much agency and there can be very few connections to everyday experiences.

So traditionally, investigations have involved activities from the science book and have been constrained to lab-based activities in the science class. And we want to expand this and allow teachers to think about, well, what is the science that students do at home? And how can they leverage that science in the science classroom?

And so again, this is getting into the cultural expertise part. Students are problem solving and making sense of all sorts of things in their everyday environment in their homes and their neighborhoods. And so they already have a rich repertoire of making sense of problems, of designing problems about looking at science to understand cooking. So they have a lot of cultural expertise already.

And so when these two dimensions come together, the critical reflection and the cultural expertise, we can identify and leverage students wonderings and cultural connections and be able to leverage them in the science classroom. And additionally, we can facilitate more opportunities for them to do home investigations. And so the second part of the presentation, we'll talk about what we can do to help support students to be investigators in their own home.

They already are, but now they can think of even more ways to investigate the things in their environment. So critical and cultural responsiveness is seeing science as a body of knowledge derived from acultural practices is a very impoverished view that leads science educators to focus on methods and facts rather than motivation, fascination, and personal relevance.

And I think this is really important as we think about home investigations because as we look at the science in our lives everyday around us, there's something compelling, there's some sort of phenomenon that is motivating us to do science. Why isn't the electrical socket working? Why isn't the air conditioner on?

Or when I'm cooking something, why is the water boiling? And so these everyday events that we observe have a science basis to it and they have a motivation. Students are motivated to fix things there, they're curious about their everyday environments. And so the act of knowing and learning is tied to a specific context.

I want to return to this slide that you probably saw at the beginning of the PD. And thinking about investigations both from students' cultural expertise point of view. And also as teachers, reflecting on how we can support students' understanding of everyday science and leverage it in the classroom.

And so as we do this, there are lots of critical questions we can ask ourselves. And I'm going to highlight the second one here. Is am I teaching only one way to do science? Or am I hiding that there are multiple ways of sensemaking and doing science? I want to highlight the STEM teaching tool. And this is provided in the resources in your folder.

And essentially, students were asked to take photos of what are the things you and your family do to stay healthy and keep from getting sick. And here are some of the examples that were observed. So here a student took a picture of the kitchen and student's talking about how the family drinks tea because drinking tea is healthy.

And another example that student takes a photo of the bathroom because washing hands helps keep germs away. And so these different science ideas are manifesting themselves in the home. And through self-documentation, through these photos, students are able to take these photos and say how these science ideas are connecting to their everyday home lives.

And so right now, I would like to take some time for us to take a critical and cultural stance on home science investigations. And so here is an example of a vignette from the second grade about a student engaging in a card sort activity. And I would like you all to pause and reflect on the following vignette. The vignette is provided in the Resources folder.

But as you read the vignette, please think about the following questions. What are your thoughts about what the teacher did? What came up for you as you read this vignette? Thoughts about students from other cultures, thoughts about what is relevant for their learning. And as you do this, please be kind and honest with yourself. This is an opportunity for critical reflection and an opportunity for growth.

And then lastly, think about how this activity may be tweaked to harness the experiences of home science. So go ahead and pause your video for about 10 minutes and then we will resume. OK. Welcome back. So I want to emphasize that many units have a type of card sort activity.

And while these can generate important discourse and push students to dive deeper into aspects of the content, these also can silence students' prior experiences, expertise, and divergent ideas. And so turning a card sort activity lesson into a home science activity, we can identify and leverage students wanderings and cultural connections and facilitate opportunities for students to do science at home.

I would like us to do another example of home science. So let's step into the role of a student who has been learning about forces and is about to begin learning about magnets. So this is an example of a lesson from the third grade and it's about what objects do magnetic forces act on.

Here are the student directions which are also the adult directions for the task. So using the camera on your phone, take at least three photos of things that remind you of magnets, add them to a photo gallery board, and then we'll be using Padlet as we engage in this activity. After adding your images, spend a few minutes looking through them. And then with your partners, share out what trends you noticed and ask each other questions about your pictures.

And so for this activity, I have a QR code. So please use your smartphones. Often the cameras are able to use these QR codes and take you directly to the link. But if not, here is the unattractively long link on the right, you can type it in. So please go ahead and spend about 15 minutes on this activity. And I have some reflection questions on the next slide, which I will advance to in just a second. And again, 15 minutes.

OK. Welcome back. I hope you enjoyed that. And I hope this also gave you some ideas of different technological resources that you can use to support students in home science investigations. And so we have developed this tool for you to use to connect your unit with home science. And a copy of it is placed in today's resources. So feel free to use it for your upcoming activities.

So I would like to take some time to process this tool with what we just did. So today, we were talking about what objects do magnetic forces act on and then we asked you to take photos of things that remind you of magnets. And this is critically and culturally responsive because students are able to identify things that are a part of their lives and make them a part of the classroom investigation rather as something separate and never engaged in a classroom.

And some of the tensions and considerations to consider for this activity are access to technology. If you're using smartphones for cameras or if you're using Padlet or some other platform, do students have access to the technology? Another consideration is how do you invite and consider divergent ideas in this activity? So as students come together and share their different connections, how are you going to make sense of these activities and help both honor and leverage them in classroom instruction.

And so finally, we want to talk a little bit about ways that you can engage in home science that aligns with one of your existing units. So we have three examples, which I'll talk about in more depth. And again, these examples are also in your resource folder. You can do a home interview.

And in a home interview, students can ask siblings, parents, neighbors, grandparents, friends to share their experiences about something related to a science unit. And encourage storytelling and oral histories during the interview as this is a time for students to learn from others' stories and value knowledge and experiences not typically privileged in the curriculum. And here is an example. On the right, there is a document here that talks about thinking with our families about local transportation.

Here's another example of a home interview. And this one was actually taken from the kindergarten unit in Amplify chapter 4.1. It's a home investigation on monarch habits. And another thing to consider is when would you use this home investigation? At the beginning of the unit or bookending it? So that's another consideration to take when deciding when to have students do their home interviews.

Another example is neighborhood and home connections question board. So we can ask students to develop questions that connect their neighborhood with the phenomenon being studied in class. And so you might be able to find valuable ways of returning to these questions throughout the unit. And here are some examples of the neighborhood electricity board. Why do some houses have wires to them but not all? Why are the wires different sizes?

And so you can see here that the question that the students are generated are tied to the unit but the students are not just being constrained to think about the ideas with respect to a phenomenon, but they're being encouraged to think about how these ideas show up in their homes, their neighborhoods, and their communities. And this can be a way for them to form deeper connections with the science and their everyday lives.

And then, of course, lastly we have try out your idea. Often students want more time to explore their ideas or they have home experiences that they can further explore that connect to the units. Encourage students to try out their ideas and share their expertise with their classmates. So here are different examples that we saw from students from a bird feeder to one of those domino activities.

So students already have a lot of creative ways of doing science. And so depending on your unit, you can prompt them to think about how they engage with nature or how they engage with birds or how do they feed them and then they can bring those ideas to class. And again, I just want to remind you that we do have this tool to support you as you think about your unit activities and how it connects to the home science activities.

All right. Finally, we want to end with developing a cycle of inquiry. And this is an opportunity for you to be curious about your students and the connections that they're making. And so this figure here is essentially saying that in order to improve our critical and cultural approaches to teaching science, we need to make observations and collect data. And reflect on this data and look at some of the patterns that we notice.

And today we have two different studies that you can choose from that can support you in designing activities around home science investigation. So study 1 is about developing a home science experience or incorporate into your unit. And I'll talk about that more in just a second. And then the other one is about analyzing classroom discourse around home science activities and looking at students' connections more deeply and looking at their personal connections as well.

So again, to develop the home science investigations and to incorporate it into your unit, we have this tool that you can use to think about the activities that you're using and how you can modify them or add on to them to bring the home science connection alive. The second is the part where students, once they've done their home investigations, they might have an opportunity to share this data in many different ways.

And so this can occur through classroom discourse. And we want teachers to be able to see the reasoning students bring about their connections and to attend to the different dimensions that students may talk about. From science knowledge, to how they use the language in different representations, how they might talk about race, power and justice, history, and possible futures that they might see for themselves. And so this is a way for you to take notes as students are sharing their connections with the home science.

Lastly, I just want to let you know that we do have additional resources for you. And they're in the folder that had the video. And so finally, thank you so much for attending this session. We do want to learn about your experience. So please do fill out the exit ticket. And as a reminder, you get to clock hours for participation.

And we would love your feedback on how this is going. We are very curious about the different ways that you will be incorporating home investigations in your units. So please do reach out to us if you would like to share anything or if you would like any support. Thank you so much.