Learning Frameworks

Culture, Learning and Identity Framework

Why is thinking about culture, learning, and identity important for educators?

In this framework, we emphasize 2 major areas related to culture, learning, and identity: 1) issues of equity in science teaching and learning and 2) growing scientific knowledge and discovery itself. Engaging in high quality equitable instruction requires engagement with both.

Science and science learning is deeply connected to culture, identity, and power, even though we are often taught that science is "acultural" and "ahistorical." Historically, science education has often perpetuated a view of science as objective and value-neutral, and scientists as people who make "discoveries" without meaningful engagement in social, cultural, and historical contexts or practices. However, this is not an accurate view of the history of science, how professional science works, and how scientific knowledge generation using a wide range of scientific practices actually works. Social forces and dynamics are always at play - from the research questions that are asked and resourced, to how questions are investigated and knowledge is constructed, to how knowledge is disseminated. And indeed the body of knowledge in science that exists has been developed from people all over the earth with varied cultural backgrounds. Often learners are not given this view of science, and furthermore, research has shown that learners tend to imagine and be exposed to stereotyped images of science and scientists. Science is much more than a white man in a lab coat with test tubes. And yet, that is the visual image that many young people are given or have when deciding who counts as a scientist and what it means to do science. These perceptions of science have to be deliberately engaged and transformed. Indeed the NGSS framework says "All science learning can be understood as a cultural accomplishment....What counts as learning and what types of knowledge are seen as important are closely tied to a community's values and what is useful in that community context." (p. 284, NRC, 2012) Further, learners need opportunities to see that science can, and has, made important contributions to the social world. Creating opportunities for learners to ask authentic questions and explore the utility of science as a powerful pathway to making contributions for themselves, their families, and their communities is critical to science teaching and learning.

In addition, attending to culture, learning, and identity is important for scientific discovery and sense-making itself. All humans belong to complex and diverse webs of social and environmental relationships. Learners who have a wide array of diverse experiences are often tasked with making sense of science in school and other institutions of learning that is very disconnected from their everyday lives and the experiences of their communities. Research has shown that learners are more likely to engage in science sensemaking, and identify with science and science-related activities, when science is taught in a way that connects to their lived experiences and identities. In order to engage every learners in the richest opportunities for learning, they should have opportunities in their science learning experiences to make these connections and to ask questions that are authentically

connected to their lives in ways that matter. This can be done in a variety of ways, from the design of lessons, to the opportunities educators give students for discussion and other ways of sensemaking, to the questions that educators ask, to how educators ask learners to show what they know and are able to do. Connecting science to learners' everyday lives shows them that science is relevant to their lives, that they are competent doers of science and scientific thinkers, and that science is a tool to solve complex problems facing their communities and the world. An important point to remember is that identities can be both chosen and imposed, and as an educator, you wield a lot of power in how you design learning environments and instruction. Science learning environments can either impose narrow identities onto learners (impositions that might be harmful to them), or invite them to choose from the many facets of their identities that will support them in their learning.

How to use this framework

Learner Sense-Making: Design learning activities that purposefully connect to learners' and families' lived experiences, personal interests, and community practices by using stories and knowledge from field observations, family knowledge and practice sharing, and educational research.

Planning and Implementation: Guide your planning, implementation, and reflection on your own practice by considering how you have made culture and community, as well as their variations, explicit in your practice

Educator Reflection: Reflect on your own knowledge, values, identities, and experiences in place, and with science. This should include the ways they shape your instruction and interaction with learners and families. How are you perceiving learners' cultures, identities, and experiences? Have you critically reflected on how your own positionality and how social narratives are influencing the way you are seeing and interacting with learners and their families? How have you supported them in bringing their identities and experiences into learning in meaningful ways?

Collaborative Practice: Support field-based science practices that explore and investigate questions that are relevant to learners and families, and their communities

Co-Design and Assessment: Reflect on how the design of your instruction, including the assessments you use, invites expansive ways of reasoning based on learners' ways of knowing, their identities, their experiences, and the issues that are important to them and their communities. Also make sure to connect these with standards and practices in the Next Generation Science Standards to engage in meaningful and authentic science learning. "Authentic" activities need to feel important and relevant to learners and their lives in order for them to engage in consequential sensemaking (and consequently show you what they have learned). Instruction, including assessments, that is narrowly construed, or where there are limited ways for learners to show what they have learned, will not provide an accurate assessment of what learners know and are able to do. Consider the ways in which families and family values, knowledges, and experiences are incorporated into learning environments in ongoing ways.

Framework for Thinking about Culture and Identity in Science Learning and Teaching

There are many opportunities to connect learners' socio-ecological sensemaking with their lived experiences, interests, cultural practices, and the like. Here are some ways to start:

Reflect on your relationships, histories, values and identities in relation to what ideas learners are exploring and the practices they are using. While science ideas and practices might at first seem disconnected from your life, you might, upon further reflection, find unexpected connections to your own experiences, family, or community. Recognizing this yourself can help you learn to see your learners. This will help you support learners in making their own connections.

Recognize and engage multiple ways of knowing. The history of science is not neutral and is often not accurately understood. Scientific knowledge and discovery has emerged from different cultural communities all over the world. Further, western science has been involved in harming some communities. Educators can commit to not perpetuating value neutral narratives about science and actively engage and value multiple ways of knowing.

Allow opportunities for learners to ask (and answer) their own questions. This can seem very daunting as an educator because you give up some control over the direction of investigations. But allowing your students to pursue answers to their own questions (as long as they are within the boundaries of what is being studied) is a powerful way for them to see themselves as scientists, who can use scientific practices to answer their own questions and find solutions to problems that they identify and that are relevant to them.

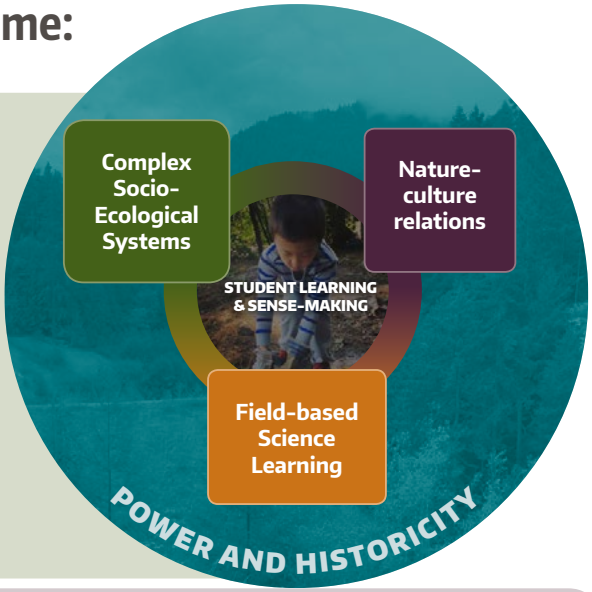
Assume heterogeneity. Do not assume that learners from similar racial, socioeconomic, ability-, gender, religious, etc. backgrounds have the same or even similar experiences and viewpoints. Give time and space to hear from learners and their families what their experiences are, and then strive to make connections to those experiences in your teaching.

Reach out to community organizations and families who can support learners by sharing their work, personal experiences, and/or career trajectories.

Engage families and communities. Learners come from rich family and community backgrounds that deeply influence how they see the world. Families and communities are a rich learning resource for learners, and making deep connections between family and community and other learning like in-school learning is essential to supporting learners' cultural and academic identities.

Routinely recognize and disrupt powered dynamics that produce inequality. Structural inequalities are persistently present even if educators don't intend them. Your learners are living them thus a key responsibility for educators is to work to disrupt them deliberately. This means colorblind claims to neutrality and fairness are leaving accumulating disparities in tact in your learning environment. This is tied to recognizing and engaging multiple ways of knowing.

Connections to the Learning in Places Rhizome:



Complex Socio-Ecological Systems: Research has shown that the places in which people engage in learning about complex socio-ecological phenomena shape sense-making and can support engagement with complex scientific phenomena in authentic and tangible ways. Socio-ecological systems refer to the interactions between human systems and ecological systems. The underlying premise is that humans are part of the natural world, and all of our systems (e.g. social, political, institutional) are always in relationship with ecological systems. Therefore, humans' cultural practices, identities, values, and ways of knowing are in interaction with the natural world in a myriad of ways.

Nature-Culture Relations: Complex socio-ecological systems can also be thought of as factors and relations, such as natural, socioeconomic, and cultural relations, whose flows and uses are shaped and regulated by a combination of ecological and social systems. There is evidence that when people reason about humans as part of the natural world, reasoning and decision-making are more complex. Learners must have opportunities to think about how the various facets of their identities, cultural practices, and community values intersect with ecological systems in ways that are personally relevant to them.

Field-Based Science Learning: Emerging research demonstrates that there is cultural variation in the coordination of attention in observation practices, and this variation could serve as a resource for more equitable and expansive field-based science learning. This suggests that learning outdoors in places that matter for learners and their families, that is, in complex socio-ecological systems, may enhance reasoning and decision-making. Further, learning environments need to engage learners' lived experiences, cultural practices, and home languages as decision-makers with the agency to affect real change in the places that are important to them.

Power and Historicity: Socio-ecological relations with place are political, contested, and intimately linked with ways of knowing and being in the world. Supporting learners in perspective taking and reasoning through contradictory histories of place are equity practices that allow for multiple and diverse stories to be told, honored, and incorporated in science learning. Often, science education in the U.S. has positioned humans as separate from the natural world, or places as neutral spaces in which to conduct investigations. This renders the intersections of social and ecological systems invisible and thus ensures that learners do not have access to powered and historical analyses of these intersections.

Appendices

The following appendices provide examples and other supports to help educators use and then deepen their use of the Culture, Learning, and Identity Framework over time. Appendix A is a vignette that showcases one example of how a teacher used this framework. Appendix B contains some example data to highlight how young people use aspects of culture and identity to make sense of elements of socio-ecological systems. Appendix C is an example checklist that educators can use as they design learning environments, including assessments, to support learners' sense-making and decision-making in ways that connect deeply to their, their families', and their communities' identities, cultural practices, and ways of knowing.

APPENDIX A

Vignette: Ms. Hue

PLANNING FOR INSTRUCTION:

Ms. Hue, a first grade teacher who grew up in China, is planning a set of lessons on the seasons and how the places that students in her class are studying might change with the seasons. She knows that there are some "common" seasonal markers, such as holidays, length of day, and temperature, but she also knows that different cultures celebrate the seasons in different ways and therefore, she does not want to assume that all of her students practice or notice the same seasonal markers. She does some research on how the amount of daylight, average daily temperatures, and average amounts of rainfall change each month. She also reflects on her own family's seasonal practices (and how these practices have changed for her since she immigrated to the Pacific Northwest), as well as specific memories she has of her family marking the seasons.

LAUNCHING INSTRUCTION:

As a launch to the lesson, she asks the students, "what season is it now?" The students all reply, "fall!" Then she asks, "how do we know it's fall?" The students respond with answers like, " the leaves are changing colors", "it's starting to get cold", "there's Halloween candy in the grocery store," and "the days are getting shorter". Ms. Hue explains to students that, just like they just shared, the seasons are a combination of things that happen outside, like the leaves changing and the days getting shorter, and things that humans do, like harvest and eat different foods, dress warmer, and go back to school. She explains that they are going to be starting an investigation of how we know it's fall, and that they will do this for every season during the school year. This will include going outside to collect some data to try to understand how things change across the season, while also doing some investigations in their homes about what their families do during the seasons. Ms. Hue hands out a packet for the students to complete with their families that requests that families do two things together: (1) families will go for a walk around their neighborhoods to make observations about how they know it's fall, and (2) children will interview adults and other members of their family about important family practices they do in fall, both in the place they live now and in other places they used to live and/or have visited.

The next day, Ms. Hue takes her class outside to record the "signs of fall" that they observe. As students walk, Ms. Hue asks them questions like, "What are you noticing? Why do you think that is a sign of fall? How do you think this would look in another season? Do you think this looks the same here as it does in your neighborhood? Why do you think it's called "fall"? Does your family have another word for this season? I would love for you to walk around with your family and see!" From their observations, Ms. Hue realizes that her students are noticing not only "typical" signs of fall (changing leaf colors) but also interactions and relationships (squirrels picking up acorns). Back in the classroom, she asks students to get into small groups and compare their drawings and observations to answer the question, "How do we know it's fall?" Once they discuss in small groups, Ms. Hue leads a whole-class discussion to hear students' ideas about the

discussion question. As students share their ideas, Ms. Hue organizes them under different categories like "relationships", "species and kinds", "things humans do and decide" . She concludes the discussion by pointing out all of the different ways we know it's fall, and she shares with students that she finds the seasons both complicated and exciting because there is so much change in each one.

CONNECTING TO FAMILY AND COMMUNITY KNOWLEDGE AND PRACTICES

On the day that students return with their family reflections on seasons, Ms. Hue once again has students get together in groups to share their family practices around the seasons. She notices that there is a different level of excitement in the room as students share about their families: students speak with authority and answer questions confidently about their family practices. Once students discuss as a whole class, Ms. Hue adds the family practices and observations to the chart that she started after the previous class discussion about what students observed outside on their school walk so that students can see their families' ideas added to the class's ideas from their walks. For example, one student said that in the fall, their family harvests the last of the tomatoes from their garden, but they have to finish harvesting before the first frost. Another student says that in the fall, their family starts to get more colds from being around lots of people at school. A third student says that they notice more snails on the sidewalks because of the rain. After students share their family practices and observations, she says, "I can tell that you and your families know a lot about relationships among different things in and around your homes. You notice the relationship between rain and snails, or between the tomato plants and frost. You're also noticing that your families do different things inside the house because of what's happening outside of the house. I used to think about the change of seasons as dates on a calendar. Now I can see from our class chart that the change of seasons brings changes in lots of things both outside and inside. Our families change what we do in each season, what foods we eat, and what clothes we wear. Outside, the plants look different, the animals do different things, and the ground feels and even smells different. In the next few lessons, we're going to be asking questions about these changes and how they affect the places that we care about!"

REFLECTING ON INSTRUCTION:

As Ms. Hue reflects on this series of lessons, she realizes the importance of giving students multiple opportunities to show what they know. If she had stopped with the first class discussion, she would have missed the rich family knowledge that came from the family walks and interviews. She previously thought that the family tool was a good exercise in getting families to know what their students were doing in school. She was also apprehensive about how to incorporate family knowledge into the class's developing ideas. But Ms. Hue now realizes that by designing her family tool to specifically connect to the questions the class was answering,and by asking clarifying questions during class discussion, she and the students were able to connect the family knowledge and practices directly to the class's ideas. She now also sees that by connecting her classroom science instruction to family knowledge, students were able to show another aspect of what they knew. For example, they were able to talk about new kinds of relationships when they were connected to practices that were important to their families. They were also positioned as experts in their own families' practices, and Ms. Hue realizes that this was a powerful moment for her and the students to see each other in this way. This was a good start to thinking about socio-ecological systems!

In this vignette, Ms. Hue makes connections between ecological and human processes in seasonal change, as well as emphasizing the importance of family practices in how we mark the seasons. She engages students in outdoor observations and family investigations around seasonal change, and helps the class understand that seasonal change, or how we mark the beginning and end of seasons, is much more rich and complex than simply dates on a calendar. This sets up the class for conducting investigations later in the storyline around seasonal changes they observe across multiple places.

APPENDIX B

Example of Learner Thinking Related to Culture, Learning, and Identity

The following transcript segment is from an interview with an elementary school student. In this interview, the interviewer showed the student a photograph of an outdoor place that included raised garden beds in what looked like a neighborhood. The interviewer then asked various questions about the photograph (for example, about what the student observed in the photograph, what season the student thought it was in the photograph and why, what the student would be doing if they were in the place in the photograph and why).

1	Interviewer:	What would you be doing if you were in this place?
2	Student:	I would be trying to get the grass and the plants and the trees greener.
3	Interviewer:	Mh-hmm (affirmative). And if you could go to this place to learn, what would you wanna learn
4		more about?
5	Student:	I usually want to learn more about the plants and the trees and the evergreens, so learn
6		about the evergreens. I watched this video that's got evergreens so I know what it looks
7		like.
8	Student:	Oh. These look not like evergreens but nettles, you never wanna go near them. I got stinged by
9		five nettles at once so I'm not getting stinged by another ever again. It really hurts
10		getting stinged by a nettle.
11	Interviewer:	Aw.
12	Student:	Do you know what helps stinged nettles?
13	Interviewer:	Mh-hmm (affirmative).
14	Student:	When you go in the woods, there's like this thing that if you ever get hit by a nettle it really feels
15		good or you rub it on it. It has to be broke if you wanna get healed. One time my sister's at the
16		apartment, she got lost and then she got stinged by some nettles and then she went up
17		to the plant, it was fully grown, and she rubbed where she got stinged on the plant and
18		it started to get better.

In this example, the student used elements of his personal experience, interests, and family practices to make sense of what he was seeing in the picture. In line 5, the student shared that he is interested in plants, especially trees and evergreen trees specifically. In lines 6 and 7, the student shared that he watched a video that included evergreen trees so that is how he knew what those trees looked like. In lines 8-10, the student shared a personal experience with a plant, specifically a nettle. He said he was stung by several of those plants and that it hurt. In line 12, the student signaled that he had information about what might provide relief if one is stung by a nettle. In lines 15-18, the student shared that his sister was stung by nettles and used another plant to soothe the pain.

When you consider this example, how are you creating space in your educational practice for learners to use their experiences, cultural practices, and interests to help them make sense of phenomena, ideas, and practices with which you are engaging them? Have you ever told a learner that "now" was not the right time to share stories and experiences like the ones shared by the interviewee in example 1? When you did that, how might that have interfered with the learner's sense-making and opportunities to learn?

APPENDIX C

Self-Assessment for Educators

Below is a self-assessment for designing learning environments, including instruction and assessments, to support sensemaking that connects to learners' identities and cultural practices. Take this self-assessment and return to it yearly to assess which elements you have started to incorporate into your educational practices, which elements you have deepened over time, and which elements you have yet to engage.

Nurturing Science Identity Classroom Practices

Educator Self-Assessment created by Megan Bang & Carrie Tzou

Which of the following do you incorporate into your teaching practice?

Yes!	Some!	Not yet!	Dimension of Practice
			I position science as something that contributes to learners' families and communities.
			I position science as something that people from communities and cultures from around the world have always done, and show examples, especially contemporary examples.
			I connect science to learners' family practices and knowledges.
			I incorporate learners' family and community experiences in my instruction.
			I engage learners in learning science in multiple places.
			I understand learners' sensemaking in the context of their family and cultural practices.
			I engage learners in expansive experiences about what counts as "doing science."
			I work to show that multiple ways of knowing are valued and respected in science.
			I elicit learners' ideas and family knowledges regularly in class.
			I recognize the role of my own power and position in my decision-making and interactions with learners and their families.
			I engage learners in field-based science practices.
			I connect science to the places that are important to learners and their families.
			I recognize that the social histories of place are powered and have impacted and shaped learners" experiences and sensemaking.
			I work to make the social histories of place visible in my learning environment, including for example tribal lands and waters.
			I include or connect "cutting edge" science to needs in learners' communities.

self-assessment continued next page...

Yes!	Some!	Not yet!	Dimension of Practice
			I ensure equitable and diverse forms of engagement during science class – I pay careful attention to the participation of and interactions between students to ensure respectful and equitable experiences.
			I make space for learners to be authentic decision-makers.
			I make space for learners to authentically deliberate about phenomena and decisions.
			I make space to confront and challenge assumptions about the race, ethnicities, religions, class, gender identities, and/or family configurations of learners and their families.
			I expose learners to professional scientists and their connections to communities.
			I recognize professions that utilize science but may not be typically seen as scientific.
			I represent scientists from a diverse variety of backgrounds in non stereotypical ways (even in posters I display in my learning environment and in the resources I provide for learners).
			I include detailed information about science related careers.
			I acknowledge to learners that science has and continues to hurt some communities
			I refer to learners as developing scientists.
			I have multiple ways for learners to show what they have learned and do it over time.
			I incorporate families and community-based organizations into my instruction.

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