Cultural ways of knowing as intellectual strengths in robust science learning.

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Plan for our time

- Shifts in understandings culture and learning (20 minutes).
- Seeing culture in moment to moment classroom interactions (45 minutes).
- Engaging culture in planning for change (10 minutes).

Changes in conceptualizing culture: developing a science of culture and learning

- Deficit orientations and models of students TO
- Seeing students intellectual strengths

- Transforming box model approaches to looking at the repertoires of practice within and across cultural communities. (i.e. Vygotsky, 1978a;Cole, 1996; Nasir et. al, 2006; Gutiérrez & Rogoff, 2003, Gutiérrez, 2002, 2006; Rogoff, 2003, Warren & Rosebery, 2008, Nasir et. al, 2008; Lee, 2001, 1993;)

- Understandings of cognition and development– new information and experiences are connected to old – these things impact knowledge organization, conceptual change, and ways of reasoning

Implications for learning environments

- Reconsider what opportunities for learning means.
- Learning environments need to incorporate cultural funds of knowledge.
- Learning environments need to connect to students everyday practices.
- Need to more explicitly consider identity and interest in learning environments.
- Value and incorporate multiple modes of expression and forms of reasoning.

Communities involved in research

Urban inter-tribal Native community (Chicago)

- Founded on federal relocation policies during the 50's & 60's
- 32,000 Native people, with over 100 tribes represented in Chicago-land area

Rural Native community in Wisconsin (Menominee Nation)

- Tribal Schools, Public Schools, Tribal College, and Private College
- Primary source of employment is a logging company: received world recognition for its sustainability practices.
- Still in economic recovery from federal termination policies

Rural non-Native community in Wisconsin (Shawano)

- "Border town"
- Primarily European American
- Middle Class & Working Poor

Urban non-Native communities in Chicago area

Broad context of my work:
Science and Science Education in Indigenous Communities

STEM achievement:

- PhDs awarded to Native students in past 10 years in select disciplines: 14 in Computer Science, 10 in Physics, 5 in Astronomy, 3 in Ocean Sciences, and 1 in Atmospheric Sciences (NSF, 2007)

- In some states, and in some years (doesn't hold as a trend every year of testing) in 4th grade Native students test very well in science but by 8th grade Native students test poorly. No other historically defined cultural community has this cross-over in performance.

- Our research has demonstrated that Native children come to school with a more robust understanding of the biological world than other children.

STEM and CULTURE:

"The cold gave me my language. The cold gave me my culture.
The cold makes me who I am. Without it, I am nothing."

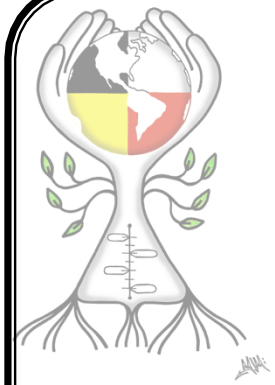
-Oscar Kawagley, Yupiq elder & scholar, February 13th, 2008, Keynote speech

Not just an issue of representation,
fundamentally issues of survivance and sovereignty (Vizenor, 2002)

Epistemology is a critical dimension

- "Epistemology, the study of knowledge, is the starting point for any discussion of indigenous education. It is also a discussion of the priorities and need for identity. Understanding what Native peoples believe about their knowledge origins, priorities, context, and exchange teaches us more about its continuity. Knowing something, then, is a cultural experience that strengthens or fractures culture (Meyer, 2002)."

- The national standards encourage not only a focus on learning scientific concepts, but also on developing an "appreciation of how scientists know what they know in science, the nature of science, the skills necessary to become independent inquirers about the natural world, and the disposition to use the skills, abilities, and attitudes associated with science."



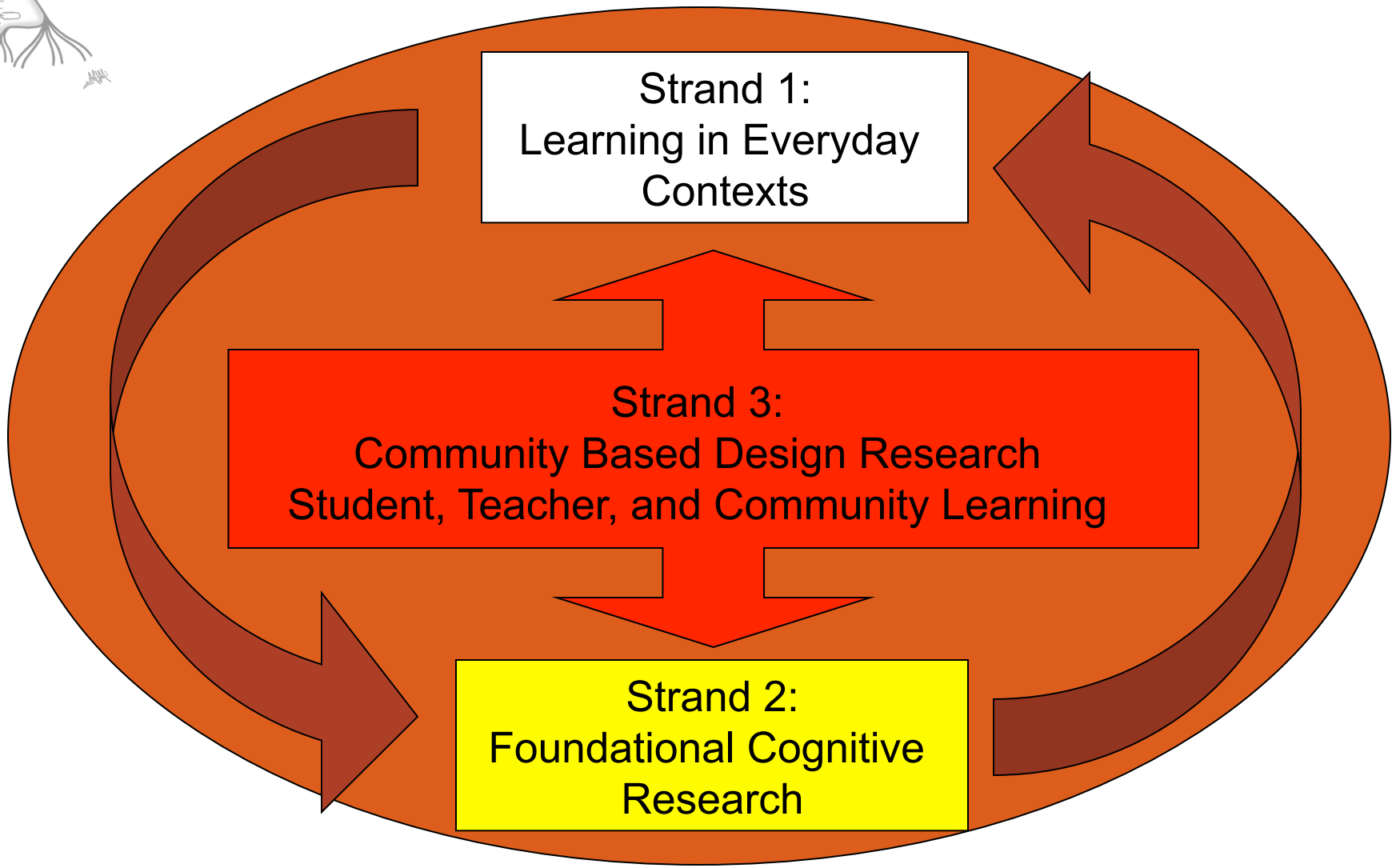
Understanding epistemology in learning.

Epistemology, that is the nature, scope, source, and validity of knowledge (broadly construed), is *implicitly* brought to life, carried by, and learned in our day-to-day practices.

A definition of relational epistemologies

The ways in which knowledge, its source, scope, and validity, knowledge organization, knowledge construction, and knowledge dissemination are rooted in the premise that "***everything is related, that is,*** [everything is] ***connected in dynamic, inter-active, and mutually reciprocal relationships***" (Cajete,2000).

3 major strands of work exploring culture and cognition in domain of biology/ecology



Design of Learning Environments BASED in community based ways of knowing

- Shift from the cultrual add on model.
- Found significant differences in reasoning across age cohorts.
- Native children patterns of reasoning look more like practicing experts.
- Developed learning environments anchored in students everyday practices and ways of knowing.
- Result in a curricula and a set of design principles.
- Part of the way we helped teachers to be able to this was to not only help them look at what students were thinking but how they were constructing meaning.

Strand 3: CBD design principles

1. use local, place-based instruction and hands-on experiences (see Schroeder et al, 2007 for a relevant meta-analysis),

2. are inextricably linked with community participation and practices and includes community values, needs, language and experiences (Cajete, 1997),

3. are premised on the idea that nature is not an externality, apart from humans, but rather that humans are a part of nature,

4. are motivated and organized around a big idea, in our case the idea that everything is related and has a role to play in the universe (systems level or ecological thinking),

5. place science in an inter-disciplinary or holistic context that invites the learner to view phenomena from multiple perspectives, particularly exploration of phenomena from a seasonal/cyclical perspective

6. place science in social policy and community contexts that highlight the need for participation and leadership (e.g. Aikenhead, 2006),

7. exploring and addressing the relationships and tensions between Native ways of knowing and Western modern scientific ways of knowing (e.g. Cajete, 1997, Barnhardt & Kawagley, 2005)

Part 2: Seeing culture and learning

- Together: an example from our work: Thinking about what students are learning in their community and home lives.

- Small groups looking at transcript.

“Tell me about the last time you went fishing”

“Me and my dad, we went and found this one beaver pond, and it was just loaded with trout…I learned it was important to take care of our resources and I figured I was lucky that I had my dad to teach me all this, I learned how beautiful nature was, cause as we were catching the trout we looked at them and they were just all colorful and we seen ducks and geese, and the ducks would come right by us…we seen beaver and otter and mink…The thing is when the beavers dam up a creek, and all the fish get stuck in there and get bigger and bigger. And eventually the cycle changes again and the pond dies off. Eventually it will break open and somewhere above or below it a new pond will start.”

Analysis: Scope of biological knowledge in OBSERVED during fishing

Interview Segment	C1 Kinds or elements	C2 Behaviors & Descriptions of kinds	C3 Relations	C4 Source
"Me and my dad once, we went and found this one beaver pond, and it was just loaded with trout…I learned it was important to take care of our resources and I figured I was lucky that I had my dad to teach me all this, I learned how beautiful nature was,cause as we were catching the trout we looked at them and they were just all colorful and we seen ducks and geese, and the ducks would come right by us…we seen beaver and otter and mink…The thing is when the beavers dam up a creek, and all the fish get stuck in there and get bigger and bigger. And eventually the cycle changes again and the pond dies off. Eventually it will break open and somewhere above or below it a new pond will start."	Animals (KA) Water (KW)			

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Key insight here: Children are making complex observations all the time – connecting this to the practices of observation

Analysis: Sources of biological knowledge in fishing routinely engaged with

Interview Segment	C1 Kinds or elements	C2 Behaviors & Descriptions of kinds	C3 Relations	C4 Source
"Me and my dad once, we went and found this one beaver pond, and it was just loaded with trout…I learned to it was important to take care of our resources and I figured I was lucky that I had my dad to teach me all this, I learned how beautiful nature was,cause as we were catching the trout we looked at them and they were just all colorful and we seen ducks and geese, and the ducks would come right by us…we seen beaver and otter and mink…The thing is when the beavers dam up a creek, and all the fish get stuck in there and get bigger and bigger. And eventually the cycle changes again and the pond dies off. Eventually it will break open and somewhere above or below it a new pond will start."	Animals (KA) Water (KW)	Fish Behavior (BF) Animal Behavior (BA) Water Behavior (BW)	Human related (RH) Functional (RF) Causal (RC) Ecological (RE)	More knowledgeable other (SKO) Freely constructed (SFC)

Key insight: Family is an important source of knowledge and in everyday contexts students assume independent meaning making/inquiry.

Analysis: Constructing narratives and explanations

Interview Segment	C1	C2	C3	C4
	Complex systems/ causal explanation			
"Me and my dad once, we went and found this one beaver pond, and it was just loaded with trout…I learned to it was important to take care of our resources and I figured I was lucky that I had my dad to teach me all this, I learned how beautiful nature was, cause as we were catching the trout we looked at them and they were just all colorful and we seen ducks and geese, and the ducks would come right by us…we seen beaver and otter and mink…The thing is when the beavers dam up a creek, and all the fish get stuck in there and get bigger and bigger. And eventually the cycle changes again and the pond dies off. Eventually it will break open and somewhere above or below it a new pond will start."				

Analysis: Constructing narratives and explanations

Interview Segment	C1	C2	C3	C4
	Complex systems/ causal explanation	Context? – Validity?		
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Analysis: Constructing narratives and explanations

Interview Segment	C1	C2	C3	C4
	Context	Context? – Validity?	Values/ Identity	
"Me and my dad once, we went and found this one beaver pond, and it was just loaded with trout…I learned to it was important to take care of our resources and I figured I was lucky that I had my dad to teach me all this, I learned how beautiful nature was, cause as we were catching the trout we looked at them and they were just all colorful and we seen ducks and geese, and the ducks would come right by us…we seen beaver and otter and mink…The thing is when the beavers dam up a creek, and all the fish get stuck in there and get bigger and bigger. And eventually the cycle changes again and the pond dies off. Eventually it will break open and somewhere above or below it a new pond will start."				

Changes in Youth's engagement and concepts of nature of science in pre/post interviews

Sources of knowledge

- Almost exclusively school & books to including community & people (paired t-tests community t=3.606 p<.01, people t=2.280, p<.05)

Who, where & how knowledge is constructed

- Facts memorized in school and done by non-Native people to practices seeking to understand/know the world in school and community (paired t-tests Native people t=2.280, p<.05, Practices in community t=2.482, p<.03)

Content & forms of knowledge

- Increase in explanations being focused on properties & behaviors of kinds and causal chains (paired t-tests properties & behaviors of kinds t=2.280, p<.05, causal chains t=2.121, p<.0)5

Classroom example: Is Water Alive?

1. Get in small groups of 4-6. Please try and sit with people you do not work with everyday.

2. Read the transcript aloud. Each person be one of the students/teacher in the segment.

3. As you are reading try and make sense of what your person is saying from THEIR point of view.

Classroom example: Is Water Alive?

After you have read, consider/discuss following questions:

1. What do you imagine this experience was like for your person?
   - Why, what from the transcript gave you that impression? What other things are you mobilizing to make that interpretation?
2. Specifically consider what Karen, Carl, and Mrs. Wright might have experienced. Use the transcript to develop your theory.
   - What did Mrs. W. do well? What was problematic? What missed opportunities do you see?
3. Where in this segment can you see the kinds of issues around culture we just talked about? What specifically?
4. What are the implications if this is routinely how students experience learning?

What did you see?

- Where in this segment can you see the kinds of issues around culture we just talked about?
- What are the implications if this is routinely how students experience learning?

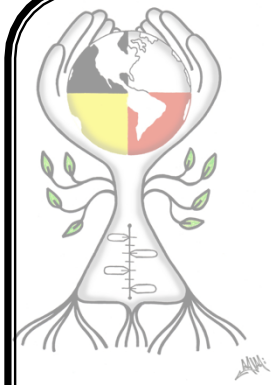
Part 3: Engaging culture in your planning for change.

- Engaging communities!
- Building capacity to see students intellectual resources!
- Thinking big about the disciplines themselves.

Moving to intellectual strengths

- Changing our stances towards, understandings of, and engagement with the practices and knowledge children develop in their everyday life, especially children from non-dominant communities, is critical to increase the rigor and depth of learning environments for all children (i.e.Warren et. al, 2001; Gutiérrez, 2002, 2006;Lee, 2001; Nasir et. al, 2006; Hudicourt-Barnes, 2003; Bang et. al, 2007).

- In short, people do not—and indeed can not—shed their cultural practices and perspectives at the door when they engage in teaching, learning, or researching/ doing the work of any of the disciplines. All people live culturally (Moll et. al, 1992).



Connecting to the disciplines themselves.

- Significant differences between the disciplines as they are practiced and as they are engaged in schools.
  - [All] Students are positioned to receive or observe expert theories as facts and classifications systems as settled rather than provisional theories and contending systems particularly at the primary grade levels (i.e. Wilensky & Reisman, 2006; Varelas et. al, 2007).
- History of many of the disciplines reflect that when diverse practices, perspectives and values are embraced, they affect choices of what is studied, how its studied, often leading to new important findings.

Chi mii gwetch!

- This work is made possible by the efforts of more than 200 elders, adults, & young people in the Chicago inter-tribal community and the Menominee Nation community.
  - Especially the design teams and teachers in these two communities.
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