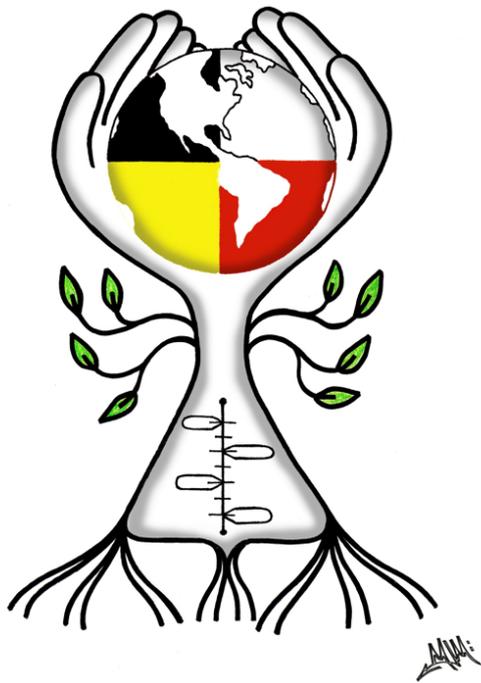


Transformative Science Education for and with Indigenous Communities?



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Although the insights presented comes from work conducted with large team including:
Doug Medin, Karen Washinawatok, Cynthia Soto, Ananda Marin, Adam Kessel, Lawrence Curley, Julia Brownwolf, George Strack, Eli Suzokovich, Lori Faber, Jasmine Alfonso, Mike Marin, Gen Garvin, Anthony Roy, Alexis Ballinger and the more than 300 community members who shaped, participated, and grew our efforts.



Broad context of our work:

Science and Science Education in Indigenous Communities

STEM under-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).

Participation, power, and expertise related to socio-scientific issues (e.g. Climate change)?

While representational issues and protecting sovereignty remain critical, Education that contributes to community wellness and regeneration needs to build from stances of lived survivance and self-determination.

(Vizenor, 2002, Deloria, 1999, 2004, Kawagley, 1995, Cajete, 1999, Deloria & Wildcat, 2003, Smith, Battiste, 2004, Sutherland, 2004, Richardson, 2011, Yazzie-Burkhart, 2002, Marker, 2006)



“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, Yupiaq elder & scholar, February 13th, 2008, Keynote speech

“What will we do if the rice moves? Will the Ojibwe people have to move with the rice once again?”

- Kelsey Simmons, Ojibwe youth, Tribal Youth Media Producer

“Just because something can be known doesn't mean it should be known” “We are therefore I am.”

- Brian Yazzie-Burkhart, 2004



United Nations Declaration on the Rights of Indigenous Peoples

Article 31 1. Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts



Science Education in Indigenous Communities?

CENTRAL DILEMMAS:

- Relationships between Indigenous Knowledge Systems and “western”, and/or colonized, and/or non-Indigenous knowledge systems.
- Are the goals of science education to produce scientific literacy or new scientists?

CENTRAL DIMENSIONS

- Epistemology & Ontology
- Learning and Development
 - Trajectories to expertise
- Curriculum/Design of Learning environments
- Relationships to land
- Classroom Praxis: Teachers and Teacher Education



Starting with epistemology

“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 (AAAS, 2003).”



Issues of Human Development

Theories of human development shape k-12 education.

- These theories problematic along a whole host of dimensions but centrally produce thinking where there is something acultural or universal and then you add culture to it.
- Theories developed with western technologically saturated middle class predominately white population samples – underlying assumption here is the same from contact/manifest destiny logic that these are most advanced communities so “best” model.
- Knowledge across development: Even if there is no difference in content per se there is differences in knowledge organization and reasoning patterns (e.g. Medin et. al, 2010).



Issues of Human Learning

Theories of “human” learning shape P-12 education.

- Indigenous educators continue to critique fundamentally theories and tenants of learning theories in a variety of dimensions but like development has been predominantly characterized as acultural.
- For today, central concern in science education is the ways in which students’ “prior” knowledge is defined and taken up in science instruction. Often characterized as misconceptions – wrong ideas – that teachers need to change.
- Epistemic and conceptual violence – e.g. Deloria, many; Fricker, 2010; Marker, 2009



Design of Learning Environments

Who is deciding and through what processes are goals, objectives, content and standards being defined?

- Self-determination? Sovereignty?
- Expertise from outside community?

Is it different than previous processes?

STEM Education and Relationships to Land



SOOO MANY.

- Ways of knowing and constructing knowledge about the natural world.
- Defining relationships to land.
- Defining forms of engagement with land.

Compulsory education laws and child abuse laws require participation in learning environments that teach particular relationships to land. Without some significant changes this erodes self-determination.



Science classrooms as sites of movement toward self-determination? (Tippeconnic, 2002)

- Significant progress in some ways particularly at the Administrative level.
- At the “classroom” or learning moments level?
 - Standards by force, coercion, and choice set by federal government.
 - The majority (80%+) of American Indian/Alaska Native (AI/AN) students are enrolled in schools where the population of Native teachers is less than 5% (Moran & Rampey, 2008).
 - Need to develop pathways to increasing Native teachers but Native teachers does not alone guarantee transformative shifts.
 - Teacher education is far from trying to actively engage, regenerate, and develop Indigenous pedagogical practices (i.e. Brayboy & Maughan, 2009, Marin & Bang, in press).
 - How do schools become places that support the epistemic labor in just ways? Pedagogies of epistemic navigation? Wayfinding?

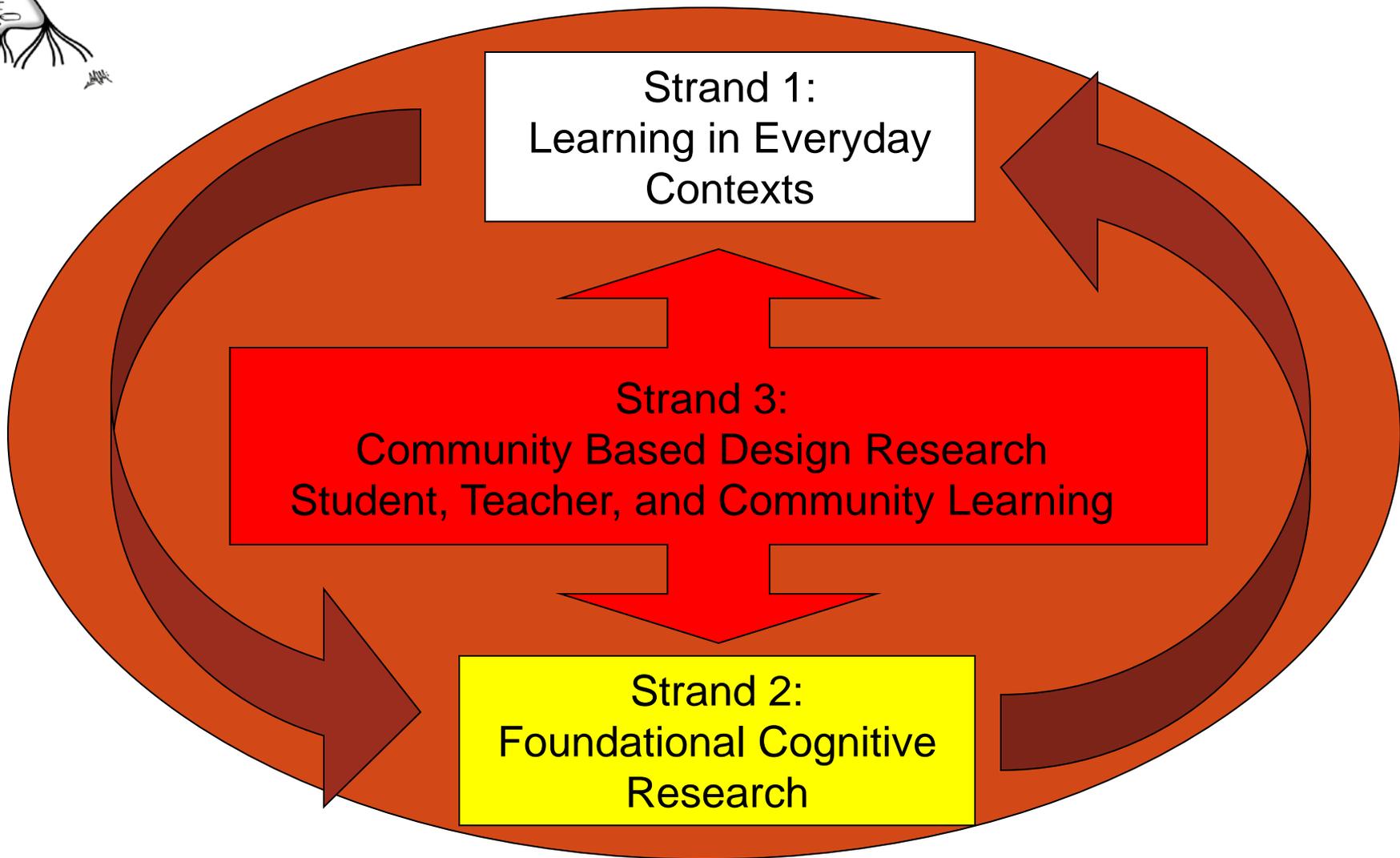
Indigenizing the Design of Learning Environments



Actualizing Indigenous theories in our day-to-day teaching and learning practices.

- Moves from deficit orientations towards children and actions driven by rhetorics of loss in community to a practice which helps us see, mobilize and build on the resources and strengths in community.
- Reclaims the responsibility of schooling to all community members...this means the elevation and honoring of youth voices as well.
- The hard work: differences in tribe, age cohorts, places of childhood, gender, traditional knowledge, family affiliations, enrollment and blood quantum, and multi-racial identities all contentious issues that are negotiated and taken up during this process.
- But the design process becomes a place in which to COLLECTIVELY struggle with these and make decisions through consensus

So what does this look like in the “real” world:
our example moving towards this issues





Dimensions in our work we are always grappling with:

- Epistemology and Ontology
- Architecture of research projects
- Participation & leadership
- Forms of inquiry
- Tools of inquiry
- Conceptions of data
- Ownership and control of data
- Analysis
- Communication and Dissemination



Architecture of research projects: Collaborative participatory action research

Approach to inquiry that provides people with the means to take systematic action to resolve specific problems (Smith, 1995)

- Learning in Community Contexts
 - Foundational Cognitive Research
 - Community Based Design Research
- Institutional Collaborations and Partnerships
 - Research 1 Institution (Northwestern), Urban Indian Community (AIC of Chicago), Tribal College, Menominee reservation (East-West University, Keshena campus)
- Co-PIs, not subcontracts**
- Not only does this help to do what have been called appropriate methods in Indigenous communities it contributes to organizations overall fiscal security, opens access to other federal funding opportunities, provides research experience for NA students in higher ed that is Indigenous based, provides jobs in community, ensures power is in community



Chi mii gwetch!

- This work is made possible by the efforts of more than 300 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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