IMPROVING SCIENCE EDUCATION FOR NATIVE STUDENTS: TEACHING PLACE THROUGH COMMUNITY

By Megan Bang, PhD, Douglas Medin, PhD, and Gregory Cajete, PhD

THE "PLACES" OF LEARNERS AND PRACTITIONERS of science from communities of color are increasingly a focus in analyses of science learning and education in the U.S. Typically, these places are defined through the discourse of equity that focuses on representation and the goal of creating learning environments that will allow students of color to perform as well as their white peers. More recently, this focus has shifted from performance to actual knowledge of and the ability to think critically about science, technology, engineering, and mathematics (STEM) content.

Although critical thinking and diverse representation within STEM remain necessary lenses for understanding the challenges facing science and science education, by themselves they are incomplete because they tend to focus on the goal and not the nature of learning itself. At worst, they lend themselves to deficit orientations and prescriptions in the form of thinly disguised or overt efforts to get children and parents of color to adopt white, middle-class practices and orientations. At the core of this issue is the persistent perception that science and science teaching is acultural.

TEACHING AND LEARNING AS CULTURAL

To improve teaching and learning for all students—including indigenous children—we must delve more deeply into understanding learning, teaching, and content as fundamentally cultural. Science classrooms are often the sites at which indigenous children are implicitly and explicitly told that the knowledge of their people, their histories, and their ways of developing knowledge of the world are myth, informal, or outright wrong.

Over the past several decades, indigenous scholars have been aggressively working toward the articulation of Native science or traditional knowledge. Dr. Gregory Cajete, among other important indigenous scholars, has articulated that Native science is foundationally about an orientation, a process, for knowing place and engaging in the world under the premise that everything is related—that is, connected in dynamic, interactive, and mutually reciprocal relationships. Native science is not something relegated to the past nor confined to the knowledge that has been developed through this process over ancestral time.

Our science learning environments need to begin to reflect this view. While developing culturally and community-based science curricula is far from straightforward, it does have concrete starting places. Everyday community practices and their connections with Native ways of knowing must be the foundation of a community-based science curriculum.

In his book *Igniting the Sparkle: An Indigenous Science Education Model*, Cajete says, "Native science evolved in relationship to places and is therefore instilled with a 'sense for place.' Therefore, the first frame of reference for a Native science curriculum must be the 'place of the community, its environment, its history and people.' Native students must be made to feel that the science class is reflective of 'their' place."[1]

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GUIDELINES FOR CREATING EFFECTIVE SCIENCE-LEARNING ENVIRONMENTS

This reframing of teaching and learning requires careful reflection on the purpose of schooling. Much of schooling has been intentionally designed to bring students from their everyday or community-based ways of understanding into "formal, expert ways of knowing." This goal has failed to see the trajectories of expertise and the deep process of knowledge creation within indigenous communities. Teaching and learning environments, we believe, must be reoriented and reorganized toward supporting students' successful navigation through multiple ways of knowing. Thus, schools must take seriously the incorporation of indigenous ways of knowing and students' communities into classrooms.

Classrooms must become places in which teachers, parents, elders, and other community

members are actively participating and collectively empowered for the education of our youth. The challenge facing the education system is to reorient how we see the place of learning from school-based to community-based. Building on previous work and through ongoing research, we have articulated the following principles for creating effective science-learning environments.

EFFECTIVE SCIENCE-LEARNING ENVIRONMENTS:

- Use local, place-based instruction and hands-on experiences[2]
- Are inextricably linked with community participation and practices, and include community values, needs, language, and experiences[3]
- Are premised on the idea that nature is not an externality, apart from humans, but rather that humans are a part of nature
- 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 ecosystems thinking)
- Place science in an interdisciplinary or holistic context and invite the learner to view phenomena from multiple perspectives, and especially from a seasonal/cyclical perspective
- Explore and address the relationships and tensions between Native science and Western science[4]
- Place science in social policy and community contexts that highlight the need for participation and leadership[5]

By using these principles in science classrooms, we believe teachers, parents, elders, and community members will be mobilizing the intellectual resources that students develop in their everyday lives and bring to classrooms. Doing this opens the possibility of embracing a multiplicity of goals that reach beyond representation. The challenge to improving science education for indigenous people is to create learning environments that do not implicitly or explicitly aim at ushering indigenous people away from their community-based understandings into Western modern scientific understandings.

Formal education as an instrument of assimilation has long been the experienced aim of education by indigenous communities and, although our communities heavily support academic achievement, the real challenges of identity development and academic achievement that young indigenous students face require more than encouragement. We must transform learning environments so that the phenomena of "border crossing" (that is, students who are navigating what it means to be a learner of science) becomes an asset and a source of generativity rather than a place

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of reified histories defined by dominance.[6] Moving through ideas of survival into the vitality of community and sustainability requires that we actively reconfigure what counts as science learning and who is teaching it. ■

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[1] Cajete, Gregory A., 1999. *Igniting the sparkle: An indigenous science education model.* Skyand, N.C.: Kivaki Press.

[2] Schroeder, C., et al., 2007. "A meta-analysis of national research: Effects of teaching strategies on students' achievement in science in the United States." *Journal of Research in Science Teaching*, 44(10):1436-60.

[3] Cajete, Gregory A., 1997. *Native science: Natural laws of interdependence*. Santa Fe, N.M.: Clear Light Publishers.

[4] *Ibid.*

[5] Aikenhead, G.S., 2006. Science education for everyday life: Evidence-based practice. New York: Teachers College Press.

[6] Aikenhead, G.S., 2001. "Students' ease in crossing cultural borders into school science: Culture and comparative studies." *Science Education*, Vol. 85, Issue 2, pages 180-188.

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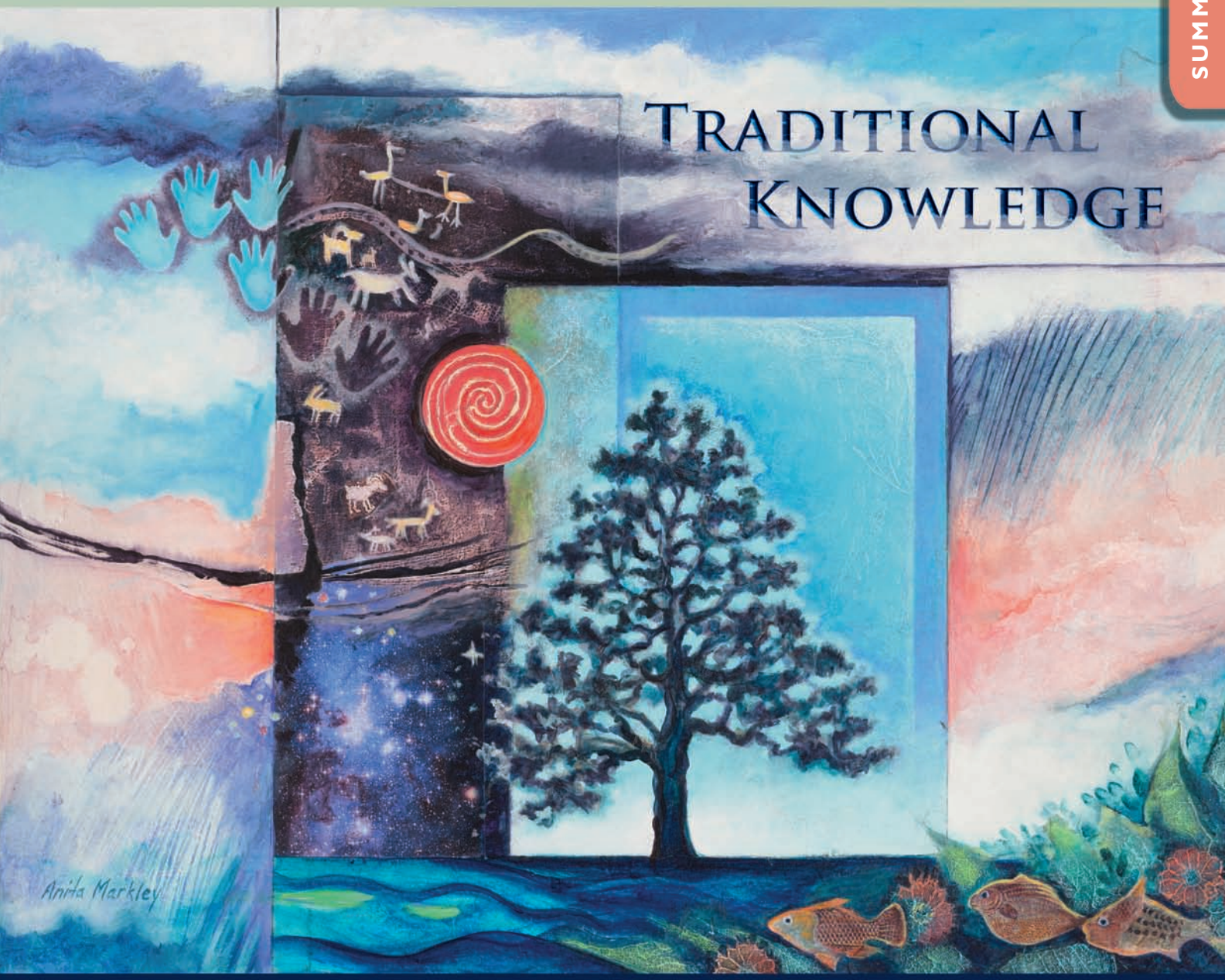

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