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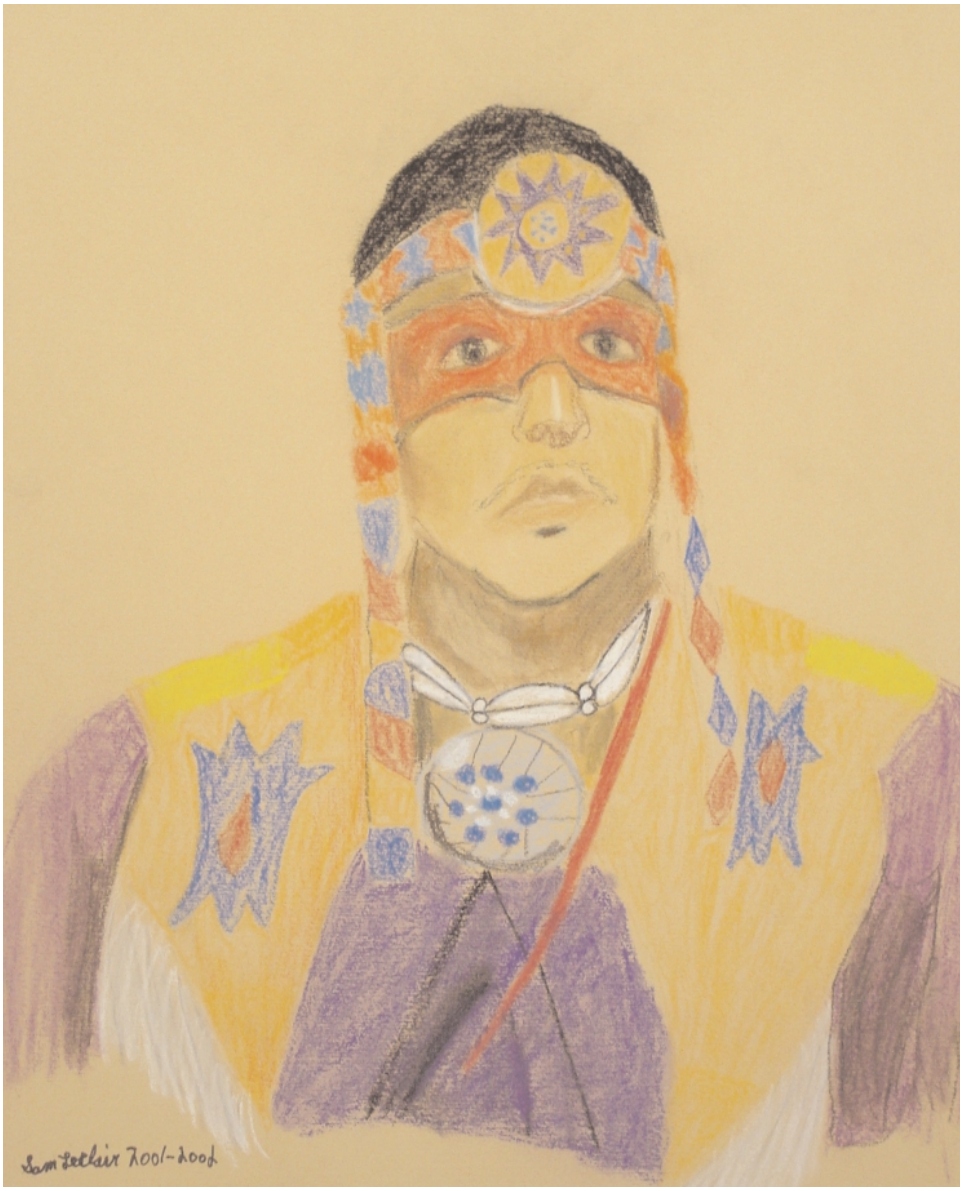
A PUBLICATION OF THE NORTHWEST EISENHOWER REGIONAL CONSORTIUM FOR MATHEMATICS AND SCIENCE

A MATH AND SCIENCE JOURNAL

DEVOTED TO RIGOROUS AND IMAGINATIVE LEARNING



WAYS OF KNOWING: NATIVE KNOWLEDGE AND WESTERN SCIENCE

- JOURNEY TO UNDERSTANDING: LESSONS FROM A CANOE CURRICULUM
- LANDSCAPES OF LEARNING AT ALGEBRA CAMP
- NATIVE AND WESTERN KNOWLEDGE: WHERE MINDS MEET

Northwest Regional Educational Laboratory

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contents

WAYS OF KNOWING: NATIVE KNOWLEDGE AND WESTERN SCIENCE

ON THE COVER:
Sam LeClair, a student at Wa He Lut Indian School in Olympia, Washington, drew this portrait of a Native American dancer in a costume inspired by traditional designs.

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IN THIS REGION, MOST NATIVE American and Alaska Native students are learning from non-Native teachers—at a time when educators, parents, and lawmakers are increasingly calling for culturally relevant schooling for children.

While programs around the region are in place to recruit Native people into the teaching field, there are also fruitful efforts to develop culturally relevant curricula that can be used by all teachers.

We feature one such project being piloted in Washington schools this year. Canoes on Puget Sound: A Curriculum Model for Culture-Based Academic Studies is an interdisciplinary elementary curriculum being developed at the University of Washington that teaches math, science, and language arts through the study of traditional canoes.

Also in the works is a K–2 reading curriculum based on the canoe, drum, and hunting and gathering being developed by Washington's Office of the Superintendent of Public Instruction and Evergreen State College.

We also feature a pre-algebra curriculum taught at summer camps in Montana and Idaho. Northern Rocky Mountain Tribal Pathways to Academic Excellence, created by Salish Kootenai College and the Nez Perce Tribe, helps prepare students for high school algebra while immersing them in tribal culture and history.

We also make note of other resources, such as the guidebook *Culturally Competent Standards-Based Math and Science Lessons*, for grades K–4, 5–8, and 9–12, developed by Salish Kootenai College.

EDITORS' NOTE

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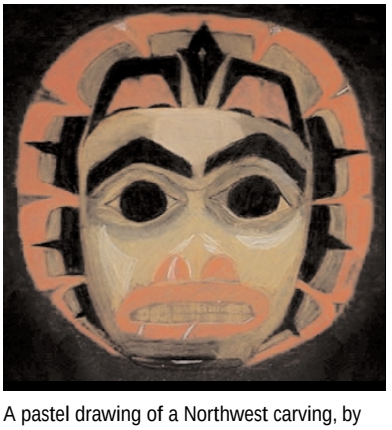


A pastel drawing of a Northwest carving, by Deshawn LittleEagle, Wa He Lut Indian School, Olympia, Washington.

The Alaska Native Knowledge Network publishes *Northern Science*, *Village Science*, and *Village Math*—with wonderful ideas for applied math and science lessons in ways that are relevant to the everyday lives of students in rural Alaska. The *Handbook for Culturally Responsive Science Curriculum* addresses how to correlate local knowledge with science standards.

Such resources can be of great value to teachers who are looking for ways to make academically sound and culturally meaningful connections between Native culture and language and core subjects like math, science, social studies, history, and literacy.

From the Indian Education Act of 1972 to the presidential Executive Order 13096 in 1998, a sequence of laws has directed funds and research for the betterment of Native education. And reports from the research arena, such as William Demmert's *Improving Academic Performance Among Native American Students: A Review of the Research Literature* and the U.S. Department of Education's *American Indian and Alaska Native Education Research Agenda*, are showing that culturally congruent curriculum and practices can pay big dividends in student learning.

Our vision is that *Northwest Teacher* will serve as a tool for professional development by actively engaging readers and by speaking to them as imaginative problem solvers, thoughtful inquirers, and lifelong learners. The stories that follow were selected to inspire teachers to reflect on and talk about their own experiences and beliefs.

Professional development providers might use an article to illustrate a concept, providing time for reading and discussion. Teachers might want to share the journal with their colleagues, discussing their responses to the stories, perhaps even collaborating to try a new approach. Administrators might distribute copies to staff members, inviting them to share their reactions and reflections at a meeting or by e-mail exchanges. *Northwest Teacher* can serve as a starting point for group dialogue about issues in mathematics and science teaching, as well as for independent reading and personal reflection.

NATIVE AND WESTERN KNOWLEDGE

WHERE MINDS MEET

STORY BY Denise Jarrett Weeks ART BY Students of Wa He Lut Indian School, Olympia, Washington (above: Kalea Salvador, Christy Harp, Thomas BlueBack, Tenaya White Star, Sam LeClair, Skyla White Star, George White Star, Shawneen Sanchez)

NATIVE AND WESTERN IDEAS converge along the rivers of human knowledge. When teachers tap these confluences, learning takes on the rich realities and complexities of life.

"As we enter the first decade of a new millennium, Native and Western cultures and their seemingly irreconcilably different ways of knowing and relating to the natural world are finding common ground..." — Gregory Cajete (2000)

"Affiliation is part of being human," writes Gregory Cajete in his incisive and elegantly written book, *Native Science: Natural Laws of Interdependence* (2000). And when Native students' cultural affiliation is valued in the classroom, motivation for learning is highest, concludes William Demmert (2001) in a review of the research.

These writers, both Native American, are members of a community of researchers who've long examined what Native students need in order to do well in school. They share a view that cultural congruency between schools and communities is essential to students' success.

A potentially powerful affiliation can be forged from the congruency that exists between Western and Native ways of understanding how the world works. New developments in Western science and a growing presence of Native worldviews in the education dialogue have given rise to a convergence of science and math ideas. From the applied sciences embedded in hunting and fishing, gathering and gardening, and Native architecture and craft, to the intriguing resonance of environmental science and quantum physics with the Native American understanding that all in the universe is "alive" and related, there are compelling intersections of Western and Native knowledge (Cajete 2000; Deloria, 1995).

"Native traditional values and practices of students and families, when clearly understood in the modern context, may be significant assets to learning," says Demmert. But to do it right, schools must create learning opportunities that go beyond surface observances of multicultural celebrations. They must engage students in authentic and purposeful problem solving and investigating key concepts that are embedded in culturally relevant knowledge and tasks.

Jerry Lipka, a researcher at University of Alaska, Fairbanks, has for years studied what happens when Yup'ik culture and language are integrated into core learning in village schools in Western Alaska. He's witnessed the power of culturally relevant curricula and teaching practices to lift Native students' learning to new heights, but he cautions: "The connection of local knowledge to schooling is not an easy process... The challenge is to adapt local culture and knowledge to Western schooling without trivializing and stereotyping" (2002).

Elders and other acknowledged experts in the community can be

invaluable to teachers in this respect. Cultivating collaboration, in such things as developing integrated curriculum or sharing cultural knowledge and skills with students in the classroom and in outdoor learning activities, can make it possible to create deep connections between the concrete realities of local life and the abstract ideas posed by academic math and science.

In fact, says Cajete, "in Native traditions, guides or teachers—individuals who have gone that way before—are necessary," and, according to Vine Deloria (1995), throughout Native American history, "elders functioned pretty much as scientists today" in that they developed specialized knowledge.

While elders have stature as sources of knowledge in Native communities, learning, it is understood, flows not only from the old to the young, but from the young to the old, says Cajete: "All persons have the ability to know and to share..." Linda Miller Cleary and Thomas D. Peacock (1998) agree. They write: "All told, the most important endeavor for teachers in Indian schools and in schools where Indian children are served is to see themselves as learners..."

Teachers, especially those who are non-Native, will want to learn as much as they can about individual students' cultures, say Cleary and Peacock, for Native students in the same classroom may be from different tribes, with cultures and traditions differing in important ways. Learning to view oneself as a learner as well as a teacher is in keeping with many Native worldviews. Drawing on the knowledge of elders and other knowledgeable people from the Native community will not only boost learning for teachers and students alike, it can go a long way to earning community support for school, says Demmert.

"Community attitudes and participation of parents in the educational process appear to be critical elements for teachers to be more successful with Native students," he writes.

By Lee Eagle Speaker

math across cultures

"In every community, expertise exists outside of school. Artisans, tailors, architects, and others have experience that can be used in the classroom to show students how mathematics is applied in various endeavors," says Jerry Lipka.

To teach granddaughters how to create patterns for clothing and footwear, or to tell a story describing happenings in the intimate spaces of a home or the vast geography of the landscape, Yup'ik grandmothers etch pictures and symbols representing three-dimensional shapes in the delta mud of Western Alaska, write Lipka and coauthors in "Elastic Geometry and Storyknifing: A Yup'ik Eskimo Example" (2001).

Storyknifing prepares girls to use concepts of math and geometry in everyday tasks that require envisioning all sides of three-dimensional objects, then creating two-dimensional representations, he writes. This develops their spatial sense and skill in creating geometrical patterns; it deepens their understanding of ideas of "symmetry and motion geometry, which involves using such transformations as rotations, slides, and flips to move a symbol while preserving its size and shape."

Lipka is working with Yup'ik elders, teachers, and other researchers to develop an elementary math curriculum and toolkit, Adapting Yup'ik Elders' Knowledge (which includes this storyknifing module), with funding from the National Science Foundation. This culturally relevant curriculum for girls and boys can also be used to teach fractions, factors, prealgebra, problem solving, symmetry, and tangrams, says Lipka.

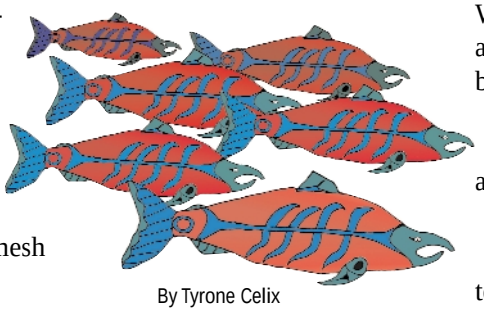
Math is routinely used by women and girls in Alaska villages to accomplish other everyday tasks. At summer fish camps, Lipka points out, it's their responsibility to cut and prepare fish, estimate how much will fill a smokehouse, distribute fish equitably among extended family members, and store it for winter in the most effective manner—a task that involves tessellation to make the most efficient use of storage space.

Before Western units of measurement were adopted in Alaska Native villages, men taught boys to use a system of measurement based on the human body to calculate the dimensions and ratios needed to carve well-made kayaks (Lipka, 1998). Today, Alaska Native men use Western math, for example, to calculate how much fiberglass and resin they may need to refinish a boat, or how much nylon line they may need to make a seine or gill net with the proper mesh size for the kind of fish they wish to catch (Dick, n.d.).

"Numerous forms of everyday knowledge may have mathematical content that can be connected with schooling" and aligned with state and national standards, say Lipka and colleagues (2001). Counting, locating, measuring, designing, playing, and explaining, he says, are mathematical activities that are common across cultures.

Some writers observe that Native and Western traditions differ on the importance of measurement to understanding the world. Oscar Kawagley explains that "in ancient times, it was not important to measure things precisely," yet precision is paramount in the Western scientific tradition (as quoted in Lipka, 1998). While measuring is Western science's most powerful method, recognizing relationships is Native science's. Rather than using measurement to predict and control, the priority of Native science is to make meaningful relationships and to understand one's responsibilities within them.

Native people today use the Western system of measurement in their daily lives, but the philosophical difference remains an important one. "The perspective of Native science goes beyond objective measurement," writes Cajete, "honoring the primacy of direct experience, interconnectedness, relationship, holism, quality, and value."



By Tyrone Celix

storied participation

Remarking that "Native science is born of a lived and storied participation with the natural landscape," Cajete evokes two principles of Western inquiry-based science: direct experience with natural phenomena and building on the accumulated knowledge of others.

In fact, the more one learns about Native science, the more one sees corollaries with the West's standard for scientific inquiry. Cajete's description of the "creative participatory process" of Native science—involving "first insights," immersion, creativity, and reflection"—doesn't seem that different from the process of Western scientific inquiry involving observing, hypothesizing, creating investigations, and reflecting on findings.

Cajete speaks of the primacy of direct experience in Native science being validated through vision, diligent thinking, and conferring with others: "It is a 'given' in Native traditions that deep knowledge is not easily gained and requires time and dedication to attain." These values are also shared by the Western scientific community and are principles of inquiry-based learning that involve working independently as well as collaboratively over an extended period of time.

These and other commonalities are important and useful to teachers, but one should never obscure the fact that Native and Western science differ fundamentally in a particular respect. Native science is imbued with spirituality, while Western science is founded on the separation of the two.

"Native science conforms in many ways to the definition of Western science, but it is not possible to separate it from ethics, spirituality, metaphysics, ceremony, and social order," says Cajete.

In "Teaching Through Traditions: Incorporating Languages and Culture Into Curricula," Linda Skinner (1999), a Native American, writes: "Traditionally, education among Native people helped children find meaning in life" through cognitive, emotional, physical, and social means of learning. "All these lessons are connected to spirituality, which is at the center of our existence."

What's central for teachers' understanding is that Native students, like many other youth, tend to learn better when they can be actively involved in real-life learning experiences that

build on their prior knowledge, and when the activity is purposeful and the outcome has real value to others beyond the classroom (Lipka, 1998; Kawagley, 1999; Cajete, 2000; Cleary & Peacock, 1998).

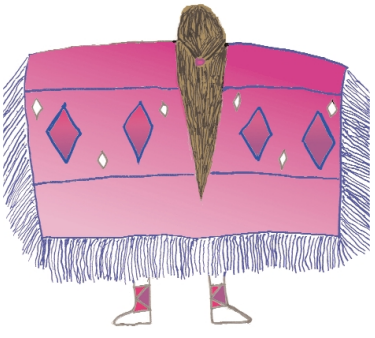
learning styles

The literature on Native learning styles is instructive, but teachers will want to know their individual students' learning preferences. While some Native students may prefer to see a new skill demonstrated before trying it themselves, others may prefer to dive in and master it through trial and error. Some may prefer written to oral communication, or vice versa (Cleary & Peacock, 1998). Challenging the view that Native students aren't comfortable speaking out in class, Demmert writes that "in classrooms where dialogue is shared between students and teachers and where students' ideas are encouraged within the context of their Native language and culture, Native students are found to respond eagerly to questioning, even in English."

Furthermore, some students' daily lives may be filled with the traditions of their Native culture; others, living in cities, may be disconnected from tribal life, grandparents, and other keepers of tribal knowledge. But research shows that the potential to flourish academically is likeliest for Native students—rural and urban—when schools value and incorporate the knowledge and skills their cultures have accumulated through the ages (Demmert, 2001; Lipka, 2002; Research Agenda Working Group, 2001).

a nation's heritage

The lines of cultural affiliation extend not just to Native students, but to other students as well. Integrating Native and Western knowledge in the classroom can cultivate affiliation between classmates—Native and non-Native—as they learn, together, about the cultural heritage of their nation.



By Dakota Cummings

From Lewis and Clark's 1803 expedition to learn about the land and its first inhabitants, through today's public discourses about Native rights, the environment, scientific ethics, and more, both Native and Western ways of knowing are relevant and edifying. As the confluence of two powerful rivers, they create rich deposits for learning.

References

Cajete, G. (2000). *Native science: Natural laws of interdependence*. Santa Fe, NM: Clear Light Publishers.

Cleary, L.M., & Peacock, T.D. (1998). *Collected wisdom: American Indian education*. Boston, MA: Allyn & Bacon.

Deloria Jr., V. (1995). *Red earth, white lies: Native Americans and the myth of scientific fact*. New York, NY: Scribner.

Demmert Jr., W. G. (2001). *Improving academic performance among Native American students: A review of the research literature*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED463917) Retrieved January 13, 2003: www.ael.org/eric/demmert.pdf

Dick, A. (n.d.). *Village math*. [Draft.] Fairbanks, AK: Alaska Native Knowledge Network. Retrieved January 13, 2003: www.ankn.uaf.edu/VillageMath/village_math.html

Kawagley, A.O. (1999, Fall). Yupiaq education revisited. Alaskan Native education: History and adaptation in the new millennium. *Journal of American Indian Education [special issue 2], 39*(1), 31–51. Retrieved January 13, 2003: www.ankn.uaf.edu/YER.html

Lipka, J. (1998). Expanding curricular and pedagogical possibilities: Yup'ik-based mathematics, science, and literacy, In J. Lipka with G.V. Mohatt and the Ciulistet Group, eds. *Transforming the culture of schools: Yup'ik Eskimo examples.* Mahwah, NJ: Lawrence Erlbaum.

Lipka, J., Wildfeuer, S., Wahlberg, N., George, M., & Ezran, D.R. (2001, February). Elastic geometry and storyknifing: A Yup'ik Eskimo example. *Teaching Children Mathematics, 7*(6), 337-343.

Lipka, J. (2002). *Schooling for self-determination: Research on the effects of including Native language and culture in the schools*. [ERIC Digests Special Edition]. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED459989) Retrieved January 13, 2003: www.IndianEduResearch.net

Research Agenda Working Group with Strang, W., & von Glatz, A. (2001). *American Indian and Alaska Native education research agenda*. Washington, DC: U.S. Department of Education. (ERIC Document Reproduction Service No. ED462216) Retrieved January 13, 2003: www.indianeduresearch.net/agenda.pdf

Skinner, L. (1999). Teaching through traditions: Incorporating languages and culture into curricula. In K.G. Swisher and J.W. Tippeconnic III (Eds.), *Next steps: Research and practice to advance Indian education* (pp. 107–134). Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED427907) Retrieved January 13, 2003: www.IndianEduResearch.net

JOURNEY TO UNDERSTANDING:
LESSONS FROM A CANOE CURRICULUM

STORY AND PHOTOS BY Suzie Boss

TRIBAL TEACHERS SET OUT TO help design an integrated curriculum around the canoes of Pacific Northwest Native American tribes.

A cedar canoe handles water differently from any other vessel. A kayak bobs on top of the waves … A fishing boat digs through the swells… Pleasure craft bounce on the chop… It is the canoe that participates in the sea, riding the waves and carving through the roll like a pilot whale. —Tom Heidlebaugh, "The Canoe Way of Knowledge," in The Great Canoes

FORKS, WASHINGTON—The materials are compact enough to fit atop a child's desk: a flat wooden plank, triangular block, some plastic cubes. Laura Tyler hands out the pieces and encourages participants to play. There's little need for prompting. Before she's done giving instructions, hands are reaching out to move things around, creating a system that distributes weight across a fulcrum to achieve balance.

"Now," Tyler says, walking around the conference room to observe, "can you write a sentence that explains how you get to balance? What happens if you move the pivot point? If you want to draw some different ways to achieve balance, label your drawing with the vocabulary we've been using—fulcrum, beam, weights."

A heavyset man named George Adams fiddles with the materials, then looks up to announce to the others at his table, "This is just what we do in the canoe! Before every race, you divide the canoe into halves: front to back, side to side. The weight has to balance. But you don't want it exactly level. In a race, you want the bow up so the waves will plane over the top. And you have to consider, is the water rough? Then you'll want the bow out of the water even more."

The attention of the room shifts while he speaks so that, before long, everyone's turned to listen. This is no unwanted distraction. Adams, a teacher and an experienced canoe racer from the Lummi Tribe, is here precisely because of his knowledge of navigating the waves in a canoe made of cedar.

Participants in this summer institute are all adults, but they're experiencing learning in the same way that they hope their students will when they return to elementary classrooms in the fall.

The goal is to inspire students to do their best work as they think about, question, and reflect on the knowledge of people who, for centuries, have used canoes to navigate the waters of Puget Sound.

maiden voyage

The Canoes on Puget Sound Institute took place on Washington's Olympic Peninsula during a sunny week in August. Teams of teachers represented seven Indian schools from Quileute and Quinault on the Olympic Peninsula, Nisqually, Puyallup, and Lummi from the Puget Sound, and Yakama from Eastern Washington.

Canoes on Puget Sound: A Curriculum Model for Culture-Based Academic Studies was developed by educator Nan McNutt. Working with teachers and students in King County schools, McNutt tested and revised the curriculum over the course of four years before inviting teacher teams from tribal schools to try it out at the institute. These teachers are now piloting the curriculum in their own classrooms.

Institute participants, including both Native American and non-Native teachers, shared the goal of teaching a curriculum that would engage all learners but resonate especially with Native students. Some teachers brought special expertise in Native language and culture or contributed knowledge of a particular skill, such as canoe carving or storytelling.

Institute leaders were as diverse as the participants. Tyler, a science teacher by training and Euro-American by birth, works with a University of Washington-based program called Mathematics, Engineering, Science Achievement (MESA). Chenoa Egawa, with MESA's Success Through Collaboration program, brings experience in motivating teachers to include indigenous languages and cultures in their teaching. Her family tree includes Native American and European branches, but she identifies most strongly with her Lummi heritage.

McNutt, author of *The Button Blanket: An Activity Book Ages 6–10* and coauthor of *The Cedar Plank Mask: An Activity Book Ages 9–12*—collections of Northwest Coast Indian discovery kits—is also an experienced curriculum developer. McNutt's ancestry is British Isles, but she grew up on the island of Pohnpei in Micronesia and considers herself "bicultural."

"This way of teaching is a learning expedition," says McNutt, explaining the challenge of creating and teaching a culture-based academic curriculum. "All too often, we teach other people's cultures as a separate entity. As educators who have been schooled in the Euro-American curriculum, we do not see cultural connections with language arts, history, health, and most particularly, science and math. What this curriculum does is to center the study around a cultural object, in this case canoes. It's a platform for the academic studies from which students also examine their questions about the canoe to formulate a total understanding."

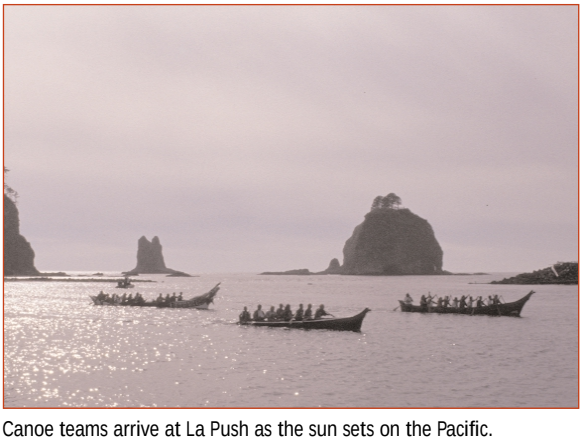
Institute planners didn't expect to emerge from the weeklong session with participants fully prepared to teach the entire curriculum. That would take more time back in their classrooms, where students' questions and learning needs would continue to shape how the lesson would unfold. Throughout the 2002–2003 school year, McNutt would be visiting these tribal schools, helping teachers make the bridge from theory to practice.

But at the moment, the institute is giving participants time to learn from each other as they explore a guiding question: How can canoes teach us about First People?

The curriculum learning model McNutt follows is circular: You

Prayers and ceremony greet the paddlers of Paddle Journey 2002 (above and at left).

begin with the canoe, the vessel that carries a people and their history. Then you move outward, exploring the principles of math and science that are involved in canoe carving and paddling. "You 'mathematize' the canoe," McNutt explains, "and go as deep into concepts as you can go." But that's not the end. "You have to bring the understanding back to the canoes," she says, like a paddler circling for home at journey's end.



Canoe teams arrive at La Push as the sun sets on the Pacific.

powerful learners

Exploring their own thoughts and questions with hands-on materials, the teachers are recording their observations in notebooks, and these data inspire further thoughts to be examined. Along the way, they're getting fresh ideas about how to introduce these math and science concepts in their own classrooms. For example, they can see how a simple device involving pegboards and movable weights, used to teach about mass and distance, could help students use algebraic thinking to formulate equations. Similarly, measuring the dimensions of canoes could segue into a class discussion about ratios. Such learning supports what Adams calls "an environment of inquiry, where students want to know why."

Jack Fry, principal at Quileute Tribal School, says the beauty of inquiry is that "it engages minds in ways that rote learning can't do." Posing a simple question—"Why does a canoe sit in water?"—opens the door for discussing complex properties of the physical world. For Indian students, he says, such a question has the added advantage of "moving from the known to the unknown. We can show our students that they can learn science and math. That's evidence they can use against fear that wells up," he adds, as academic work gets harder.

Nationally, Native American students often fare poorly in math and science achievement, even though their heritage includes a wealth of knowledge about botany, medicine, navigation, engineering, and other technical fields. Having a curriculum that takes advantage of Native students' culture "has been seriously lacking," admits Tyler. She sees that concern paralleling another: Too few elementary teachers are comfortable teaching science. "Less than 1 percent have a science back-

Questions To Consider

• **Why is inquiry and open-ended questioning so central?** Because, says Chenoa Egawa, evidence shows that students of many learning styles learn better when they're actively involved and investigating some of their own questions. And Laura Tyler adds, "So kids will know that there's more than one way to think about the world. You want kids to think about what they already know and build upon that. We want to respect their past and their knowledge—to honor what kids bring to the table."

• **How can I get this curriculum?** If you teach at a Washington state tribal school or a public school with a high population of Native students, Chenoa Egawa (egawa@engr.washington.edu) and Nan McNutt (nmcnutt@attbi.com) invite you to pilot the curriculum during the 2003–2004 school year. Teachers who are selected will attend a summer institute at Concrete, Washington, to become familiar with the curriculum and learn strategies for using it in their own classroom. If you teach elsewhere and are interested in using the curriculum, contact Nan and Chenoa, they may be able to help you. In future, they hope to publish the curriculum and make it available to teachers everywhere.

ground," she says, "and many are a little afraid of science." Her mission is to convince more teachers that "science is fun. True science has always been taught by exploring, manipulating, investigating."

A hand-written sign on one wall of the institute conference room summarized the scientific method in Western terms: making a prediction, gathering data to provide evidence, and drawing a conclusion. But that's not the only route to knowledge that participants considered. "There's a difference between Native knowledge and Western ways of instruction," pointed out Chenoa Egawa. Traditionally, Native children have learned "through their senses, learning intuitively." Young carvers, for example, often learn their craft by watching elders work with the physical properties of wood and blade and steam. They learn that each carver's style is customized by everything from the span between his outstretched arms to the width of his fingers. Understanding those nuances "is different from reading a book or doing work with paper and pencil. Modern education is starting to come back to hands-on learning," Egawa said, "but this is how Native kids have been taught all along."

John Crabb, a fourth-grade teacher from Taholah, says he's tried to bring his students' heritage into classroom studies. But as a non-Native, he admits, "I've never had a curriculum that integrates the two. I would teach math then send the kids off to another teacher for a cultural lesson. This curriculum," he says, "is about making connections. That's the missing link."

a time to stand tall

Chris Morganroth, a renowned carver and storyteller who grew up on the Quileute reservation, says he's been seeing "an explosion of interest" in canoes among young people. The distinct tribes of the Puget Sound region share many traditions, he notes. "We all have canoes. We all have fishing. We all have our own languages. We all have an understanding of science and numerical systems. But if not for the canoes, he adds, "we would not be as powerful. The canoe for us is like the buffalo to the Plains Indians." A curriculum that takes advantage of this important repository of information "is one of the greatest things you can offer" to Native students, he says.

The resurgence of interest in canoes, he adds, "helps our young people get stronger. They will have more desire in their hearts to carry on the culture—to make a drum, to make a canoe, to carve a paddle. Knowing your culture is one kind of knowledge. Keep it in your heart. Then it becomes wisdom. Then you can carry it to the next generation."

An event called Paddle Journey, an annual ocean voyage involving tribes from Canada and the United States, has helped to buoy interest in canoes and the people who carve and navigate them. Not by accident, the Canoes on Puget Sound Institute coincided with an overnight encampment at the Quileute reservation.

As afternoon leaned toward twilight on the day of the scheduled landing, a crowd gathered along the shore at La Push to await the arrival of 20 canoes. Each carried a dozen or more pullers, along with centuries of tradition. Drumming and chanting greeted the canoes' arrival. One by one, the canoe leaders—speaking first in tribal language, then in English—requested permission to come ashore. All were welcomed by leaders of the Quileute nation.

Along the crowded beach stood teachers from the canoe institute. For the non-Native participants, it was a chance to step out of a workshop discussion about culture and walk right into the beating heart of it. For Native teachers, the event was "a time for us to stand tall," said Adams, the canoe racer. Another teacher, wiping away tears as she watched the canoes come ashore, said, "You feel your ancestors here. You hear them in the songs." McNutt, watching the day unfold, felt herself rising to the challenge: "This is what we hope to bring with us, back into the classroom." NWT

Suzie Boss, a former NWREL editor, now writes for Intel Innovation in Education.

Postscript: *Waterborne: Gift of the Indian Canoe* is a 13-minute documentary video, produced for the Suquamish Tribe, that can be an evocative supplement. Order from New Day Films, www.newday.com.

CANOES IN THE CLASSROOM

"It's a no-brainer," says William Gilstrap, a former policeman and first-year teacher at Chief Leschi School in Puyallup, Washington, near Tacoma. "My main surprise is that it hadn't been thought of sooner."

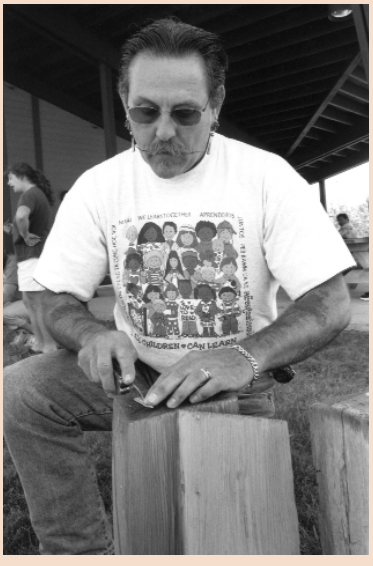
He's talking about Canoes on Puget Sound: A Curriculum Model for Culture-Based Academic Studies developed by the University of Washington. It integrates math, science, history, and social studies in the context of Pacific Northwest Native culture. Gilstrap and other tribal teachers are piloting it this year in their classrooms, and he says his students have taken to it like, well, a canoe to water.

They're learning about the cedar tree that Pacific Northwest tribes used for their superbly and variously crafted vessels that plied the ocean, sound, rivers, and lakes. They're learning how, traditionally, Native people used body measurements to determine the necessary circumference of a prospective cedar log and the proper proportions for a well-made craft.

They're examining the concepts of symmetry, buoyancy, and surface tension, and the power of *pi*, leverages, and counterbalance weights. And they're hearing and reading age-old stories about the canoe in tribal mythology and history, and learning new words in their native language.

This learning has taken them outside the classroom to examine the trees around the schoolyard, to water's edge to ride in canoes, to museums to look at hand-carved canoes. And it's brought Native experts into their classrooms to share tribal stories and demonstrate traditional skills.

A carver himself, Gilstrap adds his own touch to the curriculum, here and there. For example, he carved a "story stick" for his class, and students decide what gets carved on it as the year progresses—the face of an animal or a symbol—images that tell the "history" of their fifth-grade class and their memorable studies of the canoe. Gilstrap's also chipped river rock into a hammer and carved cedar into a wedge so that students can try their hand at using tools similar to those their ancestors used to fell cedar trees and carve them into canoes.



Chief Leschi School teacher William Gilstrap.

But you don't need to be a carver or an expert in Native knowledge to use the curriculum effectively, stresses Gilstrap. Any teacher will find that it provides "enough material to readily implement the curriculum in the classroom without supplementing."

legacy of ideas

John Montrose teaches seventh-grade students at Wa He Lut Indian School at Frank's Landing, near Olympia and the Nisqually River. He's a seasoned teacher who's taught in tribal schools for nearly 15 years, but he's been startled to find just how much the canoe curriculum boosts not only cultural knowledge, but core ideas in math and science.

"Our students aren't doing as well as the broader population, especially in math," he says. "I need help, too, since we don't have rigorous math and science curricula." He's been at least as enthralled as his students to learn how rich the study of canoes can be.

"There's so much that I was totally unaware of," says Montrose, a non-Native who's worked on behalf of Native rights and issues since the early 1980s. "I'm amazed. People were so well adapted to their environment," and what they understood about how the world works, they perfected. "Hopefully, the kids will take a great source of pride in that," he says.

Gilstrap, also a non-Native who's long been engaged in Native American culture and who is married to an educator who is Blackfeet, reports the same enthusiasm from his young pupils: "It amazes them how much Native people have given to the Western world. They didn't develop *pi*, per se, but they had the concept. They also contributed to geography, astronomy. There's all kinds of things the Native Americans have developed."

This revelation can be heard in the excited voices of these youngsters from Gilstrap's class:

Raven, 11: "I like the assignments, how you can listen to what our ancestors did, what they did to survive," she says. "I want to go to the ocean and be able to get into a canoe and ride."

Taralyn, 10: "I like it, learning the math and how to make a canoe," she says. "I would like to be a carver someday. And I'd like to paint it."

Phillip, 10: "I want to be a scientist."

They pepper their teacher with questions:

"I wanted to know if women hunted and stuff, you know, if they rode in canoes or if they paddled in canoes," says Raven.

Phillip wonders this, too. "Did the women make the canoes too? Because all you hear is the men made the canoes and the woman cooked. I wanted to know if the women made the canoe, because, then, it's not just the men that are doing everything, but it should be the woman, too." And, about canoes, he also wants to know: "Who invented them?"

inquiring minds

Questions are at the heart of the curriculum. Teachers pose guiding questions that prompt students to think and come up with their own questions to investigate and reflect on in journals and class discussions. This synergy of inquiry animates the learner in teacher and student alike.

"Most teachers, when they come to this curriculum, are in a subject area where they have no background," says Nan McNutt, who developed the curriculum with the help of Native educators and elders. Both Native and non-Native teachers are inclined to see the canoe as a cultural object, she says, but not as a human artifact of math and science knowledge. "Making this link between the traditional and modern knowledge requires a lot of reflection."

Traditionally, Native people made sense of the world through private reflection and communal discourse, and accepted ideas were passed on to new generations through storytelling. These stories endure as vessels of tribal knowledge and history, even as oral traditions have faded.

"The Native stories are in Historical Nonfiction in our library," says Gilstrap. "They're considered to be true. They had no written language, so stories were used to pass down tribal history and knowledge. Today, they're very shy, but in the old days that's how they shared their history, by talking."

Deborah Allen, librarian for Chief Leschi, has been helping Gilstrap and his students with their study of the canoe. She observes: "Even though their parents might be Native, many of them have acculturated into Western society. So for many children, this is their first experience with the traditional canoes. There's a brightening in their eyes when they're doing math and reading as part of the canoe curriculum."

Montrose is witnessing his Wa He Lut students opening up like never before: "During this curriculum, they have been much more verbal, more curious, and more willing to ask questions than when I'm teaching my normal curriculum. On the whole, they're pretty quiet, but when they're working on the canoe curriculum, they're a little more relaxed because they're more familiar with the subject. It's good to see the energy. I like that."

where the heart lies

Like the vast majority of teachers in the Pacific Northwest, Gilstrap, Montrose, and Allen are not Native, but teaching Native students is what they've set their careers—and hearts—on doing.

Says first-time teacher Gilstrap: "At this time in my life, it's something I'm being called to do. They understand immediately that I don't pretend to be a Grey Owl. I'm not an Indian," he says, referring to a British man who famously posed as a Native American in the 1880s while championing environmental conservation. "I wanted to teach at a Native school. That's where my heart lies," he says. "This is what I set out to do, and I'm doing it, and I'm happy."

Says Raven: "My mom asked me how do I feel having a white man teach our Native culture. I feel comfortable because he says he's Native American by heart, and it's the heart that counts."

— *Denise Jarrett Weeks*

FOR THESE MONTANA AND IDAHO STUDENTS, ALGEBRA CAMP IS ALSO A TIME FOR LEARNING ABOUT THEIR CULTURE AND HISTORY.

Students take a jet boat ride on the Snake River to view Nez Perce petroglyphs.

LANDSCAPES OF LEARNING AT ALGEBRA CAMP

STORY AND PHOTOS BY Judy Blankenship

FLATHEAD LAKE, MONTANA—It's day three of the Northern Rocky Mountain Tribal Pathways to Academic Excellence (PACE) pre-algebra camp, and 41 seventh- and eighth-graders from the Flathead Reservation in northwest Montana are gathered in a meeting room at Blue Bay Camp, set on the shores of spectacular Flathead Lake. A team of scientists and technicians from the Rocky Mountain Laboratories in Hamilton, Montana, are here to conduct science workshops. Dr. Mike Parnell, chief veterinarian at the lab, has riveted the young peoples' attention with slides of genetically altered lab mice, grotesquely diseased or injured animals, and heroic restorative surgeries. "Okay," Parnell says, shutting off the projector at the end of his presentation, "get ready to suit up and do some surgery of your own."

Three years ago, Salish Kootenai College in Pablo, Montana, was one of 11 minority colleges and universities around the country to win a three-year, $300,000 grant from NASA's Pre-College Awards for Excellence in Mathematics, Science, Engineering and Technology program. The college teamed up with the Nez Perce Tribe in Lapwai, Idaho, to mount an annual, two-week math and science camp for middle school students. The Nez Perce had initiated a similar camp two years before, and the NASA grant allowed the two tribes to expand their program and design a new curriculum that, while continuing to include science classes, would emphasize the math skills students would need for high school algebra.

"We have discovered that Native American students, especially young women, are not our scientists, mathematicians, or technological wizards," says Roger McClure, director of the Montana camp and coordinator of K–12 education in the Indigenous Math and Science Institute at Salish Kootenai College. "And why is that? A gender issue? An ethnic or socioeconomic issue? We figure all of these come into play," asserts McClure, "but what we've found, based on national research and our own experience, is that algebra is the gateway to upper division math and science courses."

Too many Native American students are socially promoted to high school prepared only for a general math course, according to McClure, who describes himself as a Flathead Indian of Scotch-Irish descent, with more than 30 years' experience in public and tribal schools. And too many never get beyond basic math. "If, with proper tutoring and assistance, we can get students to the point where they can complete entry level algebra, then upper level courses, then go on to college, maybe they'll look

back and say it was because of this summer boost."

Idaho camp

Meanwhile, about 350 miles to the west, in Lewiston, Idaho, 30 Nez Perce campers from the Lapwai Reservation settle into their morning routine in a classroom at Lewis-Clark State College. "Oh man, not again," says one young seventh-grader as math teacher Tami Church hands out graph paper. After this morning's session, the students are going on a six-hour jet boat ride on the Snake River with a Nez Perce ethnographer, and math is the last thing on their minds. However, Church, a tall, animated blond woman who also teaches math at Lapwai High School, deftly grabs their attention with a couple of intriguing examples. "Did you

PACE teachers provide lots of personalized help to students.

know you can use a graph to figure out how tall you'll be when you're grown? And how about the weather? They said on the news it would be sunny today, but when I left my house it was pouring. Boy, did they get that wrong!"

Soon, the students have their heads down over a connect-the-dots plotting exercise, the jet boat trip, petroglyphs, and Chief Joseph's crossing forgotten for the moment. Six counselors, all Native American college students, quietly circulate among the tables, stopping to help, praise, or simply monitor progress. Dayne Swift, an eighth-grader, finishes first and brings his paper up to show Church. He has plotted a perfect bird, which he says would be an eagle if it had a few more feathers. "The best so far!" says Church, taping it on the blackboard.

integrated math

After the initial year, in 2000, when a combined camp was held in Lewiston, Idaho, the program separated into two camps. In Montana, where the camp is residential, students sleep in teepees and use the facilities at the Blue Bay Tribal Camp. Ten counselors, called group leaders, are on duty "24/7," eating, sleeping, attending classes, and studying with their charges. In Idaho, due to logistics related to accommodations and teaching facilities, the program is a day camp. Students are bused daily from the Nez Perce Reservation to Lewis-Clark College, about 10 miles away.

The math curriculum is the heart of both camps. Designed by Polly Dupuis, math teacher at the Montana camp and at nearby Polson High School, with input from Church, the integrated math model incorporates the best of traditional algebra instruction with hands-on, cooperative, problem-solving activities. In addition to a three-hour math class each morning (except for the day of the visiting scientists), students have supervised study and home-

Questions To Consider

- **Can a non-Native teacher be responsive to Native students' learning needs?** Math teacher Polly Dupuis, a non-Native, says, "I think students need to know there is a support system of teachers out there who care, whether they be Native or not. I've had great luck with my Native students because I use a methodology that works well with them: cooperative group settings, peer tutoring, manipulatives, and hands-on activities."

- **Must cultural relevancy to math and science always be made explicit?** Cultural relevancy is always in the background of the PACE curriculum. When the students tie-dye T-shirts at the Montana camp, for example, they use dyes made from native plants. When they erect teepees, they must measure the spacing of poles. As one counselor says, sometimes students "don't even realize they are being exposed to science and math."

- **How is culture evident in the PACE algebra curriculum?** Solo Greene points out that Native American students learn better in a non-competitive environment. The PACE math curriculum is effective and fun for the students because it uses traditional Native ways of teaching: hands-on activities in cooperative group settings.

- **Why does the PACE curriculum infuse basic math with an integrated approach?** The PACE curriculum uses modeling activities and simulation games that allow students to understand and apply the basic math concepts.

work time in the afternoons, one-on-one with their counselors.

"A lot of our students are still struggling in basic math," says Dupuis, who trained as a teacher leader for the state SIMMS program (Systemic Initiative for Montana Mathematics and Science), "so we try to give them a good understanding of the foundations and then enhance that with modeling activities so they can see the application of basic skills. It's not just drill and kill.

"The first day of camp," Dupuis continues, "we give a pretest that focuses on the areas we have deemed important to be successful in algebra: decimals, fractions, percents, integers, exponents, proportions, modeling, variables, and solving equations. Some seventh-graders are up to speed and ready for algebra, while some eighth-graders are still having trouble dividing fractions. But all will benefit from the camp."

Daily quizzes on the material presented the previous day provide teachers and counselors with feedback on how the students are doing. Then, in the afternoon study sessions, the campers get one-on-one help. "In this way we can individualize the program for each student," says Dupuis. "There's also a lot of peer tutoring, which is great," because it helps the one being tutored as well as the one doing the tutoring."

culture as context

Tribal elders and natural resources professionals are central to the science lessons and field trips that occupy the campers in the afternoons, but each program designs its own curriculum. "The Nez Perce tribe relies on its natural resources to reinforce our cultural beliefs and traditional lifestyles," says Solo Greene, director of the Idaho camp "and we try to integrate Nez Perce culture as much as we can because a lot of our youth don't know about our history."

Students visited an Appaloosa horse camp, learning just how central the Appaloosa is to the Nez Perce people's culture and history, says Greene, and "how the horse changed our way of life in hunting, traveling, and trading." Understanding this may spark some students' aspirations to become veterinarians, researchers, or breeders.

"If we are going to continue as a culture, we need to get our young people educated in the contemporary world of science and math so they will come back one day and run our forestry, water conservation, and fisheries programs," says Greene, who is an education specialist for the Nez Perce tribe. "That's our real mission."

In Montana, students camp in tepees at Flathead Lake.

In Montana, science activities include a river ecology field trip, a visit to the Creston Fish Hatchery, a GPS (global positioning system) treasure hunt, native plant identification field trip, and a weekend trip to the Big Hole Battlefield.

The success of both camps relies heavily on the role played by the counselors. Carefully selected to provide the young campers with effective tutors and role models, almost all are Native American college students. Several are working toward science and math degrees, and others are preservice or inservice teachers.

During the past three years, the PACE camps have served about 200 students from tribes all over the Northwest, according to McClure. This is the final year of the grant, and tribal educators from both Idaho and Montana are anxiously waiting to see if NASA will put out another request for proposals, which if successful would give the program another three-year lease on life. "Whatever happens," says McClure, "the camps will continue in one form or another."

For the Native American youth who have attended the camps, however, their success is in the bag, at least according to one of them. "Last year I was just expecting a math camp," says Tori Bick, a 15-year-old who has returned to the Montana camp for a second year. "I didn't know about the water slide trip, white water rafting, fishing, or the water Olympics. They fit everything into math and science, and it is really exciting. Last year I pretty much doubled my IQ in math," he concludes.

Judy Blankenship is a freelance writer and photographer in Portland.

A Network of Native Knowledge

IF YOUR GOAL IS TO INTEGRATE NATIVE cultures and customs with Western science in your classroom, the Internet offers a wealth of timely and relevant resources. To get your search off to a good start, the following Web sites are just a click away.

Alaska Native Knowledge Network

[www.ankn.uaf.edu/]

This site includes links to guidelines, lessons, and resources for creating culturally based learning opportunities, including:

- **Alan Dick's lesson guidebooks**
  Village Science
  [www.ankn.uaf.edu/VS/index.html]
  Northern Science
  [www.ankn.uaf.edu/nshtml/]
  Village Math in draft
  [www.ankn.uaf.edu/VillageMath/village_math.html]

While these resources were created for schools in Alaska Native communities, they are relevant for many rural schools throughout the region.

- **Handbook for Culturally Responsive Science Curriculum**
  by Sidney Stephens
  [www.ankn.uaf.edu/handbook.pdf]

This handbook is designed to help teachers develop and teach standards-based and culturally responsive science curricula. It addresses how to involve elders in the classroom; cultural standards; guidelines for standards-based units; correlating local knowledge with science standards; promising assessment strategies; traditional Yup'ik learning, knowledge sharing, and integrated study.

- **Observing Locally, Connecting Globally**
  [www.uaf.edu/olcg/index.html]

Primarily a summer institute for teachers in rural Alaska, much of the content of this Web site is relevant to teachers throughout the region who teach Native students, with links to culturally responsive resources and information.

The Cradleboard Teaching Project

[www.cradleboard.org/main.html]

This project connects Native and non-Native students around the world with activities and core curricula that are culturally relevant for all grade levels in geography, history, social studies, music, and science. *Science: Through Native American Eyes*, for example, is an interactive multimedia CD-ROM package that meets national content standards for middle school science while addressing scientific concepts from within Native American culture.

Baseline Essay Project

[www.pps.k12.or.us/depts-c/mc-me/essays.php]

Portland Public Schools' series of essays gives information about the history, culture, and contributions of specific geocultural groups in art, language arts, mathematics, science, social science, and music. The purpose of the essays is to provide the reader with a holistic and thematic history of the culture and contributions of specific groups from ancient times to the present.

Indian Education Research

[www.indianeduresearch.net]

This is a federally funded project assisting individuals and organizations committed to improving education for American Indian and Alaska Native children and adults. The Web site includes a link to the *2002 Native Education Directory* and *Improving Academic Performance Among Native American Students: A Review of the Research Literature* by Native American researcher William Demmert.

American Indian Science and Engineering Society

[www.aises.org/]

This site features schools throughout the nation, including the Northwest, where students can participate in the National American Indian Science & Engineering Fair and other learning activities. Teachers will find information about professional development opportunities and online versions of the magazine *Winds of Change*.

Native Web

[www.nativeweb.org]

This site features a revolving list of many worthy and hard-to-find educational resources and ideas. From the home page, click on Resource Center, then Education, then K–12.

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books and materials available from THE CENTER'S LENDING RESOURCE COLLECTION

THE NWREL MATHEMATICS AND SCIENCE EDUCATION CENTER'S RESOURCE COLLECTION is a lending library of teacher-support material. Search the collection and request items from the Web site at www.nwrel.org/msec/resource/ or call (503) 275-9170. Mailing items back is at library rate.

The following titles and resources will be helpful to the teacher who is working to integrate Native knowledge and Western science.

Native Science: Natural Laws of Interdependence
Gregory Cajette (2000)
This book describes indigenous science as a way of understanding, experiencing, and feeling the natural world. It provides parallels and differences between the paradigms of indigenous science and Western science, with special emphasis on environmental/ecological studies.

Red Earth, White Lies: Native Americans and the Myth of Scientific Fact
Vine Deloria, Jr. (1995)
This book examines modern science as it relates to Native American oral history and documents traditional knowledge about evolution, planetary history, the origin of humans, and natural disasters.

Collected Wisdom: American Indian Education
Linda Miller Cleary & Thomas D. Peacock (1998)
Interviews of teachers of American Indian students examine how cultural differences and real-world issues affect students' education. Included are perspectives on learning styles and literacy issues, approaches teachers have found that work well with American Indian students, and issues of historic oppression and its impact on contemporary Indian education.

Power and Place: Indian Education in America
Vine Deloria, Jr. & Daniel Wildcat (2001)
This collection of essays examines the challenges Native American students face when placed in American educational institutions that reflect a western worldview rather than a culture and society in which children are taught how to live harmoniously with nature, the earth and sky, and other creatures.

Culturally Competent Standards-Based Math and Science Lessons
Julie Cajune & Gina Sievert (2001)
Teachers from the Flathead Indian Reservation compiled standards-based math and science lessons based in a cultural context. The curriculum is available by grade level: K–4, 5–8, and 9–12.

Motivating Native American Students: Strategies That Work
Sally Brownfield (2002)
This item contains information, ideas, and strategies to assist teachers working with American Indian students and communities. It includes sections on building relationships, the learning environment, curriculum, and methods.

Learn-Ed Nations Inventory: A Tool for Improving Schools With American Indian and Alaska Native Students
Northwest Regional Educational Laboratory (2002)
This tool is designed to help schools work with their communities to define school improvement plans that are informed by cultural context as well as education research.

Mathematics and Science for All: Native American Students
Gerald Lieberman and Linda Hoody (1998)
Annenberg/CPB (1996)
Through interviews with students and teachers, and scenes from diverse, interactive classrooms, this video illustrates the issues involved in creating culturally relevant math and science, and poses options for overcoming barriers.

Celebrating Cultural Diversity
NSTA (2001)
This collection of articles addresses inclusive curriculum design, multicultural teaching strategies, and language diversity in science teaching and learning. The articles present teaching techniques, tips on working with English language learners, and insights on helping students to appreciate the scientific contributions of all cultures.

Culturally Responsive Mathematics and Science Education for Native Students
Sharon Nelson-Barber & Elise Trumbull Estrin (1995)
This paper examines current math and science reforms in terms of how they meet the needs of Native students. The authors believe that the constructivist view must be complemented by a sociocultural perspective.

AMY COYLE
works in NWREL's math and science program.

A WORD FROM THE DIRECTOR

KIT PEIXOTTO
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IN FEBRUARY, I WAS ON A PLANE on my way to a conference, and I was using the time to draft my column for this issue of *Northwest Teacher*. But the thought that occupied me and, probably, many of my fellow travelers was the recent, terrible loss of the Columbia shuttle astronauts.

The loss of the space shuttle Columbia seemed especially sharp as I thought about how this crew, particularly, represented the diversity of today's scientists—in gender, ethnicity, and knowledge traditions. On board were modern explorers descended from African, Middle Eastern, East Indian, and European ancestors.

Just before Columbia's tragic flight, the shuttle Endeavour had flown the first Native American into space: astronaut John Bennett Herrington.

In fact, nearly 200 years to the day before the space shuttle Columbia's final liftoff, the Lewis and Clark Corps of Discovery—which included an African American man and a Native American woman—also set out on a science and research mission. The knowledge and skills of York and Sacagawea would prove invaluable to the success of that more fortunate expedition.

Clearly, the pursuit of scientific understanding is made stronger by a plurality of views and scientific traditions. Each person brings his and her own background, knowledge, and life experiences to science—and these personal resources inform our accumulating knowledge about the universe. Science, as we are seeing, is not a singular and sterile realm. It's rich, diverse, and interconnected. Just like us.

There are corollaries to be found between cultural knowledge and key concepts in math and science, and wise teachers will make these connections in the classroom when they're pertinent and appropriate. But every lesson needn't be shoehorned into some cultural context, cautions Robey Clark, a Native American educator and researcher here at NWREL. "Cultural relevance is important but it is not a guarantee of academic achievement. Native kids can and do learn concepts that aren't necessarily 'Native.' It's our responsibility not only to honor and celebrate their cultural heritage but to expand their horizons," he says.

This pastel by Earl Pluff, a student at Wa He Lut Indian School in Olympia, depicts a Tsimshian carving of the sun.

The No Child Left Behind legislation calls for schools to use practices that experimental studies show to be most effective in improving student achievement. But there hasn't been a lot of experimental research on language and cultural programs for Native American and Alaska Native students. Therefore, the U.S. Department of Education has contracted with NWREL to study the feasibility of using experimental methods—involving control groups and replication of results, for example—to determine the effectiveness of these programs. The results may help point to particularly useful research and resources teachers can draw on to inform and enhance their students' learning experiences.

Robey reminds us that good teaching can transcend culture, yet interestingly, key teaching strategies of the education reform movement—such as integrated, authentic, and collaborative learning experiences—are also traits of traditional teaching in Native America that have stood the test of time. NWT

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