Educators of Native American Students (EONAS) Adapted from the presentation at the EONAS Meeting, Phoenix Regional, 2016 Presenter-Richard Sgarlotti, Ed.S., EONAS Chair Hannahville Indian School, Retired Bay College, Adjunct Mathematics Instructor

Educators of Native American Students is a Special Interest Group (SIG) of TODOS, an NCTM affiliate.

The mission of EONAS is to advocate for an equitable and high quality mathematics education for all students — in particular, Native American students by increasing the equity awareness of educators and their ability to foster students' proficiency in rigorous and coherent mathematics.

EONAS Resources

Middle School Algebra

If this was a strand of beads, and was 100 beads long, what color is the 100th bead?

1, 4, 7, 10, 13, 16, 19



Y = 3X - 2

High School Geometry Using points A and B as midpoints of opposite sides, construct a square using only a cord, straightedge and a pencil. $A \circ$ Using points A and B as midpoints of opposite sides, construct a square using only the cord and a pencil.



The Kwakiutl of Vancouver Island used a configuration of pegs and cords to lay out the plan for square houses. As reported by Franz Boas in the 19th century and reinterpreted by a modern scholar, the builders would start by driving two stakes to define a line marking the centers of the front and rear walls of the house. They would then stretch a cord between these two stakes and, having obtained the distance, double the cord on itself to identify its midpoint. With the midpoint known, it is placed at one of the two stakes with the cord's ends extended roughly perpendicular to the line marked out by the two stakes. A second cord is run from the second stake consecutively to each of the first cord's ends to make sure that the ends are located precisely to bring the cord exactly perpendicular to the line between the two stakes. These endpoints are then marked and the whole process repeated with the first cord centered on the second stake to locate the remaining two corner points of the square.

From: American Indian Mathematics Traditions and Contributions, Michael P. Closs

American Indians generally have had a pragmatic orientation to the use and study of mathematics. In most Indian cultures, mathematics traditionally was practiced by most of our ancestors, ... for its value in daily life rather than for its own sake or as an intellectual challenge.

> American Indian Mathematics Traditions and Contributions by Chris R. Landon <u>Portland Public Schools Geocultural Baseline Essay Series</u> 1993

Research Links Center for Research in Education, Diversity & Excellence (CREDE) University of California, Berkley

http://manoa.hawaii.edu/coe/crede/

Strategies that work well with Indian students (All Minority students)

Joint Productive Activity Teacher and Students Producing Together
Language Development Developing Language and Literacy Across the

Curriculum

- •Contextualization Making Meaning: Connecting School to Students' Lives
- •Challenging Activities Teaching Complex Thinking
- •Instructional Conversation Teaching Through Conversation

Making Meaning:

Connecting School to Students' Lives Connect teaching and curriculum to students' experiences and skills of home and community. The teacher:

- begins activities with what students already know from home, community, and school.
- designs instructional activities that are meaningful to students in terms of local community norms and knowledge.
- acquires knowledge of local norms and knowledge by talking to students, parents or family members, community members, and by reading pertinent documents.
- assists students to connect and apply their learning to home and community.

Culture Based Initiatives

"Creating Sacred Places for Children" is a National Indian School Board Assoc. effort to provide an Indian model of school reform that includes:

*The Effective Schools framework (Larry Lezotte)

***The integration of Indian culture in the curriculum:**

CSP Curriculum-6 Volumes by Dr. Sandra Fox (Oglala Lakota)

Creating Sacred Places -Means responding appropriately to students' academic, physical, social, emotional, and spiritual needs. Research by Cummings, "The Empowerment of Indian Students", lists four characteristics that schools must include if Indian students are empowered to learn. Cummins, Jim, 1986 Empowering Minority Students: A Framework for Intervention. Harvard Educational Review, v56 n1 p18-36

1.Language and Culture must be incorporated into the school program.

Research suggests that for minority groups experiencing school

failure, the extent to which students' language and culture are incorporated into the school program constitutes a significant predictor of academic success.

2. There must be an unbreakable bond between school and community.

When educators involve parents as partners in their children's education, parents communicate to their children a positive attitude toward education that leads to improvement in the students' academic achievement.

3. Appropriate Instruction must be provided.

The experiential-interactive model of instruction focuses on giving students hands-on classroom experiences that provide students with a basis for understanding more abstract academic curricula. Learning styles of students must also be taken into account.

4. Appropriate Assessment must be Provided.

There should be more emphasis on performance based assessment.

Minority students are over represented in special education because of improper testing.

Creating A Sacred Place for Students In Mathematics Grades K - 12

Edited by Richard Sgarlotti, Ed. S. Published by the National Indian School Board Association 2006

The units are related to one or more of the following topics:

- Indian Contributions to Mathematics
- Mathematical Concepts in Traditional
- **Culture** (Mathematics as the science of patterns)
- Mathematical Concepts in Present Day Cultural Activities
- Math as the Language of (Indian) Science
- Math in the Study of Indian People
- Indian Mathematicians/Scientists

 Past and Present

Some sample units in Creating a Sacred Place for Students in Mathematics



<u>Shota and the</u> <u>Star Quilt</u>

A Native American story, Shota and Ester are about to part, but before they do they make a star quilt with **Shota's grandmother** at Pine Ridge **Reservation**.

What are some math problems that can be developed from the quilt square on the next page?



Traditional Activities and Traditional foods can be the basis for many kinds of math problems.

Ininatig's Gift of SUGARR Traditional Native Sugarmaking



Laura Waterman Wittstock Photographs by Dale Kakkak

Ontario produces between 908,000 and 1,362,000 liters of maple syrup and between 9,000 and 11,000 kg. of maple sugar annually.

Present Day cultural Activities

Science Activities of syrup making

- Temperature
- Density
- Flow
- Weather
- State of matter
- Anatomy of a tree

Math Problems??

About 4 in 10 of the nation's 1.9 million American Indians identified their tribe as either Cherokee (308,132), Navajo (219,198), Chippewa (103,826), or Sioux (103,255), according to figures released today by the **Commerce Department's Census Bureau.** The census tabulations present population counts for 542 tribes for the United States, its regions, divisions, and states. Website for the Census Bureau:

Sports are a great way to bring in math. What problems do you see here? **Jim Thorpe** Winning Performances **1912 Olympic Pentathlon Place Distance**/Time Event Long Jump 1 23 ft. 2.25 in 3 153 ft 2 in. Javelin 200 m 1 22.9 sec 117 ft 3 in Discus 1 1500 m 4 min 44.8 sec 1

Students need Role Models

Fred Begay (Navajo), Nuclear Physicist "The Long Walk of Fred Young" Nova Special My mother is from the Lakota tribe, and life wasn't always so cheery for an Indian kid in a small rural school. When I was a child, the **Indian stereotypes from the Western movies** were still very strong. Some teachers and fellow students didn't believe that Indians would need education or that Indians would eventually compete for the top jobs in our society. One year I ended up in the "slow" section of the class just because of my Indian background. (Robert Megginson, SACNAS biography project, http://bio.sacnas.org/biography/



One of my greatest passions is mountain climbing, and my current project is to climb all of Colorado's Fourteeners, the mountains in Colorado whose summit elevations exceed 14,000 feet.

We have not wings, we cannot soar; But we have feet to scale and climb By slow degrees, by more and more, The cloudy summits of our time. - From The Ladder of St. Augustine, by Henry Wadsworth Longfellow

• Robert Megginson, Professor of Mathematics, University of Michigan

• On the way up Bear Peak in the Colorado Rockies



John Herrington (Chickasaw) received a bachelor of science degree in applied mathematics from the University of Colorado at Colorado Springs, in 1983, and a master of science degree in aeronautical engineering from the U.S. Naval Postgraduate School in 1995.

ORGANIZATIONS: Life member of the Association of Naval Aviation, University of Colorado at Colorado Springs Alumni Association. Sequoyah Fellow, American Indian Science and Engineering Society.



Edna Paisano

•When Edna Lee Paisano (b 1948) was growing up on the Nez Perce Indian Reservation in Sweetwater, Idaho she learned to preserve her families traditions and make them a part of her daily life. For example, her grandmother taught her how to make moccasins and beaded purses, which they sold to help support the family. Additionally, owning the fishing, hunting, and mineral rights to the land in the Nez Perce area made it easier for the tribe to be self-sufficient, and in the teepee in the backyard of Paisano's home, the family regularly prepared, dried, and smoked the meat of deer, elk, and moose.

- A talented mathematics and science student, Paisano attended the University of Washington and earned a graduate degree in social work, studying statistics in the process.
- As a result of visiting tribal areas and of examining the data from both a questionnaire she developed and the 1980 census, Paisano discovered that American Indians in some locations were undercounted. Because the allocation of important federal funds to tribal units is based on census figures, Paisano used modern statistical techniques to improve the accuracy of the census. By encouraging education in relevant mathematics-related fields such as computer programming, demography, and statistics, and by coordinating a public information campaign, she and her colleagues alerted American Indian communities to the importance of the census. As excerpted from Agnesi to Zeno, Key Curriculum Press, P.O. Box 2304, Berkeley, CA 94702



High School Algebra??

NE

Arrow Flight and the Quadratic Equation Brent Sauve, Hannahville Indian School

Native Americans used the bow for defense and for the taking of game animals for food. Many aspects of the flight of the arrow can be described using mathematics. When shot, the general flight of an arrow is a parabolic arc. Of course, any parabola can be described using a quadratic equation. This lesson helps to define for students how a, b, and c affect the graph of the quadratic equation, and should be considered as an introduction into graphing of quadratics.



This looks like the graph of an arrow in flight. In fact, if the distance between each grid line is equal to one yard, our arrow rose 1 yard while it flew 20 yards.

Links to other organizations

The North American Study Group on Ethnomathematics (NASGEm) strives to increase understanding of the cultural diversity of mathematical practices, including that of traditional American Indian knowledge and to apply this knowledge to education and development. nasgem.rpi.edu



Ethnomathematics is the term used to describe the mathematical practices of identifiable cultural groups. Mathematical practices include:

- symbolic systems,
- spatial designs,
- practical construction techniques,
- calculation methods,
- measurement in time and space,
- specific ways of reasoning and inferring, cognitive and material activities which can be translated to formal mathematical representation.

Math Is a Verb Activities and Lessons from Cultures Around the World

line Barta - Rite Folash - Cattly Barbley



NCTM Publication by Jim Barta, Ron Eglash and Cathy Barkley

... this book is a guide for teachers who would like to enhance their mathematics instruction by integrating it with examples and activities from cultures throughout the world. It provides culturally situated examples ...

Chapter 11 **Two-Sided Dice of the Potawatomi**



Kwezage'win

The game (kwezage'win) was played only by women, and mostly in the winter in place of double-ball. Like the two preceding games, this one is also sponsored by a woman in honor of her guardian spirit, and similar ceremonial preliminaries are held. After the feast, a blanket is spread out on the floor and the women sit in a circle, but divided into two teams with each side sitting in a semi-circle facing the other. As many women can play as want to, but there are only four prizes: yard goods of red, blue, green, and white. The gaming equipment consists of a wooden bowl and eight dice, six of which are thin, circular discs; one is carved in the form of a turtle and one represents a horse's head. Dice were formerly made of buffalo rib, but horse's ribs are used at present. One surface of each die is colored blue (red may also be used). Thus each die has a colored and a white side. The bowl is held with both hands, and the dice shaken to the far side of the bowl which is given one flip, set on the floor, and the score counted

http://www.nmai.si.edu/exhibitions/all_roads_are_good/Index.ht

Math and Native Language

Earl Otchingwanigan A Concise Dictionary of Minnesota Ojibwe





... it has been documented that certain materials such as wood strips, also "string-like" strips of inner basswood bark were used as measurement tools....also, the use of certain body parts were used in measurement such as canoe making....but specifically *ningodoninj* refers to the length of the forefinger from the knuckle to the joint nearest its finger nail, e.g; if you were to bend your forefinger as it would look much like an upside down "L", it approximates an inch more or less on the average male/female and, also then, you can also note how easy it is to use that bent forefinger to apply to a surface for a fairly general but not exact measurement ---- Earl O



Wigwam Measurement

finger width **izhinoo'iganinjiikanjige** vai, determine width/length in a certain way with forefinger measurement.

knuckle to knuckle length **dibikwaakoninjiikanjige** vai, determine width/length by knuckle to knuckle measurement.

finger tip to elbow **dibadooskwanikanjige** vai, determine width/length by using elbow to finger tip measurement.

chest to fingers **inikaakiganaangikanjige** vai, determine width/length in a certain way by chest area to finger tip measurement.

Other Websites



Virtual Beadloom from Ron Eglash, Rennsaeler Polytechnic Institute http://csdt.rpi.edu



Hannahville Indian School Math Wall www.hannahvilleschool.net/math-wall/



"Using Native Legends to Teach Mathematics"

Judith Hankes UW-O

http://www.uwosh.edu/coehs/cmagpro ject/ethnomath/legend/legend1.htm

Children's Mathematics: Cognitively Guided Instruction Based on more than twenty years of research, this eyeopening book will help you understand how children's intuitive mathematical thinking develops and how children can build up their concepts from within. Thomas Carpenter, Elizabeth Fennema and others

How the Bear Lost His Tail an Ojibwe legend t old to Marian, Doreen, and Leonard Belille by Jerry Smith Long, long ago there were only creatures on the earth. There were birds, bears, deer, mice, everything but people. In this long ago time, all the animals spoke the same language. And just like some people nowadays, they played tricks on one another and made each other laugh. They also helped each other. So it was with all the animals.

One day in the winter when the lakes had frozen, but before the winter sleep, Bear was walking along the lakeshore. As he was walking, he came upon Otter sitting near a hole on the ice with a pile of fish.

"You've got a mighty big pile of fish there," Bear said.





Archives of the National Museum of the American Indian http://www.nmai.si.edu/exhibitions/all_roads_are_good/Inc ex.htm **American Indian Science** and Engineering Society (AISES) www.aises.org **National American Indian Science and Engineering Fair** -Mathematics Competition

Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) www.sacnas.org

Changing the Faces of Mathematics: Perspectives on Indigenous People of North America

This volume is meant to give classroom teachers, administrators and principals, curriculum supervisors and program developers, ethnomathematicians, and researchers a deeper understanding of indigenous people's mathematics and pedagogy. (Published by NCTM)

Math, Science and Art

CLUNOIS



Spirit ~ Knowledge ~ Vision Many Roads. One Direction

American Indian Science & Engineering Society • 17th Annual National Conference • November 1995 • Denbits Michigan



Part of an 8' x 16' Mural at the entrance to the Hannahville Indian School done by Sam English and students.





Math, Science, and Art

Presented at NAISEF, 2009

Educators of Native American Students is a Special Interest Group of NCTM Affiliate: TODOS- Mathematics for All

The mission of EONAS:

To advocate for equity and high quality mathematics education for all students, in particular Native American students.

Regional Meeting: Thursday, October 27, 7:00 Cowboy Artist room, Atrium level , Hyatt Hotel All Welcome

Do you teach Native American Students? Join Now!

Educators of Native American Students

The inclusion of local knowledge and local people in the processes of schooling is one strategy to improve the performance of American Indian/ Alaska Native students. Dephle and Swisher, 1997





Integrating Culture into Mathematics Indian Contributions to Mathematics Mathematical Concepts in Traditional Culture Mathematical Concepts in Present Day Cultur Math as the Language of (Indian) Science Math in the Study of Indian People Indian Mathematicians/Scientists



http://nasgem.rpi.edu/pl/eonas

EONAS What are your ideas? Reply to: Chairman-Rich Sgarlotti Richsgar10@gmail.com