2013 MAA Travel Study Tour to Alaska
Notes and Resources on Mathematics Education and Ethnomathematics

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1. Summary of the Early History of Education in Alaska

Source: http://www.akhistorycourse.org/articles/article.php?artID=185

"When the Russians were in Alaska, they had built schools, but closed them when they left the area in 1867. After the Sitka residents formed a civil government, they opened a school in 1868, but when they could not afford to pay the teacher, the school closed later that year. A few private schools were open for short periods of time in the 1870s for Native children. In 1880, Sitka had two public schools: one for Natives, and the other for non-Natives.

In 1870, a provision of the United States hunting lease included a requirement that the company, the Alaska Commercial Company, maintain schools on the St. Paul and St. George islands for at least eight months out of the year. In 1890, another company, the Northern Commercial Company, had the same provision. More than 50 students attended the schools."

In 1881, Commander Henry A. Glass, the senior navy officer, made school attendance mandatory for all Native children in Sitka. When he discovered that attendance rates were low, he took a census of all the houses and children and devised a method to take attendance that would hold adults accountable. When a child was willfully absent, he would fine or punish the head of the household.

2. Alaska and the Common Core State Standards (CCSS)

What are the common core state standards?
The Common Core State Standards are a single set of educational standards (see http://www.corestandards.org/) for K-12 in English language arts and mathematics (http://www.corestandards.org/Math) that states can voluntarily adopt. The standards are designed to ensure that students graduating from high school are prepared either to enroll in credit bearing entry courses in two- or four-year college programs or to enter the workforce. The standards are clear and concise to ensure that parents, teachers, and students have a clear understanding of the expectations in reading, writing, speaking and listening, language and mathematics in school. The nation's governors and education commissioners, through their representative organizations the National Governors Association (NGA) and the Council of Chief State School Officers (CCSSO) led the development of the Common Core State Standards and continue to lead the initiative. Teachers, parents, school administrators and experts from across the country together with state leaders provided input into the development of the standards. The Math-CCSS consist of both content and practice standards (see http://www.corestandards.org/Math/Practice). States that adopted the Common Core State Standards are currently collaborating to develop common assessments that will be aligned to the standards and replace existing end of year state assessments. These assessments will be available in the 2014-2015 school year. There are two consortia working on developing these: PARCC (http://www.parcconline.org/) and Smarter Balanced (http://www.smarterbalanced.org/).

Which states have (have not) adopted the CCSS for Mathematics?
As of July 2013, forty-five states have adopted the CCSS for Mathematics, while a total of five states have either rejected (Alaska and Texas) or not yet adopted CCSS for Mathematics (Nebraska, Minnesota, and Virginia). Also, among the US territories, only Puerto Rico has yet to adopt. Source: http://news.heartland.org/newspaper-article/2010/03/25/alaska-texas-reject-common-core-standards

What are the current math standards for Alaska?
The State of Alaska adopted its own New Math Standards in June 2012. See http://www.eed.state.ak.us/tls/assessment/GLEHome.html.
Rather than wait for the new state standards, the Anchorage School District (the largest in the state) adopted the CCSS in March 2012. See http://www.ktva.com/home/outbound-xml-feeds/ASD-Implements-Common-Core-Standards-Right-Away-144316925.html

Comparison of Alaska 2012 State Standards to CCSS
An assessment performed by Alaskan educators rated their state standards against the common core, and provided a tri-color-coded analysis, that indicated where the CCSS are more/less rigorous than or equivalent to the State Standards. This document was posted on the Alaskan Department of Education and Early Development website at http://www.eed.state.ak.us/tls/assessment/AlaskaCCStandards.html as recently as April 2013, but it is no longer there. At the NEA-Alaska (an affiliate of the National Education Association, an organization of public school employees) website (http://www.neaalaska.org/) one can find a different, less detailed comparison of the two sets of standards (http://www.neaalaska.org/sites/default/files/Attachment%20to%20Q&A.pdf), which states the

following: "Most of the differences for the math standards are found in grades K-8. There are few differences between the standards at the high school level. As noted … where differences … exist, it is for the following reasons: (1) Alaskan educators were focused on making sure that the standards had clarity to ensure that teachers would easily understand the focus and purpose of each standard; and (2) Alaskan educators wanted key Alaskan standards retained, especially math standards in measurement found in the early grades" (p. 5). However, in April 2013, Alaska's Department of Education and Early Development announced that it will join the Smarter Balanced Assessment Consortium, one of the two state-led consortia developing assessments aligned to the Common Core State Standards. This means that an assessment instrument developed to measure how well students are doing against the CCSS will be used to measure how well Alaskan students are doing relative to Alaska's standards. Some view this as a way for Alaska to bring in the CCSS through the back door. See http://truthinamericaneducation.com/common-core-state-standards/alaska-is-bringing-common-core-through-the-back-door.

3. Types of Schools/Schooling in Alaska

Public Schools
Alaska has about 500 public schools within 55 school districts. Thirty-four of these school districts are urban or borough (in Alaska, borough refers to an administrative division similar to a county in other states) school districts, while the other 19 are in Regional Educational Attendance Areas, which are "politically unorganized areas of rural Alaska." A high school in Anchorage may serve more than 2,000 students, while other urban schools in areas such as Juneau may only have a few hundred students. On the other hand, schools in rural areas may have 20 or fewer students in a given grade level. Several schools in Alaska cover the grade range K-12.

The rural areas may have only a handful of schools and fewer teachers, such as in the Aleutian Region School District, which services the small islands off the southwest coast of the Alaskan mainland. This school district has 2 schools, 5 teachers, and 31 students total. Meanwhile, the Juneau School District has 14 schools, 366 teachers, and about 5,000 students. Several schools throughout rural Alaska, referred to as "the Bush," employ multi-grade teaching, meaning "three or more grade levels are combined for instruction." Of course this structure requires a different kind of teaching than in a normal one-grade-level classroom.

For more information on teaching in Alaska, visit http://alaskateacher.org/index.php. For information on specific cities, villages, and towns, see http://commerce.alaska.gov/cra/DCRAExternal/Community.

Boarding Schools in Alaska
Mt. Edgecumbe High School is the state boarding school in Sitka, Alaska, hosting grades 9-12. There are approximately 400 students and about 30 teachers here. Approximately 95% of the students are Native Alaskans. See http://www.mehs.us/.

The Galena Interior Learning Academy is a statewide boarding school and is accredited for grades 9-12 and post-secondary adult vocational programs. Here students are given "the opportunity to gain industry standard vocational certification" in a variety of programs, such as innovative technology, aviation, etc. It currently has about 100 students enrolled. See http://gila.galenaalaska.org/index.html.

Home Schooling in Alaska (See http://www.homeschoolinginalaska.com/.)
It is hard to get accurate numbers of how many children are home schooled. According to http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2009030, there were 1.5 million home-schooled students in the United States in 2007, up from 1.1 million in 2003 and 850,000 in 1999.

Brian D. Ray, head of the nonprofit National Home Education Research Institute, claims the actual number of home-schoolers in America is between 1.9 and 2.5 million students. (See http://www.nheri.org/HomeschoolPopulationReport2010.pdf). Ray culled data from private home-school organizations and co-ops to supplement statistics from state departments of education, finding that "a notable number of home-schoolers might not show up on government records." See Ray's comments at http://today.msnbc.msn.com/id/39342787/ns/today-parenting_and_family/t/home-schooling-moves-mainstream-stigma-fades/#.

Estimates of home schooling by state are found at http://homeschooling.gomilpitas.com/weblinks/numbers.htm#.UN4JT7ahD-k. This site indicates about 4% of Alaskan children are home schooled as compared to 5% overall in the US.

Alaska is one of 10 states that require no notice from those doing home-schooling (see http://www.hslda.org/laws/). Other states that require no notice are: Idaho, Texas, Oklahoma, Missouri, Illinois, Indiana, Michigan, New Jersey, and Connecticut.

Distance Education in Alaska

Not surprisingly, support and resources for home schooling appears on the Internet. Interior Distance Education of Alaska (http://www.ideafamilies.org/) is "the most popular homeschool program in Alaska." IDEA states that its mission is to provide parents who have chosen to homeschool their children with the support and resources that they will need to be successful in overseeing their children's education. IDEA gives students opportunities to take some classes at public schools, and it has certain coursework requirements for those students involved either part-time or full-time in IDEA.

At the collegiate level, there are many opportunities for distance learning as well. A complete list of distance learning programs offered by the various branches of the University of Alaska appears at http://www.alaska.edu/distance/programs.html. The website for the University of Alaska Southeast distance education (or e-learning as it is called)is http://www.uas.alaska.edu/students/getahead/elearn.html. A 35-page guide for e-learning at University of Alaska Southeast is found at http://www.uas.alaska.edu/sitka/documents/e-learning_resource_guide_2012_2013.pdf.

4. School Enrollment in Alaska by Ethnicity

The source for the following data is http://www.eed.state.ak.us/stats/StatewidebyEthnicity/2013Statewide_Gr_X_Ethnicity.pdf.

Statewide percentages:
Alaska Native-22.13% of total enrolled
American Indian- 1.36%
Asian- 6.14%
Black- 3.54%
Hispanic- 6.37%
Native Hawaiian/Pacific Islander- 2.34%
White- 50.19%

Of the 400 students at the state boarding school, Mt. Edgecumbe High School, 322 are Alaska Native. These 322 students make up about 1.1% of the total Alaska Native students enrolled in the state.

Of the 2,063 students enrolled in the Interior Distance Education of Alaska program, 127 are Alaska Native or American Indian. These 127 students make up about 0.4% of all Alaska Native students in the state.

5. General Resources for Teaching about Native Alaskan Mathematics

Internet Resources
The Alaska Native Knowledge Network (http://www.ankn.uaf.edu/npe/ansme.html)

The *Alaska Native Knowledge Network* was designed as a resource to gain access to knowledge attained by Alaska Natives over millennia. It assists Alaska Natives, government agencies, educators, and the general public in gathering and exchanging information on Alaska Native knowledge. In other words, the ANKN serves as a cross-cultural knowledge bridge.

Within the website, the ANKN provides several resources, lesson plans, etc. that can be used to teach Alaska Natives the curriculum they need to learn, while at the same time making it relevant to their lives, especially for those students who live in rural Alaska villages. Of the ANKN resources, two are specifically for teaching math: *Village Math* by Alan Dick (a draft is available online at http://ankn.uaf.edu/publications/VillageMath/), and *Story Problems for High School Students* (see http://ankn.uaf.edu/curriculum/units/StoryProblems/index.html).

Cynthia Valenzuela (an LMU student and future elementary teacher) notes: While these resources are extremely helpful for Alaska Native students, both the math and science resources, it is important to note that the cultural context of these resources is specialized for Alaska Native students. If a future teacher were to teach in California, these resources would be useful for gaining ideas of how to make curriculum relative to students, but they might not necessarily reflect the cultures of the students with whom this future teacher would be interacting.

The Sitka Native Education Program (http://snep99835.tripod.com/index.htm)

The Sitka Native Education Program began in 1974 as a non-profit organization designed to meet the special needs of Native children. The main components of the program were cultural and tutoring. Under the cultural component, children were taught language, dance, beadwork, and carving. In recent years, due to reduced funding, the program has had to cut back on many things, including employees, travel programs, and a youth work program.

The SNEP website does not necessarily provide resources in the same way as the ANKN website. The SNEP website does provide translations of words for colors, weather, objects, and creature, and translations of some old legends. These resources are available to teachers who would like to incorporate these translations and stories into their teaching plans. There is no explicit math resource available here.

Cynthia Valenzuela (an LMU student and future elementary teacher) notes: When using these resources, it is important to note that they are not precisely for teacher use. They are not designed as explicit lesson plans. If a future or current teacher plans on using these translations, s/he will need to devise a way to incorporate them into lessons.

The Alaska Native Curriculum and Teacher Development Project (http://www.alaskool.org/)

The *Alaska Native Curriculum and Teacher Development Project* (ANCTD) brought together teams of teachers, elders, and community members in various parts of Alaska with university-based specialists to develop curricula on Alaska Native studies and language. The resulting Alaskool website makes curricula from the Alaska Native Curriculum and Teacher Development Project (ANCTD) and other

curricula materials available to students and teachers all around Alaska and the world through the Internet. This was done in an effort to make the curriculum more accessible to students, as the previous curriculum did not represent what they knew and understood.

This website is dedicated to providing resources that can show teachers how to incorporate Alaska Native culture into the curriculum of public schools. It provides lesson plans and has specific pages for Land Claims, Education, Literature, Government, Languages, Traditional Life and Subsistence, Biographies, Reindeer Herding, and "Jim Crow"- Racism in Alaska. Each of these content pages provides information on its topic and possible ways that it can be integrated into a classroom.

Cynthia Valenzuela (an LMU student and future elementary teacher) notes: However, if a future teacher were looking to use these ideas, these topics would relate almost exclusively to Alaska Native students. Most of the information provided would not be culturally relevant to students in, say, California or Nevada. But if a teacher were willing to use this information simply to inform students about another culture, then everything provided on this site would be extremely helpful.

Jackie Dewar notes: The following page on the Alaskool website proved very useful in helping one of my students (a freshman taking second semester calculus) understand level curves, typically a third semester calculus topic:
http://www.alaskool.org/resources/teaching/national_archives/maps.htm. This section of the website provides examples of how to teach with primary source documents, in particular, documents from the National Archives. It draws upon documents unrelated to Alaska. This specific page of the Alaskool website contains a map of an area in Salem, MA. It has some very interesting resources on understanding maps in general and level curves [typically a Calculus III topic].

Books and Book Chapters

Closs, Michael P. (ed.). (1986). *Native American Mathematics*. Austin, TX: University of Texas Press.
This book is a collection of thirteen essays from various contributors, each addressing the mathematics of indigenous cultures of the New World, such as the Inuit, Aztec, and the Maya. The authors are from various fields, including, mathematicians, linguists, psychologists, anthropologists, and archaeologists, providing the reader with a variety of different approaches to studying the mathematical concepts of these cultures native to the New World. Those especially interested in the Inuit (Alaskan) mathematical concepts should read chapters 1, 4, and 6 closely, as these are the chapters that address the mathematics of that culture. Below is the title and author of each of these chapters and a list of the references cited in each chapter that pertain to information on the Inuits.

Chapter 1: "Native American Number Systems" by Michael P. Closs (pp. 3-44)

Chapter 1 References

Barnum, F. (1901). *Grammatical fundamentals of the Inuit language*. Boston, MA: Ginn.

Eber, D. (1972). Eskimo art: Looking for the artists of Dorset. *The Canadian Forum, 52*, 12-16

Eells, W. C. (1913). Number systems of the North American Indians. *The American Mathematical Monthly, 20*, 263-199.

Nelson, E. W. (1899). The Eskimo about Bering Strait. In *Smithsonian Institution, Bureau of American Ethnology, 18th Annual Report, Part 1*. Washington, D.C.

Seidenberg, A. (1962). The ritual origin of counting. *Archive for History of Exact Sciences, 2*, 1-40.

Trumbull, J. H. (1874). On numerals in American Indian languages, and the Indian mode of counting. *American Philogical Association, Transactions and Proceedings, 5*, 41-76.

Chapter 4: "The Calendrical and Numerical Systems of the Nootka" by William J. Folan (pp. 93-108)

Chapter 4 References

Anon. (n. d. a.). Libro de guardias para la corbeta *Atrevida*. [Typescript]. Madrid: Museo Naval.

Anon. (n. d. b.). Canto de alegrai. In *Virreinte de Mejico*. [Typescript]. Madrid: Museo Naval.

Bayly, W. (1776-1779). *A log and journal kept on board H. M. Sloop Discovery by William Bayly, August 1, 1776 to December 3, 1779*. Alexander Turnbull Library, Wellington, New Zealand.

Brabant, A. J. (n. d.). Indian language materials relative to the West Coast of Vancouver Island in the archives of the Roman Catholic Diocese of Victoria. (A. M. D. G. Dictionary of the Hesquita or Nootka language, 9 March 1911). British Columbia Archives.

Burney, J. (n. d.). Log of the discovery. (ADM 51/4528). London, Public Record Office.

Cook, J. (1967). *The journey of Captain James Cook on his voyage of discovery* (Vol. 3). In J. C. Beaglehole (Ed.), *The voyage of the resolution and discovery, 1776-1780*. Cambridge: Hakluyt Society.

Curtis, E. S. (1970). *The North American Indian* (Vol. 11). F. W. Hodge (Ed.). New York, NY: Johnson Reprint Corporation.

Drucker, P. (1951). The Northern and Central Nootkan tribes. In *Smithsonian Institute, Bureau of American Ethnology, Bulletin 144*. Washington, D.C.

Haswell, R. (1941). Voyages of the *Columbia* to the northwest coast, 1787-1790 and 1790-1793. In F. W. Howay (Ed.), *Collections of the Massachusetts Historical Society* (Vol. 79). Boston, MA.

Jewitt, J. R. (1807). *A journal kept at Nootka Sound*. Boston, MA.

Knipe, C. (1868). *Some account of the Tahkaht language as spoken by several tribes on the western coast of Vancouver Island*. London.

Moffat, H. (n. d.). Letterbook of Hamilton Moffat: Fort Rupert, Fort Simpson, and Fort Kamloops 1857-1867 (A/B/20/R2A). British Columbia Archives.

Moziño Suarez de Figueroa, J. M. (1913). Noticias de Nutka Diccionario de la Lengua de los Nutkenses y Descripcion del volcan de Tuxtla: por Joseph Marino Mosino Siarez de Figueroa. Precididos de una noticia acerca del br. Mozino y de la expedicion cientifica del siglo XVIII por Alberto M. Carreno. La Secretaria de Fomento, Madrid. Translated by the Secretary of State and revised by William J. Folan.

Sproat, G. M. (1868). *Scenes and studies of savage life by Gilbert Malcolm Sproat*. London: Smith, Elder and Co.

Strange, J. (1928). *James Strange's journal and narrative of the commercial expedition from Bombay to the North-west coast of America, together with a chart showing the tract of the expedition*. Madras: Government Press.

Viana. (n. d.). Diario del viage explorador de las corbetas *Descubierta* y *Atrevida*. [Typescript]. Madrid: Museo Naval.

Chapter 6: "Cultural Ecology of Mathematics: Ojibway and Inuit Hunters" by J. Peter Denny (pp. 129-180)

Chapter 6 References

Baillargeon, R., Noelting, G., Dorais, L-J., & Saladin d'Anglure, B. (1977). Aspects sémantiques et structuraux de la numéracion chez les Inuit. *Etudes Inuit, 1*, 93-128.

Carpenter, E. (1973). *Eskimo realities*. New York, NY: Holt, Rinehart and Winston.

Denny, J. P. (1981). The logical semantics of 'only': tuaq, innaq, and tuinnaq. *Inuit Studies, 5*, 115-124.

Lévi-Strauss, C. (1968). *The savage mind*. (Trans.). University of Chicago Press.

Secada, W., Hankes, J. E., & Fast, G. R. (eds.). (2002). *Changing the faces of mathematics: Perspectives on indigenous people of North America.* Reston, VA: National Council of Teachers of Mathematics.

This book provides resources and practical ideas for classroom teachers, administrators, principals, curriculum supervisors, program developers, ethnomathematicians and researchers who wish to develop a deeper understanding of the mathematics and pedagogy of the indigenous peoples of North America. Five of the 25 chapters are focused on Native Alaskan groups: Chapter 6 – "The Learning of Geometry of the Inuit: A Problem of Mathematical Acculturation" by Richard Pallascio, Richard Allaire, Louise Lafortune, Pierre Mongeau, and Justine Laquerre; Chapter 12 – Kakaanaq: A Yup'ik Eskimo Game" by Esteher Ilutsik; Chapter 21 – "Counting on Tradition: Inupiaq Numbers in the School Setting" by Wm. Clark Bartley; Chapter 24 – "Yup'ik Culture and Everyday Experience as a Base for School Mathematics" by Jerry Lipka; and Chapter 25 – "Yup'ik Border Patterns in the Curriculum" by Esther Ilutsik and Claudia Zaslavsky. Jackie Dewar finds Chapter 21 – "Counting on Tradition: Inupiaq Numbers in the School Setting," by Wm. Clark Bartley, particularly noteworthy. It describes how middle school students at Kaveolook School in Kaktovik, AK, in the North Slope Borough, set about developing numerals for the Inupiaq base 20 system. The result, reported in this chapter, is an amazing constructivist journey into mathematics that has far reaching impacts not just in this school but in others as well.

6. Resources for Specific Math Lessons

Mathematics in Tlingit Art

This webpage (http://juneauempire.com/stories/081003/loc_mathart.shtml) describes an inservice teacher program that makes connections between math, Tlingit art (specifically, basket weaving), patterns found in nature (animal footprints) and technology (using the Logo computer language). Using string cheese, Teri Rofkar, a Native weaver (see http://terirofkar.com/) from Sitka, explains which parts of the bark pulled from trees are used for the horizontal/vertical (weft/warp) weave of the cedar bark baskets. She relates how her grandma liked to say that when you weave a basket made of spruce roots, you put them back the way you found them - round on the outside, straight on the inside. The string cheese is a way for the teachers to provide the elementary school children with a tactile experience of this weaving practice. Rofkar says, "I was thinking of the little kids, and what could I say," explaining why she chose the cheese-root comparison. She added, "I like to use all my senses when I learn. I learn best that way." See http://ankn.uaf.edu/curriculum/Tlingit/MathinWeaving/MathTlingitArt.html for a PowerPoint presentation on Math in Tlingit Art by Dr. Claudette Engblom-Bradley, College of Education, UA Anchorage.

Navigating Across the Tundra

Many thanks to Ximena P. Catepillan, Ph.D., Professor, Department of Mathematics, Millersville University of Pennsylvania, Millersville, PA 17551, for pointing me to these resources for fascinating material on navigation across the tundra. She utilized these resources in a first year experience seminar course taught at Millersville University.

Engblom-Bradley, Claudette. (2003). Navigating across the tundra with Fred George. *Sharing our Pathways, 8*(4), 1-3. Available at http://www.ankn.uaf.edu/SOP/SOPv8i4.pdf

This article about Yup'ik elder Fred George's navigational practices appeared in a newsletter of the Alaskan Rural Systemic Initiative funded by the National Science Foundation, Division of Educational Systemic Reform in agreement with the Alaska Federation of Natives and the University of Alaska.

Engblom-Bradley , Claudette. (2006). Learning the Yup'ik way of navigation: Studying time, position, and direction. *Journal of Mathematics and Culture 1(*1). Available at http://nasgem.rpi.edu/pl/journal-mathematics-culture-volume-1-number-1

This paper contains descriptions and explanations of the mathematics in navigation practices used by Fred George, a Yup'ik elder, plus classroom activities (appropriate for junior high school) to facilitate student understanding of natural compasses, available on the tundra.

Eglash, Ron. (2003). Culturally Situated Design Tools. Available at http://csdt.rpi.edu/

This webpage contains material based upon work supported by the National Science Foundation under Grant No. 0634329. Many cultural designs are based on mathematical principles. The software available here will help students learn standards-based math and computing as they simulate the original artifacts, and develop their own creations. Included among the many resources here is a navigational game (http://csdt.rpi.edu/na/tunturyu/cb-training.html based on the techniques of Fred George.

More Math Lessons
Middle and High School Mathematics Problems

More math lessons can be found within the ANKN website: (1) For middle school lessons (percent, ratio, area, distance, etc.), see *Village Math* by Alan Dick. A draft of this material is online at http://ankn.uaf.edu/publications/VillageMath/ and the final version is available for purchase at http://ankn.uaf.edu/publications/. These materials involve students in "thinking" about the math they are doing; see for example, Round Trip Puzzle at http://ankn.uaf.edu/publications/VillageMath/roundtrip.html. Excellent contextual photographs accompany many of these lessons. (2) High school lessons involving real data, graphing and interpreting graphs, setting up functions, geometry and many other topics are found at http://ankn.uaf.edu/curriculum/units/StoryProblems/index.html .

Elementary School Problems

The University of Alaska Fairbanks website has information about a supplemental elementary school math series developed through a collaboration of Yup'ik elders and teachers, mathematicians and math educators, and Alaskan school districts. See *Math in a Cultural Context* (http://www.uaf.edu/mcc/) consisting of 10 supplemental math modules for 2nd grade to 7th grade accompanied by 8 stories and CDs and DVDs that show exemplary cases of teachers using MCC and elders demonstrating their knowledge. Quite a bit of additional information (movies, podcasts, and assessment data and resources) is available to download at this site.

7. General Resources on Ethnomathematics

D'Ambrosio, Ubiritan. (1997). Where does ethnomathematics stand nowadays? *For the Learning of Mathematics 17(*2), 13-17.

This article was summarized in the Media Highlights column of the January 1998 issue of the *College Mathematics Journal*. The half-page summary found there (p. 76) stated: "With the crises now besetting our world, it is not at all clear that the dominant Western Civilization has the answers to the survival of our species. And thus we must even allow that there are other ways of dealing with mathematical thought. Such a conclusion is bound to be surprising …, because we have always been taught that, unlike the case in many other disciplines, the truths of mathematics are universal." Jackie Dewar notes: The original article by D'Ambrosio provides excellent background/rationale for the foundations and value of ethnomathematics. Anyone seeking to understand the viewpoint and rationale for ethnomathematics would do well to read this five-page article.

Holden, Constance. (2004, August 20). Life without numbers in the Amazon. *Science*, *305*(5687), 1093. *DOI: 10.1126/science.305.5687.1093a*

A small Amazonian tribe of ~200 members only have words for 1 and 2, and do not make "more/less" comparisons between quantities. What does this imply about the existence of universal mathematical concepts if there are no words to express them? Holden writes that linguist Daniel Everett, who along with his wife spent 20 years with the tribe, holds that "the absence of both concepts and words for numbers is the 'result of cultural constraints against quantification.' " Holden continues, "That view seems to be bolstered by the Everetts' attempts to teach the Pirahã numbers. Although children easily learned number words in Portuguese, the adults lost interest during the lessons." Also years of attempts to teach the adults to use Brazilian currency failed.

Olin, Dirk. (2003, February 23), THE WAY WE LIVE NOW: 2-23-03: CRASH COURSE: Ethnomathematics. *New York Times*, Section 6; Column 1; 23.

This 2003 article, prompted by the then "new curriculum" for New York City schools, discussed how even arithmetic has its culture clashes. The artwork and photos are worthwhile enough to justify the effort to get a copy (from microfiche) that contains them. (The Internet version and database downloads such as one can get from LexisNexis typically do not contain the artwork.) A short bibliography accompanies the article.

Secada, W., Hankes, J. E., & Fast, G. R. (eds.). (2002). *Changing the faces of mathematics: Perspectives on indigenous people of North America.* Reston, VA: National Council of Teachers of Mathematics.

This book provides resources and practical ideas for classroom teachers, administrators and principals, curriculum supervisors and program developers, and ethnomathematicians and researchers who wish to develop a deeper understanding of the mathematics and pedagogy of the indigenous peoples of North America. The first six chapters focus on theoretical foundations for ethnomathematics, chapter 7 is concerned with portfolio assessment, and the remaining chapters contain classroom lessons and topics for elementary and middle school (chapters 7 through 17 and chapter 25) and high school (chapters 18 through 24).

Wiest, Lynda R. (2002). Multicultural mathematics instruction: Approaches and resources. *Teaching Children Mathematics, 9*(1), 49-55.

This article is notable for at least two reasons. In addition to giving a basic rationale for multicultural mathematics instruction, it describes four approaches (and gives an example of each) to teaching mathematics from a multicultural perspective. They are: (1) portraying cultural groups in instructional materials, (2) adding historical perspective to math concepts, (3) examining formal and informal math of various cultures, and (4) using math to study sociocultural issues. It ends with a substantial bibliography including 17 books, 17 journal and newsletter articles, 5 posters and pictures, 11 resources for mathematical history and biography, and the 12 references cited in the article.

The *International Study Group on Ethnomathematics* (http://isgem.rpi.edu) has a *North American Chapter* (http://nasgem.rpi.edu/). You will find links on both of these pages to many other ethnomathematics resources, including the *Journal of Mathematics and Culture* homepage (http://nasgem.rpi.edu/pl/journal-mathematics-culture-s37).

IMPORTANT NOTE: This section lists only the works consulted in preparing this document. For well-known works by Ascher, Frankenstein, Gerdes, Zaslavsky and others on multicultural mathematics, consult the bibliographies found in Olin (2003) and Wiest (2002) above or the Internet.

7/22/13