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Notices of the North American Study Group on Ethnomathematics

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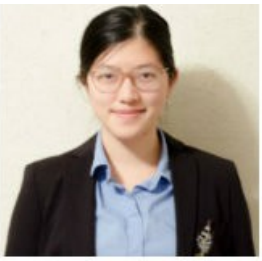

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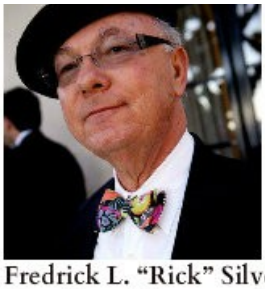


Fredrick L. "Rick" Silverman,
Newsletter Director of Development

President's Column

Chadd McGlone

I've heard travelers say, "The best way to truly visit a country is to spend time with the people in that country, learning from them and sharing a bit of yourself with them." In my experience, spending time in schools in these countries provides a wealth of invaluable information.

School visitors learn what individuals, community, and the government hold dear. For instance, you might learn that, after a noon dismissal, some children in the Guatemalan Highlands spend their entire afternoon clearing weeds from their families' coffee plantations. You might discover that a 3rd grade classroom in Haiti contains students ranging in age from eight to eighteen because they have failed to pass the assessments necessary to advance. In Honduras, you might discover teachers who are struggling to complete government-required college coursework while working a 60-hour workweek.

Because of technological advances, you don't always need to travel to a country gain this type of knowledge. Teachers around the world are using the Internet to build relationships and share unique aspects of their specific communities. Of course, these relationships are strengthened when individuals physically share space together, solving the problems that arise during a week teaching students. NASGEm has a close relationship with an organization, called Teachers2Teachers – International, that exists to facilitate these partnerships. In 2015, Teachers2Teachers – International is building teams of experienced STEM educators to work in school locations as diverse as the Ecuadorian jungle, the Guatemalan Highlands, the Haitian mountains, and the Belizean coasts.

A major focus of T2T-I is respecting the local cultures to which it travels. Trip members do not see their mission as "fixing" anything, but rather, their intent is to create an empowering, long-term partnership with a teacher. Before leaving on a trip, participants sign a document that espouses:

Committing to long term relationships and service in each school for a period of 5-10 years

Connecting teachers by building relationships that empower them to recognize their skills and talents

Creating mutual respect and professional growth while honoring differences in cultural and educational level

Honoring our role as guests in the communities we are invited into; striving to respect local cultural norms

I am committed to leading NASGEm to be a strong player in this major international mathematics educational and cultural experience. The Executive Board is supporting this undertaking. It is an extension of the work NASGEm has been doing for years, but in a more auspicious way. We will change our logo to reflect this bold initiative, clearly adding to the work we did some years back by financially supporting Faviana Hitsch Dubin's publications of three math books for Mayan students and teachers.

If you or a colleague is interested in learning more about T2T-I, please visit www.t2t-i.org or Facebook/Teachers2Teachers. Please phone me if you wish at (919) 923-6479.

Sincerely,

Chadd McGlone, President of NASGEm

Paulus Gerdes – In Memoriam

Ubiratan "Ubi" D'Ambrosio

The world was deeply saddened by the recent death of Pierre Joseph Paulus Gerdes, who left us on the 11th of November, 2014, the day he would have completed 62 years of life. The world has been deprived of a great educator who in the broadest sense, was not only a thinker and rigorous researcher, but also a great friend to all who had the opportunity to meet him. Our condolences to the family and to his many disciples, colleagues, and friends.

My relationship with Paulus was very special. I met Paulus in the mid-70s, when he was a young man of just over 20 years. He was an early adherent to the ethnomathematics movement and quickly became a leader in the area.

His life story was very special. He was born to a traditional family in the Netherlands, where his father was a minister for state religious services. Paulus attended the University of Nijmegen, where he received a bachelor's degree (with honors) in Mathematics and Physics in 1972. He was engaged in humanitarian support for the Vietnamese people while in Nijmegen, where he completed a Baccalaureate Degree in Cultural Anthropology in 1974, and in 1975 finished a Master's Degree in Mathematics. Also in the Netherlands, he became a professor in the "Third World Centre", linked with the liberation movements and the anti-apartheid movement in southern Africa. In late 1976 he moved to Mozambique, where he spent the rest of his life, and where he became a Mozambican citizen and built a family. He was a professor at the University Eduardo Mondlane until 1989, when he transferred to the Pedagogical University, where he remained until the end of his life. In 1986, he earned a doctorate at the University of Dresden in Germany, with a dissertation: "The Awakening of Geometric Thought." In 1996 he returned to Germany for a second PhD at the University of Wuppertal with a dissertation entitled: "Sona Geometry: Reflections on traditions drawn in the sand between the peoples of South Africa and Ecuador."

As an academic, Paulus was responsible for numerous contributions to theory and also crafted the formulation and solution of imaginary mathematical questions in relation to folk crafts. All his contributions have important implications for pedagogy with strong socio-cultural roots.

Paulus was one of the leading researchers in ethnomathematics. He was always trying to analyze the historical and epistemological foundations of mathematics and proposed important pedagogical innovations. He managed to organize a very active group of young researchers, where he expertly brought together mathematicians and educators. The publications of the group, mainly in Portuguese and English, are an important resource for anyone interested in conducting research in ethnomathematics. Many of these publications were generously made available to all interested parties for free or at low cost on the publisher's website "**Lulu.com**," where Paulus published almost all of his books.

In addition to his many academic research activities, Paulus has always been involved with education, especially mathematics education. The way he connected research and education is exemplary. He founded, the "Research Center for Ethnomathematics - Culture, Mathematics and Education" in Maputo in 1989 and, thanks to its innovative proposals, was very successful in attracting academics from around the world to Mozambique.

As a historian, Paulus Gerdes contributed significantly to the understanding of the history of mathematical ideas, theories, and practices in Africa. His concern was to organize the historical context of existing practices and theories found in various African cultures, with the main focus on developing a wide literature on the History of Mathematics in Africa. The results of his research have been central to historians of mathematics worldwide.

His concerns went beyond identifying other models in mathematical thinking. He felt that creativity could be improved if cultural dignity is restored. The post-apartheid period in South Africa had many repercussions throughout the African continent. It represented a new and important space for the development of creative potential of native populations. Ethnomathematics proved to be an important strategy for the rebirth of African creativity, and Paulus Gerdes was always extremely skilled at channeling this potential to form a large cohort of researchers in mathematics education.

Prof. Gerdes was responsible for an important change of attitude towards crafts and folklore. Crafts have been considered of minor importance in relation to science and mathematics where its use in education has been neglected. Paulus recovered many forms with his work with artisans, where he showed us that the fundamental importance of crafts form a solid basis for the historical development of mathematics. The most important primary sources for his research were a variety of artisanal practices. His research on these

practices revealed its theoretical foundation.

Paulus Gerdes acknowledged that the culture of the indigenous peoples, which includes artists and craftsmen, has become an inexhaustible source for mathematical research and mathematics education. Mathematics teachers of all levels can learn from their students, which is characteristic of their cultures. Students can show ways in which to achieve these practices. He showed us how the work of diverse craftsmen, fishermen, and peasants, in short all social groups, dominate and develop these practices that are based on the knowledge that has been arduously developed coherently over generations and that highlighted the very, very special way that Paulus credited women in the evolution of African cultures.

As well, when studying these examples, Paulus found that many people rarely understand how the result turned out. He showed us the path that leads to a discovery is, in general, very different from the paved road. In poetic language, Paulus told us that "The path of discovery opens up after winding through an area of dense vegetation, full of obstacles, where it seemed hopeless until, suddenly, it came to a clearing of sparkling surprises. And almost immediately, the joy of the unexpected "eureka" triumphantly opens the way"

In fact, Paulus was very much a poet in his thinking, as a philosopher, mathematician, anthropologist, and educator.

To mourn a poet and an irreplaceable life so dear to us all, such as Paulus, I am helped by a beloved poet who also left us prematurely, Fecundo Cabral. His farewell to a friend expresses well my feelings about Paulus.

Cuando un Amigo se Va
Facundo Cabral

Cuando un amigo se va, queda un espacio vacio
Que no lo puede llenar la llegada de otro amigo
Cuando un amigo se va, queda un tizón encendido
Que no se puede apagar ni con las aguas de un rio
Cuando un amigo se va, una estrella se a perdido
La que ilumina el lugar donde hay un niño dormido

Cuando un amigo se va, se detienen los caminos
Y se empieza a revelar el duende manso del vino
Cuando un amigo se va, galopando su destino
Empieza el alma a vibrar por que se llena de frio
Cuando un amigo se va, queda un terreno baldío
Que quiere el tiempo llenar con las piedras del astillo
Cuando un amigo se va, se queda un árbol caído
Que ya no vuelve a brotar por que el viento a vencido
Cuando un amigo se va, queda un espacio vacio

Que no lo puede llenar la llegada de otro amigo.

Ubiratan D'Ambrosio, São Paulo - March 2015

Trans:

When a Friend is Gone - Facundo Cabral

When a friend is gone, there is an empty space
that can not be filled by the arrival of another friend
When a friend is gone, there remains a firebrand
That you can not shut down with the waters of a river
When a friend is gone, it is like a lost star
That illuminates the place of a sleeping child
When a friend is gone, the roads are blocked
That begins to reveal a gentle elf of wine
When a friend is gone, galloping towards his destination
The soul begins to vibrate because it is filled with the cold
When a friend is gone, he leaves a wasteland
Who wants time filled with splintered stones
When a friend is gone, a tree has fallen
That can no longer sprout or hold itself against the wind
When a friend is gone, there is an empty space

And it can not be filled by the arrival of another friend.

A Spring Ethnomathematics Tour in Brasil

Tod Shockey
Daniel Orey
Milton Rosa

Tod Shockey, of the University of Toledo, Toledo, Ohio recently visited the Universidade Federal de Ouro Preto (UFOP) in Minas Gerais, Brasil. Partial funding for the trip came from the Kohler Foundation at the University of Toledo. Professor Milton Rosa and Professor Daniel Orey hosted Shockey. The two main agendas for the trip were ethnomodeling and the development of academic relations between Shockey's home institution and UFOP.

Shockey's visit began with a lecture for the inaugural course for the Professional Masters in Mathematics Education, titled "An Ethnomathematics Journey." The audience was very engaging and very accepting of a visitor that does not yet speak Portuguese In the lecture Shockey spoke of his inaugural work in Ethnomathematics, The Ethnomathematics of a Group of Thoracic Cardiovascular Surgeons. For skeptics of ethnomathematics remarked as to how this aspect made more sense to them than "the exotic" that they had been accustomed to hearing about. Two afternoons at UFOP were spent with a fantastic group of teachers that have begun their Masters studies in Mathematics Education. This group was very enthusiastic and great fun to work with. Shockey introduced some puzzles and challenges to the group that werevery well received. A peg puzzle game was introduced to these students as they served the role of the puzzle pieces. This led to a lot of laughter and much surprise when the puzzle generalized into more sophisticated forms of mathematics including quadratic functions. An element of this course is an "Ethnomathematics Walk" directed by Professor Orey. On one evening we went looking for Pi on the UFOP campus. The students were impressed that we found it and that they could do the same with their students. It is interesting that these students, after a rigorous admission process, once admitted are released from their teaching responsibilities in their respective schools for Thursday and Friday afternoons.

Figure 1 Friday Night Pi Group

Rosa and Orey are professors in the **Centro de Educação Alberta e a Distância (CEAD)**. Their program serves **more than 30 Polos** (distance education sites equipped with labs and libraries) in 3 states in Brasil. On one Saturday, the group had an opportunity to visit the Polo in Barão de Cocais for a Saturday workshop. This was an event that attracted over fifty educators from the surrounding community. All academic grades were represented as well as educators from a diversity of subject areas. This was an incredibly dynamic group that was very engaged in the workshop. You can read about this day in Ediçao 233 – 11 a 17 de Março de 2015; "A Coordenadora do Polo da UFOP Madalena Fonseca acompanhou os trabalhos e destacou a importância dessa intervenção através do Professor Tod, "Estamos tendo uma experiência riquíssima ao receber o Professor em nossa Instituição. A nossa Educação só terá a ganhar ao se envolver com novas pesquisas, especialmente envolvendo a matemática, que é um dos cursos que oferecemos em nosso Polo." Shockey first presented a lecture on Making Mathematical Connections to the Classroom. This was followed up by a group activity of using a children's game to make connections to arithmetic and mathematics.

Figure 2 Some of the Fantastic Educators at Polo Barão de Cocais

While at UFOP arrangements were made for a trip to São Paulo and to visit the Ethnomathematics Group at the Universidade de São Paulo. Spending the afternoon with seven great Brazilian intellects was a highlight for Shockey. This group is doing important work in Ethnomathematics and were very open in sharing their thinking and their current endeavors. There is very important work happening in Brasil, from Ethnomodelling to Learning Theory, which is leaded by Prof. Rosa and Prof. Orey associated with Ethnomathematics.

Figure 3 Ethomathematics Group at Universidade de São Paulo

Of course a trip to the "birthplace" of Ethnomathematics is not complete without an opportunity to visit with Professor D'Ambrosio. Shockey, Rosa, and Orey enjoyed an evening of fine food and wonderful conversation with Professor Ubi.

Figure 4 Our Wonderful Friend and Mentor, Professor D'Ambrosio

This academic interchange between both universities is important because it helps the development of

Ethnomathematics as a Lakatosian Scientific Program by proposing innovative ways to understand mathematical ideas, procedures, and practices developed by the members of distinct cultural groups.

Teaching Ethnomathematics in a Mathematics Methods Course

Jenni Harding-DeKam

Previously published in *NASGEm News: Notices of the North American Study Group on Ethnomathematics*, 2013: 6(1), 13-16.

Ethnomathematics helps children learn mathematics by incorporating real world connections building on authentic mathematics experiences brought from students' homes and cultures. Students will see mathematics in other contexts, subjects, and circumstances, allowing them to create meaningful understanding of mathematics. Ethnomathematics is a "broader view of how mathematics relates to the real world" (D'Ambrosio, 2002) that facilitates understanding of mathematics content, including specific connections to experiences outside of the classroom. The mathematics education course for prospective elementary teachers gives a platform to introduce ethnomathematics, discuss equity, and examine classroom resources.

Prospective elementary teachers evaluate ethnomathematics curricula for mathematics classroom lessons.

First, prospective elementary teachers watch a presentation explaining the Equity Principle (NCTM, 2000), equitable learning environment (Gutiérrez, 2008), classroom equity (Gutiérrez, Bay-Williams, & Kanold, 2008), ethnomathematics (D'Ambrosio, 2002), and how to gain home and cultural knowledge of your students. Then they explore Ron Eglash's Culturally Situated Design Tools website (**http://csdt.rpi.edu**) to consider ways that ethnomathematics might be used to teach math concepts with connections to Africans, African-Americans, Native Americans, Latinos, the Youth Subculture, etc.

Elementary preservice teachers use ethnomathematics resources to create a reference resource chart with websites, children's literature, and curriculum information.

These prospective teachers continue in an online discussion by answering the following questions and responding to their peers:

1. Why is equity important for mathematics in the (K-6) elementary classroom?
2. How can ethnomathematics be used in the (K-6) elementary classroom?

Their discussions are thoughtful, reflecting upon the mathematics teaching they are observing in their elementary school classrooms, how they might integrate equity and ethnomathematics (theory and practice) into their teaching, and connecting to the larger picture of mathematics content, standards, curriculum, etc.).

Next, the evaluation of classroom resources gives exemplars of how to teach ethnomathematics concepts in an elementary classroom. Here are images from resources the preservice teachers use (Irons et al., 1993).

Warps and Wefts

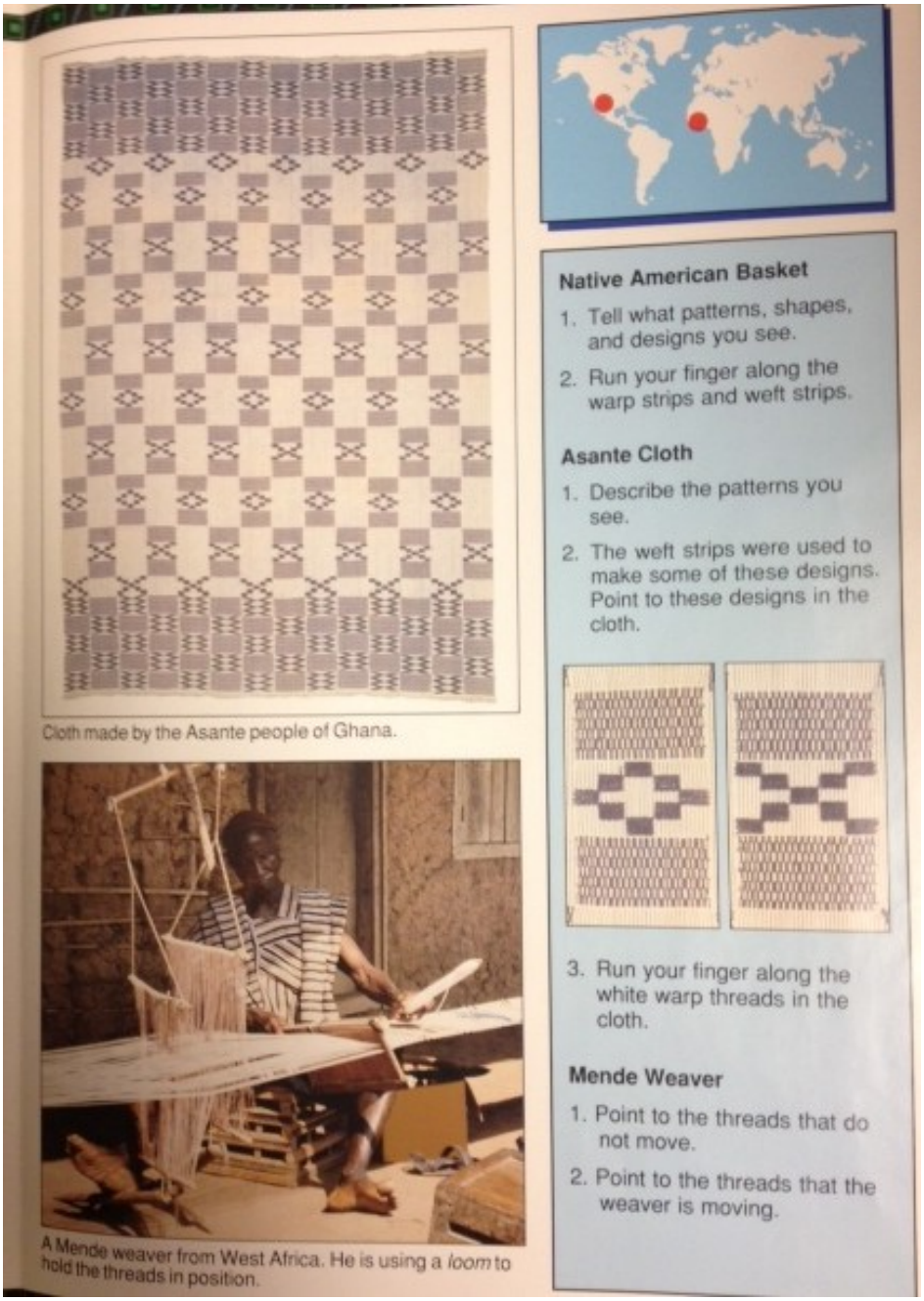
Weavers use patterns and designs in clothes, blankets, baskets, and bags. They use fibers made from yucca trees, bear grass, and corn husks, as well as wool and cotton.

This Native American weaver is making a basket with fiber from the yucca plant. To make the design, the weaver lays out *vertical* strips of yucca. *Horizontal* strips are woven over and under the vertical strips.

The finished Yucca basket.

A small piece of the basket. The white fibers are the vertical *warp* strips. The green fibers are the horizontal *weft* strips.

Weavers use patterns and designs, ethnomathematics in practice (Irons, et al, 1993).



Cloth made by the Asante people of Ghana.

A Mende weaver from West Africa. He is using a *loom* to hold the threads in position.

Native American Basket

1. Tell what patterns, shapes, and designs you see.
2. Run your finger along the warp strips and weft strips.

Asante Cloth

1. Describe the patterns you see.
2. The weft strips were used to make some of these designs. Point to these designs in the cloth.
3. Run your finger along the white warp threads in the cloth.

Mende Weaver

1. Point to the threads that do not move.
2. Point to the threads that the weaver is moving.

Native American baskets and cloth making to demonstrate mathematics (Irons, et al., 1993).

The prospective teachers analyze culture-rich curricula such as *Building a Fish Rack: Investigations into Proof, Properties, Perimeter, and Area* (Adams & Lipka, 2003) and *Mathematics from Many Cultures* (Irons, Burnett, Wong Hoo Foon, 1993). Next, they analyze children's mathematics literature books such as *Emeka's Gift: An African Counting Story* (Onyefulu, 1995), *Ten Little Rabbits* (Grossman & Long, 1991), *Grandfather Tang's Story: A Tale Told With Tangrams* (Tompert, 1990), *If the World Were a Village: A Book About the World's People* (Smith,

2011), and *Gabriela's Beautiful Carpet* (Thompson & Thompson, 2007). In pairs, these students use a cultural lens creating a chart of what the book is about, math concepts taught, ethnomathematics concepts taught, how equity is used, academic standards used, and overall thoughts. The charts are then shared with everyone in the course to create a reference resource list.

These course inquiry-based experiences contribute to a foundational understanding of what ethnomathematics is as well as how to teach using it in the elementary classroom.

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What exactly does it mean to 'Know the Right Answer'?

Thomas E. Gilsdorf

Let us start with a simple problem: Inez has six pennies and Sophia has five pennies. What it the total amount of money (in cents) that they have together? Please choose the right answer from below:

(a): 13.

(b): Many.

(c): This problem cannot be done.

Have you figured it out? We can look at each response to determine if it is correct or not. Starting with (a), let us consider how numbers are expressed. Most of us are used to the decimal system in which numbers are represented by powers of ten. Positive integers for example have the format

N= a1*100 + a2*101 + a3*102 + etc.

Usually we write the number in decreasing order of the powers of ten. For example, the number 645 is 6*102 + 4*101 + 5*100. Meanwhile, people who work in the area of computer science often express numbers using a different base, namely base eight. People of the Yuki culture, from what is now part of California also express numbers in base eight. The structure is the same as in decimal counting, but the base is different, so it goes like this:

N= a1*80 + a2*81 + a3*82 + etc.

Let us look at the number 13. In base ten it is 1*101 + 3*100. However in base eight thirteen is expressed as: 1*81 + 3*80, which amounts to 8 + 3 = 11. So, in the context of computer science or cultures like the Yuki, the expression "13" is correct.

Now let us examine the second response. In theSiriona culture of what is now part of Bolivia, the expressions for numbers are: komi which translate to 'one', yeremo which is 'two', yeremono for 'three', and any other value higher than three is expressed as eata which means 'many'. This means that in the context of the Siriona culture the response "many" is correct.

Finally, the third response. You probably already suspect something. It turns out that in traditional Inca culture (Urton, 1997), money is not counted. Thus, in the context of traditional Inca culture, the response "this problem cannot be done" is correct.

We conclude that, depending on the cultural context, every response to the problem above can be considered to be 'the Right Answer'.

We can step back and contemplate what this means. What we have just seen is that there is a cultural aspect to mathematics. People from different cultures and backgrounds understand, express, and interpret mathematics in distinct ways. Does this seem strange? If we think about the role of mathematics in any particular society, one aspect of it that is absolutely necessary is communication. Indeed, if a person finds a solution to an important problem, that solution only becomes useful to society when the person communicates the details of the problem and its solution to the rest of the community. Hence, mathematics includes an aspect of communication. Like language, another form of communication, people from distinct cultures and backgrounds express and interpret language in distinct ways. When we talk about ethnomathematics as a discipline, an essential part of it is the effort to understand how people from different cultures and backgrounds understand, express, and learn mathematics in distinct ways. Part of that understanding includes the realization that 'the Right Answer' can be very different for distinct cultures.

If we are going to study the mathematics of a culture that is different from our own, then one thing we will have to do is distinguish between our version of a 'Right Answer' and a possibly (very) different version of a 'Right Answer' in the other culture. That is to say, we need to distinguish between how we interpret mathematics and how mathematics is interpreted in the other culture. This is easier said than done because, while we want to understand the mathematical perspectives of the other culture, we would describe those perspectives from the point of view of our own culture- a culture that is different than the one we are studying. The thing is, cultural tendencies can be subtle, so distinguishing between cultures involves recognizing some cultural tendencies of our own culture. Assuming that 'our own culture' is Western culture, there are some cultural aspects of Western mathematics that we can identify, and hence, distinguish from other cultures. A brief description of four main aspects is next.

The first aspect is an emphasis on number and precision in Western mathematics. We really like to crunch numbers. Just page through a typical newspaper, and you will find many items described in terms of percentages, statistics, numerical trends, and so on. Not every culture has this same point of view. TheSiriona, for example, do not consider extensive counting to be culturally important. On the other hand, traditional Inca culture did include an emphasis on number (despite the part about not counting money). The Incas kept complicated, detailed information in numerical form on a system of knotted strings called quipus.

A second aspect is an assumption that the mathematics of other cultures will follow a path of development that is similar to how mathematics in Western culture has developed. Nevertheless, in many cultures, mathematics has been considered very differently than how it is in Western culture. We can cite the Siriona culture again, as an example. Concepts such as equations, theorems, complicated properties of numbers, and so on, do not appear in Siriona culture, yet the Siriona have survived for a long time without the need to develop such concepts.

A third aspect is writing. Much of modern Western mathematics is connected with writing, such as in expressing concepts with mathematical symbols. It is tempting to assume that other cultures must develop a system of writing in order to develop mathematics. This time we can look at the Incas as a

counterexample. The Incas did not develop any kind of expression that would be considered a system of writing, yet they developed sophisticated mathematical concepts by way of their quipus.

A fourth aspect has to do with gender. Until relatively recently, in Western culture activities typical of women have been excluded from the realm of mathematics. Consider the Russian mathematician Sofia Kovaleskaya (also referred to as Sonya Kovalesky) (1859-1891). Sofia was the first woman to be awarded a doctorate in mathematics, however, because of her gender she was not allowed to present her dissertation on her own. There are other cultures in which activities of women that involve mathematics are given importance. An example of such an activity is traditional weavers of cultures in the Andean region of South America. One of the cultures in this region is that of the Incas that we have been discussing. Urton (1997) made a careful study of weaving techniques done by female Inca weavers and found that the general process of weaving requires knowledge of concepts like symmetry as well as a skill of keeping track of complicated patterns of thread counts. Urton also found that Inca women who have attained a high level of expertise as traditional weavers are highly regarded in their communities for their skills.

There are many connections between culture and mathematics, even in Western culture. Here comes one more example. Take a look at the photo below and describe what you see:

Figure. 1: Photograph from inside a building. Photo © 2014, Thomas E. Gilsdorf.

As you have probably already figured out, it is a photograph of the inside of an elevator. The building in which I took the photo is in the Baltimore metropolitan area, so this is a piece of everyday culture in urban areas of the United States. Do you notice anything strange about it? Well yes, there is no number thirteen on the panel. Now, constructing a building of seventeen floors like this one is a very complicated process involving architects, engineers, city planners, building inspectors, and more, plus a lot of careful planning. Is it possible that after all that, someone miscounted the number of floors? Hardly! We can safely conclude that thirteenth floor was left out of the planning intentionally. Why? It's because in most of Western culture, the number thirteen is considered to be bad luck. This is a cultural aspect of mathematics!

If you find this discussion interesting, then you may want to read more about ethnomathematics (aka cultural mathematics). I have listed several good references below, by people like Marcia Ascher and Claudia Zaslavsky. Maybe you have probably already read some of them. I find the interplay between culture and mathematics to be fascinating, and that fascination was my motivation for writing the book listed in the references as well. Details and explanations of most of what you have read here can be found there. Perhaps you might find something interesting there, too.

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Please briefly describe any projects in which you are involved that may be related to ethnomathematics or mathematics and culture, more generally.