Big Math

Dani Alvarez-Gavela, Dave Auckly*, Bruce Bayly, Henry Fowler,
Damain Hunter, Dawnlei Hunter-Ben*, Kaybah Hoycott*, Matthias Kawski,
Kim Klinger-Logan, Shay Logan

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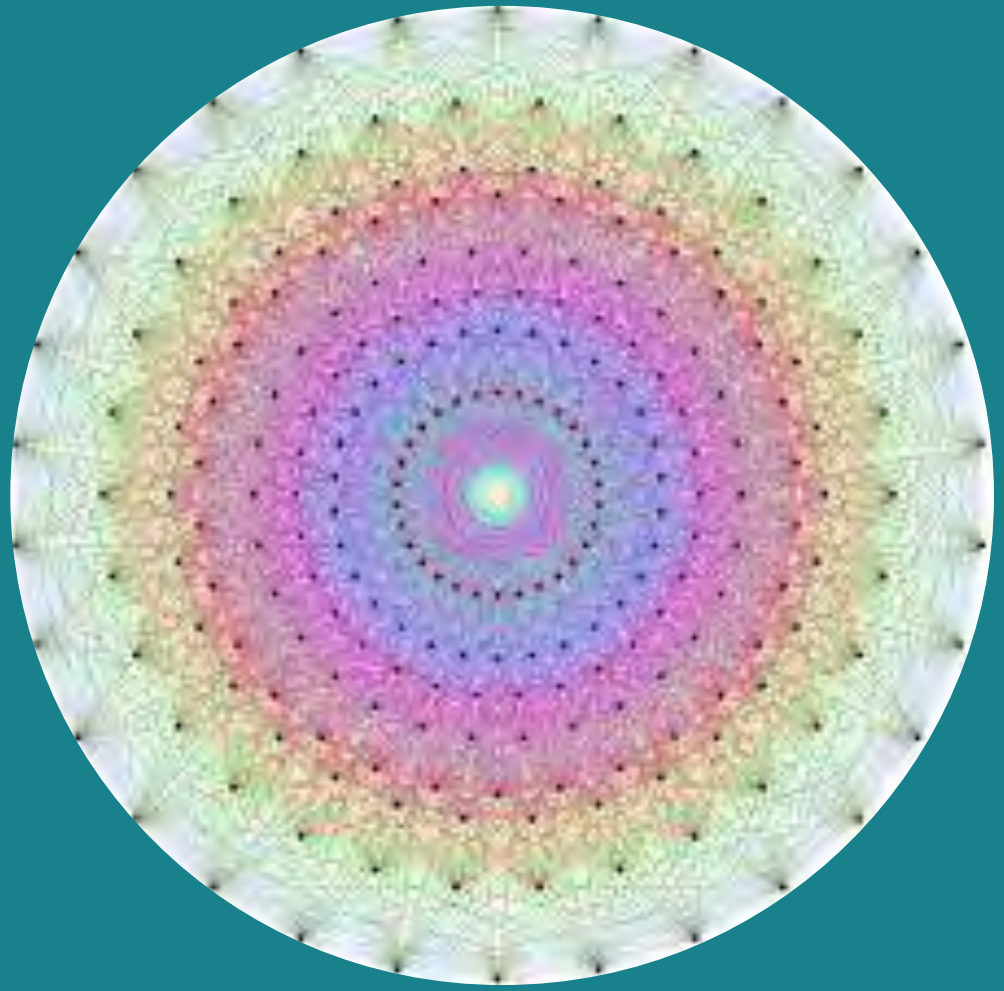
Some Connections



Proofs, Puzzles, and Patterns at the Flandrau Science Center

Glickenstein (2015) Bruce Bayly brought this to the

Rez in 2016.

Julia Robinson Mathematics Festivals

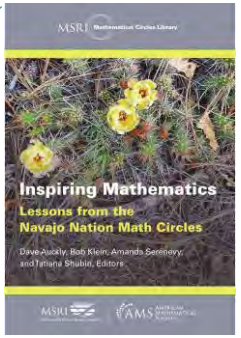
David Glickenstein PVC

Bruce Bayly Physics Bus

Circle on the Road 2010

Vector fields on balloons + …

Tatiana Shubin



Matthias Kawski
ASU Math Circle

NAVAJO NATION MATH CIRCLES
Naabeehó Bikéyah Dawóxta'ígíí bi názbaz

Trish Claw-Tsosie and a small rhombicosidodecahedron

Constructed using Zometools.

Hyperboloid of one sheet

- Inexpensive ($25.00)
- Demonstrate doubly ruled surfaces
- Demonstrate conic sections and Dandelin spheres
- Cats like them!

PVC Hyperbolic paraboloid z = xy

- **Financials:** two 10’ long sections of 1” PVC at $6.70 ea, two 90 deg corners at $1.60 ea, two 45 deg 3 way, corners at $1.80 ea, role of twine or cord $4.00. Total: $25.00
- **Easy to make:** just 2 sections of 10’ PVC, 2 corners, 2 three way 45 deg, and string.
- **Math:** This is a wonderful, geometric way to demonstrate why the product of two negative numbers is a positive number. Students do not often get to see a geometric model of the multiplication table. An off-center slice parallel to the plane y = x gives a nice geometric proof of the second derivative test.

Navajo Nation Math Circles

WHAT THE NNMC IS:
A math outreach program that serves 1,500 students and 250 teachers per year in the Navajo Nation. We like to hear, "I am Diné and I love math."

The program has been running since 2012 in an area the size of West Virginia in the American Southwest.

COMPONENTS:

For K-12 students
- After school math circles
- Math and engineering festivals
- 2-week summer camp

For teachers
- Regular workshops
- Mentoring throughout a school year
- Scripts and other materials

DIRECTORS AND CONTACT:
- David Auckly
- Henry Fowler

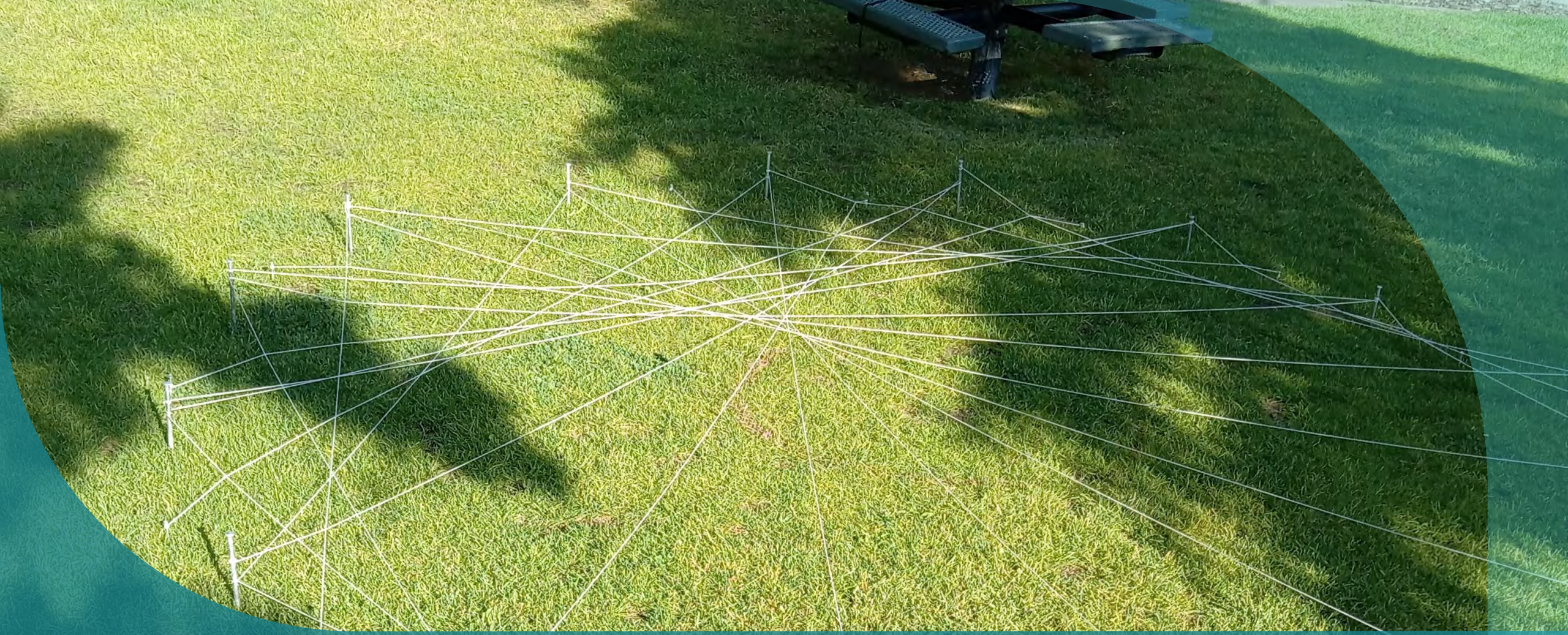
navajomath@gmail.com
https://navajomathcircles.org/

See The Documentary:
Navajo Math Circles
http://www.zalafilms.com/navajo/

Bruce Bayly Physics Bus

Dave Auckly – ruled surfaces in Many Farms

Bruce Bayly – in Ghana

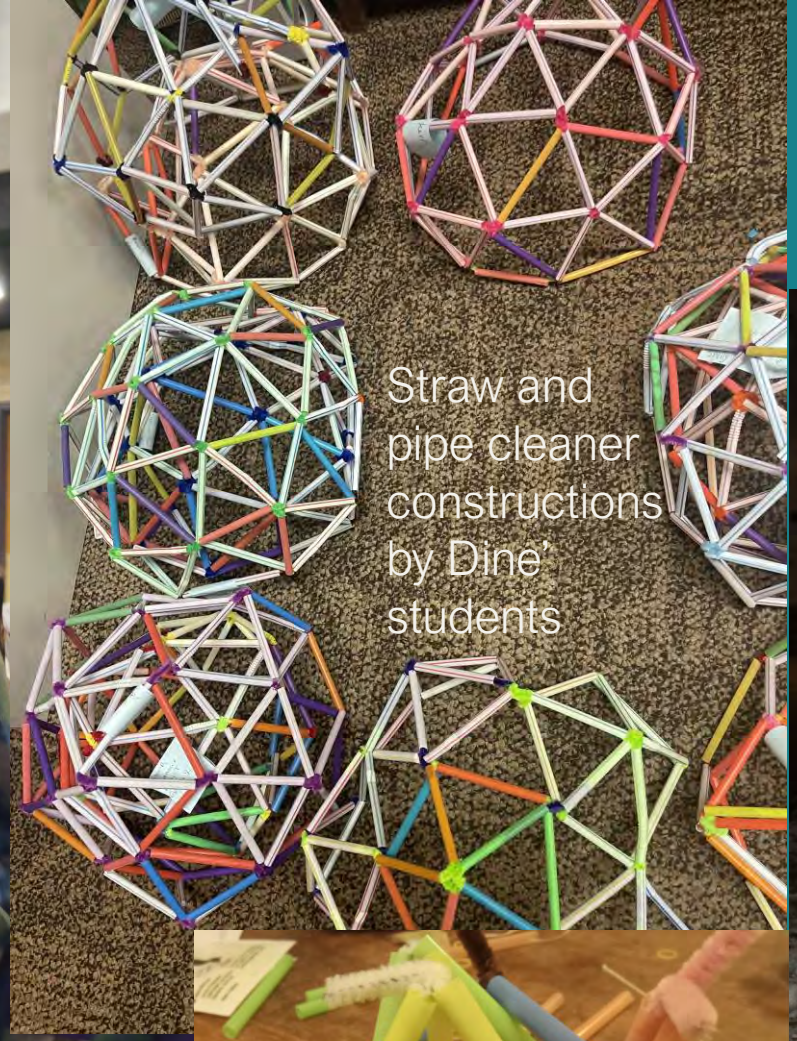


Big Caustic Heart

Shay Logan and friends Jumping Big Julia

Prototyping

Carson and straws thingy



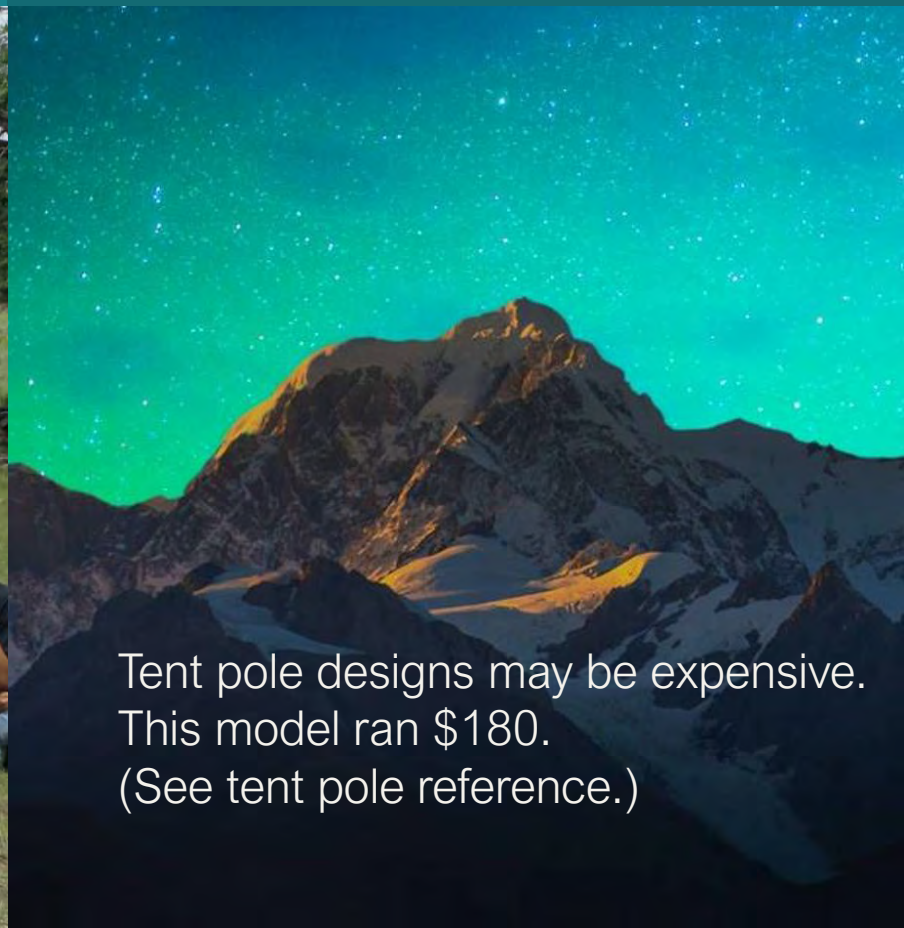
Straw and pipe cleaner constructions by Dine' students

Sharing in the community

The icosahedral group is isomorphic to A_5

Icosahedral compound of octahedra as a tent

CUSTOM TENT POLES TRAVEL AND SET UP QUICKLY. (DEPICTED IN THE CHUSKA MOUNTAINS OF THE NAVAJO NATION.)

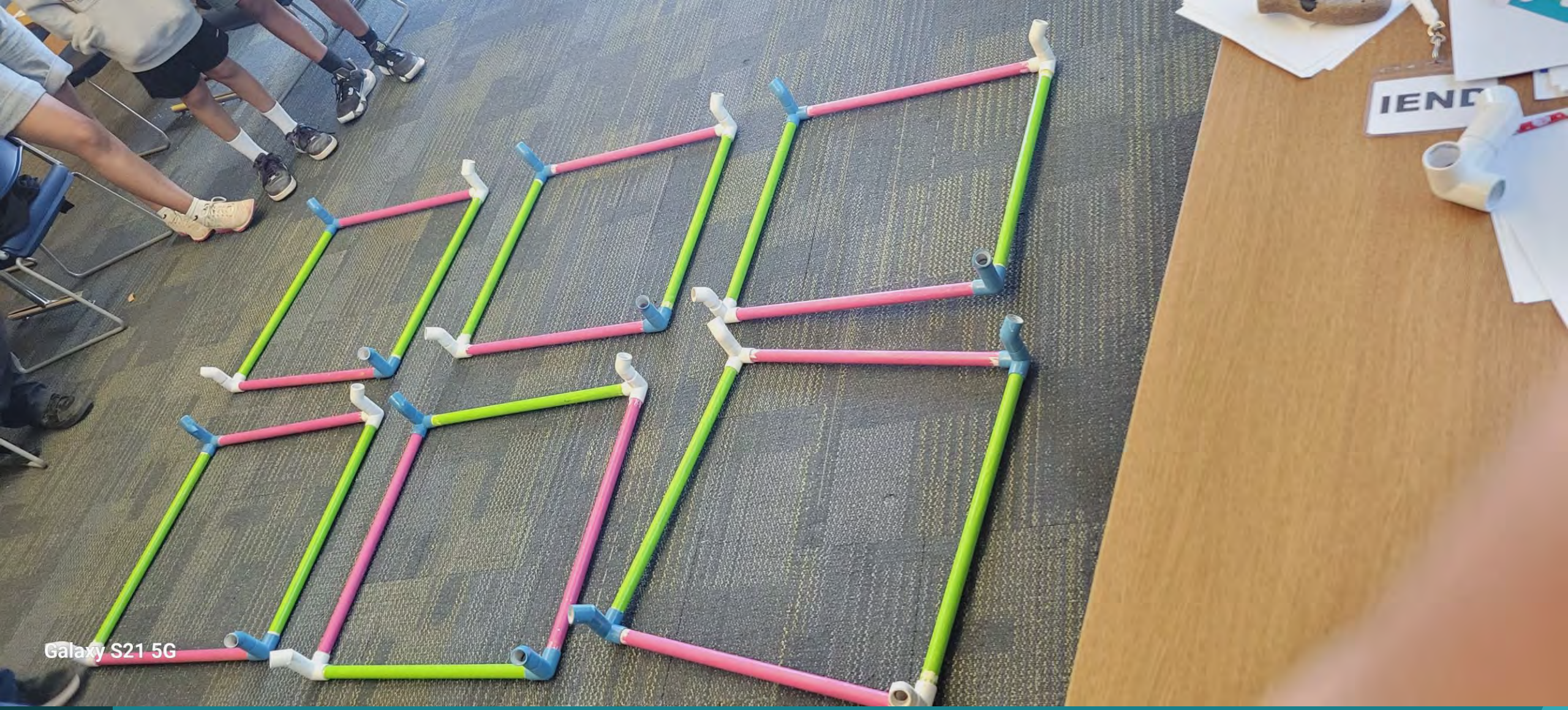


Tent pole designs may be expensive. This model ran $180. (See tent pole reference.)

Permutohedron

From a group to a shape

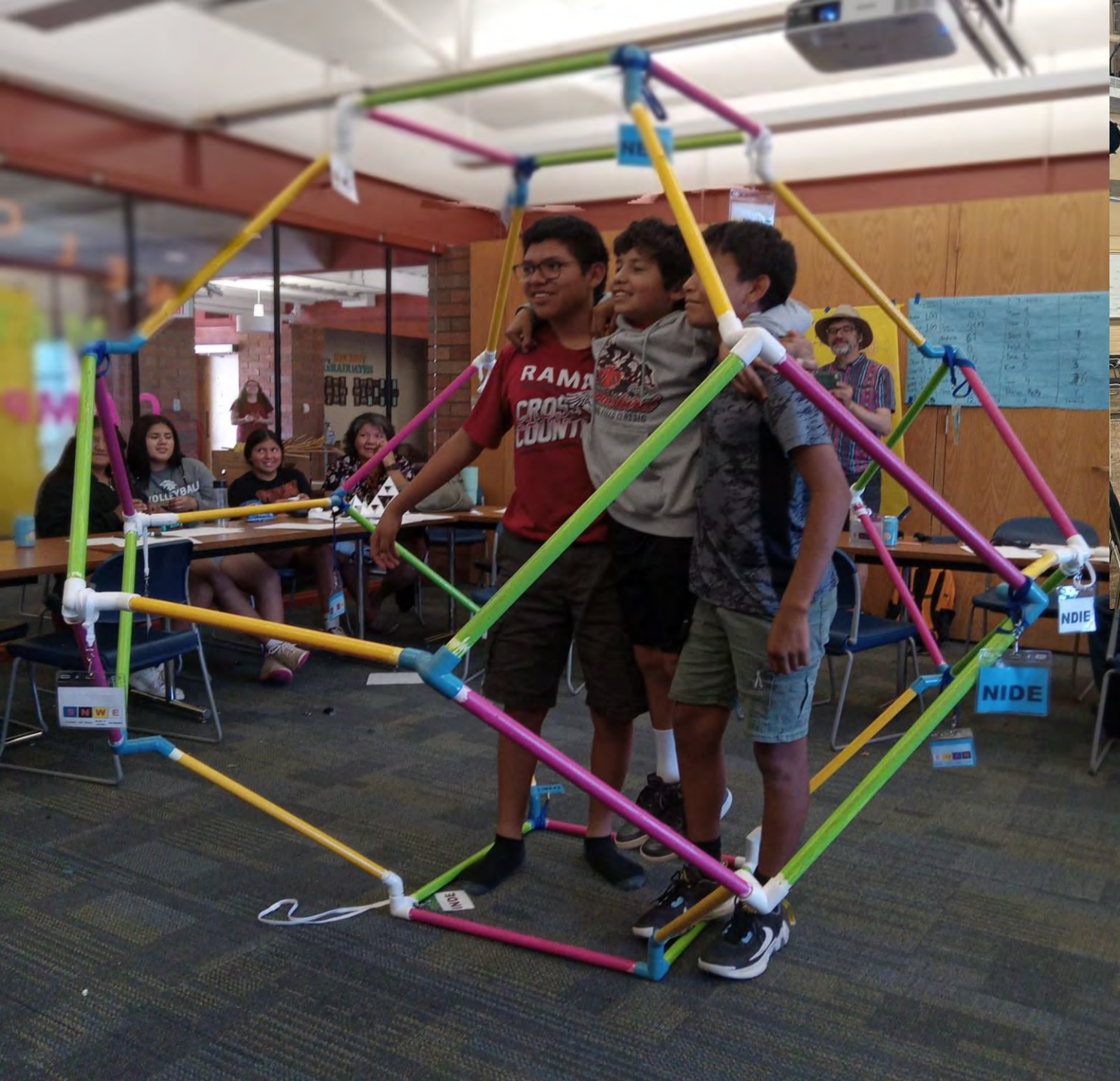
- One vertex for each element of the permutation group on 4 symbols.
- Connect two vertices precisely when the associated permutations are related by a transposition of adjacent elements.
- Color edges according to first, middle, or last transposion.
- Gives a geometric construction of the sign homomorphism.
- Is the Cayley graph of the group.
- The affine version of the group proves that the shape tiles space.



Commuting elements

One Big Thing

Matthias Kawski's Beautiful Model at
The Navajo Math Camp 2024



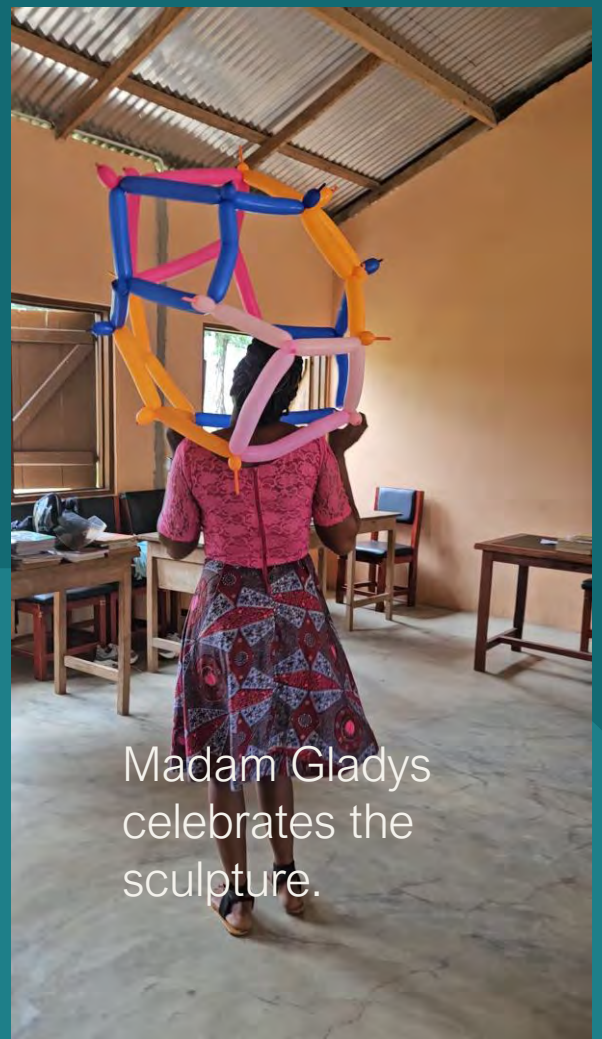
The inside view

Matthias

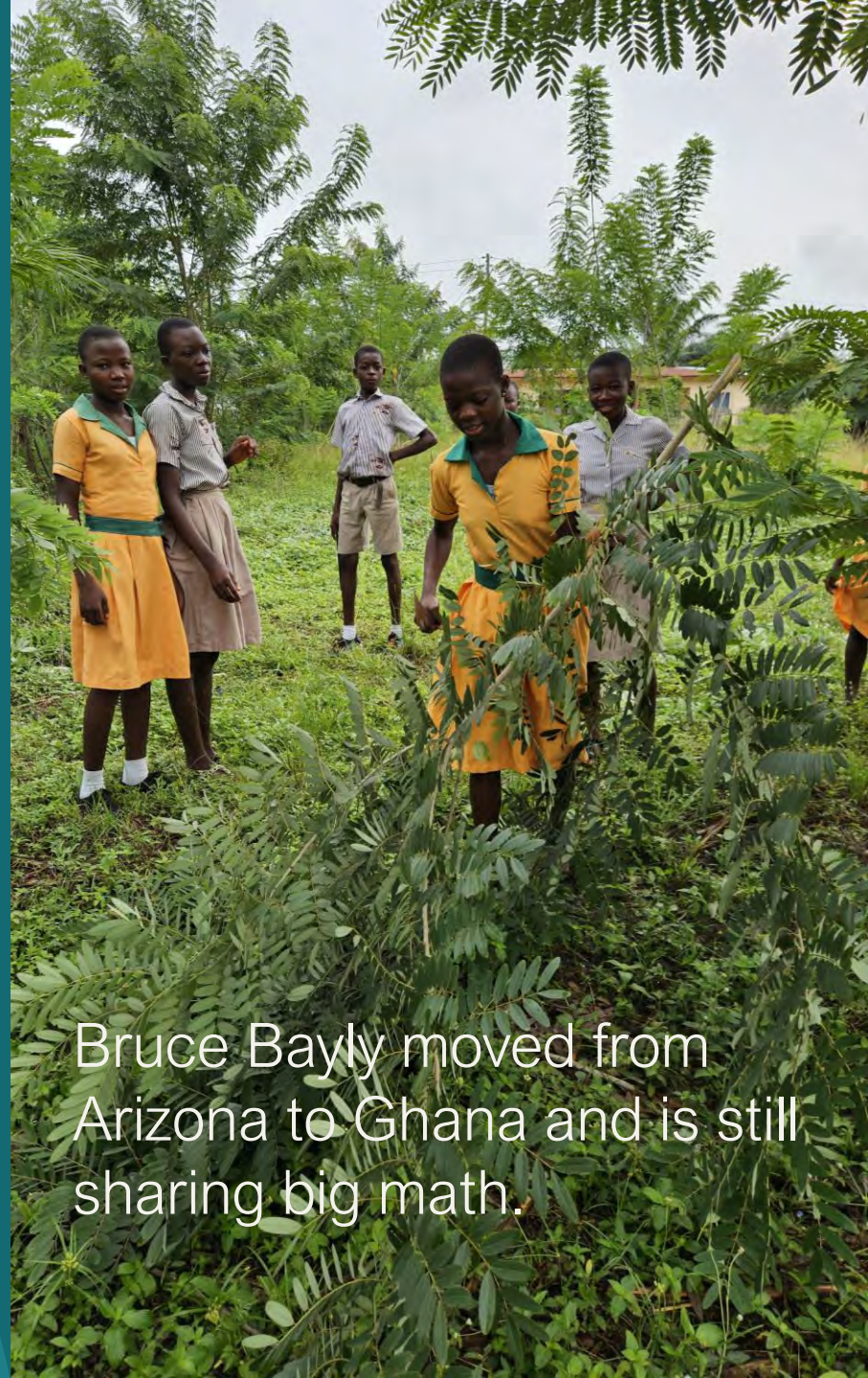
Prototyping in Ghana

Carrie Krenke trying bamboo kebab skewers, which folks in Ghana use a lot for chicken, goat, and even marinated tofu! We tied the ends together with sewing thread, and then dabbed on Elmers-type school glue to make vertices secure.

Collecting Branches, displaying the bamboo and balloon versions.



Madam Gladys celebrates the sculpture.



Bruce Bayly moved from Arizona to Ghana and is still sharing big math.

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Big Thought

physical embodiment, including physical action and the use of visual and other senses

is one of Tall's "Three Worlds of Mathematics."

Future Work

Mathemalchemy is going to Arizona for exhibition at the **Navajo Nation Museum**, and to collaborate with the **Navajo Nation Math Circles Project** on a Mathemalchemy-themed summer camp.

The Navajo Nation Math Circles Project's goal is to bring the highest quality mathematical outreach to students and teachers in the Navajo Nation. We are honored to be working together.

https://tinyurl.com/BigMathPVC

Bring Mathemalchemy
to the
Navajo Nation Museum