Beautiful Mathematical Indigenous Connections

Ear to the Ground features voices from several corners of the mathematics education world.

Jo Boaler and Donna Fernandez

We want to share new teaching resources for Indigenous art that is beautifully mathematical. Having students notice and wonder about this art can help them learn about mathematics, art, and Indigenous cultures.

In February 2023, I (Jo) was invited—along with youcubed cofounder Cathy Williams—to visit the Senpaq'cin School, a First Nations school in Canada, to work with teachers and students. We shared Indigenous artwork that we knew illustrated interesting mathematical concepts that students could recognize and discuss, such as geometric figures or algebraic functions.

First, we shared an image (Figure 1) and asked the students what they noticed and wondered, encouraging them to draw from their own experiences and cultures. The students said they saw a river, a laptop, a medicine wheel, and a room, as well as quadrilaterals and triangles. Some people might say that there are no triangles on the shape, but if we are to help students see the value of a mathematical lens in the world, it is important to take an "-ish" approach; we acknowledged that there were triangle-ish shapes on the dreamcatcher (Boaler, 2024). We then invited the students to "mathematize" the image (i.e., to use a mathematical lens to see what else they could identify in the artwork that was interestingly mathematical). Students decided to explore the triangles and find their area on the shape.

Figure 1 An Image of a Dreamcatcher

Our trip to the Senpaq'cin School was lovely, but I was even more pleased when a teacher contacted me a week later to share that she had extended the lesson, inviting students to design their own dreamcatchers and analyze the patterns and algebraic functions they produced (see Figures 2, 3, and 4).

STARTING A NETWORK

The event was so inspiring for us that it prompted us to ask our

youcubed newsletter subscribers if any of them wanted to join an initiative to help share additional Indigenous art. We now have a group of roughly 120 educators, all of whom work in Indigenous education and/or are Indigenous themselves. Donna (co-author) is one of our senior advisors and a member of the Pomo tribe in California.

Together we gathered four artists: Kanaka Maoli (Native Hawaiian), Bundjalung and Yorta Yorta of Anglo-Celtic ancestry (Aboriginal, Australia), and members of the Métis Nation (Canada) and Oklahoma Cherokee Nation (California). In a new section of the youcubed (n.d.) website (link online), we share the artists' work, in order to encourage teachers to have Indigenous mathematical conversations with students, asking them what they notice and wonder (see Figures 5 and 6). Other online resources include Indigenous mathematical art and questions to guide mathematical discussions (link online).

MAKING CONNECTIONS

I (Donna) was excited to hear about Jo and Cathy's mathematical experiences with students at Senpaq'cin School. This was familiar to our work at the Alliance of Indigenous Math Circles (link online). AIMC has inspired Indigenous students through enriching math problems at our annual Math Circles Summer Camp held at Navajo Preparatory School and through our newsletter, Bluebird Math Circle. I was thrilled to help lead youcubed's Indigenous Mathematics Educators Group. The group is passionate and joyful. This initiative has allowed teachers to increase the visibility of Indigenous knowledge through art and math.

Figure 2 Student Work Example

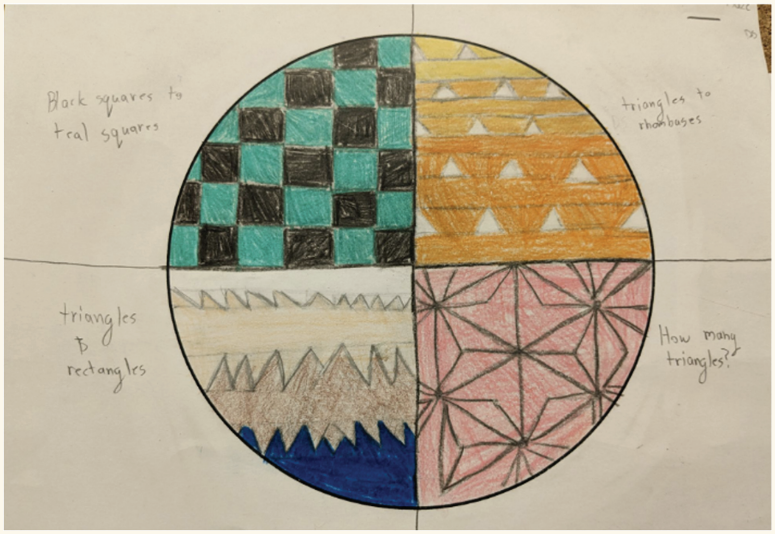


Figure 3 Student Work Exploring Hexagons to Triangles

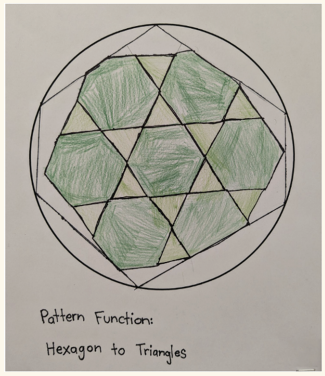
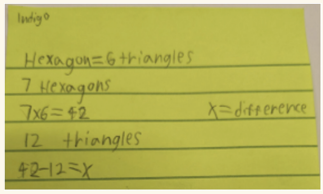


Figure 4 Student Work Exploring Algebraic Functions



Jo Boaler is a Stanford professor, a cofounder of youcubed.org and Struggly.com, and the author of *Mathematical Mindsets and Mathish: Finding Creativity, Diversity & Meaning in Mathematics*.

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As an Indigenous person teaching in a public school, I (Donna) was disappointed but not surprised that my students were not aware that Native Americans still exist in our community, nor did they know about our culture. I take pride in sharing my culture within my classroom, so it was special to launch the Indigenous Mathematical Art page on youcubed. Students heard the story about the art, and they were able to notice and wonder about the mathematics and culture within the art. Incorporating Indigenous art into mathematics classes expanded the students' views and knowledge of Native people.

Figure 5 Artwork From Aguenus (Angela Hall), Métis Nation Member of Cree and Stoney Ancestry, Living in Alberta, Canada

Figure 6 Artwork From John Balloue (Oklahoma Cherokee Nation), Living in California

A CALL TO ACTION

The Indigenous Mathematics Educators Group continues to meet quarterly to suggest more Indigenous art to be featured on the youcubed website, through a partnership between youcubed and AIMC. Visit us online to learn about group membership (link online). AIMC recently released the Bluebird Math Circle issue (#58), inviting students to explore mathematical ideas in the work of featured artist Angela Hall. The mathematical activities focus on geometrical ideas of similarities and scale factors. The mathematical art also features iterating functions to model growth as a sequence, fractal structures, and rotational and mirror symmetry, providing a bridge to numerical methods in calculus via dot art (link online). We invite all educators to explore the Indigenous art resources being developed through AIMC and youcubed and to introduce this beautiful mathematical approach to your students.

REFERENCES

Boaler, J. (2024). *Math-ish: Finding creativity, diversity and meaning in mathematics*. Harper Collins.

youcubed. (n.d.) *Indegenous mathematical art*. https://www.youcubed.org/resource/indigenous-maths-art/

