

CULTURALLY RESPONSIVE AND COGNITIVELY DEMANDING INFORMAL MATHEMATICS TASKS

organized by
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Workshop Summary

Organized in collaboration with the American Institute of Mathematics (AIM), this workshop is part of a broader effort to welcome multicultural learners in informal mathematics learning spaces by reforming pedagogical practices and curriculum, and designing safe, high-quality, out-of-school mathematics experiences that leverage youth’s cultural knowledge and assets.

The long-term goals of this workshop are to:

- (1) Build a solid community of educators and leaders in formal and informal mathematics education ecosystems, centered around a shared commitment to equitable and Culturally Responsive Teaching (CRT) of mathematics.
- (2) Co-create a framework for the design and implementation of culturally responsive and cognitively demanding informal mathematical investigations.
- (3) Together, generate diverse, high-quality, culturally-responsive and cognitively-demanding informal mathematics activities for out-of-school programs that engage culturally diverse learners.

The workshop is structured into two distinct parts, each occurring over three days in the summer. The first half of the workshop took place from June 30 to July 2, 2024; the second workshop is planned for summer 2025, tentatively on the same dates.

Participants.

Participants in the first workshop included: Aakriti Bish, Alessandra Pantano, Bahar Acu, Camilo Morales, Claudio Gomez-Gonzales, Cynthia Sanchez Tapia, Daniel Kline, Darius Frelis, Diana Cheng, Donna Fernan, Javier Haro, Joseph Ochiltree, Karl Zeiber, Khushbu Kshirsagar, Marcos Lopez, Mark Yu, Matthew Gherman, Naehee Kwun, Robin Wilson, Sara Rezvi, Sarah Cobb, Sarah Cobbt, Sharon Lanaghan, and Vanessa Cerrahoglu. All the participants worked actively together in a friendly and collaborative environment; they engaged in “playing” and designing culturally-responsive math activities, shared their experiences and expertise about culturally responsive pedagogy, and contributed their perspectives towards a shared understanding of how to generate culturally responsive and mathematically demanding curriculum for informal learning spaces. Interesting ideas came (indistinctly) from students, teachers and researchers.

Current projects.

The first workshop set the ground for a productive collaboration among participants. Participants were tasked with the design of informal mathematical tasks which met the

following characteristics: (1) have a low floor and a high ceiling, (2) leverage and strengthen youth’s cultural knowledge, (3) provide opportunities for responsive relationship-building, (3) connect youth with issues they care about, and (4) be joyful, engaging, and collaborative. Our teams initiated the following projects:

- **Papel Picado** by *Matthew Gherman, Camilo Morales, Marcos Lopez, and James Taylor*. Inspired by the Mexican folk art “Papel picado” (perforated paper made by cutting elaborate designs into sheets of tissue paper), this project explores the math of symmetries and paper folding.
- **Sona** by *Sharon Lanaghan, Joseph Ochiltree, Naehee Kwun, and Robin Wilson*. The Sona designs from Angola, Zambia, and the Democratic Republic of Congo are a particularly attractive form of “mirror curves,” which can be visualized as a curve drawn through a lattice of dots, bouncing off the edges of the lattice and off “mirror” placed between some of those dots. This project explores mathematical properties of Sona designs drawn as a single, uninterrupted line and the types of symmetry of these designs.
- **Together against bullying** by *Darius Frelix, Diana Cheng and Jasmine Gomez*. This project explores bullying through national or statewide statistics, and how students might address bullying in schools when they encounter it.
- **Art and Architecture** by *Sara Rezvi, Claudio Gomez-Gonzales and Bahar Acu*. This project incorporates cultural art and architecture to explore symmetry and proportions, as well as social uses of architecture (such as bringing people together).
- **Iterative Survey Design** by *Donna Fernandez, Karl Zeiber, Mark Yu, Eryn Maher and Vanessa Cerrahoglu*. In this project, students engage in survey design while they explore and learn statistics. To generate data, students ask questions to their peers about issues that concern them or they feel passionate about. The idea is for students to ask questions, use data representations to make sense of the answers they get from their peers, reflect on whether the answers give them the insights they hoped for, and create new questions that might give them access to additional/better information.
- **Kolam** by *Daniel Kline, Indira Vijaysimha, Sarah Cobb, Aakriti Bisht, Khushbu Kshirsagar, and Javier Haro*. Kolam is a form of art practiced by women and girls in South India. It consists of drawing intricate patterns on the floor with coloured powders. This project explores equivalences of Kolams; in particular, students explore what it means for two Kolams to be the “same” or to be “different.”

Future plans.

During the first part of this workshop we focused on (1) building the foundation for our community of practice, by getting to know each other and our motivations, (2) co-develop a shared understanding of Culturally Responsive Teaching and, (3) co-create examples of culturally-responsive and cognitively-demanding informal math activities, which we will further develop in future collaborations.

During the second part of this workshop (Summer 2025), we plan to

- Continue to grow our community of educators and leaders who are committed to CRT in informal mathematical learning spaces.
- Continue to create examples of culturally responsive informal math activities, and develop a parallel teaching guide for each of these activities.

- Develop guidelines for curriculum development that are aligned with CRT principles.
- Focus on pedagogical practices that fully activate the potential of our CRT curriculum.