

# Seeking out Math in Making Experiences

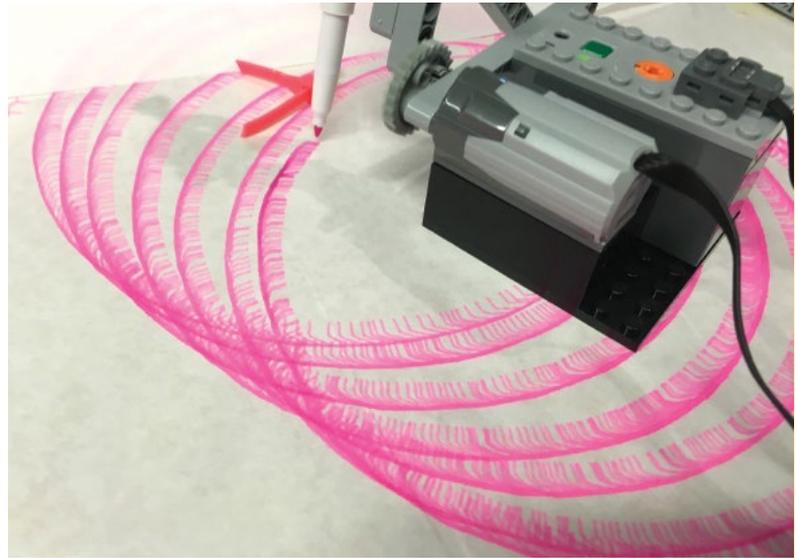
By Andee Rubin, Scott Pattison, and Tracey Wright

Negative attitudes about mathematics and the poor performance of U.S. adults and students on measures of mathematical reasoning are well-documented problems that limit many people's identities and career aspirations. At the same time, the last decade has seen a proliferation of out-of-school environments that foster making and tinkering activities. Enthusiastic participants in these activities are often engaging in mathematical reasoning without realizing it—and thus do not consider themselves competent mathematical thinkers. Is there a way we can leverage the popularity of making and tinkering to change people's conceptions of mathematics and their identities with respect to math? TERC and the Institute for Learning Innovation delved into this question by convening over 50 researchers and practitioners from out-of-school math and making settings at the New York Hall of Science, Queens, for two days in May 2016. Here are a few insights that emerged from the collective wisdom of participants in the (U.S.) National Science Foundation (NSF)-funded Math in the Making workshop ([mathinthemaking.terc.edu](http://mathinthemaking.terc.edu)):

**1. Broaden your idea of what counts as “mathematics.”**

There are challenges to identifying math in making environments. This is at least partially due to the limited view of “what counts” as mathematics that is built on school math. Math is much more than calculating with numbers: it includes thinking about space, functional relationships, and data, among other things. If you sharpen your “math eyes” and use them as you facilitate or design activities, you can support math reasoning in making environments.

**2. Explore the tension between authentic making and explicit math.** There is a perceived tension between the importance of highlighting math in making experiences and concerns about compromising essential qualities of making, such as creativity and self-direction. But math is



Math in the Making workshop participants designed Art Machines to create patterns, leaving traces of paths as data. Photo © Exploratorium, [www.exploratorium.edu](http://www.exploratorium.edu)

at the heart of many creative endeavors, such as designing origami figures or paper pop-up books. Mathematical reasoning is also a critical part of refining designs, based on data generated by testing processes. We need more opportunities to figure out the best ways to integrate important characteristics of math and making in a variety of settings.

- 3. Honor the math and making knowledge that exists in your communities.** Making is not a new activity, even though official “maker spaces” are a relatively recent phenomenon. Historically many communities have engaged in making activities out of necessity or as expressions of cultural identity. We need to be more inclusive about who is considered a maker and what knowledge—mathematical and otherwise—people can contribute.
- 4. Build opportunities for the math and making communities to collaborate.** When math and making communities first meet, as they did at the Math in the Making workshop, they may find their preconceived notions are challenged. They often discover deeply shared values and become energized about finding collaborative solutions to what seem to be intractable problems.
- 5. Develop concrete tools and resources.** Educators need specific examples of integrated math and making experiences. Case studies, facilitation strategies, and a research agenda are all part of our call to action as we advance the field's understanding of how to highlight and enhance mathematics in a variety of making experiences.

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