RECOMMENDATIONS FOR INTEGRATING MATHEMATICS INTO MAKING AND TINKERING EXPERIENCES

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Making, tinkering, and other informal design and engineering experiences offer rich opportunities to engage children and adults in mathematics and build mathematical skills, knowledge, and interests. But how can educators successfully integrate mathematics into these experiences?

One approach to answering this question is to better understand how children and adults engage with and think about mathematics outside of school, in every day and informal learning environments. As part of the NSF-funded *Math in the Making* project, Pattison, Rubin, and Wright (2016) synthesized the research on everyday and informal mathematics from the last several decades. The literature summary affirmed that children and adults regularly engage in mathematical thinking and reasoning outside of school. The summary also highlighted how this thinking often looks very different from classroom mathematics, is driven by different goals and motivations, and may go largely unrecognized as mathematical, by both educators and learners.

Building on these findings, below we outline a series of recommendations for educators interested in leveraging the unique characteristics of everyday and informal math in order to successfully integrate mathematics into making and tinkering experiences. These recommendations will hopefully serve as useful and practical guidance for educators, as well as a foundation for much-needed research on mathematics in designed informal learning environments.

RECOMMENDATIONS

- Educators and researchers should adopt a broad and inclusive perspective on mathematics and understand the unique and complex nature of mathematical thinking and learning outside of school.

- Educators working in making and tinkering environments should build on the unique, and often highly successful, characteristics of everyday mathematics. This might include supporting the range of pragmatic and individual goals pursued by different learners, providing tools and resources that allow for the natural integration of mathematical thinking into the experiences, celebrating and affording the flexible use of multiple mathematical strategies, and encouraging social interaction and facilitation.

- Because individuals do not often engage with mathematics for its own sake outside of school, educators working in making and tinkering environments should think carefully about how to design the goals, framing, structure, and resources of an experience so that mathematical thinking and reasoning are an integral and authentic component.

- Recognizing that many learners will enter making and tinkering experiences with a narrow perspective on what counts as mathematics, or even negative attitudes and memories about math, educators in these settings should carefully consider the trade-offs of highlighting the presence of the mathematics relative to the overarching goals of the program.

- Researchers should take advantage of the growing number of making and tinkering experiences to extend the limited literature on mathematical thinking and learning in designed informal learning environments. Moving beyond simply documenting evidence of mathematical thinking and learning, researchers should begin to identify and explain the processes underlying these experiences and test a variety of design strategies for supporting mathematical thinking and learning outside of school.

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