The Maker Movement and K-12 Education in California

The Maker Movement and Education

- **Community Investment:** Community centers and businesses are moving quickly to adopt the tenets of making, investing in spaces and tools in hopes of encouraging an innovation economy. Making has become a focus in education as well, from K-12 to higher education.
- **Anecdotal Support:** Educators often accept anecdotal evidence to support their intuition that making is a pathway for STEM learning, with claims of improved student understanding of STEM/STEAM concepts. Maker education is also argued to help students develop critical "21st century soft skills" such as critical thinking, communication, creativity, and collaboration. Educators also see direct alignment with newly-implemented standards such as the Next Generation Science Standards.
- **Nascent Research:** Rigorous academic studies analyzing assessment, efficacy, and best practices of maker-centered education have really only been published since 2014, although similar approaches, such as play-based learning, have established roots in Western pedagogy.

Challenges for Integrating Makerspaces into K-12 Education

- **Costs:** Investing in making as an educational practice requires a commitment of many resources, perhaps beyond what many K-12 schools may be able to muster. After the initial capital outlay required to build or establish and outfit a makerspace, operation costs (e.g. consumable materials, staff, programming) can be significant.
- **Strategy and Implementation:** Most importantly, the type of curriculum development, assessment, and actual instruction necessary to fully realize maker-based education is considerable. Even if focus is placed on adopting the pedagogy of making ("maker mindset") versus outfitting a physical makerspace, the time and attention required to thoughtfully incorporate making into the classroom can still pose significant challenges.

Trends in K-12 Maker Education in California

- **Growing Adoption:** Despite challenges and the lack of quantitative or rigorous studies, many K-12 schools are adopting making in various degrees. In California, an informal survey of K-12 educators found that half said they have a makerspace at their school already, and half of those who didn't said their school was planning one.
- **Questions to Pursue:** Looking forward, K-12 educators and students should actively connect with California's growing network of higher education makerspaces (in the California Community Colleges, University of California, and California State University systems, as well as many private universities). Additionally, a uniform, comprehensive approach to tracking maker education impact in K-12 systems is needed to ensure that makerspaces are a boon for student development, not just a drawdown of resources. Access and equity issues posed by makerspaces should also be considered. Finally, considering how widespread maker adoption is already, professional development opportunities for educators should be considered.

Glossary

- **Maker Movement:** A growing collection of people who embrace the "do-it-yourself" ethos. An influx of small-scale, faster-prototyping tools such as 3-D printing, and the growth in local and online communities of practice both contribute to the movement.
- **Making:** A class of activities focused on designing, modifying, or repurposing material objects, for playful or useful ends, with the end goal of producing a shareable artifact.
- **Makerspace:** A community workspace where people come together to create things. Makerspaces my focus on fields such as robotics, woodworking, sewing, programming, or any combination of these and other skills.
- **Maker Mindset:** The belief that the skills required to create a desired object can be developed, improved, or expanded as necessary. Characteristics include problem solving, critical thinking, inquiry, collaboration, curiosity, playfulness, responsibility, risk-taking, and optimism. Developing this mindset is increasingly the focus of maker-based education.

References

The following resources form the basis of this summary:

The Maker Movement and K-12 Education: Current Status and Opportunities for Engagement in California
Brie Lindsey and M. Daniel DeCillis. California Council on Science and Technology, December 2017.
ccst.us/publications/2017/2017K-12makers.php

A CCST Emerging Topics Report examining the opportunities and challenges for incorporating maker mindset and makerspaces in K-12 education in California.