

How to Draw Women into the Maker Movement

Taking Steps to Address Disparities in the Emerging Maker Movement



This brief reviews the research and provides insight into how California Community College Makerspaces and other Maker communities can take steps to be more inclusive and benefit from a diverse community of Makers.

Global excitement for Making is growing, with Maker spaces, fairs, and online and in-person communities emerging in California, across the country, and around the world. However, there are substantial disparities in who participates in these venues.

- Surveys show that over 80% of Makers are men, reflecting the same kind of gender imbalance found in most tech companies. This has significant implications for the kinds of ideas and inventions produced.
- Women more often describe their path into Making as through arts and crafts; men through the physical sciences and engineering.
- Women use terms like artist, designer, creator, or crafter; men with hobbyist, do-it-yourselfer, and builder.
- Female Makers are more often motivated by a desire to help others; men by a love of problem solving.

What is the Maker Movement?

The Maker Movement extends the do-it-yourself approach into technology, inviting people to create new devices and/or adapt existing ones to new purposes. It covers many disciplines, including scientists, engineers, programmers, artists, crafters, cooks, jewelers, musicians, metalworkers, designers, and woodworkers. It employs new technologies such as 3-D printers, lasers, computerized machine tools, and robots, using open-source programs and materials, with a focus on practical skills and products. And it embraces an interactive community, using settings such as Makerspaces, Fablabs, Techshops, and Maker Faires, along with more traditional community centers, libraries, museums, and schools.

Makerspaces Provide Essential Career Skills

The Maker movement also offers a promising new path into education and careers in science, technology, engineering, and mathematics (STEM). People come to Making with interests and inventions of their own, and learn sophisticated technical skills and STEM concepts to achieve their own goals. In this way, Making encourages STEM learning in an innovative, collaborative and motivated population.



tips

Based on a review of the literature on Makerspaces and how to build an inclusive Maker community, the tips in this document can help colleges and other organizations as they build Makerspaces.

An inclusive culture will attract people with a broad range of skills, experiences and view points. Together, they can create a collaborative Makerspace environment where everyone can learn, experiment and share.

By drawing more women into Making, Makerspaces can also encourage them to participate in various STEM fields.



Make Women Welcome: Proven Methods to Attract a Diverse Community

Broaden the Definition of Making

One of the ways that Making can bring more females into STEM fields is by allowing STEM learning to fluidly overlap with students' existing interests, skills, and goals. The innovative spirit, experimental process, and technical skills required to "Make" overlap with the kinds of abilities needed for STEM education. They also align with the movement from "STEM to STEAM," which adds an "A" for art to the focus on science, technology, engineering, and mathematics. These movements can complement and reinforce each other. Research suggests the following related strategies:

- **Encourage interdisciplinary education that bridges STEM fields** with arts, crafts, design, and other endeavors appealing to women.
- **Be led by women's existing interests.** Female Makers are likely to rank self-expression as important to their work. Find ways to foster this.
- **Develop multiple paths through which to apply new technologies.** Cluster projects by student interests rather than technologies, and design these across subjects.
- **Use familiar materials.** Students are more likely to be open to Making if they see things they're familiar with.
- **Encourage documentation of the design process.** This can include planning, sources of inspiration, brainstorming, overcoming obstacles, and describing the steps needed.
- **Allow for flexible learning and scheduling.** Avoid tightly scheduled and heavily sequenced course structures, where prerequisites may dominate and classes may be offered infrequently.

Offer Open-Ended, Versatile Instruction

Providing open-ended and versatile prompts allows students to combine their learning with their own interests, skills, knowledge and goals. Research shows that declining confidence is a central reason women leave STEM fields. The hands-on, self-directed nature of Making can combat this by providing ways for them to demonstrate their abilities through personally-relevant projects. Research suggests approaches that:

- **Provide a supportive tone.** Females in particular often benefit from open, playful, hands-on learning—designing, building, and modifying projects in an iterative process.
- **Design the Making environment to be social and inviting.** For example, have students sit facing each other to encourage the exchange of ideas and collaboration.
- **Provide smaller classes and accessible faculty.** Structure things so that students can more easily connect with teachers.
- **Design assignments around themes rather than specific tasks.** This engages students not only in solving problems, but in identifying problems, important to real-world innovation and design. Seek themes that tap students' existing interests and foster collaboration.
- **Emphasize a diversity of goals.** Maker products need to be durable, flexible, scalable, and useful. All these can be emphasized in designing classroom activities.
- **Design projects that allow for experimentation and growth.** Limit the setup required, and select prompts with both simple and complex solutions so students can move toward more sophisticated projects over time through an iterative process.
- **Encourage collaboration over competition.** Provide galleries and exhibitions rather than holding contests.
- **Use competency-based credit.** Let students move through material at their own pace, in their own style, giving credit not just for courses completed but via demonstrations of what they have learned, through projects, papers, presentations, and portfolios.



Emphasize the Human Benefits of Making

It is a common misconception that STEM learning is dry and esoteric. Many of the greatest innovations of our time are coming from STEM fields, and engaged women can help to steer those innovations toward solving issues important to them. To demonstrate how Making and STEM learning can be applicable to their interests, research suggests:

- **Seek to solve specific social problems.** For example, encourage students to address an issue in their own community.
- **Encourage students to launch projects of personal relevance.** For example, they might invent something they would like to have themselves.
- **Emphasize the versatility of the skills developed through Making and STEM.** There are many career opportunities opened by honing such skills. Provide examples.
- **Overcome stereotypes.** Combat the perception that women are less interested in Making. Common here is the misconception that Making is for “geeks” obsessed with technology for its own sake, rather than practical applications that can help others.

Build Inclusive Maker Communities

Research shows that connecting with others and incorporating mentor and mentee roles are important. To establish such connections, research suggests the following strategies:

- **Encourage meaningful social interaction.** Provide opportunities to share things Made. Encourage students to offer each other help and to work together. Model productive feedback and constructive criticism.
- **Recruit through approaches appealing to women.** Sponsor open events and “taster” sessions with a range of appeal. Provide someone to meet-and-greet attendees, and stay in touch with them prior to and following such events. Hold events at different venues, days, and times. Ask related local organizations to help raise awareness, and explore possible joint projects with them.
- **Create welcoming physical environments.** Make such spaces clean and comfortable, and free of gendered or otherwise potentially offensive decorations.
- **Incorporate practicing Makers as teachers.** They can illustrate concrete examples and useful applications of Making, translating broad concepts into meaningful specifics. Recruit them from a diversity of backgrounds and fields.
- **Encourage teachers to become mentors.** Where teacher and student interests match, teachers can play this role themselves.
- **Incorporate the Making philosophy into teaching.** Show the value of flexible environments, collaboration, iteration, and supporting individual interests.
- **Provide smaller classes and accessible faculty.** Structure things so that students can more easily connect with teachers.

Research shows female Makers are especially driven by a desire to help others, make a difference, solve social problems, and give.



Strong maker communities are inclusive of women and reflect the diverse demographics of the local community.



Community College Making Leads to STEM Careers

Strengthening women's interest in Making as they enter college can be a key to retaining them in STEM fields, as the transition from high school to college is a time when many lose confidence and disengage from STEM. The Maker movement invites students to come to learning with their own interests and goals. Offering this kind of individualized, self-directed learning in women's early college experiences can help to retain their interest in post-secondary education in general and STEM fields in particular.

Making also offers an appealing route into STEM learning for older adults returning to college. Here they can draw on the knowledge and skills they have developed through previous work and experience.

Community colleges are well positioned to take a lead in this new and growing field. They serve students at both these key points in time: the transition from high school to college (and work); and the transition from raising a family back to school and potential future work. For both, Making offers a valuable path into STEM learning, letting students build skills and products needed in our economy, based on their own interests, goals and creativity.

Research Paper: This brief was based on a research paper by Elizabeth Dayton, Ph.D. which elaborates on each of these themes, with a full bibliography. Access the full research paper at <http://cccspecialpopulations.org/Publications/DrawingWomenintotheMakerMovementALiteratureReview.pdf>

For more information and to download a copy of this brief, go to:

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