# Making and Mentors

## What It Takes to Make Them Better Together

**Linda Kekelis, Jean J. Ryoo, and Emily McLeod**

One way afterschool programs can create equitable learning opportunities in science, technology, engineering, and mathematics (STEM) is to build bridges between program participants and mentors from their local communities. To build meaningful connections that inspire and engage youth, mentors need to do more than simply come and talk about their job or lead an activity.

They need support to learn to be effective role models and facilitators with whom participants can find genuine connections. Our research-practice partnership, focused on an afterschool Making program for high school girls, reveals promising practices for supporting mentors in STEM-oriented making programs.

### Why Making?

*Making* as an educational approach holds promise both for introducing mentors into STEM programming and for showing girls new pathways into STEM (Wittemyer & Gill, 2014). With its merger of cutting-edge technol-

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ogy and traditional arts and crafts, Making can help girls learn about electronics, robotics, metalwork, woodwork, sewing, and many other fabrication techniques. It can also attract mentors who have both technical expertise and personal interest in the creative aspects of Making.

Making's collaborative culture and cross-disciplinary approach draw girls in and sustain their engagement (Girl Scouts Research Institute, 2016). Making also enables adults to support youth in creating projects that both are personally relevant and can have a positive impact on their local communities (Liston, Peterson, & Ragan, 2008; Mosatche, Matloff-Nieves, Kekelis, & Lawner, 2013). The chance to design a low-cost wheelchair from bicycle parts or build a newborn resuscitator from a household aquarium pump can motivate girls who might not otherwise have participated in STEM programs. At its best, Making moves beyond step-by-step projects to give young people autonomy in designing projects that are driven by their interests and that include aesthetic and playful qualities (Blikstein, 2013; Martin, 2015; Petrich, Wilkinson, & Bevan, 2013).

## Mentors in Afterschool and Making Programs

Mentors have been part of youth development for a long time, especially in programs for youth from low-income and underresourced communities. As afterschool programs have introduced STEM programming, they have brought in mentors as volunteers to design and lead STEM activities. Programs in which mentors help to close the STEM opportunity gap for students from lower-income families include Citizen Schools' use of AmeriCorps members and community volunteers to lead semester-long hands-on projects (Fabiano, Pearson, Reisner, & Williams, 2006). Another is US2020, in which city-based coalitions support mentors in afterschool programs for underserved and underrepresented youth (US2020, 2017).

Incorporating mentors into afterschool STEM programs has produced benefits for educators, mentors, and youth (Akiva, Povis, & Martinez, 2015; Groome & Rodriguez, 2014; McDaniel, Yarbrough, & Besnoy, 2015). For educators, working alongside mentors can increase their confidence in teaching STEM and using inquiry practices, increase access to ideas about innovations, and reveal the wide range of STEM career opportunities (Dolan, 2008). Mentors derive benefits that include increased confidence in their teaching skills, stronger communication skills, and opportunities to network with other scientists (Groome & Rodriguez, 2014; Science and Health Education Partnership, 2016).

But the benefits of STEM mentoring that matter most are the benefits for students. Mentors can help dispel young people's stereotypes about who can do STEM and what can result from STEM studies and careers (Dasgupta & Stout, 2014). They can support improvements in social, emotional, and behavioral domains (Karcher, 2005) and can offer academic and career guidance (Kekelis & Gomes, 2009). For youth who are first in their families to attend college or consider a career in STEM, guidance from mentors about classes, extracurricular activities, and support systems can make the difference between moving along a pathway and having to give up an aspiration (Cole & Blacknall, 2011).

The need for role models and mentors is especially important for girls. In a national study of female high school students, only 4 percent of those who were interested in pursuing STEM majors or careers had been encouraged to do so by mentors (National Research Center for College and University Admissions, 2014). For African-American and Latina girls, who often have fewer role models in STEM, the need is especially significant (Modi, Schoenberg, & Salmond, 2012). Mentors can show girls how technology and engineering can be personally meaningful and address needs in their communities (Kekelis & Joyce, 2014).

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Making programs follow in a long line of STEM programs that incorporate adult mentors to support youth. We celebrate the efforts of afterschool programs that introduce STEM mentors to participants, especially girls and those born into communities where

STEM professionals are not particularly accessible. However, it takes significant time to train afterschool mentors and support them to do the job well. Without adequate training and coaching, mentors not only will fail to inspire youth but can even discourage youth from engaging in STEM. This article's case studies illuminate promising practices that can set mentors up for successful partnerships with girls—or boys, for that matter—in afterschool Making programs.

## Techbridge Girls

Techbridge Girls has a 17-year history of delivering afterschool STEM programs to girls in underserved communities and of offering professional development to other organizations. Girls participate in afterschool programs, co-led by a Techbridge Girls program coordinator and a school teacher, once a week during the school year. Role models visit programs or host field trips in which they share personal experiences working in STEM, dispel stereotypes about STEM careers, facilitate hands-on activities, and provide academic and career guidance. These role models receive one to two hours of training before their visit.

In 2013, Techbridge Girls began to incorporate Making projects into its high school programs to make them more girl-driven and less prescriptive, moving from step-by-step "recipes" toward open-ended design projects. Program coordinators and teachers initially found that the projects were technically challenging and difficult to support. Several groups would be working simultaneously on projects that differed enormously, from self-zipping jackets to electricity-generating bicycles. Such projects required a different kind of support than staff felt prepared to offer.

Techbridge Girls addressed the challenge by bringing in mentors to serve as a sounding board for girls' ideas, reinforce STEM skills and knowledge, and provide insight into practices that are valued in the workplace. Mentors, who are chosen through an application and interview process, have included graduate students, teachers, environmental engineers, and designers at toy companies. After being trained, mentors join the Making program for a full semester, leading up to students' presentations at San Mateo's Maker Faire. Initially, Techbridge Girls was interested in mentors who could support and troubleshoot the technology of girls' projects. However, staff found that mentors who were not subject matter experts could still support technology-based learning while sharing professional skills such as how to plan a project, solve problems, and collaborate.

Mentors recruited for the high school Making program participate in a one-day professional development workshop. The first year we offered the training, it focused mostly on the technology the girls would use, introducing activities with Arduinos, an open-source electronics platform that can be programmed to control physical devices. We also spent some time on our standard role-model training content, such as how to talk to girls about work and personal experiences.

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After that first year, we realized that the mentor training needed to focus less on technology and more on the practice of mentoring: how to support projects without taking them over. The second year's training focused explicitly on the expectations for Making projects and the role of a mentor. We conducted a growth-mindset activity during which mentors practiced giving feedback to girls. We also shared tips for working with youth and presented a role-play that demonstrated the sometimes challenging experience of engaging girls in conversation. Throughout, we emphasized that, although mentors can support and coach participants, the girls should always be driving the work.

## Data Collection and Analysis

The learnings in this article come from a research-practice partnership between the Exploratorium and Techbridge Girls as part of a larger project called the California Tinkering Afterschool Network (Bevan et al., 2016; Ryoo & Kekelis, 2016). To address the gap between educators and researchers, we jointly negotiated research questions and explored ways of examining and analyzing data together toward co-creating articles and resources that can be relevant to everyday practice—key activities of research-practice partnerships as described

by Coburn, Penuel, and Geil (2013). Observation field notes, video, and interview data were collected at every two-hour program meeting during two school years. Researchers also accompanied girls to San Mateo Maker Faire. The data were regularly reviewed by the researcher-practitioner team to inform both the afterschool program and the research methods. Each year of the data collection, we followed 25 girls, of whom approximately 40 percent were White, 20 percent Asian/Pacific Islander, 20 percent Latina, 8 percent African American, and 12 percent multiethnic. The program had two mentors in 2013–2014 and six mentors in 2014–2015.

## Successes and Challenges in Supporting Mentors

Three cases of how mentors worked with Techbridge girls on their Making projects illustrate the challenges mentors face and how our training, particularly in the second year, helped to overcome those challenges. The first case illustrates a common mentorship challenge that the research-practice partnership worked through. The other two cases show mentors using strategies and approaches from the refined version of the mentor training in the second year. The second mentor focused on learning alongside the girls, rather than driving their projects. The third mentor built on what she learned in the training to show girls that she valued their ideas and to prioritize the girls' ideas over her own.

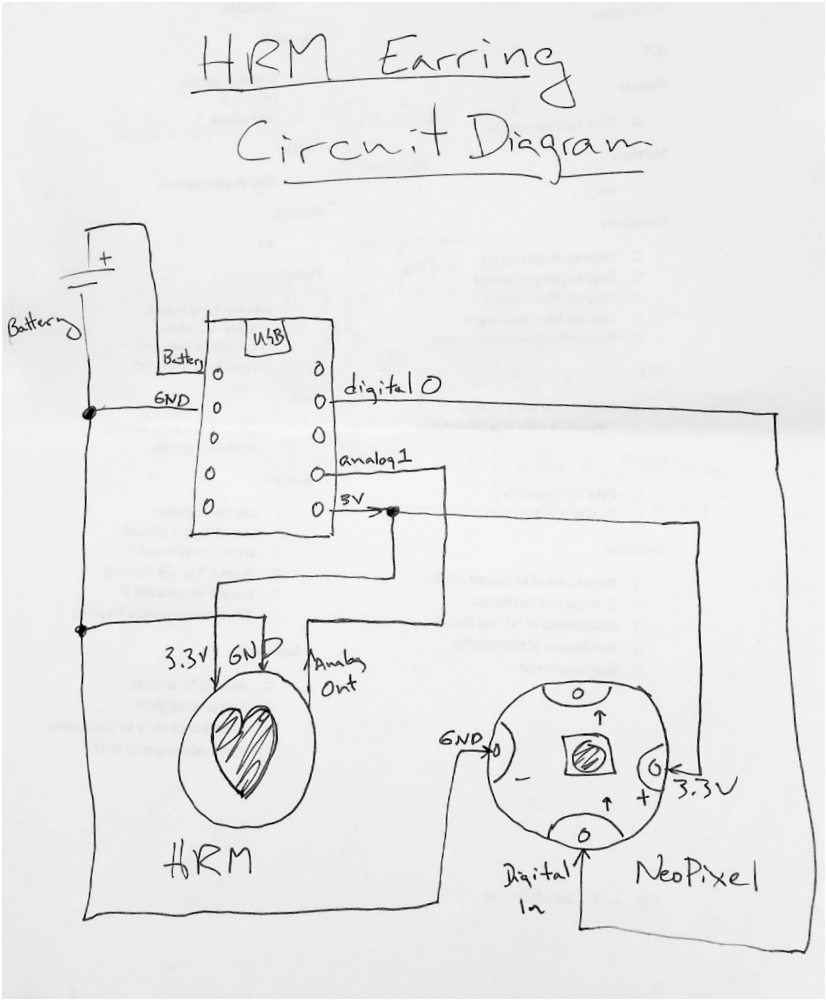


**Figure 1.** Circuitry diagram Casey drew for mentees

### *Case 1: Step In or Step Back?*

This first case describes the struggles of a mentor in the first year who, in a well-meaning effort to help a team of girls finish their project in time for the Maker Faire, ended up taking over the project. Mentor Casey worked with a pair of girls who wanted to create an earring with a heart-rate sensor, using an Arduino. The girls didn't understand how to build the circuitry, so Casey drew a diagram showing how it worked (Figure 1).

Researchers could not tell whether the girls understood the circuitry, because Casey proceeded to take the lead in both building and programming the earring. As Maker Faire approached, according to field notes, Casey became more hands-on to help the group finish in time. The week before the Maker Fair, Casey debugged the code alone, saying "*We* are fixing it," though both girls stood aside, fiddling with their earring pieces.

This vignette illustrates a common challenge for mentors in afterschool programs: knowing when to step in or step back. Casey had extensive knowledge of computer science with an ability to inspire interest in the field. However, when Casey took over the project, the girls disengaged from what had originally been their idea. Casey had the best of intentions: wanting the girls to feel accomplished because they had something to show at the Faire. However, Casey's methods did not support the girls' confidence and skill development. Stepping back

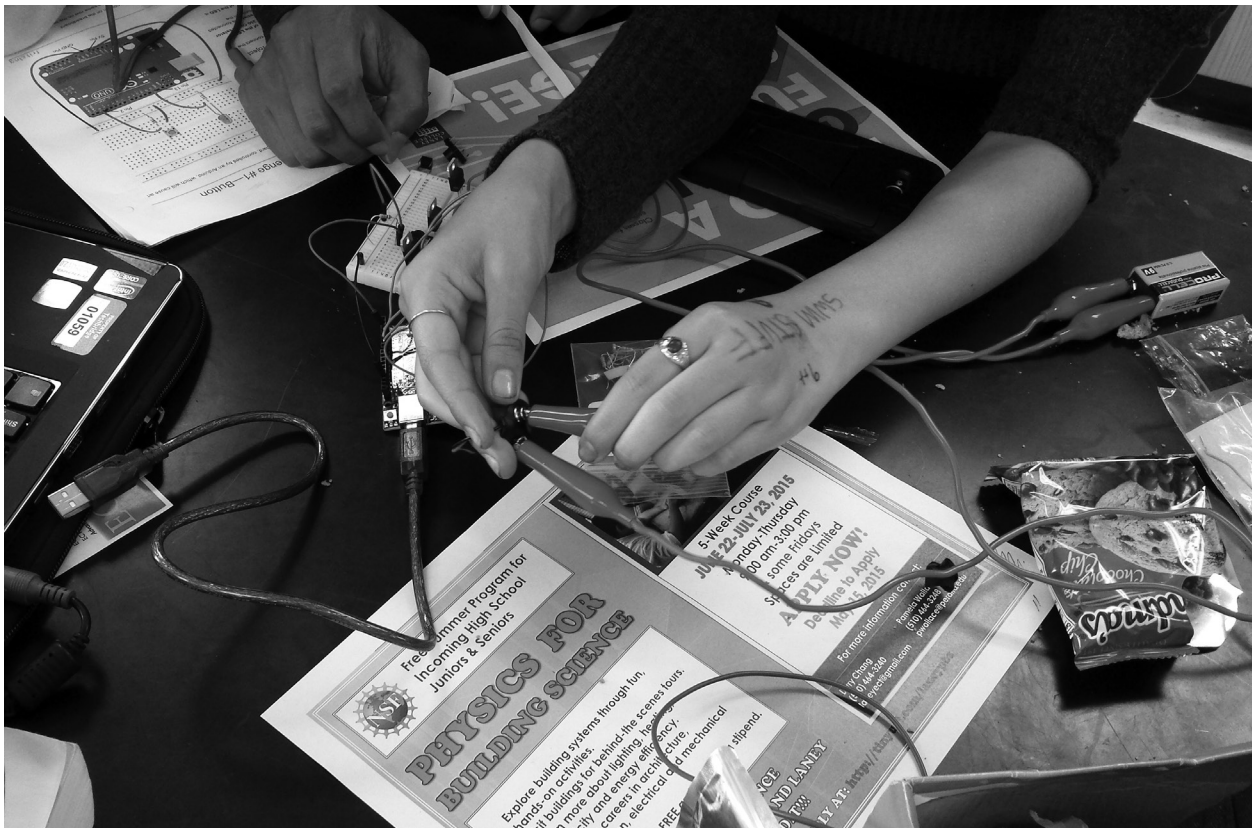


**Figure 2.** **Mentor-supported work with an Arduino**

gives youth the space to take risks, make mistakes, and learn how to work through setbacks—all important steps in personal development that are more valuable in the long run than making the perfect project.

Casey's struggle with stepping in versus stepping back made us, the researchers and educators, realize that we should have stepped in ourselves to help Casey be a more effective mentor. We never want mentors, who so generously volunteer their time, to feel that their efforts are unappreciated. However, we recognized that, going forward, we needed to set up communication measures, joint reflection time, and supports for mentors so they could excel.

### *Case 2: Learning Alongside*

Learning from our experience with Casey, the next year, we changed the training so incoming mentors would learn pedagogical practices and facilitation methods to support student learning without overstepping. Mentor training included conversations about how to support the girls in their project visions and nurture them through challenges. Roona took this professional development to heart, finding ways to approach her group as a fellow learner, while still modeling the expert practices she had to offer from her STEM background.

One day in April 2015, two Techbridge girls, Danay and Catarina, were trying to figure out how to control a strip of LED lights with an Arduino, with the eventual goal of adding the lights to clothing. They found an example of the circuitry and code online and planned to test them out. As they began, they noticed that they were missing the wires they needed. Roona quietly left and returned with the wires. As the girls built their circuit, Roona occasionally lent a hand: straightening wires, holding the Arduino steady, and pressing on wires so they didn't fall out. When the girls were confused by the complex wiring, Roona helped them align their physical Arduino with the one in the diagram, working alongside them to understand how the pins on the board aligned with the Arduino code. (See Figure 2.) She pointed out a misplaced wire and suggested useful tactics for organizing wires based on color and purpose, but she never took over the process. When the girls realized they had connected the wires to the wrong side of the board, Danay seemed ready to quit. Roona encouraged her, saying, "It's just a quick fix! Let's do it!" Danay smiled and kept going.

Roona approached the students as a fellow learner and supportive coach. She openly shared that circuitry was new to her, though she could easily have figured out the circuit diagram based on her STEM experience. She attended to the needs of the group, both big and small. Even as she offered practical help like retrieving materials, she also subtly demonstrated practices that are important in engineering work, such as paying attention to detail, prototyping and testing, and persevering in the face of setbacks. Roona's case showed us how a beginning mentor could take up the key idea of mentor training: that the role of the mentor is to support girls, be a curious co-learner, and offer feedback.

What the previous excerpt does not describe is that Danay and Catarina worked well together only when their third partner was not around. Catarina and the third girl were friends before Danay later joined the group. Roona was not the only learning facilitator who struggled to deal with the way the first two girls failed to welcome Danay. Roona's way of finding common ground by playing the role of friendly collaborator probably worked as well as any more authoritative approach. She showed the girls that people who are not necessarily friends nevertheless can work together effectively. Her experience suggested another way we could improve mentor support: providing opportunities, in trainings or regular check-ins, to discuss group dynamics with program coordinators and learn how to support collaboration.

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### *Case 3: Giving Space and Support*

Laura's case illustrates how mentors can empower girls to pursue their own ideas, subtly shifting out of the role of adult leader. During an observation in May 2015, Christine, Leslie, and Melissa were sitting at their table with Laura, trying to figure out where to put the distance sensors on the shoes they were designing for use by people with visual impairments. The shoes were supposed to vibrate to warn the wearer when they were within 10 feet of an object. To start off, Laura reminded the group that they had decided last week to put sensors on both shoes but weren't sure they had enough time. Leslie agreed, adding, "Yeah, and didn't we think that maybe we could have it be side to side instead of only at the front?" Melissa nodded, holding up a circuit board to represent a shoe and pointing to spots where sensors could be placed. But then Leslie said, "What I don't get is how it's going to help them avoid things in front." Laura stood up to physically demonstrate Melissa's point, showing how wearers might hold their shoe up and wave it side to side to address the lack of sensor at the front. She added gently, "Maybe, I don't know," as she sat down again.

The debate continued—one sensor or two? On the side or in front? When Leslie seemed confused, Laura affirmed her point and asked a follow-up question. The group finally decided to stick with one sensor—"It will be easier," noted Christine. Melissa asked, "So wait, do we need two motors? Or just one?" Laura and Leslie started to reply at the same time. Laura stopped herself. She and Leslie both tried to get the other to go first, which got the group laughing together. Laura again invited, "You go!" so then Leslie said she thought one motor attached to one sensor would be enough. Figure 3 shows the girls and their special shoes at the Maker Faire.

Laura served as an expert mentor who gave Techbridge girls the space to pursue their own ideas. While taking on the co-learner role Roona demonstrated in Case 2, Laura also engaged with the girls in subtle yet specific ways that pushed their work forward—but without taking over the process. She jumpstarted their work for the day with a reminder of what they discussed the previous week, supporting a sense of collaboration by describing previous decisions made by "the team." She demonstrated the girls' ideas about the sensors but didn't encourage them to think that her demonstration had to determine their design. When the girls shared reflections in a hesitant tone, Laura encouraged them by affirming the ideas in a way that pushed the conversation deeper.

Laura became deeply engaged as a partner in the project without being "the adult" who made the final decisions. This stance was demonstrated when Leslie and Laura started to speak at the same time, but Laura insisted that Leslie go first. This subtle move shifted power from the adult in the room to the girls. Laura gave the group the space to pursue their own ideas and solve their own problems, providing support but not instructions.

**Figure 3.** **Girls preparing to present their shoes for the visually impaired at Maker Faire**

## Promising Practices to Support Mentors in Making Programs

Our analysis of observations of Techbridge Girls yielded a series of promising practices that we have been applying to our own work and that can help others interested in building mentors into their Making and STEM programs. Though these promising practices come from a girls-only Making program, they can apply to any mentoring efforts, especially in programs for youth who are underrepresented in STEM.

### *Set Mentors Up for Success*

Casey's challenge is a common one for mentors and educators alike. Trainings in inquiry-based Making contexts should show mentors how to facilitate project work as advisers or helpers rather than doers. Programs should make the significant upfront commitment of time needed to help mentors understand the youths' needs and interests and learn the facilitation skills that support learning.

Because not all mentors have Casey's computer science background, our trainings also feature the kinds of technology, such as Arduinos, that girls are likely to use in their projects. Hands-on experience with their own Making projects can bolster mentors' confidence and give them firsthand knowledge of the challenges girls might face and how to support them.

### *Make Time for Ongoing Constructive Feedback*

Looking back on how Casey essentially took over his group's project, we realized that *we* should have stepped in to help Casey step back. Offering feedback to volunteer mentors can feel uncomfortable; educators don't want to seem unappreciative. We have found that prompts like "What can we do more of or less of to support you?" and "What did you find surprising or challenging today?" help to start conversations about areas for improvement. Making feedback an ongoing part of regular discussions can help mentors, educators, and researchers see this input as a gift intended to generate improvements rather than as a judgment. Staff need training on giving helpful feedback; they also need opportunities to talk about their reservations, to practice, and finally to debrief afterward.

### *Help Mentors Make Personal Connections*

Though mentors can be helpful in supporting activities, they can be even more important as role models. When

they come in to guide Making projects or host hands-on experiments, make sure that they are wearing their "mentor hats" and not just facilitating STEM activities. Personal stories of their own experiences and passions can help set the stage for real connections with youth. Program educators can help by showing new mentors exemplary personal stories from previous mentors. They can invite new recruits to practice telling their stories to friends, learning to avoid jargon and to include personal interests like hobbies. Mentors can look to their past experiences to offer academic guidance about how they found and explored their interests. Then they can build on these experiences to share local resources such as a summer Making program at a public library or an online computer science course.

A particular way in which mentors can make personal connections is by sharing their struggles and personal failures. For example, one of our mentors, a successful engineer, had kept her learning disability a secret from her colleagues. However, she realized the value of sharing her challenge with Techbridge participants. Her story resonated with many of the girls, especially one who had a learning disability herself. Another mentor talked about how she enrolled in too many difficult courses in her first year at college, against the counsel of her advisor. This mentor told students to learn from her mistakes and listen to advisors. When mentors talk about how they've learned from challenges, and especially when they share strategies for success in the STEM pathway, they can help youth understand the hardships that may come up in the future and how to deal with them. Mentor training can include brainstorming on developmentally appropriate ways to talk about challenges and to acknowledge legitimate feelings while empowering youth to seek solutions. This sharing can help youth understand that they, like their mentors, face hardships, but that challenges do not have to constrain them.

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### *Embrace Mentors with Diverse Knowledge and Skills*

Curious learners, no matter their STEM background, are the best mentors for Making projects. A willingness to learn is especially important because Making projects often incorporate many different STEM and non-STEM skills. For example, Roona had rich STEM experience, but not with Arduinos or Making projects. She was open with the girls about what she didn't know and showed a desire to learn alongside them. Roona helped us see how important it is to embrace the diverse backgrounds mentors bring to the table rather than choosing mentors based on content expertise alone. We have learned to help mentors become co-learners with youth. In training, we model open curiosity so that mentors can observe and try out an inquiry-based stance. We reinforce mentors during their interactions with students for using questions and observations to empower students' learning.

### *Seek Both Diversity and Shared Values*

Like most programs, we recruit mentors who share ethnic, cultural, and gender backgrounds with our youth. We understand how important it is for youth to see women, people of color, individuals with disabilities, immigrants, and people from other underrepresented groups working in STEM fields. To find mentors who reflect our program demographics, we partner with professional groups like the National Society of Black

## FOR MORE INFORMATION

- For details about our findings, as well as descriptions of student learning, afterschool facilitation, and professional learning in practice, read our full report at researchandpractice.org/resource/stem-making-in-afterschool/.
- Watch our three-minute video on the National Science Foundation Video Showcase of innovative work to improve science, math, engineering, and computer science education at stemforall2016.videohall.com/presentations/678.
- For information and resources on the California Tinkering Afterschool Network, visit www.exploratorium.edu/ctan.
- For more information about Techbridge Girls, visit www.techbridgegirls.org.

Engineers and Society of Hispanic Professional Engineers. Another way to introduce mentors who reflect the backgrounds of your students is to invite parents and siblings to show their Making expertise.

That said, our experience with Roona and Laura show how important it is to find mentors who believe in our educational philosophy and approach to learning. These mentors neither looked nor talked like the girls in their groups, yet they demonstrated the openness to learning and collaboration that the program needs to help the girls succeed.

### *Show Appreciation*

It sounds simple, but thoughtful expressions of thanks can have a profound impact on mentors. Thank-you's not only validate mentors for volunteering their time, but also acknowledge the impact they have on students. Program leaders can encourage staff to express their thanks regularly in personal and meaningful ways including specific examples of how the mentor helped. For example, a thank-you note can describe how the mentor helped a student discover a new career path or an interest in a technical field of study. Staff can also point out how they themselves have learned about STEM skills and careers from mentors and how they are incorporating these insights into their teaching. In addition, staff might encourage students to write their own notes of thanks. Receiving such notes will make the mentors feel great, and writing them will teach students to express appreciation, an art that will serve them well in their academic journeys.

## Looking Ahead

Making and mentoring are both at a crossroads. Both are scaling at a record pace, aspiring to reach considerably more youth and mentors than ever before. Each has potential for good; together, they can create a revolution in STEM learning.

Mentors can be especially helpful in bringing Making opportunities to groups underrepresented in STEM, including girls, youth of color, and students in under-resourced communities. Even when these young people choose *not* to pursue STEM careers, putting Making and mentors together has significant benefits. We've seen girls persevere through challenges in their design-and-build projects, learn to collaborate, and engage in critical problem solving—all with the support of mentors. These are essential educational and career skills in all fields, not just STEM.

As afterschool STEM and Making programs recruit more mentors, they need to devote adequate resources to mentor and staff training. Being an effective mentor is complicated. So is supporting Making projects. Put together, they can be challenging to do well. Both staff and mentors need training to work together while supporting youth to drive their own Making projects. This investment will empower mentors to feel more confident and to effectively engage and inspire youth.

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## References

Akiva, T., Povis, K. T., & Martinez, A. (2015). Bringing in the tech: Using outside expertise to enhance technology learning in youth programs. *Afterschool Matters, 22*, 45–53.

Bevan, B., Ryoo, J. J., Shea, M., Kekelis, L., Pooler, P., Green, E., Bulalacao, N., McLeod, E., Sandoval, J., & Hernandez, M. (2016). *Making as a strategy for afterschool STEM learning: Report from the California Tinkering Afterschool Network research-practice partnership*. San Francisco, CA: Exploratorium. Retrieved from https://www.exploratorium.edu/sites/default/files/pdfs/CTAN_Final_Report_Sept2016.pdf

Blikstein, P. (2013). Digital fabrication and "Making" in education: The democratization of invention. In J. Walter-Herrmann & C. Büching (Eds.), *FabLabs: Of machines, Makers, and inventors* (pp. 1–21). Bielefeld, Germany: Transcript Publishers.

Coburn, C. E., Penuel, W. R., & Geil, K. E. (2013). *Research-practice partnerships: A strategy for leveraging research for educational improvement in school districts.* Retrieved from http://rpp.wtgrantfoundation.org/library/uploads/2016/01/R-P-Partnerships-White-Paper-Jan-2013-Coburn-Penuel-Geil.pdf

Cole, A., & Blacknall, T. (2011). *The role of mentoring in college access and success*. Washington, DC: Institute for Higher Education Policy. Retrieved from http://www.wsac.wa.gov/sites/default/files/2014.ptw.(31).pdf

Dasgupta, N., & Stout, J. G. (2014). Girls and women in science, technology, engineering, and mathematics: STEMing the tide and broadening participation in STEM careers. *Policy Insights from the Behavioral and Brain Sciences*, *1*(1), 21–29.

Dolan, E. (2008). *Education outreach and public engagement*. New York, NY: Springer.

Fabiano, L., Pearson, L. M., Reisner, E. R., & Williams, I. J. (2006). *Preparing students in the middle grades to succeed in high school: Findings from Phase IV of the Citizen Schools evaluation*. Washington, DC: Policy Study Associates.

Girl Scouts Research Institute. (2016). *How Girl Scout STEM programs benefit girls*. New York, NY: Girl Scouts of the USA.

Groome, M., & Rodriguez, L. M. (2014). How to build a robot: Collaborating to strengthen STEM programming in a citywide system. *Afterschool Matters, 19*, 1–9.

Karcher, M. (2005). The effects of developmental mentoring and high school mentors' attendance on their younger mentees' self-esteem, social skills, and connectedness. *Psychology in the Schools, 42*(1), 65–77.

Kekelis, L., & Gomes, L. (2009). Bridging the engineering workforce gap through community outreach. *Journal – American Water Works Association*, *101*(8), 52–59.

Kekelis, L., & Joyce, J. (2014). How role models can make the difference for girls. *SWE Conference 2014*, 32–36.

Liston, C., Peterson, K., & Ragan, V. (2008). *Evaluating promising practices in informal science, technology, engineering, and mathematics (STEM) education for girls*. New York, NY: Girl Scouts of the USA.

Martin, L. (2015). The promise of the Maker movement for education. *Journal of Pre-College Engineering Education Research, 5*(1), 30–39.

McDaniel, S. C., Yarbrough, A., & Besnoy, K. (2015). Research-based practices in afterschool mentoring programs. *Afterschool Matters, 20*, 37–44.

Modi, K., Schoenberg, J., & Salmond, K. (2012). *Generation STEM: What girls say about science, technology, engineering, and math*. New York, NY: Girl Scouts of the USA.

Mosatche, H. S., Matloff-Nieves, S., Kekelis, L., & Lawner, E. K. (2013). Effective STEM programs for adolescent girls: Three approaches and many lessons learned. *Afterschool Matters*, *17,* 17–25.

National Research Center for College and University Admissions. (2014). *Women in STEM research: Findings from recent myCollegeOptions® college planning study*. Retrieved from https://www.nrccua.org/cms/press-room/2014/39/Women-in-STEM-Research-Gender-Gap-in-STEM-Majors-Career-Interests

Petrich, M., Wilkinson, K., & Bevan, B. (2013). It looks like fun, but are they learning? In M. Honey & D. Kanter (Eds.), *Design, make, play: Growing the next generation of STEM innovators* (pp. 50–70). New York, NY: Routledge.

Ryoo, J. J., & Kekelis, L. (2016). *STEM-rich and equitable Making: Lessons from a museum-based research-practice partnership*. Retrieved from http://www.exploratorium.edu/sites/default/files/pdfs/2016_JulyAug_Dimensions_RyooKekelis.pdf

Science and Health Education Partnership, University of California, San Francisco. (2016). *Outcomes*. Retrieved from http://biochemistry2.ucsf.edu/programs/sep/about-sep-outcomes.html

US2020. (2017). *The impact on the STEM mentor: Company-supported, skills-based volunteerism*. Retrieved from https://us2020.org/sites/default/files/stemmentoring/Impact%20on%20the%20STEM%20Mentor.pdf

Wittemyer, R., & Gill, K. (2014). *MakeHers report: Engaging girls and women in technology through Making, creating, and inventing*. Santa Clara, CA: Intel.