

Volunteers Can Do It!

Preparing Non-STEM Volunteers to Inspire Girls in Engineering: Lessons from *Engineer Your Journey*, a Techbridge-Girl Scouts Collaboration

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What We Know

Jobs in science, technology, engineering, and math (STEM) fields are growing three times faster than non-STEM jobs,¹ and STEM occupation wages are 26 percent higher than non-STEM occupation wages.² However, women are not benefiting from this, given that they hold fewer than 25 percent of the STEM jobs. And while they hold almost 60 percent of bachelor's degrees, women hold fewer than 20 percent of computer science, engineering, and physics degrees.³ Additionally, while three-quarters of high school girls across the country are interested in STEM fields and subjects,⁴ there are still persistent barriers to getting more girls into the engineering education and employment pipeline.⁵

“Even among STEM-interested girls, only 32 percent aspire to engineering; however, engineering is a field that allows girls to actualize their dreams of making a difference, collaborating, and helping people, all while making a great salary.”

—Thea Sahr, M.Ed., Director of Programs, National Engineers Week Foundation

Why doesn't STEM interest translate into involvement in engineering education and careers? Research shows there are many factors contributing to the disconnect between girls' interest in STEM and their involvement in STEM education and careers. Girls, who generally start losing interest in math and science in the middle school years, are often interested in careers in which they can help others and make the world a better place, and they may not draw connections between STEM engineering careers and their personal career interests.⁶ Additionally, because of the lack of representation of women in STEM education and careers, there is a lack of female STEM role models and persistent gender stereotypes that further impede girls' pursuit of engineering and technology careers.

¹ Department of Commerce, 2012

² Department of Commerce, 2011

³ National Girls Collaborative Project, 2015

⁴ [Generation STEM, 2012](#)

⁵ National Girls Collaborative Project, 2015

⁶ [Generation STEM, 2012](#)

“Girls who are interested in STEM have had greater exposure to STEM fields than girls who are not interested in STEM. STEM girls were more likely to have done hands-on science activities, gone to science/tech museums, and engaged in an extracurricular STEM activity.”

—*Girl Scout Research Institute, Generation STEM: What Girls Say about Science, Technology, Engineering, and Math, 2012*

What can organizations with out-of-school involvement do to inspire girls in engineering? Programs run by youth-serving organizations in out-of-school-time (OST) settings play an important role in providing STEM exposure and learning, especially when the programs involve hands-on science and engineering practices.⁷ These programs allow youth to experiment, fail, and redesign and find solutions to problems in a supportive peer and mentoring environment—aspects essential to participation in STEM fields and careers.⁸

[Girl Scouts](#) and [Techbridge](#) are two organizations that, combined, provide access to STEM programming to 2 million girls.

For more than 100 years, Girl Scouts has given girls opportunities to explore the natural world, from learning to tell time by the stars to doing environmental stewardship projects, and to learn about cutting-edge technology, from earning the Electrician badge in the early 1900s to earning today's Entertainment Technology badge. No matter the topic, Girl Scouts helps girls develop a sense of curiosity and the belief that they can do anything, both of which are key to nurturing an interest in STEM.

Through [Girl Scout National Leadership Journeys](#) and the pursuit of skill-based badges, girls engage in the Girl Scout Leadership Experience, a collection of activities and experiences that allow them to **Discover, Connect, and Take Action** to make the world a better place. Guided by supportive adults and peers, Girl Scouts engage in age-appropriate activities that are girl led, cooperative, and hands-on.

⁷ Afterschool Alliance, 2015

⁸ Afterschool Alliance, 2015

GIRL SCOUT LEADERSHIP EXPERIENCE



DISCOVER: Find out who you are, what you care about, and what your talents are.



CONNECT: Collaborate with other people to make a difference in the world.

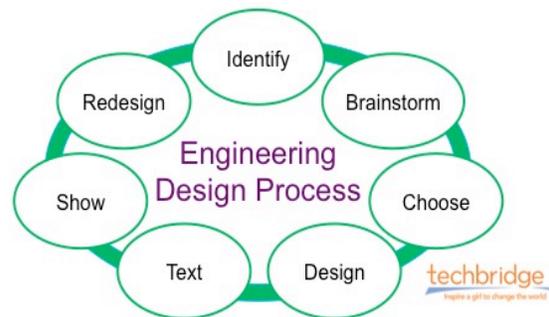


TAKE ACTION: Do something to make the world a better place

Techbridge, a national nonprofit specializing in afterschool science and engineering experiences for girls, is a leader in supporting STEM role models, educators, and volunteers as they bring hands-on learning opportunities to youth. To advance the parallel goals of the two organizations and expand the reach of STEM programming for girls, Girl Scouts and Techbridge partnered to create and implement a blended OST engineering program, *Engineer Your Journey*.

What We Did

In 2013, Techbridge and Girl Scouts of the USA, with funding from the Noyce Foundation, worked together to develop and pilot a blended engineering and leadership program for girls titled *Engineer Your Journey*. The blended approach included age-specific how-to manuals ([*Engineer Your Journey Planners*](#)), volunteer



training, and material kits, giving volunteers the tools to provide girls with hands-on engineering and leadership experiences (“Girls Go Techbridge” activities and Girl Scout Journey experiences) in the context of the Engineering Design Process (an iterative problem-solving process highlighted in every *Engineer Your Journey* session). The aim was to help girls develop critical-thinking and problem-solving skills.

The program was piloted at five Girl Scout councils and involved more than 90 Girl Scout volunteers with little to no STEM experience; they reached more than 550 girls in grades 4 through 12 over ten months.

Volunteer training. Prior to initiating the program with girls, volunteers received a half day of in-person training that covered three of Techbridge's core professional development modules for effective STEM activity facilitation: giving growth-mindset-based, skill-specific feedback; guiding an inquiry-framed activity; and making career connections. Additionally, volunteers learned about key engineering messaging and concepts, practiced hands-on engineering activities, and were given links to Techbridge's instructive YouTube videos for each hands-on activity. Training also emphasized that volunteers could embrace the Engineering Design Process themselves by experimenting alongside their girls and that any failures were opportunities to redesign.

While the pilot initially planned for, and attempted to provide, all volunteers with in-person training by Techbridge, in some instances Girl Scout council staff provided the training. To support this real-time shift in the pilot, Techbridge provided councils with age-level-specific recorded training webinars accessible through DropBox for use with volunteers.

Development of an *Engineer Your Journey* community. In addition to training, the *Engineer Your Journey* pilot provided ongoing support and networking opportunities for the participating councils. Girl Scouts and Techbridge held biweekly, council-specific, and quarterly all-council conference calls with the *Engineer Your Journey* pilot councils; created a social media group on Facebook for councils to share ideas and tips; and hosted a three-day Spotlight on STEM conference with national STEM leaders and staff from more than 45 Girl Scout councils that are implementing STEM programming.

Female STEM role models. During the training, volunteers were coached to make STEM connections in their communities through personal contacts or their Girl Scout councils. Volunteers also received manuals, and online resources helped them tap into their communities' STEM networks to initiate fruitful role model visits. For example, they were given the link to the Role Models Matter project (www.techbridgegirls.org/rolemodelsmatter) where they could find a sample communications plan for inviting and thanking role models, and sample interview questions their girls could ask role models.

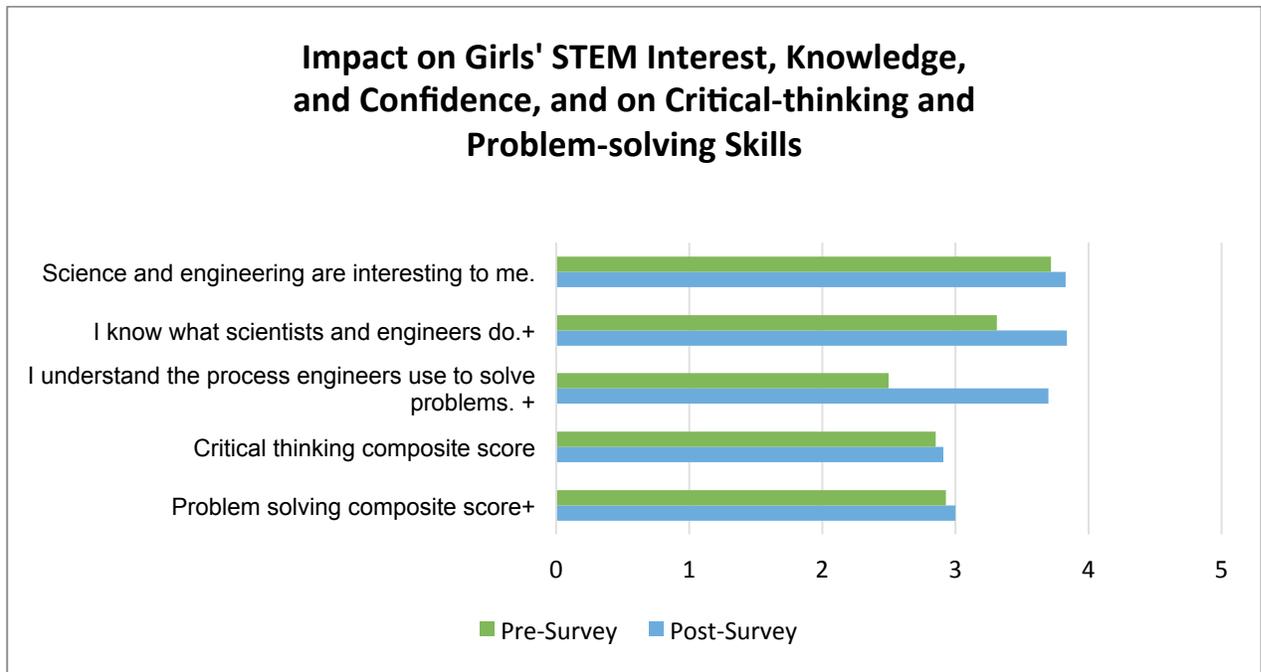
Implementation of the *Engineer Your Journey* program. On average, *Engineer Your Journey* groups met four times and completed five sessions outlined in the *Engineer Your Journey* planners.⁹ During each session, most volunteers used all components of the

⁹ Because this was a pilot, councils were required to complete at least four sessions in the *Engineer Your Journey* planners but were given flexibility in terms of the sessions. This resulted in most volunteers completing the required number of sessions and only 15 percent completing the entire *Engineer Your Journey* program as detailed in the age-specific *Engineer Your Journey* planners.

Engineer Your Journey program—hands-on engineering exercises, leadership-skill-development aids, activities to debunk stereotypes, and STEM career activities/materials—as outlined in the *Engineer Your Journey* planners. Thirty-six percent of the volunteers included STEM role models in at least one *Engineer Your Journey* meeting, and 70 percent of participating girls met a role model during their *Engineer Your Journey* experience.

What Girls and Volunteers Learned

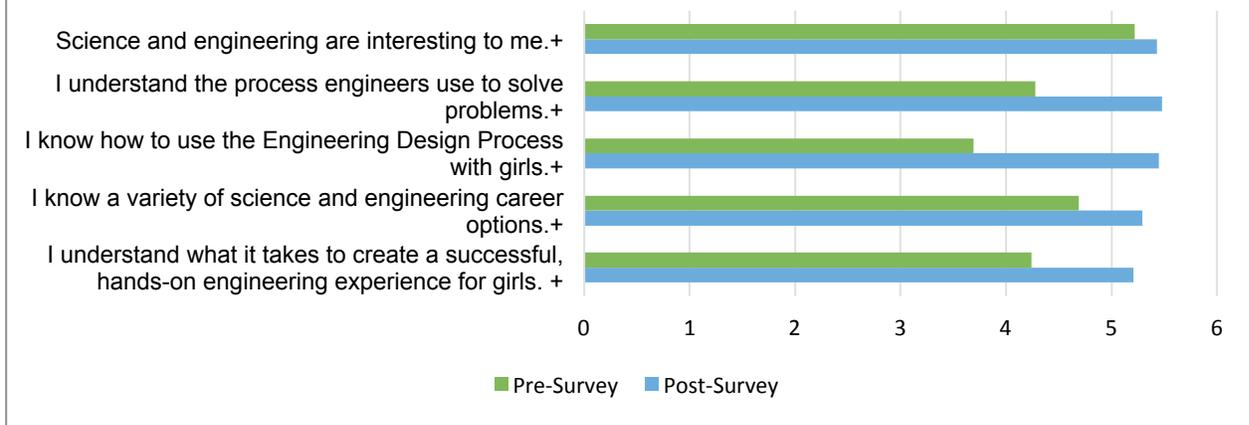
At the end of the *Engineer Your Journey* pilot, **girls** showed a significant increase in STEM knowledge and a positive change in STEM interest, as well as in their problem-solving and critical-thinking skills.



* STEM measures based on a 6-point agreement scale, composite scores based on a 5-point agreement scale across multiple items, + = significant, p<.05

Through participation in the *Engineer Your Journey* pilot, **volunteers** showed a significant increase in STEM interest and knowledge. They also showed a considerable confidence boost in using the Engineering Design Process and creating successful, hands-on engineering experiences for girls. Volunteers felt that the *Engineer Your Journey* pilot made implementing an engineering program with girls possible.

Impact on Volunteer STEM Interest, Knowledge and Confidence



* 6-point agreement scale, + = significant, $p < .05$

“I liked that EYJ made engineering accessible to people without a specific science background. I thought volunteers without prior knowledge of engineering were given appropriate tools to share information with girls.” —*Girl Scout volunteer*

“The EYJ planner made a tremendous impact on the facilitation of group activities. The activities/projects were designed in ordered steps, which allowed the girls to understand not only the problem but the science behind the problem. Girls [understood] what was necessary to conduct the activity and get a good understanding of how the activity could play a role in their personal encounters. The girls learned to brainstorm in groups as they looked for ways to complete the activity/project. This led to more open communication and sharing between girls. As the girls completed the projects each week, they better accepted that sometimes there were flaws in the blueprint that did not lead to the success of the completed project. However, they learned that they could collectively retool their efforts to determine where improvements should be made and begin the process again.” —*Girl Scout volunteer*

Lessons Learned and Recommendations to the Field

The *Engineer Your Journey* collaboration between GSUSA and Techbridge was a success. Through the pilot, more than 90 volunteers were trained to implement an engineering program with girls and provided a hands-on engineering leadership experience for more than 500 girls. By combining resources, Girl Scouts and Techbridge developed a greater understanding of the support needed to equip and empower volunteer facilitators to bring new STEM experiences to girls. The *Engineer Your Journey* pilot showed that volunteers with little to no hands-on STEM experience can implement—and feel confident about their

ability to implement—high-quality STEM programming with girls. As with any pilot, there were also lessons learned about how the program could be improved or applied to other like-minded programs. Key recommendations follow.

Provide extensive hands-on experience and training. As part of the *Engineer Your Journey* pilot program, volunteers received extensive training and hands-on experience with at least one activity, and online instructional videos for all activities they would be implementing. However, they let us know that they desire hands-on experience with all activities prior to doing them with girls and feel they could better conduct activities (i.e., guide girls through them) if they were given experience with the activities beforehand rather than learning at the same time as the girls. Other programs that use facilitators with little to no familiarity with STEM activities should consider ways to offer prior hands-on experience for all included activities.

Help volunteers identify and connect to STEM role models. As discussed above, our volunteers were given resources to connect girls to female STEM role models. However, only a little more than one-third of them incorporated role models into the *Engineer Your Journey* sessions. Volunteers reported that a lack of connections to local STEM role models and time required to make those connections were the main reasons behind this. To address this, volunteers were shown resources like www.fabfems.org and www.theconnectory.org, where STEM role models may be found. In future iterations of the program, STEM professionals could be paired with troop-leader volunteers as part of an “adopt-a-troop” model. This would increase the potential impact of role models while removing the burden on the volunteer of searching for qualified and willing STEM professionals.

Allow sufficient time to implement the program. Due to the constraints of the pilot period, few volunteers were able to work through the entire *Engineer Your Journey* planner, which incorporated the full Techbridge curriculum and Girl Scout Journey. To offer the entire experience and intended impact for girls, volunteers should complete all sessions in the *Engineer Your Journey* planner, plus a [Girl Scout Take Action project](#). This will help girls more fully experience the engineering activities, while developing their leadership skills and drawing connections between engineering skills, their daily lives, and their future career interests. To this end, staff and volunteers need to be mindful of and realistic about how much time is needed to implement the program, plan for expected obstacles (e.g., holidays), and allow additional time for unexpected obstacles (e.g., delays in receiving materials, bad weather, etc.).

Conclusion

Girl Scouts offers girls many opportunities to **learn by doing** in all-girl, informal, out-of-school-time settings in which they can feel comfortable trying new things and taking safe, supervised risks. Likewise, Techbridge creates girl-only experiences whereby girls can experiment with science and engineering activities while growing their STEM identity. Together, including with the *Engineer Your Journey* planners, Girl Scouts and Techbridge help volunteers create impactful experiences for girls, who need to be more fully represented in the next generation of our country's engineers. The *Engineer Your Journey* pilot showed that two organizations with parallel missions and target audiences can effectively collaborate to equip and empower girls and volunteers alike.