STEM READY AMERICA

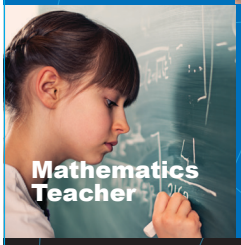
Inspiring and Preparing Students for Success With Afterschool and Summer Learning

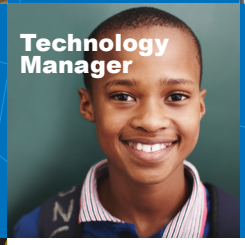
This collection of articles is excerpted from a new resource, *STEM Ready America: Inspiring and Preparing Students for Success with Afterschool and Summer Learning.* In this volume, Executive Editor Ron Ottinger and Contributing Editors Cary Sneider and Ian Hickox have collected expert perspectives on the state of the field of STEM learning—especially in afterschool and summer learning opportunities.

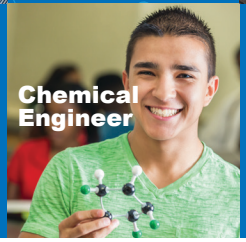
Collectively, these writings from more than 40 thought leaders highlight how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow.

The articles provide persuasive evidence and real-world examples to inform effective partnerships, policies, and actions to bring quality STEM learning to children and youth across the nation. This volume is focused in three key sections:

- **The Evidence for STEM**
- **Partnerships for STEM Learning**
- **Ensuring Access to Quality STEM Learning**







Developed by STEM Next with support from the Charles Stewart Mott Foundation, *STEM Ready America* builds on the award-winning 2013 publication *Expanding Minds and Opportunities: Leveraging the Power of Afterschool and Summer Learning for Student Success* edited by Terry K. Peterson, Ph.D., which made the definitive case for the power and effectiveness of afterschool programs and summer learning.

For more information about STEM Ready America and to download articles visit: www.stemreadyamerica.org.

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Engaging Girls in STEM: At the Crossroads

Linda Kekelis

Ronald Ottinger, Executive Editor
STEM Next | Charles Stewart Mott Foundation

What does it take to inspire a girl to find lifelong passion in science, technology, engineering, and mathematics (STEM)? To begin, they need the motivation that comes from completing hands-on projects, a safe space to take on challenges and learn from failure, and caring adults who support a pathway in STEM. More broadly, we need to nurture girls' interests so that they can become a more integral part of the STEM fields and bring new perspectives and talents to drive innovation.

There is no question that girls can do STEM. In fact, eighth-grade girls scored higher than boys in technology and engineering literacy on the 2014 National Assessment of Educational Progress (NAEP). Similarly, gender differences in mathematics at grades 4 and 8 were small or nonexistent (National Science Foundation, 2014).

But one of the problems in STEM is that there has been little progress in decreasing racial and gender disparities for interest and participation in these fields (Cook, Mason, & Neuhauser, 2015). Girls continue to be significantly less interested in pursuing college majors and careers in STEM, particularly in engineering and technology. A national survey published by Educational Resource Center of America (2015) showed that girls are 38 percentage points less likely than boys to aspire to a STEM career; they also express less confidence in their STEM abilities. These differences continue into college: Whereas almost 27 percent of male college first-years express an intention to major in engineering, math, statistics, or computer science, just 8 percent of female college first-years express similar intentions (National Science Board, 2016).

There are a multitude of factors that exacerbate these disparities. Social expectations, early play experiences, diminished confidence, fewer opportunities to engage in STEM in and out of school, less guidance than boys about career options, and a lack of role models all factor into girls' decisions not to pursue education and careers in the STEM fields (Hill, Corbett, & St. Rose, 2010).

However, there is now a girl-centered revolution underway aimed at closing the gender gap in STEM with an array of programs that welcome and sustain girls' engagement. Many of these programs are offered during out-of-school time. For girls and underrepresented minorities, out-of-school-time programs play an important role in introducing STEM through innovative approaches.

Organizations like Girl Scouts of the USA, Girlstart, Techbridge Girls, Girls Who Code, and Technovation are breaking stereotypes and "glass ceilings" in STEM. The collective impacts of these programs—which teach girls to code, introduce role models, and offer engineering challenges that connect with girls—have made important progress in helping girls imagine their futures in STEM.

The impact of STEM out-of-school programs can be life changing for girls. Take for example, the impact that Techbridge Girls had on the journey of one alumna, Jessica. Through Techbridge Girls, Jessica was introduced to opportunities in engineering and computer programming in high school. In the company of girls and in a community that supported collaboration and perseverance, Jessica experienced STEM in ways that were difficult but fun. She especially enjoyed hands-on projects, ones where she could try her own ideas and work through challenging engineering problems. She also learned from role models that you can make the world a better place with computer science and engineering.

After experiencing four years at Techbridge Girls, Jessica graduated from high school and became the first in her family to attend college. She started at the University of California, Berkeley, on the pre-med track. She soon discovered she enjoyed coding classes more than her pre-med classes, but wondered if she would "fit" into the predominantly male computer science major.. Jessica reached out to me, and I connected her with other Techbridge Girls alumnae at UC Berkeley who were studying computer science. After doing her research, Jessica switched her major to computer science.

Jessica excelled in her new major and eventually landed an interview for a competitive internship at a tech company in Silicon Valley the summer after her junior year. During the interview—her first for any internship—Jessica was asked to work through a coding challenge on the spot. The assignment proved difficult, and Jessica's performance wasn't her best, but she didn't let her struggles during the interview define what she was capable of. Jessica worked through the problem that evening and emailed her solution. Through this show of perseverance Jessica got the internship. Her confidence and ability to deal with temporary setbacks enabled her to navigate her way to a personally and professionally rewarding place in STEM.

If only every girl had an opportunity to experience STEM, like Jessica did, in a supportive network of peers and with adults who promote interest, confidence, and aptitude. Unfortunately, though, there are many more girls waiting their turn to explore STEM, waiting to join an afterschool program like Techbridge Girls, a summer program by Black Girls Code, or an engineering mentorship program with Girl Scouts. In fact, 19.4 million more youth would participate in afterschool programs if they were available (Afterschool Alliance, 2014).

Promising Practices That Engage Girls in STEM

We have the unique opportunity to build upon the research, program practices, and success stories that didn't exist 10 years ago. Organizations like Girl Scouts of the USA and Girls Inc. have long histories of STEM programming, and they reach large numbers of girls across the country each year. From high-quality informal STEM programs such as these we are able to share eight recommendations for promising practices that effectively engage girls in STEM.

These recommendations have been adapted from criteria used by the National Girls Collaborative Project to identify high-quality program models and resources that are accessible, research informed, girl-based, and that demonstrate evidence of success.

1. **Engage girls in STEM practices within projects that have meaning to them.** Programs that successfully recruit and retain girls are *relevant* to girls and tap into a diverse range of interests and experiences. Programs like CompuGirls, for example, take a culturally responsive approach in which girls work collaboratively with peers and mentors on social justice issues relevant to their communities (Ashcraft & Eger, n.d.). In Technovation, girls work in teams and with guidance from mentors, conducting user research, creating a business plan, and building an app prototype. Both approaches offer girls personal entry points to engage in STEM practices on projects that matter to them.
2. **Build confidence and challenge gender stereotypes in STEM.** Eileen Pollack's *The Only Woman in the Room* (2015) makes a strong case for how confidence (or lack of) holds back girls and women from persisting in STEM. For Girl Scouts of the USA, building girls of courage, *confidence*, and character has been part of its 100+ year mission. Girl Scouts' evaluation of its national STEM programs, from 2010 to 2015, found that girls self-reported

increased confidence related to STEM, as well as confidence overall. Adults also noted increases in girls' willingness to take on new challenges or try new things (Girl Scout Research Institute, 2016). Girls' perception of gender norms, and of STEM as a masculine domain, also influence their interests and activities. Girls may internalize roles and norms that lead them to make a choice between excelling at or engaging in STEM or being feminine. TrueChild developed a research-based curriculum to enable girls to challenge gender norms that suppress STEM interest, participation, and achievement. Results from the program are positive. Girls report feeling less conflicted and that they plan to continue to study math and science and to have a career in math and science (Eads, 2014).

3. **Add career exploration to the mix.** Girls make the connection between what they are doing and a possible career in STEM when career exploration is intentionally embedded into projects (Kekelis, Ancheta, & Heber, 2005). Organizations such as Techbridge Girls help girls make these career connections with role models, mentors, field trips, role-play, and reflections. The need for role models and mentors is considerable. In a study of 368,000 female high school students only 4 percent of those who were interested in pursuing STEM majors or careers were encouraged to do so by mentors (National Research Center for College and University Admissions, 2014). Unfortunately, African American and Latina girls often have fewer role models than white girls (Girl Scout Research Institute, 2012). Programs such as EngineerGirl and FabFems are working to address this need—connecting girls with STEM role models and mentors, both in-person and virtually. Additionally, Million Women Mentors, an initiative of STEMconnector, supports state teams of corporations and national organizations around the goal of reaching over 30 million girls and women.

4. **Support authentic family engagement.** Girls don't necessarily need their parents to be engineers, computer scientists, or college graduates, but they need their encouragement and enthusiasm around STEM. Families are instrumental in providing access to programs, supporting interest, and bolstering girls' confidence in the face of challenges. Examples of this include the Black Girls Code workshops for families that include technical talks and lessons on how to code, along with parent-daughter workshops on coding and circuits. Expanding Your Horizons offers parent workshops and introduces lessons about growth mindset, community resources, and STEM activities that families can do together. The National Center for Women & Information Technology (NCWIT) offers families an array of resources including books, games, computer clubs, and online programs to encourage girls' interest in computing. STEM *Plus* Families, which is developed by the National PTA, offers additional recommendations for strengths-based engagement that acknowledges the unique perspectives of families and leverages community assets. For more STEM activities and events, families can use The Connectory, the largest directory of STEM opportunities in the United States.

5. **Advocate relentlessly for the under-represented.** We must not forget the girls who may be harder to serve or who are underrepresented in STEM, particularly girls with disabilities, girls of color, girls in rural communities, girls living in certain zip codes, and girls who express less initial interest in STEM. The California-based engineering program DIY Girls is committed to serving girls in under-resourced, majority Latina communities. The program is intentional about its recruiting. Rather than relying on flyers, open houses, videos, and PowerPoints—which are minimally effective for reaching girls unfamiliar with engineering—DIY Girls offers recruitment workshops for all fifth-grade girls at partner schools so that every girl experiences the program through an engaging hands-on experience. This approach has been extremely positive and produces high interest and participation (Rivas, 2015). Teachers report that 97 percent of girls want to continue

participating in STEM activities, 89 percent report liking science class more, and 100 percent are more comfortable sharing their ideas in the classroom (DIY Girls, 2016). In Washington state, Rural Girls in Science works with girls in under-resourced communities—almost two-thirds of whom are American Indian or Latina girls from rural towns. The program targets girls in the "invisible middle," those who have not expressed interest in science or who have not had the opportunity to attend a science camp or build a science portfolio. The Rural Girls in Science program has been successful in helping girls to imagine themselves attending college and to see themselves as capable of doing science. In an evaluation of their first three cohorts, 84 percent of the girls went to college and 50 percent of those girls declared science or a science-related subject as their major (Ginorio, Fournier, & Frevert, 2004).

6. **Support professional development.** Ongoing professional development is part of the DNA of successful STEM programs. Girls Inc. practices this at the affiliate and national levels. For example, Girls Inc. of Alameda County, in partnership with SRI International, developed Build IT to enhance the technology skills of middle school girls through design. The project included an intensive professional development program. This helped to increase leadership around the topic and also influenced the career and education plans for 60 percent of staff. The program documented changes both in girls' attitudes toward and understanding of information technology and in staffs' capacity to sustain and scale computer science programming (Koch, Gorges, & Paneul, 2012). These successes enabled Girls Inc. to secure funding to sustain and scale Build IT across affiliates. Additional professional development resources focused on engaging girls in STEM can be found in publications like Afterschool Matters, organizations such as the National Alliance for Partnership in Equity (NAPE) and the Afterschool Alliance, and in online communities, such as LinkEngineering.

7. **Invest in research and evaluation.** Research and evaluation are not only critical for program development and improvement but also for the information that enables funders to make decisions regarding a program's readiness to scale. Texas-based Girlstart values the insight that evaluation generates. Girlstart continuously gathers data on progress, program quality, and fidelity of implementation. Results from external evaluators show positive outcomes in building STEM skills and interest in STEM electives, majors, and careers. For example, Girlstart's Project IT Girl program produced long-term impact: 87 percent of participants entered a four-year university, with 80 percent pursuing STEM majors and careers (Afterschool Alliance, 2011). Girlstart (2016) has also studied program impact on state science scores and found positive differences between participants in their afterschool programs and a comparison group of girls.

8. **Say "yes" to learning and sharing through collaboration.** Collaboration not only provides benefits for participating organizations but also yields collective research and practice that help to expand and strengthen STEM-related opportunities for girls. In its 17 years, the National Girls Collaborative Project (NGCP) has created an effective and lasting network for sharing resources and collaborating to better engage girls in STEM. To date, NGCP has achieved profound collective impact by leveraging the needs and resources of practitioners and researchers working to promote girls in STEM. NGCP's 32 Collaboratives serve 40 states, and, have, to date, facilitated collaboration between 22,800 organizations that serve 16.35 million girls and 8.5 million boys. NGCP has also issued 441 mini-grants and supported 28,434 practitioners through in-person events and webinars. Participants of these opportunities report positive gains: 85 percent continue to work with their mini-grant partners, 79 percent indicated exemplary practices increased girls' interest in STEM, and 77 percent increased girls' confidence in STEM.

Call to Action: Building a STEM Field That Supports Girls

Afterschool and summer learning opportunities are powerful forces in girls' lives that can provide experiences that lead to a lifelong engagement with the STEM fields. Over 160,000 Girl Scouts participate in STEM programs annually, and more than 77 percent of these girls are considering a career in technology because of their Girl Scout experiences (Girl Scout Research Institute, 2016). In 16 years, Techbridge Girls has served more than 15,000 girls. Evaluation results, from afterschool programs in the 2015-2016 school year, indicated that 95 percent of participating girls think engineering is a good career for women, 94 percent are more confident trying new things, and 80 percent plan to study computer science in college (Techbridge Girls, 2016). Ninety percent of girls who participated in the 2015 Girls Who Code Summer Immersion Program reported planning to major or minor in computer science or a closely related field (Girls Who Code, 2016).

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However, although individual programs like these have demonstrated positive results for the girls they serve, there are not enough programs to serve all girls, and girls typically do not have adequate pathways to sustain their STEM interest all the way from elementary school through college and into careers. Encouragingly, though, we now have research that shows how we can begin to correct these insufficiencies. Moving the needle will require us to:

- **Work together through our educational ecosystems to build girls' *skills and confidence* in order to *sustain* their interest in STEM;**
- **Scale programs that have successful track records in supporting innovative and new approaches that reach more girls and families;**
- **Commit more resources to out-of-school time programs, especially in under-resourced communities;**
- **Prioritize funding for STEM professional development; and**
- **Create authentic opportunities for educators, students, and families to give input to inform decision making, exercise leadership, and provide feedback on STEM programs.**

We have an abundance of talent and potential in all of our girls, and their contributions in the STEM fields will be important for the future. Embracing positive and supportive educational practices will make it possible for *all* children—and especially for girls—to engage in STEM and reimagine their futures in these fields. The support of policymakers, administrators, educators, and families is critical to doing this work correctly. Successfully engaging more girls in STEM nationwide requires vision and leadership, support from educators, public and private partnerships, and committed, sustainable resources. In 2020 will we be able to say to our girls that we've done all we could to support their engagement in STEM?

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Selected Resources on Girls in STEM:

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Sammet, K., & Kekelis. L. (2016). *Changing the game for girls in STEM: A white paper on best practices and learnings from leaders in the field*. Oakland, CA: Techbridge Girls.

Organizations listed in this article:

Black Girls Code: http://www.blackgirlscode.com/

CompuGirls: https://cgest.asu.edu/compugirls

EngineerGirl: https://www.engineergirl.org/

DIY Girls: http://www.diygirls.org

Expanding Your Horizons Network: http://www.eyhn.org/

Fab Fems: http://www.fabfems.org/

Girls Inc.: http://www.girlsinc.org/

Girlstart: http://www.girlstart.org/

Girls Who Code: https://girlswhocode.com/

Million Women Mentors: https://www.millionwomenmentors.org/

National Center for Women & Information Technology: https://www.ncwit.org/

National Girls Collaborative Project: https://ngcproject.org/

STEMconnector: http://stemconnector.org/

STEM *Plus* Families: http://www.pta.org/stem

Techbridge Girls: http://www.techbridgegirls.org/

Technovation: http://technovationchallenge.org

The Connectory: http://theconnectory.org/

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About the Author

Dr. Linda Kekelis is a consultant with a longstanding passion for ensuring that all youth, particularly girls and underrepresented youth, have access to STEM opportunities. She collaborates with girl-serving organizations, participates on advisory boards, and works with partners to promote participation in STEM. She was the founder and former CEO of Techbridge Girls. She directed several grants from the National Science Foundation to design and scale up Techbridge programs and develop resources for effective outreach for role models. Linda serves in a leadership role on state and national initiatives including the California Girls Collaborative Project and National Academy of Engineering's EngineerGirl and LinkEngineering projects. Linda has a master's degree in Linguistics from the University of Southern California and a doctorate in Special Education from the University of California, Berkeley.