

# Connected Science Learning

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Middle school is a critical time for fostering girls' interest in science, as it is during these years that girls begin to identify with their strengths and weaknesses and start to decide what kind of person to be (Allen and Eisenhart 2017; Carlone, Johnson, and Scott 2015). As such, these are important years in which to engage and inspire girls around science, technology, engineering, and math, or STEM. However, research demonstrates that middle school is also when girls begin to lose interest and self-efficacy around STEM studies and career paths, and form anti-STEM biases. Unfortunately, girls often carry these negative opinions into high school, at which time they “close the door” on STEM learning and career opportunities.

The good news is that out-of-school time STEM programs for middle school-age girls can and do help girls feel empowered and engaged around STEM exploration. One such program is *SciGirls*, the Emmy Award-winning PBS national project produced by Twin Cities PBS and funded by the National Science Foundation (NSF). The *SciGirls* program includes a television series, digital resources, educator professional development, and community outreach for girls and families. All project components work together to help girls—particularly girls of color and underserved learners—to connect STEM to their interests, passions, and lives.

All *SciGirls* media and educational resources are based on the *SciGirls Strategies*, a set of research-based approaches proven to improve and retain girls' interest and self-efficacy around STEM, and foster interest in STEM studies and careers. The strategies are used by informal and formal educators at 200+ *SciGirls* partner organizations, including museums, community organizations, afterschool programs, and schools. The *SciGirls Strategies* were updated in 2019 through an NSF-funded literature review that focused on both seminal and new research performed between 2013 and 2018 on the topic of gender and STEM education. Although still firmly focused on gender equity, the review also addressed intersectionality, cultural responsiveness, and inclusive learning environments. The six *SciGirls Strategies* are:

1. **Connect STEM experiences to girls' lives.** Make STEM meaningful to girls by engaging them in activities that draw on their interests, knowledge, skills, culture, and lived experiences.
2. **Support girls as they investigate questions and solve problems using STEM practices.** Engaging girls in authentic STEM experiences positively impacts girls' interest and confidence in STEM.
3. **Empower girls to embrace struggle, overcome challenges, and increase self-confidence in STEM.** Support girls' development of a *growth mindset*, the belief that intelligence can develop with effort and learning.
4. **Encourage girls to identify and challenge STEM stereotypes.** Support girls in pushing against existing stereotypes and the need to conform to gender roles.
5. **Emphasize that STEM is collaborative, social, and community-oriented.** Highlight the social nature of STEM to change the stereotypical perception that STEM jobs require people to work alone.
6. **Provide opportunities for girls to interact with and learn from diverse STEM role models.** Introduce girls to diverse women role models from varied STEM career pathways.

The strategies inform all *SciGirls* media, educator training, and aligned outreach programs, and are proven to increase middle school girls' interest in and attitudes toward STEM, and to improve educators' ability to engage girls in STEM (Flagg 2010; Flagg 2012; Flagg 2016; Knight-Williams 2008; Knight-Williams 2014; Knight Williams Research Communications 2016). So, how can educators use these strategies effectively to attract and retain their learners' interest, curiosity, and motivation around STEM?

## Employing the *SciGirls Strategies*

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An overarching framework underlies the *SciGirls Strategies* and provides guidance to educators who are seeking to translate the strategies into pedagogical approaches tailored to meet the needs of their learners. Providing an inclusive learning environment that looks and feels inviting and supportive and allows youth to feel that they belong—and using

culturally responsive practices that empower youth by respecting and incorporating their interests, backgrounds, and experiences in the learning process—are key in developing strong STEM identities and in creating a more positive and equitable learning experience for all girls (Adams, Gupta, and Cotumaccio 2014; Cakir et al. 2017; Civil 2016; Gay 2000; Hubert 2014; Ladson-Billings 2008; Riedinger and Taylor 2016; Sammet and Kekelis 2016; Verdin, Godwin, and Capobianco 2016).

The framework focuses on two powerful elements:

1. **Creating an inclusive learning environment:** Whether it is in a classroom, in an afterschool club, or at another informal STEM program, an inclusive learning environment looks and feels inviting, and ultimately fosters learners' sense of belonging. This feeling of community welcomes each learner, and helps youth feel "seen" as real scientists and able contributors.
2. **Using culturally responsive practices (CRP):** CRP are defined as teaching to and through the strengths of students who are culturally, ethnically, and linguistically diverse. Because cultural responsiveness is a sensibility acquired throughout life, culturally responsive educators continuously seek ways to incorporate students' interests, identities, cultures, backgrounds, and experiences as central to the learning process.

Inclusive learning spaces and CRP are critical in helping girls develop strong STEM identities in which they see themselves and are recognized by others as someone who uses, does, and understands STEM. Developing a strong STEM identity is especially critical for girls, as it plays a greater role in shaping their future participation in STEM. Gender roles and stereotypes are culture-specific, and highlighting this intersectionality is imperative to creating STEM opportunities for all girls. Gender-equitable strategies and CRP are inextricably linked: CRP enhances gender equity.

Ultimately, the *SciGirls Strategies* call on educators to seek to know their learners and celebrate the diverse "ways of being" that create the richest educational environments. To learn more about the *SciGirls Strategies* and discover tips on how to implement them, visit the [SciGirls CONNECT website](#).

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