

## Techbridge Girls' Essential Elements

### Guiding Principles for High-Quality, Equitable STEM Programs for Girls

These Essential Elements are based on Techbridge Girls' 18 years of experience, our evaluation and research, and research from the field. (See below for more information about the research underpinnings of this work.)

#### 1. Gender- and Culturally-Responsive STEM Programming

***Girls have hands-on, minds-on opportunities to experience STEM that reflect girls' diverse communities.***

- Activities are open-ended, developmentally appropriate, and give girls opportunities to engage in authentic STEM practices
- Program content is shaped by girls' choices and input, and draws on girls' interests and lived experiences
- Girls engage in projects that make a difference in their own communities
- Facilitators place STEM in the context of girls' communities and the wider world
- Facilitators employ open-ended questioning that guides girls' thinking, elicits prior knowledge, and makes connections to their backgrounds and experiences
- Facilitators take on the role of co-learners and honor girls' knowledge and ideas

#### 2. Inclusive and Accessible Programs

***Programs foster a sense of belonging and enable all girls to meaningfully participate and feel valued for who they are.***

- The location, timing, and cost of programs are not a barrier to participation and allow all girls to participate fully
- Recruitment and outreach strategies result in programs representative of the diversity of the community
- Programs create an environment where girl-identified youth, regardless of race, cultural background, or sexual orientation, are physically and emotionally comfortable and safe, and bias is not tolerated
- Girls are encouraged to create group norms which value mutual understanding and acceptance of each other
- Facilitators employ strategies and accommodations for English-Language Learners and students with learning and physical disabilities



### 3. Opportunities for Youth Empowerment

***A youth development approach empowers girls by building leadership and strong social and emotional skills.***

- Programs provide opportunities for girls to build community and develop cross-cultural competence
- Program activities support the development of girls' independence and confidence
- Facilitators' feedback encourages girls to develop a growth mindset and persevere through challenges
- Facilitators support girls' development of a positive STEM identity
- Girls collaborate, develop teamwork skills, and take on leadership roles in developmentally appropriate ways
- Girls discuss cultural norms and learn ways to counter stereotypes and dominant narratives about STEM

### 4. Extensive Career Exploration

***Role models, field trips to STEM companies, and hands-on STEM activities expose girls to a wide variety of careers.***

- Facilitators connect STEM careers to the lives and experiences of girls and emphasize how STEM can make a positive impact in girls' communities
- Girls are encouraged to take on the role of scientists, engineers, and programmers as they engage in real-world design challenges
- Field trips and role model visits help girls visualize themselves in STEM careers and expose them to new environments
- Role models and examples of STEM professionals reflect the girls and the communities from which they come
- Facilitators provide training to all role models to ensure that career experiences are hands-on, gender- and culturally-responsive, and free from bias

### 5. Broad Network of Support

***Programs develop a network of support for girls' STEM interest that includes educators, families, STEM workplaces, role models and organizations.***

- Professional development increases the capacity of educators, STEM workplaces and role models to support girls in STEM
- Programs disseminate STEM resources to families, encourage families to bring their own expertise to programs, and empower families to be advocates for their girls
- Programs partner with STEM-focused companies and community-based organizations that can support girls' interests and increase girls' access to professional networks
- Community events showcase girls' successes and STEM expertise to families, peers, and community members



## What the Research Says

### Essential Element #1: Gender- and Culturally-Responsive STEM Programming

A recent study of California afterschool programs found that although many programs had science offerings, few gave youth the chance to engage in inquiry-based science exploration.<sup>1</sup> However, the research shows that high-quality, culturally-responsive, hands-on/minds-on STEM activities can make a meaningful difference in the lives of youth:

- Participation in high-quality STEM afterschool programming results in improved attitudes towards STEM fields and careers, increased STEM knowledge and skills, and a higher likelihood of graduation and pursuit of a STEM career.<sup>2</sup>
- Girls who are participants in extracurricular STEM activities are much more likely to know how to pursue a career in STEM and to choose STEM classes in high school.<sup>3</sup>
- Informal STEM experiences are opportunities for girls to meaningfully engage in STEM activities and practices, and can lead to the development of a positive relationship with STEM. The best programs give girls opportunities to "engage in authentic experiences embedded in rich social and intellectual contexts, participate in an immersive climate of positive thinking around potential, capacity, and confidence in STEM, and build social capital."<sup>4</sup>
- Placing science activities in the context of real-world experiences that are related to girls' lives is a proven strategy for successfully engaging girls in science.<sup>5</sup>
- According to the National Research Council, "Understanding how to make out-of-school STEM responsive to young people's prior interests and experiences so that they can see STEM as meaningful and relevant to their own experiences and aspirations may be especially important for youths from communities historically underrepresented in STEM fields. Girls and youths from economically marginalized communities, including immigrant communities, are frequently treated, explicitly and implicitly, as less capable in STEM and therefore may approach STEM with hesitation or even antipathy. Ensuring access to high-quality, personally relevant, and responsive out-of-school STEM programming may be a valuable strategy for addressing equity issues in STEM education."<sup>6</sup>

### Essential Element #2: Inclusive and Accessible Programs

Youth spend 80% of their waking hours outside of school<sup>7</sup>, and out-of-school time can play a crucial role in developing skills and interests. However, opportunities for meaningful learning outside of the school day are not evenly distributed: "Youth access to enrichment activities ... is highly dependent upon family income. The highest-income families spend almost seven times more on enrichment activities for their children."<sup>8</sup> Accessible programs that are inclusive of all learners have been shown to have a real impact:



- Underserved youth who consistently participate in high-quality afterschool programs demonstrate greater gains in test scores, and have fewer behavior issues, than their peers.<sup>9</sup>
- Out-of-school time STEM experiences can support the development of a positive STEM identity for girls from non-dominant backgrounds and help them imagine a future in STEM.<sup>10</sup>
- Urban youth are drawn to out of school time programs that give them positive relationships with peers and adults, physical and emotional safety, and opportunities to learn.<sup>11</sup>
- Hands-on, inquiry-based science activities led by an engaging instructor can improve science interest and self-efficacy in low-income African American girls who scored low on those measures.<sup>12</sup>

### Essential Element #3: Opportunities for Youth Empowerment

Afterschool programs can be “intermediary spaces”—safe spaces for youth to experiment, develop their identities, make their own choices, and solve problems.<sup>13</sup> Girls benefit from programs that take a youth development approach, integrating social and emotional learning and leadership opportunities along with STEM practices.

- In a research study, afterschool STEM program experiences had the most impact when girls had the opportunity to participate in “a meaningful community of practice” that gave them a variety of ways to participate and engage.<sup>14</sup>
- Participants in social emotional learning programs have significantly improved social and emotional skills, behavior, and academic performance.<sup>15</sup>
- Increasing girls' self-efficacy, their belief in themselves to be successful in specific areas such as science, can help develop the perseverance and resilience needed to pursue careers in STEM.<sup>16</sup>
- According to the National Research Council, “Young people who feel supported to explore the unknown are more likely to attempt explanatory modeling and to persist after experiencing a moment of failure, which can lead to a moment of new insight.”<sup>17</sup>
- Explicit discussion about gender is one part of a group of teaching strategies that can help girls to develop problem-solving skills.<sup>18</sup>

### Essential Element #4: Extensive Career Exploration

Although perceptions are slowly changing, research still suggests that women see STEM fields as male-dominated, focused on objects rather than people, and not family-friendly.<sup>19</sup> By the time youth graduate from high school, males are nearly 3 times as likely to be interested in a STEM career.<sup>20</sup> However, high-quality STEM programming that includes exposure to female role models from similar backgrounds can help to shift that trend:

- Many female scientists reported that early, positive experiences with science set them on a path to pursuing a career in STEM.<sup>21</sup>



- Contact with successful experts (such as role models) from similar backgrounds may "inoculate" against feelings of self-doubt and lead to more positive feelings about domains such as STEM, especially for groups who are negatively stereotyped.<sup>22</sup>
- Girls who know a woman in STEM are much more likely to know how to pursue a STEM career, and understand how STEM is relevant.<sup>23</sup>
- When exposed to female STEM role models, girls developed stronger identification with STEM and stronger STEM self-efficacy.<sup>24</sup>
- When a STEM career is presented as being more community-focused, women are more likely to have a positive view of it.<sup>25</sup>
- After hearing descriptions of the real-life accomplishments of STEM professionals, girls are much more likely to describe STEM professionals as having jobs that do good things for the world.<sup>26</sup>

## Essential Element #5: Broad Network of Support

"Science capital"--a collection of the various types of social, cultural, and economic capital that are related to science--is unevenly distributed, and is highly correlated to gender, ethnicity, and parental background. Youth with low science capital are less likely to plan to study STEM in college, and are less likely to have a STEM identity.<sup>27</sup> STEM programs can support the development of science capital, and STEM interest, through work with families, teachers, role models, and others.

- Parents and teachers are important influencers of STEM interest and the pursuit of STEM pathways, particularly for girls.<sup>28</sup>
- Girls who are encouraged to pursue STEM by parents and teachers are much more likely to take STEM classes in high school.<sup>29</sup>
- When parents are given information about the importance of math and science classes, their children are more likely to take more science and math classes in the last two years of high school.<sup>30</sup>
- Girls who were mentored by female STEM professionals or students had higher self-assessments of STEM knowledge and abilities, and were more likely to have STEM-related academic plans.<sup>31</sup>



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<sup>3</sup> Microsoft. (2018.) *Closing the STEM Gap*. Retrieved online March 28, 2018 from <https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE1UMWz>.

<sup>4</sup> McCreedy, D., & Dierking, L.D. (2013). *Cascading influences: Long-term impacts of informal STEM programs for girls*. Philadelphia: The Franklin Institute.

<sup>5</sup> Baker, D. *What works*.

<sup>6</sup> National Research Council. 2015. *Identifying and supporting productive STEM programs in out-of-school settings*. Washington, DC: The National Academies Press.

<sup>7</sup> Stevens, R., Bransford, J., and Stevens, A. (2005). *The LIFE center's life-long and life-wide diagram*. Retrieved March 30, 2018 from <http://life-slc.org/about/citationdetails.html>

<sup>8</sup> McCombs, J., Whitaker, A., and Yoo, P. (2017). *The value of out-of-school time programs*. Santa Monica, CA: RAND Corporation.

<sup>9</sup> Vandell, D.L., Reisner, R.R., and Pierce, K.M. (2007). *Outcomes linked to high-quality afterschool programs: A longitudinal study of promising afterschool programs*. Unpublished report prepared for the Charles Stewart Mott Foundation. Retrieved March 30, 2018 from [https://www.purdue.edu/hhs/hdfs/fii/wp-content/uploads/2015/07/s\\_jafis04c04.pdf](https://www.purdue.edu/hhs/hdfs/fii/wp-content/uploads/2015/07/s_jafis04c04.pdf)

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<sup>14</sup> McCreedy, D., & Dierking, L.D. *Cascading influences*.

<sup>15</sup> Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D. & Schellinger, K. B. (2011). *The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions*. *Child Development*, 82(1): 405–432.

<sup>16</sup> Baker, D. *What works*.



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