CHAPTER 2

I CAN ASK!



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Between 6 and 10 years of age, girls begin to develop a greater awareness of their roles in

society. The messages girls receive during this formative period will either perpetuate negative stereotypes about women in STEM or help them carve a new path where they feel welcome and embrace STEM learning opportunities.

Four key issues impact girls' perceptions about STEM careers and girls' preparation to pursue STEM pathways:

 Girls, including girls of color and those from low socioeconomic backgrounds, often have limited exposure to STEM opportunities.

- 2. Implicit biases can prevent girls from accessing STEM opportunities.
- 3. Teachers' own confidence in their ability to teach math and science, as well as their own beliefs about girls' abilities to excel in these areas, impacts girls' confidence in math and science.
- **4.** Schools seldom teach engineering, computer science, and design thinking in early grades.

In this chapter, you will find ways to help girls develop the ability to inquire and solve problems, critical skills as young women move into middle school and high school. While we explore the four identified issues listed above, we propose ways for parents, caregivers, and formal and informal educators to help girls persevere in STEM learning opportunities. We present strategies to counter the messages girls receive that tell them they do not belong in STEM.



OUTCOMES BY AGE 10

As girls, including those from diverse backgrounds who have been historically under-represented in STEM, reach 10 years of age, they:

- Continue to be inspired in STEM
- Continue to appreciate STEM concepts and topics
- Develop 21st-century skills
- Experience the design thinking process
- Develop awareness of STEM opportunities at home and in their local community
- Participate in age-appropriate STEM opportunities
- Meet female STEM professionals and entrepreneurs
- Meet STEM professionals from diverse groups who have historically been under-represented in STEM careers

HOW CAN I HELP GIRLS CONTINUE TO BE INSPIRED IN STEM?

In Colorado, students in early grades have experienced a decrease in time spent doing science from 2.9 hours per week to 1.6 in less than a 10-year period.¹ Exposure to engineering and computer science is also very limited.² Sometimes, STEM learning experiences are not offered because parents, caregivers, and educators may not be aware of the benefits of such opportunities. Alternately, they may not have had formal training and may lack exposure to STEM themselves, so they may fear failing or not doing things right. Parents and teachers may not know where to start.

Exposing girls to computer science, maker spaces, and other STEM opportunities can begin to inspire them to develop an interest in STEM. STEM opportunities come in many forms and can be offered in a variety of learning spaces. STEM learning can occur inside a classroom, in an outdoor classroom space, or in an everyday moment. Frequently, disciplines are instructed in silos, separated from other subjects, and these silos need to be broken. In the classroom, the most engaging STEM learning occurs when math and science concepts are embedded in problem- or project-based learning through integrated experiences. Engineering and technology are core components of the "making" aspect of STEM. Through this approach, STEM becomes pedagogy rather than stand-alone subjects. Educators have the chance to make connections to real-life experiences and everyday student experiences. They can invite STEM professionals to show students how they use STEM skills and knowledge in their work and to improve their communities. Girls learn how they can make a difference in their communities through STEM. Caregivers and community organizations that serve girls can build STEM experiences

around everyday moments where students can see STEM and make connections that reinforce the important skills and concepts girls learn.

Unfortunately, not all kids in Colorado have access to STEM learning opportunities. STEM programs are limited in rural Colorado and are mostly found along the Front Range.³ However, the opportunity to create STEM learning spaces in local libraries, in schools, and at home, exists. The easiest way to start is to step outside and explore nature.

ACTIVITY 2.1:

Step Outside

Parents and caregivers can expose girls to outdoor experiences where they can develop inquiry skills by developing awareness of the natural world and the human-created world. Try this activity with your child.

Tools: A magnifying lens and/or binoculars if available, but not necessary.

Goal: To take time to start listening and observing nature without disruption.

STEP 1. OBSERVE

• Find a comfortable spot to sit and take a couple of minutes to look around in silence.

Ask yourself:

- What do I see?
- What if I look closer? Is there something new that I did not see before? Are things moving? Do I know what all of these things are around me? Why are they here?

STEP 2: LISTEN.

Ask yourself:

- What sounds do I hear?
- What do these sounds tell me about my community? What animals do I hear? What sounds come from things that humans made? What sounds come from nature?
- Just sit there and enjoy.



Getting kids outside is one of the best ways to help them develop and improve questioning skills. What do they wonder about? What problems do they see in their community? Could they develop a solution to solve such problems? Students can also begin to contribute to scientific understanding as they find answers to their questions. Citizen scientist opportunities, such as <u>Project BudBurst</u> or <u>The Great Bird Count</u>, allow girls and their families to contribute data to answer big questions in science, such as, "Are flowers blooming earlier than prior years?" Girls can keep their own video logs to document changes over time and they can also add the data to larger databases across the nation.

Kids can also access the outdoors through the Every Kid in a Park initiative. Every 4th grader in the United States (and their family) is eligible for a National Park pass "to experience the places that are home to our country's natural treasures, rich history, and vibrant culture FREE OF CHARGE!"⁴ Educators can apply for transportation grants from Every Kid in a Park, too.

Exploration helps girls become better problem solvers, more curious learners, and self-directed thinkers who can come up with innovative ideas. Adults have an active role to play to make sure that girls develop an appreciation for nature and the environment.



READ ALL ABOUT IT!

Last Child in the Woods by <u>Richard Louv</u>. This book discusses the importance of nature in the lives of all children and provides suggestions to overcome what Louv has named Nature-Deficit Disorder.

How to Raise a Wild Child: The Art and Science of Falling in Love with Nature by <u>Scott D.</u> <u>Sampson</u>. This book offers strategies for adults to help kids fall in love with nature and to foster a sense of place.



<u>The Sensory Garden:</u> Your Guide to Exploring the Gardens at the Poudre Learning Center. <u>El Jardín Sensorial (bilingual edition</u>): Su guía de exploración de los jardines en el Centro de Aprendizaje Poudre by Peggy Hoerner. Peggy dedicated her life to creating opportunities for students to explore, experiment, and experience their local environment. In addition to exploring the outdoors, girls need to know what STEM professions entail to understand why it's so important that they learn to ask good questions and to identify problems they can solve.

Girls may not be familiar with what STEM professionals do. Explore opportunities for them to learn about different professionals and the types of problems they like to solve. Let's look at Fatima's story, which shows us that sometimes girls have to see what engineering is all about before they choose to engage.

Fatima⁵ heard that there's an engineering club starting up at her school. Her parents asked her if she was interested in joining, but she explained that she really doesn't like working with computers or building bridges. Satisfied with this response, her parents didn't ask about it again. A few weeks after the program began, Fatima's friend Amy explained excitedly how she got to design air filters to help solve the city's pollution problem, and next week they would get to study how animals stay warm so they can try to develop warmer clothing for people living in cold climates. Amy was proud of the fact that the idea to develop warmer clothing was her idea - it came from a question that occurred to her as she walked to school. Fatima wondered what other cool projects she'd miss out on this year.

Providing girls opportunities to step out of their comfort zone is essential to stimulate new experiences. A girl's hesitation may come from a lack of prior experiences. Therefore, presenting opportunities multiple times can be helpful to pique their interest. Sharing testimonials from girls who have "been there, done that" also provides a unique experience. Parents and educators can invite girls through various approaches rather than accepting "no" as a final response. These types of experiences may change how they perceive people who do science and engineering.



The first images that come to mind when people consider these professions can tell us a lot about what a person knows, or thinks they know, about STEM careers. STEM professionals work on a variety of projects, many of which are grounded in the advancement of society and the development of community. Regrettably, there are a lot of misconceptions about these fields among adults, teachers, and students.⁶

For example, the "Draw a Scientist" test asks children to draw a picture of a scientist. Sketches are scored based on certain attributes, such as gender and apparel. In the original test, which was administered to almost 5,000 children across five countries, only 28 girls and no boys drew a female scientist.⁷ The results indicate the general view that society has that scientists are men.



The results of this test have not changed dramatically over many years, demonstrating the persistence of stereotypes about STEM professionals. A recent study by Wellesley College, available at <u>this link</u>, shows that the traits men and women often perceive to be important in a scientist, such as competitiveness and courageousness, and common perceptions about women, such as being caring and unselfish, are incompatible.⁸ In addition to misconceptions about science and gender, many people have the mistaken belief that science is done in a lab, in isolation, without direct consequence on people's lives.

WHAT CAN I DO TO HELP GIRLS CONTINUE TO APPRECIATE STEM CONCEPTS AND TOPICS?

Caregivers and educators can benefit from understanding the core components of STEM learning to help girls see how relevant STEM is to their everyday lives. Parents and educators can also benefit from knowing more about STEM as a pedagogy, or as a way of teaching and learning.

Core Components Of STEM Learning

At the most foundational level, STEM is about questioning the processes and limitations of the world around us to seek deeper understanding of how the world works and how we might improve that world. STEM is much more than the sum of its four parts; it is a pedagogy, and is most effectively taught or practiced when it is integrated.⁹ For a more detailed definition of STEM, please refer to the Introduction.

The more educators learn about STEM, the more confident they will feel supporting STEM learning for their students. Studies show that teachers who demonstrate science or math anxiety pass on negative perceptions and feelings to their students.¹⁰ Positive teacher support engages students in math and science learning.¹¹ Researchers found that this particular role for teachers is even more important as students enter higher grades.¹²

READ ALL ABOUT IT!

- If you would like more information about specific STEM concepts and skills that are developmentally appropriate for children ages 6-10, check out the <u>Colorado Academic</u> <u>Standards</u> and the <u>Next Generation Science Standards</u>.
- For curriculum samples, you may want to refer to Chapter 3 The STEM Road Map for grades K-2¹³ and Chapter 4 The STEM Road Map for grades 3-5¹⁴ in The STEM Road Map: A Framework for Integrated STEM Education.
- For resources that link engineering to the classroom, see Box 2.1 and <u>Engineering is Elementary</u>, a curriculum designed for elementary-age students to explore science and engineering concepts through hands-on experiences and investigations using the engineering design cycle.



BOX 2.1. IN THE SPOTLIGHT:

eGFI

The American Society for Engineering Education (ASEE) developed Engineering: Go For It to promote best practices in K-12 STEM and engineering education. Their site has resources for students, teachers, administrators, parents, community members, industry partners, mentorsbasically, everyone! Sign up for their e-newsletter, browse Find eGFI at http://www.eafi-k12.org/ lesson plans by grade level or content area, read about engineering professions, and much more.



When we talk about STEM fields we are not only referring to science, math, engineering, or technology in isolation, but rather the intersection of these fields and the exploration of how they work together to address real problems that impact the human condition. We can frame problems or issues through a humanitarian approach to better engage girls, since girls who are attracted to STEM are also interested in many subjects and career opportunities, not only those confined to these four areas.¹⁵ In fact, many organizations advancing STEM initiatives are moving towards STEAM - science, technology, engineering, art, and mathematics. Integrating the arts incorporates an additional dimension and makes explicit connections between creativity and innovation and problem solving (see Box 2.2).

BOX 2.2. IN THE SPOTLIGHT:

Integrate the Arts into STEM?

By Ruth Catchen

The acronym STEAM inherently ties itself to STEM, and it is my belief that there is no STEAM without STEM. STEM is rooted in practicality: problem solving, critical thinking, and workforce readiness. As an integrated pedagogy, it seems only natural that it overlaps with other content. The content many call for is the arts. So, what does "the arts" include and how does including them benefit STEM education?

Adding the arts to STEM should not be confused with arts classes and it is not a call to replace them. A teacher may use physical experience, such as dance, to give students an opportunity to understand how molecules move and change. Music can be used to replicate patterns and so their importance to math and science is seen and experienced in less abstract ways. Listening to music, students can hear the patterns, both melodic and rhythmic. The visual arts offer opportunities to understand and develop aesthetic skills while students work through a design challenge using the engineering design process: the use of light and color, shapes, and perspective.

Benefits Of Adding The Arts To STEM:

- Support STEM learning from varying perspectives.
- Enrich and enhance student experience giving self-efficacy so students can better engage in rigorous STEM lessons.
- Using the arts to take risks and embrace unconventional ideas or experiences.
- Use the arts as a 'hook' to attract a more diverse student base to study STEM subjects.
- This includes learning how to discern beauty (yes, evaluate 'things' and works of art from an aesthetic perspective).
- Use emotion for positive impact in solving problems.
- Add the arts to help students connect STEM skills to a larger variety of STEM subjects and STEM jobs such as fashion design, culinary arts, architecture, and structural design.
- Use the arts as a communication tool and demonstration of knowledge (i.e. a video, mosaic, newsletter, etc.).

Arts opportunities reach more students who may not engage immediately in STEM subjects benefiting overall engagement and participation in STEM subjects. The arts enhance these STEM attributes:

- Understand how to take risks and accept failure as a process
- Tenacity and persistence
- Creativity
- Exploration of innovative ideas
- Ability to evaluate and understand aesthetic value
- Collaboration and teamwork

For a how-to guide about integrating the arts into STEM, visit http://www.stemartseffect.com/.

Integration of the arts into STEM fields is common in computer science. As more careers and fields of study become increasingly entangled with technology, certain levels of creativity and design will require knowledge of computer systems. Adults can teach children to identify, evaluate, and create the processes we rely on our computers to carry out. To open our children to the widest possible view of their own futures, we have to allow them to explore not only concepts like body systems and civil infrastructures, but also computer processes and the inner workings of their favorite app. After all, the reason for education is to discover the world around us, and the world around us is full of technology.

Educators and computer scientists across the nation are excited about the opportunity to teach coding and computer science to children. Leaders in the field have built free online resources for learning how to code (e.g. <u>code.org</u> and <u>codecademy.com</u>) to meet the demand for exposure to computer science principles.

In Colorado, statewide and local initiatives support the push for computer science education for students of all ages (see Box 2.3 for a local example). Talk to your legislators about how local policy can advance computer science opportunities for girls in your school or community.

BOX 2.3. IN THE SPOTLIGHT:

Bitsbox

Bitsbox teaches kids app development, computer programming, coding language, and even typing skills. Bitsbox is unique in that it teaches younger children to code through typed, written-out commands. Their simplified JavaScript syntax lets children employ simple commands to create unique and modifiable apps.

Over 500,000 kids in 50 countries have created apps on Bitsbox's website, which has a number of free activities and apps you can create and explore. Locally, Bitsbox has partnered with a number of elementary schools in St. Vrain Valley School District in Longmont, where students as young as age 6 are typing and modifying lines upon lines of real code as demonstrated in the picture.



Check out https://bitsbox.com

Computer science literacy is quickly gaining recognition in education for younger generations, and learning how to code can quickly advance a girl's STEM interest and levels of self-efficacy. As with any other language, starting early improves ability and proficiency for a lifetime.

For a unique coding experience, open a free account at <u>Bitsbox's website</u>. You can use your web browser to access Bitsbox, or you can receive a monthly subscription box sent directly to your house with fun coding challenges and new apps to build.

There are many schools and other organizations in and around Denver providing computer science opportunities such as <u>CompuGirls</u>, <u>BlackGirlsCode</u>, and <u>OpenWorld Learning</u> (see Box 2.4).

BOX 2.4. IN THE SPOTLIGHT:

OpenWorld Learning... Creating Possibilities Through Technology

OpenWorld Learning (OWL) bridges the digital divide through supporting low-income students' school success by tapping the power of digital technology and peer teaching to develop leadership and ignite a love of learning. OWL encourages girls to assist fellow students in finding answers to their questions, to give class presentations about their work, and to share their successes. Because of this, OWL students demonstrate improved test scores in math, reading, writing, and science, as well as improved attendance, behavior, and school attitudes. Girls in OWL programs learn approximately 30 percent more essential technology skills by the end of the school year. They also consistently demonstrate stronger learning characteristics, such as responsibility and participation in the classroom, which increases the level of student learning and engagement, thereby promoting future college and career success.





OWL motivates 3rd to 6th grade girls to pursue STEM education by instilling a passion for STEM through educational programs in Denver-area schools during after-school hours. OWL transforms school computer labs into powerful learning communities where students are encouraged to develop increasingly sophisticated projects using web-based tools. OWL enables girls to develop digital literacy skills as they explore exciting new technologies, including computer programming, graphic design, stop-motion animation, and robotics.

OWL provides a 12-to-one teacher-to-student ratio, to motivate, hold their attention, and sustain individually paced and customized instruction. For example, girls get to see the beginning of <u>CodeGirl</u>, the YouTube documentary about a girls-only coding competition, and this inspires them to learn more and create. Girls are also introduced to different programs, such as <u>Scratch</u> and <u>MicroWorlds</u>, and encouraged to select the format of their choice for the rest of the quarter. They are able to pursue individual outside interests through the world of code.

WHAT ARE 21ST-CENTURY SKILLS AND HOW CAN I HELP GIRLS DEVELOP THESE SKILLS?

One of the current buzzwords in education is 21st-century skills. While there are varied definitions of 21st-century skills, the simplest list is the <u>four c's</u>: communication, collaboration, critical thinking, and creativity. The Colorado Department of Education includes some of the aforementioned skills in their definition of 21st-century skills in addition to information literacy, invention, and self-direction. Read the Colorado Department of Education's <u>Transformative Teaching</u> brochure for ideas on how to create deeper learning experiences for students by integrating 21st-century skills into lesson design. These skills can be integrated authentically through the process of design thinking.



Design Thinking

Design-based learning grounded in inquiry is an effective way to introduce girls to STEM careers and habits of mind.¹⁶ The engineering design

BOX 2.5. IN THE SPOTLIGHT:

cycle (EDC) provides a tangible, adaptable process for approaching problems and can create truly powerful learning experiences. The modification of the EDC that is becoming more widely used in many industries is called design thinking. The design thinking process is simple enough to be applied in many contexts but also deep enough to accommodate multiple levels of complexity and inquiry. Because engineering is inherently interdisciplinary, the design thinking process helps people make connections that bring about innovative solutions.¹⁷

When a young girl uses the design thinking process, she focuses on failing fast and failing often. She does this in order to learn from her mistakes so that she can develop the best idea possible. Design thinking encourages action, growth, empathy, and problem solving. Learn more about design thinking at <u>dschool.</u> <u>stanford.edu</u>.

> "Fail fast. Fail often. Learn from mistakes. Develop the best idea possible."

Design Thinking Crash Course From Stanford's d.school

The Design Thinking Crash Course provides a 90-minute, virtual introduction to using design thinking. Learn their process for design, see their methods for sharing ideas, and try out some design projects. For more ideas on lesson-based integration of design thinking in your classroom, visit the <u>d.schools' K-12 wiki site</u>, full of lesson ideas, visual resources, and curriculum around design for K-12 education.







- Don't reinvent the wheel. Use online databases of design challenges to try out a few design thinking cycles with your girls. For example, <u>teachengineering.org</u> is a collaborative, free, searchable digital library of engineering design challenges for all ages. Another place to visit is <u>engineeringchallenges.org</u>. The site hosts a list of grand engineering challenges facing future generations from the National Academy of Engineers and the National Science Foundation.
- **Design learning spaces**. Use design thinking to come up with new solutions for issues that may be impacting your house, classroom, or community. Create inclusive spaces with a variety of uses and flexibility. Check out blogs and other maker movement <u>resources</u> to create your own makerspace.



Design thinking begins with empathy and moves through a problem-solving cycle that encourages action, productive failure, and iteration based on feedback (See Box 2.5 and Box 2.6). When we provide specific, positive feedback to girls on their process and effort, we help to improve their persistence, confidence, and performance in math and science.¹⁸ Design thinking provides girls with opportunities to explore questions that address issues in their community. They can go through the entire process and design solutions to real problems that are relevant to their daily lives.

As girls experience the design thinking process, they master key skills that are widely used by STEM professionals. Table 2.1 lists some of these skills.

READ ALL ABOUT IT!

- Dream, Invent, Create published by Start Engineering provides ways to introduce engineering to kids in elementary school and early middle school through children's everyday world experiences.
- Design, Make, Play by Margaret Honey and David E. Kanter is a resource for practitioners, policymakers, researchers and program developers that illuminates creative, cutting-edge ways to inspire and motivate young people about science and technology learning.
- Inquiry & Innovation in the Classroom by A.J. Juliani provides insights as to how we might help students be more inquisitive, creative, engaged, and self-motivated.

TABLE 2.1 WHAT SKILLS, COMPETENCIES, AND ATTRIBUTES DO GIRLS DEVELOP WHILE PRACTICING THE DESIGN THINKING PROCESS?

Critical thinking	Creativity	Empathy	Synthesis
Analysis	Giving, receiving, and incorporating feedback	Collaboration	Project management
Planning	Optimization	Learning from failure	Working with constraints
Civic engagement	Entrepreneurial competencies	Scientific thinking	Identifying problems
Testing solutions	Interviewing	Communication	Objectivity
Identifying important information	Academic language development	and more	

BOX 2.6. IN THE SPOTLIGHT:

IBM Innovation Academy (IA)

Since 2010, St. Vrain Valley School District in Longmont has been partnering with IBM to provide a two-week, immersive program in STEM and design thinking aligned to IBM's Smarter Planet Initiative themes. Students in grades K-5 work alongside IBM engineers to learn about topics such as smarter water, food, or transportation, solve design challenges pertaining to those fields, and develop a solution of their own creation based on their learning and using the design process. The academy culminates in an exhibition of learning where students put their prototypes and thinking on display for IBM partners and community members. Read more and see student videos at blogs.svvsd.org/innovationacademy.





From a parent of an Innovation Academy student:

"Spending time at IBM gave our daughter a picture of what it's like to work in a technical environment. Sometimes kids think that working in a tech company is like being in math class all the time, and IA showed her that real life is much better. She loved her time on their campus, and it helped show her that she'd enjoy working in a STEM field."

There are a number of established educational approaches that are rooted in inquiry. Whether the girls in your life learn in a problem-based, project-based, inquiry-based, design-based, or other environment, combining authentic questions with the application of skills can be a powerful instructional tool.¹⁹ There are established strategies and programs such as BSCS' <u>5E Instructional Model</u>.²⁰ For an

example and an easy to understand explanation of the instructional model, visit NASA's website <u>5E model</u>.²¹ The Public Education and Business Coalition (<u>PEBC</u>)²² seeks to empower teachers to be confident in implementing inquiry in their classrooms and offers resources to support teachers in this work. No matter the method, the following tips in the Try This! box can help make student-centered learning more effective in your classroom, household, or community.



- Teach through inquiry. If you think about it, asking good questions and continuing down the path of inquiry is the heart and soul of scientific thinking. Albert Einstein and Stephen Hawking must be among the most talented minds in history, and their ability to create theory and access knowledge was and is rooted in inquiry. Teach your students or daughters about women scientists and point out how in the past, women's work had to be legitimized by men to be taken seriously. Madam Curie, for example had to conduct research under her husband for her work to be legitimized. Innovation, theory, progress, and the evolution of ideas all of these things start with good questions that can be asked by women and men alike.
- Move away from step-by-step directions. Allow for open-ended questioning and multiple pathways to meaningful learning. Give your child a goal and see how she approaches the task.
- Be a facilitator of learning. Think of yourself as an academic coach instead of a distributor of knowledge. Let girls find out answers on their own instead of providing information for them. Also, don't rush to tell them if they're right or wrong; rather, help girls explore how they might prove their answer or test their solution.
- Ask more questions. Research indicates that the volume of questions we ask in our lives peaks at about age 4.²³ Around that time, we start to scale back on our inquiry for fear of not knowing, of asking "dumb" questions, or of appearing unintelligent. Further, adults may "shush" girls for asking too many questions. If you want girls to be curious about the world, modeling curiosity is the most powerful tool at your disposal. Ask people about their professions. Oftentimes, people will jump at the opportunity to explain their work and their passion projects. Ask other adults meaningful questions during conversations. Ask your girls about how the world works they may surprise you with how much they know, and they will be more open to asking questions if they see you making the leap as well.
- Participate in community events where girls are provided with opportunities to create things from scratch. The <u>Maker Movement</u> has inspired many events in which girls get to build, create, and tinker. Other opportunities might be called hackathons, which are events that can last one to several days where many people collaborate through computer programming. Events have been held by schools and through city governments to seek solutions to local problems. Keep in mind that not all girls thrive in a very competitive environment. Sometimes, there might be maker opportunities that are longer-term commitments rather than intense 12- to 48-hour events. Get to know what your daughter prefers and encourage her to pursue new opportunities.

GROWTH MINDSET

By intentionally using growth mindset language, we develop an approach to learning that will supersede self-doubt when it comes to achievement in STEM fields. Failing forward and learning from mistakes is a skill that everyone can use; it is an essential way of thinking for girls, for their caregivers, and for the educators who work with them.

"I haven't failed, I've just found 10,000 ways that won't work." - Thomas Edison

Serena is a good student, and is used to getting straight A's. She knows how to follow directions and performs well in class and on tests. When she gets a B on a math test in 2nd grade, she comes home crying, upset because she thought she was good at math, and afraid that she has disappointed her parents and her teacher. After a few more months, math continues to get more difficult and she realizes it doesn't come as easily to her as it did before. Meanwhile, she often overhears her aunt confess that she's "Just not a math person." She's heard adults and friends use this phrase before, and she reasons that it must apply to her, too, since she has to work so hard at math these days. She wonders what other subjects she might not be well-suited to study...

Serena's story demonstrates what Carol Dweck terms a fixed mindset. Dr. Dweck of Stanford University conducted vast research into the idea of a fixed vs. a growth mindset as people approach life's challenges.²⁴ As a young student who wants very deeply to please her teacher and her parents, Serena believes her struggles in math indicate an inability to learn math or to ever be good at math. People with fixed mindsets tend to focus on the ability they believe that people were born with rather than on people's capacity for growth and development. On the other hand, people who've embraced a growth mindset understand that they can improve with effort.

Had Serena heard other adults in her life using language such as, "I'm working on learning more math" (or Spanish, or cooking, or statistics, or any subject) without fear of judgment from other people, she may begin to exhibit a growth mindset about her math performance. Due to the rigorous nature of STEM fields, it is quite common for young girls to adopt a fixed mindset about their abilities in science, technology, engineering, or math.²⁵

What message do we want to send to girls while they're developing their self-concept and becoming more conscious of their own abilities and opportunities? Parents, caregivers, and educators can examine their own language and make changes to promote a growth mindset in girls like Serena.

ACTIVITY 2.2:

Examine Your Language

Parents and teachers can use this activity for their own benefit as well as to coach girls to reflect on their use of language.

Reflect: How often do you find yourself using fixed mindset language, either in talking to yourself or in talking to others? (Note: Though the language below uses math as an example, this concept applies to any subject or skill.)

Adapt: How might you change fixed mindset language that you currently use to be more growth-mindset inspired? As a parent/educator, how might you help girls modify their language?



Fixed Mindset	Growth Mindset
"You're really smart at math."	"You worked really hard at those math
(fixed mindset praises ability)	problems!"
	(growth mindset praises effort)
"Math is just really hard for some people."	"Everyone learns in different ways. Let's keep
	trying to find the way that works for you."
"Why can't you get better scores on your	"What mistake did you make in math today
math tests?"	that taught you something?"
"I had to try really hard to understand that	"I had to try really hard to understand that
problem. I must not be good at math."	problem, and I got better at math because of
(fixed mindset looks down on effort)	that."
	(growth mindset sees effort as a good thing)



- Help to educate on growth mindset. Make it a point to understand what having a growth mindset can do for your own self-efficacy. Teach girls what neuroscience research says about plasticity and learning throughout our lives. The more girls get this message, the better they will become at using growth language around STEM learning.
- **Test yourself.** Not sure if you have a growth or fixed mindset? Test yourself at <u>www.mindsetonline.com</u>.

Experiences in design thinking connect directly to a growth mindset. The idea of design thinking has captured the attention of professionals and students in all sorts of fields, from education²⁶ to engineering, to business and marketing, to healthcare and politics. Because design thinking highlights the necessity of failure in order to grow, it has much in common with Dweck's research on mindset.

Learning environment plays another important role in the sphere of growth mindset and design thinking. Consider a girl who has an amazing growth mindset, utilizes design thinking, and learns from failure at every turn. If she is educated mostly through lecture-style instruction and hours of note-taking, will that foster or hinder her perception of how she learns best? The environment surrounding a girl can foster STEM engagement and growth through more student-led learning experiences.

START HERE!

Mindsetkit.org is a comprehensive website that provides resources for parents, educators, and community mentors on developing a growth mindset and teaching with growth in mind. Visit this site for free lesson plans, activities, research articles, and self-assessments.

Youcubed.org is another resource that provides tutorials and advice around developing a growth mindset specifically with respect to math. The site offers How to Learn Math, a free massive online open course (MOOC) developed for parents, students, educators, and mentors to help them develop the right attitude towards learning math. Jo Boaler of Stanford University, whose mission is to inspire all math learners, created both sites.

With Math I Can asks site visitors to take a pledge to stop saying, "I'm not good at math." This collaboration between Amazon Education and a number of other organizations provides lessons and ideas for every classroom.

HOW CAN I HELP GIRLS DEVELOP AWARENESS OF STEM OPPORTUNITIES IN THEIR COMMUNITY OR ELSEWHERE?

Often, girls may not be aware of STEM opportunities in their communities. Their parents may also not be aware of what's out there, or they may lack the resources necessary to take advantage of certain opportunities. For a list of STEM opportunities for girls, visit the Colorado Collaborative for Girls in STEM website, which will link you to The Connectory, a database that has a comprehensive list of STEM offerings across the nation. If you know of a STEM opportunity that is not yet listed, please contact the organizers and add it to the repository.



Educators and community organizations can help promote opportunities by making sure families understand how exciting and rewarding STEM learning can be. Creating personal, authentic relationships with families creates a sense of trust,²⁷ especially among families whose children have historically been under-represented in STEM careers. Parents and caregivers have to know that their children will be in good hands; this is especially important for girls. Creating trust is essential to serving girls whose caregivers may not be used to letting them go really far away from home alone without a family member, such as on field studies. Sometimes, educators or community organizations may have to invite two girls from the same community to partake in an experience.

> Monica, a 5th grade girl, was selected to attend Space Camp and her parents would not let her go. Upon closer examination, Monica's teacher learned that her family simply did not want her to go alone. The community raised funds to send an additional girl, Marie, to camp with her.



WHAT CAN I DO TO HELP GIRLS PARTICIPATE IN STEM OPPORTUNITIES?

Sometimes, STEM opportunities appear when you least expect them, and girls, their caregivers, and educators have to be prepared to identify such opportunities and to take advantage of them.

> Marisol was sitting at the dining room table with her brother. Her mom came into the room and announced that the radio no longer worked. She handed it to Marisol's brother, Javier, and asked if he'd like to take it apart to see if he could fix it. Marisol sat and watched her brother take apart the radio.

Parents and educators make daily decisions that positively or negatively affect young girls' self-belief about what they are capable of doing. Societal messages may tell a girl that certain activities, like taking things apart, are not meant for her. In turn, she might internalize these subtle social cues and start believing that some things are for boys and other activities are for girls. By taking a close look at your play area, at home or in school settings, and questioning the purpose of the toys and materials found in that area, you can begin to see if you are unconsciously perpetuating inequities.

Hidden biases keep girls from participating in STEM learning opportunities. Marisol's story above highlights her mom's unconscious bias regarding girls when she selects her son as the maker, the doer, and the one who can take things apart and explore. Marisol's mom may not be aware that she is exhibiting this behavior. Though it may be socially acceptable, it impedes girls from participating in STEM learning. In the classroom and outdoors, girls should be

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encouraged to be as active in their learning as the boys. Educators can be more intentional about encouraging and validating girls' participation in STEM. Typically, society tells girls to show good behavior in school and to follow instructions. In general, girls are socialized not to take risks. Boys at this age may have not yet learned to moderate behavior and impulses, and studies show teachers dedicate more attention to boys and unconsciously give them more opportunities to talk.²⁸

ACTIVITY 2.3:

Toy Check

What empowering messages do the toys you have convey regarding the potential role or capabilities of girls?	What disempowering messages do the toys you have convey regarding the potential role or capabilities of girls?
There are toys to build with.	Toys reflect gender biasgirls have only dolls, cooking sets, and babies.
Toys promote investigation.	
There are materials to draw, paint, and create new products.	Toys come with step-by-step instruction and do not promote imagination.
There are materials that can be taken apart.	You have building toys, but urge your girl to create things like the pictures in the instruction manual.
Toys promote spatial abilities.*	
There are materials that promote scientific inquiry and engineering design.	Make-believe toys that reinforce stereotypical gendered roles, such as play
Make-believe toys or dress up outfits reflect	makeup and beauty items, are plentiful.
a wide variety professions in the community and inspire creativity and a sense of wonder.	Dress up clothing is limited to princess dresses and other fictional characters.

* Spatial abilities refers to the ability to rotate objects in your mind (mental rotation), the ability to perceive objects in comparison to one's own body (spatial perception), and the ability to use multiple-step strategies to analyze objects in one's mind (spatial visualization).

Girls need opportunities to learn to experiment, to tinker, and to be self-directed learners. Often, parents, caregivers, and educators might unconsciously offer opportunities to boys without considering that girls also might enjoy taking things apart and learning about how they work. This is especially critical for the development of spatial visualization skills. Girls need opportunities to investigate how objects come together so they can see them in their heads and then be able to manipulate objects easily. These skills are essential in future advanced courses such as chemistry and organic chemistry, physics, and engineering.³⁰ Girls can improve spatial abilities through tinkering, building, playing with 3-dimensional objects, and even through <u>video games</u>.



Old equipment dissection. Find an old piece of equipment (VHS, CD player, hard drive, etc.) and teach girls how to use a screwdriver, a hammer, and other tools to take it apart. If you cannot find a piece of equipment readily, visit your local thrift shop or low-cost home improvement stores. Allow the child to explore and ask questions such as, "What types of materials did you find?" or "What do you think that part is for?" This technique, known as reverse engineering, is used by professionals, too!

Makerspace. Set aside a space for creation. This space can be as simple as a table with a storage bin. Find materials such as scissors, screwdrivers, glue gun, nails, hammer, and other basic tools to put things together and to take them apart. Let your girl tinker, build, design, and showcase her work. Be aware that it takes time to develop self-regulation, but know that these spaces foster creativity like no other. You will experience a lot of uncertainty. This is where innovation happens. Learn about what Preston Middle School in Fort Collins has done to build a makerspace in Chapter 3, Box 3.1. For more resources, check out <u>The Maker Issue</u>.³¹



Make the world a better place. Invite your girls to work on projects that are intriguing to them. Are they passionate about saving endangered species, learning about computer science, or helping younger siblings to get down the stairs safely? Helping girls see the humanitarianism and connections in engineering and STEM fields will boost their desire to learn more.

STEM opportunities can be created at home, at school, or during out-of-school hours. They can happen spontaneously or be carefully designed to meet the needs of learners. STEM learning can take place anywhere, anytime (see Box 2.7). Parents, caregivers, and teachers need to adjust their mindset and create space to make learning opportunities happen. Children are always listening, observing, and absorbing.

BOX 2.7. IN THE SPOTLIGHT:

Girls in Science

Fostering Confidence in the Sciences Through Extracurricular, Educational Programming

Girls in Science is an after-school program that nurtures and inspires an interest in science for girls in the 3rd through 5th grade. The program was developed to address a national trend of girls falling academically behind in science by their middle and high school years.

The Girls in Science program curriculum is designed to connect the study of science to real-life situations. Activities are hands-on, inquiry-driven, and fun. It is a program of <u>Walking Mountains</u> and it expands beyond the natural sciences to cover all science disciplines. Students work in cooperative learning groups during activities and then share their observations and new knowledge with all program participants.

The program also offers an opportunity to high school students to serve as role models and mentors by volunteering their time to teach and assist. High school volunteers are students who excel in science in their own academic studies and intend on pursuing collegiate studies and careers in the sciences.

Get to know some of the Girls in Science by reading this blog post!

For more information about Girls in Science visit http://www.walkingmountains.org/project/girls-science/





HOW CAN I CONNECT GIRLS TO FEMALE STEM PROFESSIONALS AND ENTREPRENEURS?

Girls can develop their STEM identity by meeting and interacting with peer mentors and by meeting and learning about STEM professionals and entrepreneurs who are women. There are efforts such as <u>Million Women Mentors</u> that seek to connect mentors to organizations, and organizations that build bridges to industry leaders, such as <u>Nepris</u> or <u>MySTEMLink</u>. Parents, caregivers, and educators can also connect with your local chamber of commerce to learn about key industries in your region, and to businesses that have STEM professionals who may be interested in sharing their story with young girls. Teachers can invite STEM professionals to their classrooms. Before doing so, take some time to think about the outcomes you hope to achieve and to help visitors prepare to share their story with your particular age group. Encourage them to do a hands-on activity with the girls so your students walk away with an exciting and memorable impression. Check out TechBridge's Role Models Matter toolkit.

When role models or mentors are not available locally, students can meet role models through virtual spaces or learn about them through vicarious experiences such as through SciGirls (see Box 2.9). The Denver Museum of Nature and Science (DMNS) also offers Scientists in Action, through which girls can see STEM professionals working on-site either at the museum or at field study sites. If one of these opportunities doesn't work, you can use videos available at Career Girls and NASA's Exploring Careers site. There is also a special site for careers connected to math (see Box 2.8). You can follow the journey of STEM professionals as they explore questions of interest to them. Then, you can take the same idea and help girls discover and solve individual problems that are of interest to them.

BOX 2.9. IN THE SPOTLIGHT:

SciGirls

SciGirls is a show for kids that features girls ages 8-12 asking questions and putting science and engineering to work. The girls work alongside a scientist mentor to design their own inquiry-based investigations. They think of ways to solve problems and design studies to test predictions, collect data, and draw conclusions based on their findings. The shows also feature a character named Izzie who poses a challenge to viewers at the beginning of the episodes and shows the process she goes through to resolve that problem.

Topics range from the environment to technology and include using robots to help people, studying animals and plants, and using the engineering design process to create solutions to everyday problems. All of the investigations are archived online and you can find supporting materials on the website, too.

SciGirls helps viewers see the variety of opportunities in science, technology, engineering, and math. Learn more at http://pbskids.org/scigirls/home.

SciGirls Latina, a Spanish language version, will soon be launched. In the meantime, you can access many of the existing, entertaining STEM videos in Spanish through YouTube, such as <u>Aquabots</u>.³²

BOX 2.8. IN THE SPOTLIGHT:

weusemath.org



"When am I ever going to use this?"

This is one of the most common questions asked in math classes today. Fortunately, weusemath.org has taken the time to ask STEM professionals for examples of how they utilize math in their work each day. You can learn more about these professions and how they use math at this site. You can also access many resources to learn more about how engaging math can be.



WHAT DO GIRLS GAIN FROM MEETING PROFESSIONALS FROM DIVERSE GROUPS WHO HAVE HISTORICALLY BEEN UNDER-REPRESENTED IN STEM CAREERS?

It is difficult to imagine a girl like Fatima, whose story was highlighted earlier in this chapter, sustaining any kind of interest in engineering or math when she does not learn and understand what people in those professions do every day, or that the people in those professions can look like she does. When asked, "What do you want to be when you grow up?" children default to what they know and who they see represented in their lives. Soccer player, doctor, teacher, and singer are all common answers at this age because children are surrounded with examples of these professions. By expanding their understanding of STEM careers and increasing their exposure to female STEM professionals, parents, caregivers, and educators can encourage more girls to follow their interests and passions around STEM. The Toolbox section on this page lists engineering careers and examples of the work these professionals do. For a more extensive list of STEM careers, visit <u>Career Kids</u>.



TOOLBOX

So...What do Engineers do?

They use creative thinking and design to create new processes and products, or to improve existing ones. Here are a few examples from <u>www.engineergirl.org</u>. Read more in their "Try on a Career" section.

TYPE OF ENGINEER	POSSIBLE EXAMPLE OF THEIR WORK
Aerospace Engineer	Create satellites that detect drought around the world
Biomedical Engineer	Create a prosthetic leg designed especially for children
Chemical Engineer	Develop chemotherapy that has fewer side effects
Environmental Engineer	Assess a project's potential effect on an endangered species
Electrical Engineer	Design cell phones that have more features
Mechanical Engineer	Design "smart" toys for kids
Materials Engineer	Invent clothing that repels mosquitoes
Software Engineer	Build apps, develop Web apps, and create games
Network and Computer Systems Engineer	Develop systems for computers to talk to one another and for the people who use them to talk to one another
Information Systems Security Engineer	Test and develop ways to make sure systems are safe from malicious activities



- Explore careers together. Many adults don't have a working knowledge of what engineers or other scientists do for a living. Learn alongside your girls and read about different career opportunities. Job titles may surprise you these days: Do you know what Machine Learning Engineers, Information Security Analysts, or Computer Network Architects do for a living?
- Play Engineering I-Spy. When you hear of an interesting technology, breakthrough, design, product, or process, dig into it a little and figure out how it was developed. Who developed the grip on your pen? Who tested the material for that waterproof rain jacket in your closet? Who made your favorite app? Were STEM professionals involved?
- Make connections. When girls learn about the rock cycle in school, take some time to explore what earth resource engineers do all day. Or if she's learning about motion, challenge her to design an assistive device for a person living with a physical disability.



READ ALL ABOUT IT!

- <u>Cool Careers</u>: From SallyRideScience.com comes this informative book series geared toward upper elementary and middle school readers. Each book introduces the reader to 12 scientists or engineers in fields such as biotechnology, earth science, and engineering.
- <u>Start-Engineering.com</u>: StartEngineering seeks to engage and inspire elementary through high school students in STEM fields and concepts. They have a number of publications (including coloring and activity books) that highlight futures in STEM careers.

WATCH THIS!

At Engineering is Elementary/Engineering is Everywhere, watch <u>Derby's story</u>. Learn how biomechanical engineering helped a dog play for the first time. <u>http://www.eie.org/</u> <u>engineering-everywhere/curriculum-units/</u> <u>prosthetics</u>



By educating ourselves and helping girls understand the impact they can have on their community through an engineering career, we'll open their world to a future they might never have dreamed for themselves. And they, in turn, will create a future none of us could have imagined and be prepared to succeed in jobs that do not yet exist.

HOW CAN EDUCATORS CREATE STEM LEARNING EXPERIENCES?





For Educators: Where do I start?

- Immerse yourself in what STEM professionals do. Shadow an engineer, a scientist, and an information technology professional. What skills does she utilize? What materials are important in her line of work? How does she utilize the design process? What are some of the concepts she is applying?
- 2. If you do not know an answer, help students learn the thinking process necessary to find the solution. Do a think-out-loud as you search together. Eventually, students will learn how to search and they may even teach you different ways to find information. You are a learner, too. Embrace that role.
- 3. Connect industry professionals to your classroom. If students are interested in meeting professionals who can provide insight to their projects, invite them. You can learn together.
- 4. Be open-minded. If you help kids develop research skills, observation skills, inquiry skills, and problem-solving skills, you will help them learn for a lifetime.
- 5. If you have anxiety about math or science and teaching those subjects, work to reduce your anxiety and embrace a growth mindset instead. Students, especially female students with female teachers, may subconsciously internalize this anxiety and messages that say that they should not be good at math or science because they are girls.

SciGirls Seven is a great way to start to change your learning environment to promote STEM. You can do a classroom makeover and start fresh, or you can implement one strategy at a time. You are the artist. Paint your STEM canvas at your own pace.

TOOLBOX

SciGirls Seven – How to Engage Girls in STEM

Check out the resources that SciGirls Seven has put together to give educators ideas about how to engage girls in STEM. On this website, you will find a book that outlines their educational approach, rooted in what research has revealed engages girls in STEM. These strategies are effective for all learners, including girls of color:

- 1. Girls benefit from collaboration, especially when they can participate and communicate fairly.
- 2. Girls are motivated by projects they find personally relevant and meaningful.
- 3. Girls enjoy hands-on, open-ended projects and investigations.
- 4. Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles.
- 5. Girls' confidence and performance improves in response to specific, positive feedback on things they can control—such as effort, strategies, and behaviors.
- 6. Girls gain confidence and trust in their own reasoning when encouraged to think critically.
- 7. Girls benefit from relationships with role models and mentors.



You can read all about each strategy and get ideas about what you can do to get started at http://www.scigirlsconnect.org/ scigirls/.

Create a community of practice. Participation in a supportive community of peers exploring new methodologies together helps educators transform their classrooms. Bring other teachers on board and help each other re-design learning spaces, lessons, or curriculum and ultimately transform the culture in your school. If you do not find a community within your school, consider ways to find your support elsewhere. You can meet people at conferences or visit other sites and see what STEM learning looks like there. STEM integration occurs along a continuum, and so it may look a bit different at your site.

Ultimately, having someone who cares about you and what happens in your classroom can be a real boost to getting your initiative started. You can check out an example of STEM educators creating their own professional development group in Box 2.10.

BOX 2.10. IN THE SPOTLIGHT:

EleSTEMary

The Pikes Peak Coalition For Elementary STEM Education

In 2012, a small group of elementary teachers created a professional development organization to share their love of STEM education with their colleagues in the Pikes Peak region. Their goal is to put more STEM into the elementary schools, so the name eleSTEMary is fitting. These leaders each have unique experiences with STEM trainings that inspire them to not only bring STEM into their own classrooms, but share ideas and success with area teachers. EleSTEMary lead teachers donate their time to create and instruct monthly workshops that are free of charge to participants. The workshop topics always connect STEM with Colorado Academic Standards. Funded by a National Defense Education Program Grant, eleSTEMary has impacted over 1,100 students from eight districts throughout the Pikes Peak Region. For more information on attending a workshop or bringing eleSTEMary into your school, visit http://www.elestemary.org.



The mission of eleSTEMary is to promote greater STEM education awareness among elementary educators as they work to incorporate 21st-century skills, contributing to the preparation of scientifically and technologically literate citizens and future workforce.

Join or Create a PLC. A Professional Learning Community (PLC) can potentially increase educators' self-efficacy in science teaching. Activities that you can incorporate into your PLC include demonstrations of labs or design thinking. You can also conduct a lesson study, a method in which teachers design a common lesson and take turns teaching while the rest of the team observes. Teachers reflect on best practices and share ways to improve after each iteration, and can build confidence by teaching others what they are doing in their classrooms. These mastery experiences are essential to identifying as an educator who fosters STEM learning.

Some organizations focus specifically on providing resources and professional development for educators and community organizations, such as Girls Scouts. Resource Area For Teaching (RAFT) in Denver is one organization doing this work. In 2016, RAFT launched a new program called RAFT on Wheels, through which the organization partners with local libraries to reach eight rural communities. You can learn more about RAFT in Box 2.11.

BOX 2.11. IN THE SPOTLIGHT:

Resource Area For Teaching - RAFT

RAFT provides hands-on experiences that help students learn best, especially when it comes to STEM and 21st-century skills of critical thinking, creative problem solving, and collaboration. Hands-on, experiential, and inquiry-based learning environments enable students to become active participants in their learning. These inclusive, learner-focused environments promote critical thinking and problem solving, and create opportunities for real world context and understanding.

Creating a place where children are encouraged to explore and discover together without fear of failure gives students the chance to find strengths and interests in themselves, and their classmates, that they may never have imagined.

RAFT's model supports all learners and focuses on girls in STEM by serving as a capacity builder for a number of girl- and STEM-focused organizations. RAFT provides low-cost resources to large groups like Girl Scouts and to small groups like Cool Girls Science and Art Club. Teachers and community organizations can learn more about RAFT on their <u>website</u>.





Collaborate on curriculum design.³³ Curriculum often has to be re-defined to better integrate STEM and having a team to do it makes it more fun than doing it alone. If you are an educator who follows a pacing guide or curriculum materials that are predetermined by your district, you can STEMify them. STEMify refers to creating units that are integrated by themes or by core concepts. This process embeds 21st-century skills and STEM competencies and abilities that students can master. Incorporating STEM concepts works best when educators have a clear understanding of why this work matters to your students, and how to ensure that materials and experiences are culturally responsive and relevant to your student population.



- Take an existing lesson and STEMify it. Be sure to embed inquiry and design thinking in your development.
- Create a concept map for your entire year/ course. This will help relieve some stress about coverage. The focus will be on exploring concepts in depth through a certain lens but will not be limited to only learning basic facts that students can simply Google anyway.
- Take a look at the STEM Road Map in the Read All About It! section in the next column for sample integrated STEM units and lessons.
- Whenever possible, guide students through questioning.
- Try creating hands-on experiences so students can discover concepts rather than telling students about them or having them read about them in a book.



🙇 READ ALL ABOUT IT!

- - STEM Road Map: A framework for Integrated STEM Education edited by C.C. Johnson, E.E. Peters-Burton, and T.J. Moore offers integrated STEM curricula encompassing the entire K-12 spectrum, with complete grade-level learning based on a spiraled approach to building conceptual understanding.
 - <u>Monitoring Progress Toward Successful K-12</u> <u>STEM Education: A Nation Advancing?</u> by The National Academies Press summarizes 14 indicators related to students' access to quality learning, educators' capacity, and policy and funding initiatives in STEM.
 - <u>STEM Learning Is Everywhere: Summary of a</u> <u>Convocation on Building Learning Systems</u> by National Research Council
 - <u>STEM Integration in K-12 Education: Status,</u> <u>Prospects, and an Agenda for Research</u> by National Research Council
 - Exploring Opportunities for STEM Teacher Leadership: Summary of a Convocation by National Research Council
 - <u>Science and Children magazine</u> by The National Science Teachers Association

Note: Items from the National Research Council are free to download.

"If you help kids develop research skills, observation skills, inquiry skills, and problem-solving skills, you will help them learn for a lifetime."



READ ALL ABOUT IT!

Resources to help parents/caregivers and teachers understand the role of math in everyday learning.

- What's Math Got to Do with It? How Teachers and Parents Can Transform Mathematics
 Learning and Inspire Success by Jo Boaler
- <u>Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring</u> <u>Messages, and Innovative Teaching</u> by Jo Boaler

The last page of this chapter contains a self-advocacy tool for girls. This tool is designed to give girls ideas about how to seek opportunities, to foster a growth mindset, and to help girls be immersed in STEM learning so they can develop a positive perception of themselves as future STEM professionals. Please share this resource with girls in your life who are 6-10 years of age.

In this chapter, we've provided a sampling of the tools and resources available in Colorado to empower girls between 6 and 10 to advocate for STEM opportunities. The resources can also assist anyone who works with girls--parents/caregivers, educators, and community organizations—to ensure that girls have the tools, preparation, inspiration, and motivation to continue on their STEM journey. Girls will benefit greatly from a solid foundation filled with opportunities to ask questions and explore their interests.



Self-Advocacy For Girls

Ask around. Stay open-minded and find out about as many careers as you can. Ask people in your community what they do for a living - if it sounds interesting, see if they can help you learn more about it. Ask an adult to help you make connections and to make a list of questions that you can ask STEM professionals when you meet them.

Try it out. Have you ever tried a new food and discovered that it's your new favorite thing to eat? It might be the same with engineering, or science, or math! Be open to trying new things and having new experiences - you never know what your new favorite subject might be.

Be your own advocate. If you notice that there are opportunities that are offered to certain kids and not to you, ask if you can be part of those experiences, too. When you see cool STEM opportunities happening in other places, ask yourself what you can do to bring that opportunity to your space. For example, if you learn of a neat summer camp happening in another city, ask your parents and teachers if there is anything like that in your city. If not, can they help bring those types of activities to you?

Enter a STEM competition or design challenge.

You might even get a special invitation to the White House! Watch a video of the Super Girl Scouts <u>here</u>.

Be a leader in starting a movement. You can start with something as small as a makerspace at home with basic tools for you to create and innovate. A makerspace is a space that has materials that are low cost such as cardboard, tape, glue, and scissors and might have other tools such as soldering irons and 3D printers and computers. You do not need to have fancy items to call your space a makerspace. Just include things that you can use to build and create. Check if your community library, recreation center, or Boys and Girls Club has a makerspace that you can use. You can reach out to your community to make sure that other kids have those opportunities at school or at local community learning spaces, such as the library. Be your best advocate.

Make mistakes and learn from them. If you work hard at understanding something, you will get better at it. It's that simple. Everyone in this world makes mistakes - what will help you become the person you want to be is how much you learn from the mistakes you make.

Be mindful of your thoughts. Listen to the voices in your head. What are they saying? Are the voices promoting messages that inspire learning and creativity or are you constantly being hard on yourself? Positive self-talk can have great effect on your attitude and approach to life.³⁴

Get outdoors. Spend time outdoors and investigate. Bring your family along!

- Read a great book about getting outside like Maisy's Nature Walk by Lucy Cousins
- Learn how to use outdoor tools such as a compass, GPS, and other equipment. Ask adults for help and, if they don't know how to use a tool, find someone who can teach all of you together.
- Join a program to spend your summer break outdoors. There are programs all over Colorado like Girls in Science (see Box 2.7).
- Join a citizen science program such as <u>Project BudBurst</u> that gives you the chance to make observations in your community and contribute your data to help scientists learn more about our environment.
- Participate in <u>The Great Bird Count</u> and help scientists who study birds keep track of where they are.
- Visit <u>The Connectory</u> to find more opportunities.

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