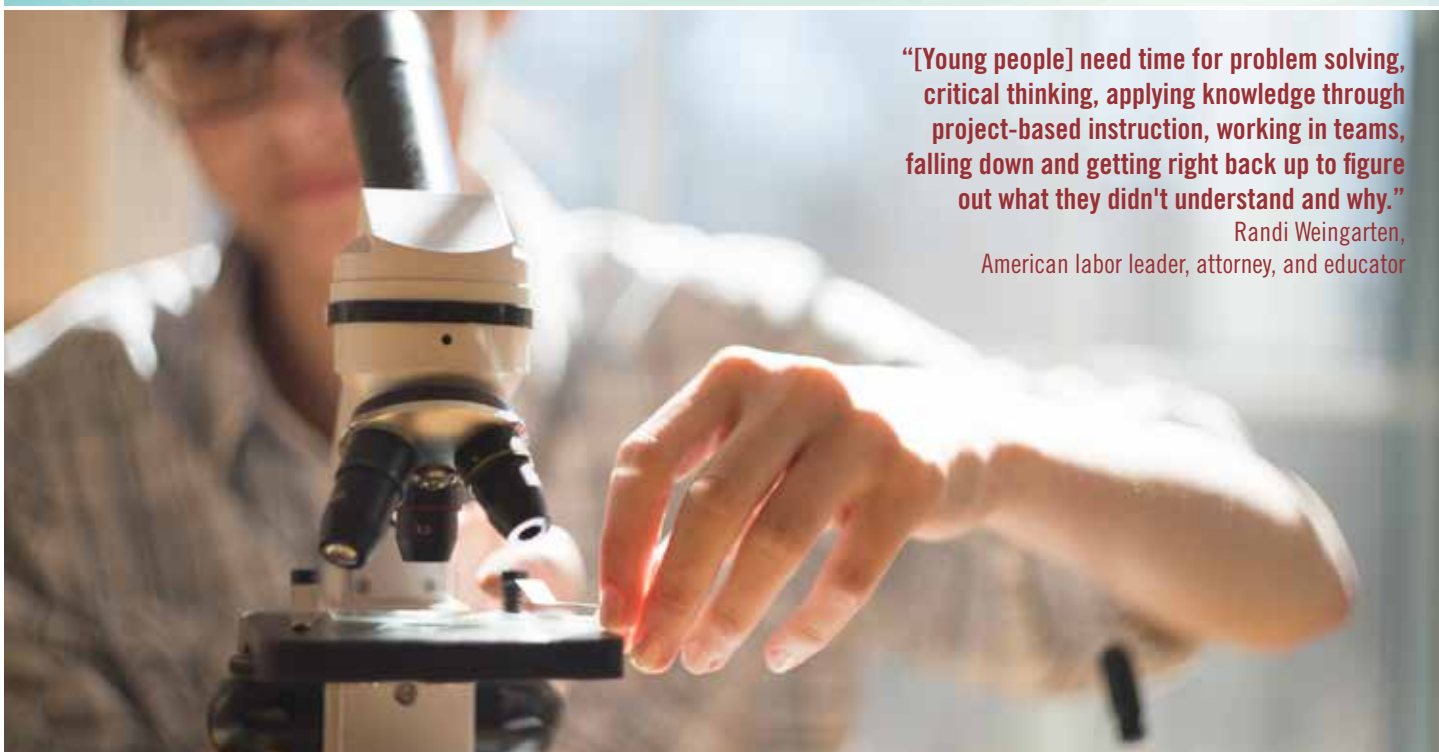


CHAPTER 4

I AM PREPARING TO SOLVE 21st-CENTURY CHALLENGES



“[Young people] need time for problem solving, critical thinking, applying knowledge through project-based instruction, working in teams, falling down and getting right back up to figure out what they didn't understand and why.”

Randi Weingarten,
American labor leader, attorney, and educator

Violeta García, PhD

In adolescence, girls can continue to learn about and prepare for STEM opportunities, connect STEM with their interests and daily lives, and understand the value of STEM careers. Girls between 14 and 18 years of age also engage in self-exploration and may, at some points, experience uncertainty about the path they want to pursue in the future. These young women are starting to give serious thought to what path they want to take in life. We know there are few career paths that are directly linked to the individual courses they take, so they need to draw the connections across different fields of study and practical applications and as members of

interconnected communities. Unfortunately, STEM subjects are often taught in silos, which may decrease girls' motivation to pursue STEM pathways and their preparation for STEM success.^{1,2} To get young women STEM-ready, educators must break the silos surrounding STEM subjects, and girls must have opportunities to learn by tackling engaging, real-world problems that keep them inspired to persist in STEM courses.

Our culture sends girls micromessages, which perpetuate micro-inequities that tell them they do not belong in STEM or make them feel out of place. These messages become a self-fulfilling



prophecy and stifle girls' interest in STEM subjects. They hear that girls are not supposed to be good at math, so they perform poorly and accept that fate because they've heard this message so often. However, parents and educators can turn these micro-inequalities into microaffirmations,³ which are messages that tells girls that they do belong in STEM and they have what it takes to succeed. Together, we can boldly disrupt systems to create more inclusive spaces for girls and young women of all backgrounds.

By the time a girl reaches age 18, she has the chance to make many choices that can either open up STEM opportunities or that can make it harder for her to take advantage of them. Parents and caregivers, educators, and the community can offer support and resources so that girls can explore interesting STEM careers, prepare themselves to pursue STEM opportunities, and develop the skills they will need to solve 21st-century challenges.

OUTCOMES BY AGE 18

As young women, including young women from diverse backgrounds who have historically been under-represented in STEM, reach 18 years of age, they can enter STEM preparation programs and:

- Participate in one or more internships or apprenticeships
- Meet diverse professionals in STEM fields
- Understand various pathways to access STEM careers
- Develop deeper understanding of cross-disciplinary connections
- Complete high school ready to begin a career in STEM or post-secondary education in STEM

When girls are in lower grade levels, they display about the same level of performance in STEM subjects as boys.⁴ As they get older, their interest and participation in STEM starts to wane. By high school, girls are less likely to be interested in STEM pathways than boys. This attrition trend continues into college and as young adults enter the workforce.⁵ Latinas, African American girls, and girls from low socioeconomic backgrounds have even lower participation rates in STEM classes.⁶ Understanding how various activities can help girls access STEM careers can expand opportunities for them to experience what it is like to be a STEM professional. Internships or apprenticeships are a great way to for girls to get hands-on, relevant experience.

HOW CAN I HELP YOUNG WOMEN FIND INTERNSHIPS OR APPRENTICESHIPS?

Teen girls can find many ways to explore careers in their communities and across the nation. Firsthand experiences can help them learn what it is like to work as a professional in STEM fields.

Internships

Internships allow girls to participate in meaningful, productive work in a STEM company. They also allow girls to explore the day-to-day operations in a specific field. The best, most meaningful internships also provide girls with work experience through at least one project with clear deliverables. Many school districts have ways to connect employers and students, such as Denver Public Schools' [CareerLaunch Internship Program](#). If your area does not yet have such opportunities, consider ways you can help get a local internship program started. There are also opportunities for summer internships beyond Colorado through government organizations, including [NASA](#), and private companies. [Pathways to Science](#) offers a searchable database of programs and [STEMnet](#) contains a list of opportunities across

the nation. [The Connectory](#) has nationwide opportunities as well.

Encourage the young women in your life to use the resources in this toolbox to find and assess internships, meet potential STEM role models, and select a meaningful opportunity.

Apprenticeships

Certain fields require in-depth and long-term training. Historically, apprenticeships lent themselves to this type of training. While apprenticeships are not as common today, students can benefit from what they offered – careful observation, practice, and long-term skill development in fields that require precision and deep attention. Some leaders in Colorado are considering the Swiss Apprenticeship Model, which may increase students' participation in STEM. This model offers young people the opportunity to start as an apprentice to enter a trade, providing flexibility for learners to move between vocational and academic pathways. You can learn more about the Swiss Apprenticeship Model from [Colorado Succeeds](#).



TOOLBOX

Meaningful Internships

- I will seek an internship that offers an opportunity to work on a meaningful project.
- I will have the opportunity to be included in the day-to-day job activities, such as meetings, events, etc.
- I will have a point person or supervisor who cares about the deliverables on which I will be working.
- I will be doing work that is interesting to me.



BOX 4.1. IN THE SPOTLIGHT:

Project DIY

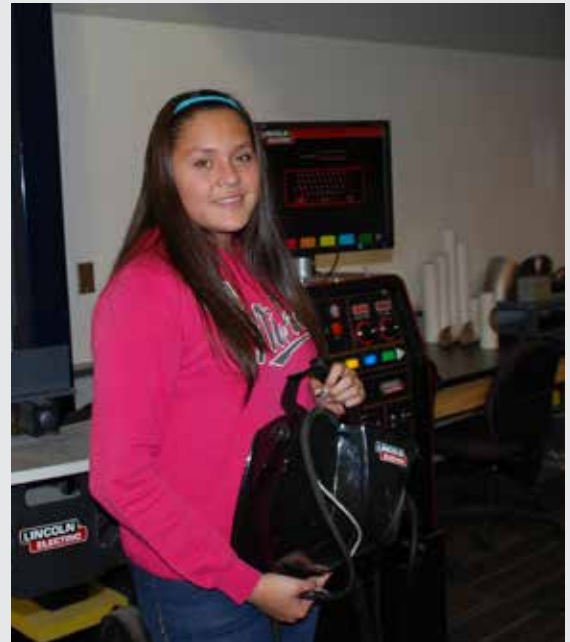
In summer 2016, 18 girls from [Denver Public Schools](#) got their hands dirty at Community College of Denver's (CCD) [Project Do It Yourself](#) (DIY) summer camp. The camp gave students from grades 9 through 11 hands-on experience in manufacturing programs and exposed them to women leaders in STEM careers.

The idea behind Project DIY is to engage young women in non-traditional careers such as welding, machining and engineering graphics, and mechanical design. CCD held two, weeklong camps with the help of financial support from [The Women's Foundation of Colorado](#).



Learn more about the program at

<https://www.ccd.edu/blog/press-room/denver-high-school-girls-get-their-hands-dirty-summer-manufacturing-camp>.



HOW CAN EDUCATORS, PARENTS AND CAREGIVERS, AND COMMUNITY ORGANIZATIONS LEARN MORE ABOUT STEM PROGRAMS?

Parents and caregivers have an important role to play in helping their girls develop a sense of identity, a STEM persona, that includes seeing themselves as scientists, mathematicians, or engineers. We can work together to support girls' interest in STEM; acknowledge girls' abilities; and let them know that even if they do not have all the tools today, they can learn by utilizing growth mindset tools (see Chapter 2 for more information). Together, we can inspire, prepare, and motivate girls to pursue and be successful in any STEM pathway they choose.

One of the biggest barriers to expanding opportunities for girls is lack of awareness of opportunities that exist. The New York Urban League⁷ has put together a [guide](#) that dispels myths about STEM and provides resources for parents and community members. These myths include: (1) STEM fields are not welcoming of girls and that (2) girls are not interested in math and science, among others.

Sometimes, parents, caregivers, and community organizations may not be aware of or may not know where to find opportunities for girls, including girls from diverse backgrounds traditionally under-represented in STEM and girls from rural Colorado, to participate in STEM.⁸ The National Center for Women & Information Technology (NCWIT) has developed resources for families and educators to help, particularly with the information technology field (see Box 4.2).

Additionally, adults may have hidden biases and may unconsciously not offer STEM opportunities to girls because they assume that girls might not be interested. Therefore, it is important to share opportunities with all students and to have universal goals and targeted strategies and objectives to personally invite girls to participate in these opportunities. For example, a universal goal is to expose every girl to a certain STEM experience or program, while a targeted objective includes creating programs that serve girls belonging to certain demographic groups that are extremely under-represented in STEM, such as Latinas, African American and Native American girls, and girls from low socioeconomic backgrounds.

Recognizing STEM opportunities when they are not labeled as such takes time and practice. A quality STEM program exhibits characteristics of personalized learning through projects and exposes girls to careers that they may not otherwise know exist. As a starting point for your search, check out the STEMworks [database](#), where you'll find programs that have gone through an intensive vetting process. This resource was originally created to help funders identify high-quality programs. Then, visit [The Connector](#) to check if any of the programs listed are offered in your community.

BOX 4.2. IN THE SPOTLIGHT:

National Center For Women & Information Technology (NCWIT)

NCWIT, based in Boulder, CO, is an organization that works to correct the imbalance of gender diversity in technology and computing. They understand that gender diversity positively correlates with a larger workforce, better innovation, and increased business performance. Therefore, they develop tools and resources to increase the number of women in technology and computing. Women have the potential to improve the design of products and services to better serve a more diverse population and increase their economic and social well-being by providing more women with stable and lucrative careers.

In addition to great [resources](#) for educators and families, you can also find information about [TECHNOLOchicas](#) and about the [Aspirations in Computing](#) program for girls interested in pursuing computer science. Be sure to also check out the [Top 10 Ways to Engage Underrepresented Students in STEM](#).



Learn more at <https://www.ncwit.org/>.





TOOLBOX

STEM Program Check

High-quality STEM programs for girls and young women have the following attributes:

- Hands-on learning
- Opportunities for girls to ask and investigate their own questions and design solutions
- Based on real-world experiences or solving actual problems in communities
- Promote the development of STEM habits of mind: asking questions, defining problems, finding solutions, constructing explanations, communicating information, etc.
- Focus on developing 21st-century skills: collaboration, communication, critical thinking, and creativity
- Make connections to professionals in STEM who can relate to girls, including girls of color
- Train staff on inclusive practices
- Focus on youth development and ways to work with girls, including girls of color
- Utilize strategies to attract and retain girls

For more detail, refer to page three in the [Design Principles 3.0 of effective STEM philanthropy](#).⁹

The [National Science Teachers Association](#) (NSTA) offers a comprehensive list of opportunities that give educators the chance to learn more about STEM careers by immersing themselves in research experiences. Educators can do a Semester at Sea or participate in summer research experiences or educational tours.

There are also opportunities for educators to learn more about the work of STEM professionals through externships with industry employers. The BioScience Institute, featured in Chapter 3, provides teachers with opportunities to get into companies, learn about STEM professions, take what they learn, and connect it to classroom experiences (see Box 3.10 in the previous chapter).

Educators can use online resources to find discipline-specific content. For example, the National Science Digital Library has a wealth of educational resources about STEM, including those that can help teachers make meaningful connections across STEM disciplines (see Box 4.3).



BOX 4.3. IN THE SPOTLIGHT:

The National Science Digital Library

Educators benefit from having a one-stop site for resources in the sciences. The National Science Digital Library provides high-quality online educational resources for teaching and learning, with current emphasis on the STEM disciplines—both formal and informal; institutional and individual; and in local, state, national, and international educational settings. The NSDL collection contains structured descriptive information (metadata) about web-based educational resources held on other sites by their providers. These providers contribute this metadata to NSDL for organized search and open access to educational resources.¹⁰

To view the thousands of resources, many adhering to Open Educational Resource access, visit <https://nsdl.oercommons.org/>. You can filter by grade level, type of resource, and by standard type.

Other hubs also share resources and some list professional development opportunities. For example, the Colorado Consortium for Earth and Space Science Education lists discipline-specific resources and offers opportunities for educators to develop integrated STEM learning experiences for their students (see Box 4.4).

BOX 4.4. IN THE SPOTLIGHT:

Colorado Consortium For Earth And Space Science Education (CCESSE)

CCESSE is a compilation of opportunities for educators, nonprofits, and corporations to work together to provide STEM programming; it currently highlights opportunities in the Pikes Peak region and beyond. For example, you will find information on the STEM BootCamp for K-12 Teachers and Peak Area Leadership in Science (PALS).

STEM BootCamp is a focused, three-day professional development program hosted by the Air Force Academy to enhance STEM teaching skills for Southern Colorado K-12 educators. Held annually each summer since 2010, the [Challenger Learning Center of Colorado](#) organizes and delivers the program and the National Defense Education Program (now known as DoD STEM) provides funding. This program is open to any educator nationwide. In 2015, 105 educators participated.

[PALS](#) provides science teachers in the Pikes Peak region with the opportunity to participate in a professional learning community in which they share educational ideas, lesson plans, methods, and materials related to science education. Teachers participating in PALS' monthly meetings have the chance to network with colleagues and increase their content knowledge and enjoyment of science related topics.

You can also find more programs for educators at <http://ccesse.org/Educators.aspx>.
For a list of nonprofit STEM programs, mostly in the Pikes Peak region, visit <http://ccesse.org/NonProfits.aspx>.



WHERE CAN I FIND DIVERSE PROFESSIONALS WORKING IN STEM FIELDS AND HOW CAN I CONNECT THEM TO MY STUDENTS?

Role models and mentors matter in the quest to increase the participation of females in STEM. There are several directories, such as FabFems and Million Women Mentors, aimed at matching girls to organizations that recruit and train role models and mentors (see Box 4.5). In addition, NCWIT's AspireIT program uses a near-peer model to connect high school and college women with K-12 girls interested in computing.

BOX 4.5. IN THE SPOTLIGHT:



FabFems

FabFems is a database of women who come from diverse backgrounds and career paths who work in STEM disciplines. Girls and family members who support them can search for and contact role models listed in the FabFems national directory.

The FabFems directory is accessible to young women, girl-serving STEM programs, and other organizations that are working to increase career awareness and interest in STEM for girls.

Search for mentors and role models
at <http://www.fabfems.org/>.



Young women and their mentors can also try directly contacting companies interested in doing outreach with girls and under-represented populations and invite them to act as mentors for your school or community organization. Girls can also participate in formal mentoring programs offered by community organizations to expose them to female role models in their communities. Read more about mentoring in Box 4.6.

BOX 4.6. IN THE SPOTLIGHT:



Girls in STEM

The mission of Girls in STEM is to empower high school girls to seek out a STEM career by connecting them with a network of professional women in STEM industries. These women serve as role models and/or mentors to empower girls so that they can identify with, and ultimately visualize themselves in, a similar career. Throughout the program, girls have the opportunity to visit work sites and interact with professionals in STEM fields. Girls in STEM serves approximately 50 girls in the Denver metro area.



Learn more at

<http://www.gstemdenver.org>.

Before working with girls in schools or enrichment programs, mentors and role models benefit from formal training. Techbridge developed the Role Models Matter Toolkit to help professional women connect with young girls in ways that are beneficial for both mentees and mentors. This resource is great for anyone who works with girls, including those in community organizations. When mentors are not properly trained, unintentional messages may portray STEM careers as something unattainable.¹¹ Therefore, preparing women who will serve as mentors and role models is a critical step so that girls can see their future selves as STEM professionals.

Many community organizations practice inclusivity as part of their core mission. For example, Girls Inc. of Metro Denver builds in youth training programs as part of all professional development for their staff (see Box 3.7 in the previous chapter). The staff who work with girls in the Eureka! program (see Box 4.7) also benefit from youth development training.

BOX 4.7. IN THE SPOTLIGHT:

Eureka! Program At Girls Inc. Of Metro Denver

Girls Inc. of Metro Denver aims to develop girls' enthusiasm for and skills in science, technology, engineering, and mathematics. Through hands-on activities, girls explore, ask questions, and solve problems. They also consider careers in these fields by interacting with women and men pursuing such careers.



The Girls Inc. Eureka! program is an intensive, five-year, STEM-based program that builds girls' confidence and skills through hands-on opportunities. Utilizing a "whole girl" approach, the program also incorporates sports and physical fitness, personal development, and college and career readiness. Serving middle and high school girls from across the Denver metro area, Eureka! broadens girls' future academic and career interests, encourages enrollment in advanced math and science courses, promotes positive risk taking, and assists girls in developing networks of peers and mentors to support their future endeavors.

Girls in elementary school participate in a Eureka! pipeline program called *Creating the Future* that connects Lockheed Martin volunteers with girls ages 9-12 to strengthen their interest and confidence in pursuing STEM education and careers.

To learn more about Girls Inc. of Metro Denver's program, visit www.girlsincdenver.org.





WHAT ARE THE VARIOUS PATHWAYS TO ACCESS STEM CAREERS?

The preparation necessary to enter STEM careers is somewhat of a mismatch with our current educational system. The traditional high school science sequence—biology, chemistry, and physics, coupled with math levels—does not engage students in STEM learning experiences directly connected to the most in-demand, high-growth careers in engineering and computer science. As a matter of fact, most high schools do not offer engineering or computer science courses to the majority of their students. While some programs are being designed to integrate engineering principles, these specialized courses are often not widely available and tend to exist in the career and technical education space.

In addition, even though the majority of engineering majors at the college level require a foundation in physics, many students do not have the opportunity to study physics until the 11th or 12th grade if they go through a traditional biology-chemistry-physics sequence. However, if students start in lower-level science courses, they may never reach physics since they will fulfill their required three years of science before they

get a chance. Some schools have switched their course offerings to algebra-based physics¹² so that students can take a wider variety of courses that will open rather than close future choices. Other schools have redefined the high school experience by creating exploration courses for the first two years of high school and offering advanced courses relevant to a particular pathway the final two years.

Looking at the educational continuum as having multiple on-ramps and off-ramps can open and broaden choices for students who may not have considered a STEM pathway early in their education. Career exploration may also open up possibilities that may interest students as early as 9th grade or as late as 12th grade or into post-secondary experiences.

Exposure to multiple STEM learning experiences in and beyond the classroom can help engage students who may not have considered STEM careers at all. Denver Public Schools (see Box 4.8) and [St. Vrain Valley Schools](#)¹³ have created programs to expose students to a variety of STEM learning opportunities. These pathways intentionally embed out-of-school experiences through internships and community-based learning.

BOX 4.8. IN THE SPOTLIGHT:

Denver Public Schools (DPS) CareerConnect

DPS CareerConnect brings together over 100 local businesses and more than 15 colleges to help 6,000 students envision and pursue a personalized path to their professional aspirations.



DENVER PUBLIC SCHOOLS
CAREERCONNECT

CareerConnect pathways are designed to strengthen college and career readiness and deliver greater impact. The curriculum pathways include sequenced courses beginning in 9th grade and culminating in a diploma, as well as industry-recognized credentials/certificates and earned college credit. Students experience personalized learning and college exploration, Advanced Placement courses, and concurrent enrollment at either community colleges or higher educational institutions.

At the same time, DPS CareerConnect provides a valuable link between students and industries. Students participate in hands-on workplace experiences and mentoring. DPS CareerConnect equips graduates with high-demand skills and leads them to opportunities for continued education and careers in Colorado's fastest-growing and highest-opportunity industries.

More information is available at www.dpscarerconnect.org.



WHAT IS INTEGRATED STEM LEARNING?

STEM integration refers to providing students with opportunities to learn in settings that require the cross-pollination of disciplines. Often, integration occurs around a big idea, such as energy. For example, students can explore energy issues through both a science lens and a social studies lens while using math to solve real-world issues.

STEM integration gives students opportunities to experience engineering design, explore technologies, and develop the habits of mind of STEM professionals so that students prepare to solve 21st-century challenges.¹⁴ Integration in formal educational spaces for girls 14-18 is more complex than in earlier stages of girls' education. High schools are typically organized in silos, where the math department may be at the opposite end of the building as the science wing and where English and social studies teachers

may or may not see connections between their subjects and STEM learning. Students may also be tracked into certain courses by math ability, which means that some students may never have the opportunity to take advanced courses in certain disciplines, such as physics. All of this makes integrated STEM learning a challenge during this stage; however, with collaboration and an intentional plan, STEM integration is doable.

Although integrated STEM learning may appear more feasible in informal educational spaces, such as during after-school or summer programs, incorporating integrated STEM in school settings can help bridge disciplinary boundaries and provide students with opportunities to collaborate on meaningful projects that pertain to issues in their local communities. Bryan et al. (2016) propose three different types of integration: content integration, supporting content integration, or context integration.¹⁵ Content integration refers

to the integration of learning objectives from various STEM disciplines to create lessons or units of instruction. Supporting content integration refers to the prioritization of one of the disciplines to focus the lesson and using other disciplines to support the learning of the primary discipline. For example, using math skills to understand science concepts. Context integration refers to the utilization of a story to ground the experience for learning specific content for a specific discipline, for example, using a story of migration and settlement to understand natural resource availability. Each of these types of integration can create bridges among the disciplines, and with careful design, they can be powerful in students' STEM learning.

In addition, educators have the opportunity to access resources such as the *STEM Road Map: A Framework for Integrated STEM Education*¹⁶ and the [Arizona STEM Immersion Guide](#), which can help them assess what they are already doing and to better understand opportunities for

integration. The STEM Road Map suggests thematic units where each content area contributes content to create an experience in which students make connections between disciplines throughout the day. This resource also outlines ideas for problems or challenges students can explore in 9th, 10th, 11th, and 12th grades. The challenge with this approach is that in many districts, students do not take the same courses in the same sequence and so the proposed standards may have to be realigned. The STEM Road Map provides a foundation and schools and districts will have to determine how they can best use the ideas presented. To learn more, read about the STEM schools featured in Box 4.11.

Integrating STEM with policy issues can also help girls see connections to complex challenges facing our nation. The Keystone Science School offers several programs designed to create leaders ready to address these 21st-century challenges (see Box 4.9).

BOX 4.9. IN THE SPOTLIGHT:

Keystone Science School (KSS)

Keystone Science School is a 23-acre campus in Keystone, CO. KSS provides diverse and accessible programs around leadership development, STEM-based education, health and nutrition, teacher professional development, and experiential learning. KSS's programs prepare future leaders to address the increasingly complex issues our society faces.

In early 2015, KSS kicked off the Girls in STEM program to give young women the opportunity to explore the fields of science, technology, engineering, and math through games, experiments, and group activities. High school girls serve as student volunteers at Girls in STEM day programs.

KSS piloted an overnight retreat for upper-middle school and high school girls. This program is based loosely around the concept of "Start-up Weekend" with a focus on coding/apps/tech to have the girls work in teams and develop a marketable prototype.

Opportunities for high school students at KSS also include Basin Voyage, which is an application program open to students all over the country to delve into environmental education and issues while doing some outdoor education as well.

To learn more about upcoming events, visit <http://keystonescienceschool.org/>.



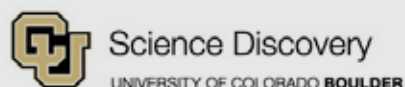


Girls can also benefit from integrated STEM learning experiences in summer programs or programs beyond the school day. CU Science Discovery offers a wealth of programming for students of all ages (see Box 4.10).

BOX 4.10. IN THE SPOTLIGHT:

CU Science Discovery- High School STEM Academies

The University of Colorado Science Discovery program's mission is to heighten interest and increase literacy in science, technology, engineering, and math by providing hands-on experiences that connect students and teachers to current CU science. Science Discovery capitalizes on CU-Boulder's scientific resources, facilities, and expertise to excite students about STEM, expose them to a variety of STEM careers and professionals, and inspire a future generation of scientists and engineers.



One of the programs Science Discovery offers allows students to have a STEM research experience during the summer months. Students in this program get to see firsthand what it is like to perform research at the university level. Last summer, one of their students, April, said: "From what I've seen over the past few weeks and have experienced, this might have to be one of the most exciting things I've done in my life. My research experience has been outstanding since I've gotten to work with kids and create things I couldn't even dream of. This whole experience has really opened my eyes to see what kind of new creations are created and just waiting to be made."



For more information, visit

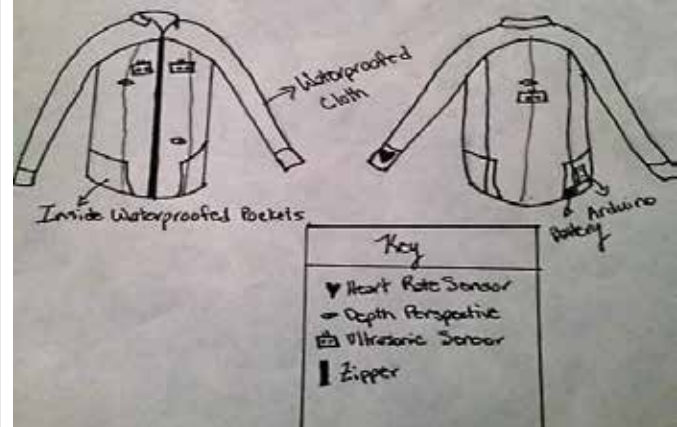
<http://sciencediscovery.colorado.edu/>.



BOX 4.11. IN THE SPOTLIGHT:



Descriptions and Illustrations - Jacket



STEM School And Academy

The mission of the STEM High and Middle Schools in Highlands Ranch, CO is to provide an integrated educational system to engage all students in an academically rigorous core curricula, promoting a strong foundation in the sciences, technologies, engineering, and math, relevant to real-world contexts and building on student character and community assets to prepare students for successful post-secondary endeavors.



The student project above shows a prototype piece of clothing designed for people who suffer from Ablepsia, to help patients become aware of their surroundings, and for visually impaired individuals. The team of two brainstormed possible solutions considering the restrictions and availability of materials. Then, they selected their best option and created a prototype of the solution. Their jacket design was entered into the Technology Student Association competition.

Learn more at <http://www.stemhigh.org/>.

HOW CAN STUDENTS LEARN MORE ABOUT STEM CAREERS WHILE IN HIGH SCHOOL?

Incorporating career exploration in any STEM learning activity helps girls see a direct connection to the professions they can pursue in the near future. Mentors and role models, as discussed previously, can share their own pathways to STEM careers with girls. Exposing girls to a variety of STEM professions shows them the breadth of opportunities available to them. For example, girls may not be aware that there are many types of scientists and engineers. They may hold

on to stereotypes that reinforce the misconception that scientists are white men with crazy hair and glasses.¹⁷ Providing examples that counter this idea helps girls build a sense of identity or a STEM persona.

Girls can learn about STEM careers through direct exposure throughout the year as part of the units of study in their courses. They can also explore specific pathways as they build more confidence and realize that STEM skills can be improved over time. Internships and apprenticeships, described earlier, can be a great way to expose

young women to STEM careers. In addition, opportunities to shadow or to participate in research programs can also be great ways to expose girls to STEM.

Shadowing Or Externships

Job shadow opportunities introduce students to “a day in the life” of any given profession. This is typically a short event, which can last from one hour to a full day. Externships might last for a couple of days and are typically unpaid. The goal of externships is to give girls quick exposure so that they can decide if they want to pursue work in a specific field or with a specific company. These experiences offer great opportunities for girls to see women in the field and understand what their work is like.

Companies without the resources to host students for an entire summer and who want to expose students to their work and their employees in a real setting may find shadowing opportunities fit their goals. The commitment involved is minimal, and students, employers, and employees may decide to continue to work together if job shadowing experiences are successful.

Research Programs

Research programs share many characteristics with internship programs; students have the chance to contribute to an existing research project or to develop a question that they are interested in exploring. Research programs in the summer usually last six to eight weeks. During this time, students work alongside scientists or research engineers to test questions or develop solutions to problems. Research programs can also take place during the academic year, though these are more common for undergraduate students. Many universities also offer summer research programs for local students and may open up experiences for students across the nation.

Documenting Experiences

All students in Colorado are required to have an Individual Career and Academic Plan (ICAP). An ICAP is a central document with all academic and career-related activities. As students document their accomplishments, developing interests, and existing gaps in their education, they are better able to plan for future careers. College in Colorado also helps students with career planning (see Box 4.12). Having a record of programs and experiences they've participated in is a great asset for girls as they apply for college or pursue other pathways to reach their goals.

BOX 4.12. IN THE SPOTLIGHT:

College In Colorado

College In Colorado serves the state of Colorado by promoting access to, affordability of, and success in higher education for all students. College In Colorado provides services to help all Coloradans explore career and education pathways, break down barriers to post-secondary attainment, and create a plan for their post-secondary and workforce success.

By utilizing the College In Colorado portal, parents and students have access to a one-stop resource to plan, apply, and pay for college.

The College In Colorado team reaches out to students, parents, educators, and workforce centers through ongoing events and training opportunities, as well as providing practical tools to assist every student in Colorado in furthering their education past high school.¹⁸



To get started, visit

<https://www.collegeincolorado.org/>.

Girls can benefit from one-time career exploration events. Such events can cover a breadth of careers and help girls disrupt preconceived notions about what engineers or information technologists do and what they look like. While these events may provide initial introductions to STEM fields, they may not provide enough exposure to help girls see themselves as future STEM professionals capable of solving 21st-century challenges. Programs, such as Big Hair, Bigger Dreams (see Box 4.13), that develop longer lasting relationships through multiple touch points improve girls' STEM skills, inspire them, motivate them, and create a sense of belonging that girls may not otherwise experience on their own. These tools of empowerment will be critical for girls as they continue on their STEM journeys. The more confident, capable, and motivated girls become, the more likely it is that they will persist in STEM, even if the waters get rough.

BOX 4.13. IN THE SPOTLIGHT:

Big Hair, Bigger Dreams

Big Hair, Bigger Dreams is a nonprofit organization in Denver, CO that helps African American high school girls realize their potential by eliminating the barriers to their dreams. Through collaborations with organizations such as [CompuGirls](#), [TechnologyForAll](#), and [The JEKL Foundation](#), girls explore social justice issues by using technology tools to create webpages, videos, and apps. The organization creates culturally responsive programming with the whole girl in mind, relying on peer mentors who are graduates of past camps to connect with and inspire younger girls.

 **Learn more at**
<http://www.bighairbiggerdreams.org/>



WHAT DO GIRLS NEED TO BE READY TO PURSUE POST-SECONDARY STEM OPPORTUNITIES?

We have shared many ways parents, educators, and community organizations can connect girls to different STEM opportunities. Girls benefit from exposure to career pathways early in high school so they can understand how to prepare for, enter, and advance in STEM fields. In addition to developing 21st-century and STEM skills, deep content knowledge, and real-world experiences, girls need to understand the various certificates and degrees that can help them land a career in a STEM field or prepare them to become entrepreneurs and job creators. You can read about a joint effort to expand access to certifications, training, and career pathways in Box 4.14.

BOX 4.14. IN THE SPOTLIGHT:

STEM Career Pathways

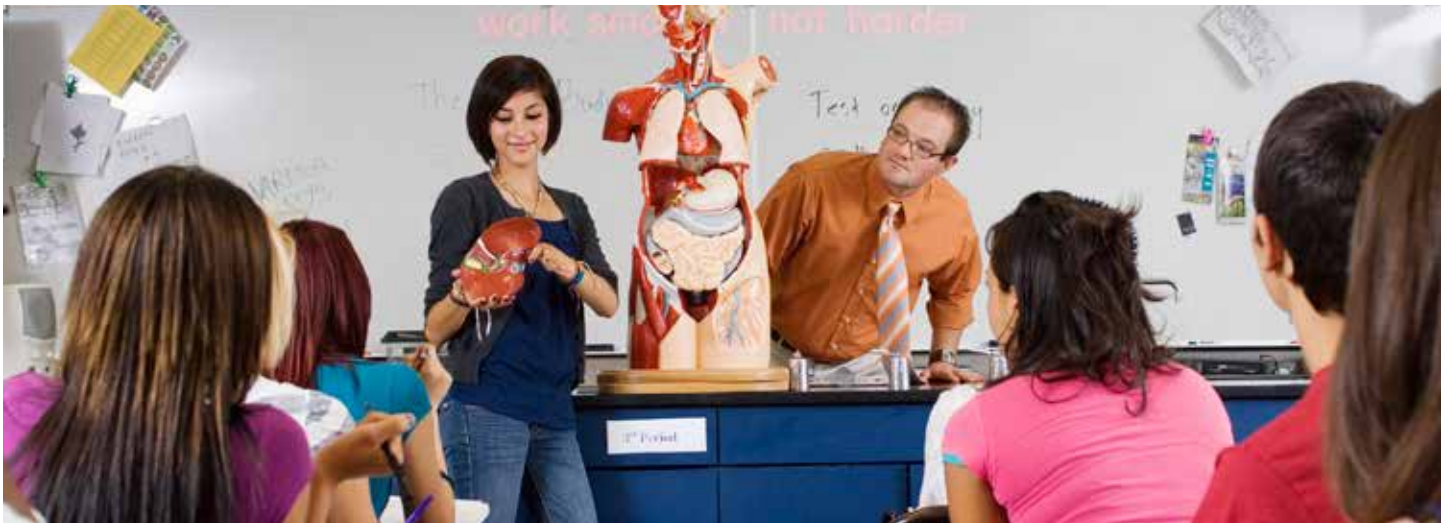
The Women's Foundation of Colorado and JPMorgan Chase funded the development and expansion of STEM career pathways in Delta School District and Poudre High School to serve more than 450 students. The [Colorado Workforce Development Council](#) (CWDC) and the [Colorado Education Initiative](#) (CEI) partnered to support these sites to ensure they are industry-driven pathways that align with local needs.

After a rigorous evaluation and selection process, CEI selected Poudre High School and Delta School District. Both sites are developing career pathway programs driven by local Sector Partnerships and the grants are enabling them to focus on expanding participation by female and low-income students.

Poudre High School expects an increase in female participation in its pathway classes from 20 percent to 50 percent and an increase of low-income students from 40 percent to 45 percent. It will implement a recruitment strategy to engage under-represented populations, expand internship opportunities at local businesses, create a CAD certification pathway, and upgrade a welding lab. Delta School District will implement a pathway program in each of its four high schools with a focus on supporting teachers with professional development and solidifying partnerships with local businesses to offer internship experiences for students. It expects to see increased participation of under-represented students, with a goal to have a student population that is 35 percent female and 40 percent low-income.

Additionally, the research and impact team at CEI is conducting an evaluation of the impact of the career pathway program on student outcomes and increased participation of female and low-income students. The team will conduct focus groups with administrators, teachers, and students to understand the strategies that supported program outcomes. Student outcome data will also be evaluated once available to understand impact.

In high school, students can prepare for various certificate, diploma, and degree programs. As early as 9th grade, a girl needs to ask herself if the course load she is taking is the most challenging for her. As girls navigate high school, they will notice many types of programs that may or may not lead to a degree. Understanding the difference between all of these programs and how they fit with their goals will help students make informed decisions. For example, some girls may want to pursue certificate programs or associate degrees through concurrent enrollment so that they can enter the workforce immediately after high school. Other young women might want to attend one of the newly approved Pathways In Technology Early College High Schools programs in the state (see Box 4.15). Girls may later decide to continue post-secondary education in a four-year degree program. The more information girls have about different educational options, the better prepared they are to pursue career opportunities.



BOX 4.15. IN THE SPOTLIGHT:

Pathways In Technology Early College High Schools (P-TECH) In Colorado

A 2016 press release from the Colorado Department of Higher Education and Colorado Department of Education indicated that two new P-TECH schools had been approved. The two new schools, located in St. Vrain Valley School District and El Paso County School District 49, are innovative, public, six-year high schools where students can earn an associate degree in a STEM field while simultaneously earning a high school diploma.

Learn more at <http://www.cde.state.co.us/postsecondary/p-tech>.



“The more information girls have about different educational options, the better prepared they are to pursue career opportunities.”

Concurrent Enrollment

The Concurrent Enrollment Programs Act, passed in May 2009, created opportunities for students to take one or more courses at post-secondary institutions before they receive a high school diploma. This means that students in Colorado can enroll in a local education agency (high school) and take post-secondary academic courses and career and technical education courses at the same time. The act also included the creation of a “5th year” program, ASCENT, in which students can take these courses for one year following the 12th grade. You can learn more about concurrent enrollment programs [here](#).

Advanced Placement And Mentorship

Students can also gain college credits through Advanced Placement (AP) courses. Students of color who are under-represented in STEM fields are also under-represented in AP courses.¹⁹ The lowest participation rate in STEM areas is in computer science and AP computer science courses also have among the lowest participation rates for students of color. Colorado Legacy Schools is seeking to change AP participation for the most under-represented groups by providing extensive training for AP teachers as well as coupling their program with a mentorship opportunity for students (Box 4.16).

BOX 4.16. IN THE SPOTLIGHT:

STEM Mentorship at Colorado Legacy Schools

The Colorado Education Initiative is partnering with companies to provide students with real-world understanding of STEM careers – especially girls and minority students who are under-represented in the STEM field. Through the STEM Mentor Program, industry leaders mentor students in Advanced Placement (AP) high school courses at participating Colorado Legacy Schools.

Specifically, the STEM Mentor Program is meant to support students that are typically under-represented in AP STEM classes. Pueblo Centennial and Abraham Lincoln high schools host STEM Mentors who share their personal career pathways, demonstrating the practical value of the skills developed through AP coursework and highlighting the obstacles they have overcome to succeed in male-dominated industries.

These STEM Mentors first meet AP students during class time then the bulk of the volunteer experience occurs outside the classroom. Throughout the school year, STEM Mentors engage small groups of students and develop students' relationships with STEM careers by meeting outside of class in informal sessions, connecting at Legacy School events, providing opportunities for students to observe STEM careers during organized site visits, and collaborating with AP teachers to host motivational events.



The following toolbox lists activities that girls should experience by the time they exit high school and pursue post-secondary opportunities. Parents, caregivers, educators, or community organizations can give this list to teenaged girls so that they can check off items on the list through their high school years.



TOOLBOX

Empowerment Strategies For Girls 14-18

- Educate yourself about the barriers women face in STEM fields, including in STEM classes and the workplace in general.
- Learn how to recognize bias and speak up against it.
- Know when to ask for help—this may include situations where you have been denied an opportunity because others assumed you were not interested. Ask for it. Also, ask your parents, caregivers, and friends to be your advocates and teach them how to recognize bias and micromessages so they can always watch your back.
- Learn about different careers.
- Meet and shadow STEM professionals.
- Learn about STEM pathways and STEM affiliated pathways by exploring [career clusters](#).
- Learn about skills necessary to pursue different pathways.
- Find an internship locally, or somewhere else in the nation or the world! You can start by visiting <http://www.internshipprograms.com/>. There are many other sites that can help you find internships in STEM.
- Join a STEM organization, such as the [Technology Student Association](#) (TSA).
- Enter a competition or a challenge.
- Take advantage of online courses or free learning platforms, such as [Khan Academy](#) or [code.org](#).
- Find funding, like STEM scholarships. Set aside two or three hours on Saturday or Sunday and dedicate this time for scholarship applications and researching post-secondary opportunities. If you have attended DPS for four years, check out the many options through the [Denver Scholarship Foundation](#). For other opportunities around Colorado, visit the resources listed in the [College In Colorado](#) site.
- Immerse yourself in a summer STEM experience. Do research through programs for high school students at a university across the state or the nation. Search for programs at the [Pathways to Science](#) advanced search page. There are also opportunities to conduct research at scientific and cultural organizations, such as the Denver Museum of Nature and Science (see Box 4.17) or Denver Zoo.
- Volunteer or travel across the nation or to another country to develop your STEM skills.
- Plan your own BioBlitz or participate in one!
 - What is a BioBlitz? “A BioBlitz is an event that focuses on finding and identifying as many species as possible in a specific area over a short period of time. At a BioBlitz, scientists, families, students, teachers, and other community members work together to get an overall count of the plants, animals, fungi, and other organisms that live in a place.”²⁰ Learn more at <http://www.nationalgeographic.org/encyclopedia/bioblitz/>.

BOX 4.17. IN THE SPOTLIGHT:

Teen Science Scholars @ DMNS

The Teen Science Scholars (TSS) internship provides high school students opportunities to work in the Archives, Anthropology, Earth Sciences, Health Sciences, Museum Conservation, Space Sciences, and Zoology departments at the Denver Museum of Nature and Science. Selected students will be involved with various aspects of their mentors' research and/or collections programs. Students present overviews of their TSS work at an annual symposium held at the Museum at the end of the summer. This program introduces students interested in science careers to various aspects of museum research and/or collections work and helps strengthen investigative and communication skills. The internship program is open to students who will be entering their junior or senior year of high school.

This program has provided over 140 high school students the opportunity to be mentored by Museum scientists and collections staff since its beginning in 2006. Students who have completed this program have gone on to study science at universities such as MIT, Duke, and University of Denver. The program also provides a networking system for TSS alumni who help support students after the end of their internship.



**“The Teen Scholars Program really has given me that exposure
that I needed to really pursue a science career.”**

- Teen Science Scholar Georgina Romero

BOX 4.17. IN THE SPOTLIGHT: *CONTINUED*

Teen Science Scholars Reflection

In 2014, the Denver Museum of Nature & Science Health Sciences Department received an extensive histology collection from retired pathologist Dr. Robert H. Shikes. Following the work done in 2015, new Teen Science Scholar Georgina Romero and returning Scholar Ashley Hernandez set out to take the histology collection project to its next stage.

The goals for the collection were to create an easy-to-use database of all the slides and related notes. Ashley and Georgina dug into Dr. Shikes' teaching slides and affixed new Museum catalogue numbers printed on archival paper to facilitate future scientific research. They reviewed his slide keys in an attempt to match up his documentation and diagnoses to the slides. The database of diagnoses was then sent to colleagues in the Pathology Department and the Modern Human Anatomy program at the University of Colorado Anschutz Medical Campus, where the Museum would be given a professional opinion on the condition and medical value of the slides.

"For a couple of months, I felt like the Museum had always been a part of my life. I learned and matured more in two months at the Museum than I have anywhere else," Hernandez said. "That is the biggest thing I owe and thank this internship for: my personal growth. I learned the value and importance of community and teamwork."

"The Teen Scholars Program really has given me that exposure that I needed to really pursue a science career. I got to experience such new things on such an early stage of my school career," Romero said. "One of my favorite experiences from this program was going to Anschutz Medical Campus and learning how to properly digitize Dr. Robert H. Shikes' pathology slides."

The TSS application closes mid-spring each year. To apply, visit <http://www.dmns.org/about-us/jobs-and-internships/internships/>.

The following list provides a taste of books that feature girls in STEM roles. Share with your adolescent girls (and boys). Seeing other young women as heroines and problem solvers can help boost girls' confidence and inspire them to see themselves as creative, innovative thinkers who can design solutions for our most challenging 21st-century problems.



READ ALL ABOUT IT!

STEM Books for Adolescent Girls:

- [*Headstrong: 52 Women Who Changed Science – And The World*](#), by Rachel Swaby. This book shares the stories of 52 inspiring women who made contributions to science.
- [*101 Things You Wished You'd Invented—And Some You Wish No One Had*](#), by Richard Horne and Tracey Turner (Fiction). This book encourages readers to write their own ideas and to explore how certain inventions were created.
- [*Temple Grandin: How the Girl Who Loved Cows Embraced Autism and Changed the World*](#) by Sy Montgomery. This book is about Dr. Temple Grandin, a professor at Colorado State University, Fort Collins and an autism advocate.
- [*3:59*](#), by Gretchen McNeil. This science fiction horror story will keep young readers engaged 'til the end.

For additional STEM books for teens, visit:

[Young Adult Library Services Association](#)

[STEM Girls: Books with girls rocking science and math](#)

[A Mighty Girl](#)

Better STEM learning experiences can give girls more positive views about STEM fields and help them see themselves as future STEM professionals. Girls enjoy hands-on learning that is challenging and engaging. They want to know why things happen and are not engaged by rote memorization. Raising girls' awareness about the types of STEM opportunities available, while at the same time assuring that girls successfully graduate from high school, can open many doors for STEM opportunities. This action and awareness in turn prepares girls to help to solve the problems of the 21st century. Society often sends girls the message that they should pursue careers that serve others; interestingly, STEM professionals do just that, solving complex problems and creating tools that make our world a better place. These high-demand, middle- and high-skill STEM careers can help girls prepare for lives in which they can both earn family-sustaining wages and contribute to solutions to local and global problems.

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