CHAPTER 5

I AM THRIVING…I AM CHANGING THE WORLD

"We have the opportunity to create the future and decide what that's like."
Mae Jemison,
The first African-American woman
to travel in space

Violeta García, PhD
Akaxia Cruz

Young adulthood is a time of transition and a time of rapid change. In this chapter, we provide information about resources and tools that help young women enter STEM training programs and career pathways that lead to family sustaining wages. Women age 19 and older benefit from professors and trainers who are willing to challenge their own biases to create equitable, inclusive spaces that support women's skills and abilities. Young women can also get a boost from opportunities that help them build their self-confidence and from opportunities to lead. They need to learn about, explore, and understand the preparation required for the many pathways that lead to STEM careers. During this stage in life, young women must prepare to enter the workforce with the skills and abilities they need to succeed and thrive in STEM fields.

In this chapter, we focus on topics and issues that impact young women and their entrance to, participation in, and retention in STEM careers. Critical issues for women between the ages of 19 and 30 include impostor syndrome, gender bias, low self-concept, self-doubt, childbearing expectations, and balancing a tight rope between being perceived as too feminine or too masculine.

OUTCOMES FOR WOMEN BEYOND 19 YEARS

As women enter adulthood, including women from diverse backgrounds who have been historically under-represented in STEM, they enter the STEM workforce or post-secondary STEM programs at rates that represent the diversity of all populations in the U.S. They:

- Understand on- and off-ramps for STEM careers and how to navigate the post-secondary space

- Access internships and apprenticeships

- Access mentorship programs

- Are aware of the STEM skills needed to succeed in post-secondary education or in workforce training programs

- Are aware of, prepared, motivated, and encouraged to obtain advanced degrees

- Can solve daily challenges in the workplace

- Can apply STEM skills to be engaged, contributing members in their community

- Use STEM skills to solve 21st-century challenges

- Are entrepreneurs or work in STEM fields that require mid- and high-level STEM skills

- Are self-sufficient and earn family sustaining wages through STEM careers

- Have opportunities for career advancement in STEM fields

A BRIEF LOOK AT ISSUES IMPACTING WOMEN'S PARTICIPATION IN STEM

Researchers have thoroughly documented women's participation in STEM in recent years. Reports such as *Why So Few?*[1] and *Solving the Equation*[2] by AAUW and *Double Jeopardy?: Gender Bias Against Women of Color in Science*[3] paint a grim picture of the many issues that women face during these career-forming years. To begin, there are societal expectations that put a lot of pressure on women to have children while they are young.

EXPECTATIONS FOR CHILD BEARING

Women may face societal or community expectations to enter motherhood within a certain timeframe and they do not necessarily need to conform to those external expectations. Women working in STEM fields may face some bias regarding their decision to have or not have children, including biases regarding women of child-bearing age. Educators and employers may fear that there will be productivity losses or weakening commitment when women become pregnant, and opportunities for women to receive assignments that offer challenges and chances to grow may become limited. Collectively, the barriers women face as they enter child-bearing age and motherhood are referred to as the Maternal Wall.[4]

Ms. Ascencio landed her first job as a science teacher when she was 23. During a brief conversation with her female students, ages 14-16, they asked her, "How come you don't have kids yet?" Ms. Ascencio was caught a little off guard but promptly replied, "Because I want to continue my own studies and finish graduate school. Not all women have to have kids right after they graduate from high school or from college. I want to travel the world, then I'll decide if I want to get married and if I want to have kids. I've been to 19 countries so far! I love to travel." The girls went on to ask her about the places she had traveled to around the world.

Ms. Ascencio's experience highlights one of many issues that young women grapple with early in their careers. Societal expectations can send messages that women are expected to stay home and have children. It's important to teach girls and young women that they have the opportunity to pursue a career before having children. Ms. Ascensio's experience with her students highlights this childbearing expectation and she counters the expectation by sharing a different story of what she has chosen for her career path. Some women may choose to have children, others may not. Sharing her experience showed her students that there are options for them.

In addition to changing her students' expectation of roles in society, Ms. Ascencio noticed that her students did not have a clear understanding of careers and career paths, and their parents did not understand the idea of career pathways either. She created a space for her students to consider a wider range of post-secondary options other than having children as the first step after graduating from high school. She helped them establish goals and think about careers that

would help them earn family-sustaining wages so they could afford to support their future children with a higher quality of life.

HOW CAN WOMEN WITH CHILDREN SUCCESSFULLY NAVIGATE A STEM CAREER?

As educators, parents, and community organizations work to help advance young women in STEM, they can help them know and understand the following: (1) she can have a STEM career whether or not she has children, (2) she does not have to conform to external expectations regarding when she will start her family or have a family at all, and (3) if she does decide to have a family as she is navigating a career path, it may be helpful for her to know she may encounter biases and learn about effective ways to advocate for herself.

Ways to advocate can include having conversations with supervisors about career aspirations and mapping out an approach to fulfill those goals. When women are proactive about initiating those conversations and are clear about how much they want to take on, educators and employers may be more willing to help them reach their goals. Mentors can also encourage women who choose to have families to advocate for themselves when it comes to their employment compensation packages and to advocate for family-friendly policies that have been shown to support women's long-term success in STEM fields.

Mona was a graduate student completing her doctoral degree at a research institution. Initially, she was afraid to share that she was pregnant with her supervisor for fear that he might see her with differently or change his expectations. Sure enough, in preparation for her leave, her supervisor commented, "Don't worry, we'll go easy on you when you return."

Mona's story shows the importance of having conversations with her supervisor to share career aspirations and her desire to continue to advance in her career as well as being a parent. Regular opportunities to check in will remind her supervisor that this is her decision and she would like his full support in achieving her goals without lowering expectations of her potential.

The following section delves into gender bias and offers strategies parents and educators can use to change behaviors.

GENDER BIAS

Bias refers to the preferences every person has for certain things. This can be bias for a particular food type or a specific beverage. In school and in the workplace, this translates to bias for some students, a specific classroom, or the type of people with whom we prefer to interact, often subconsciously. Even scientists who pride themselves on having objective perspectives are inherently biased. In a study where scientists were asked to evaluate applications to hire a laboratory

manager, scientists preferred male candidates to female candidates. The applications were identical on paper, except for the names used: John vs. Jennifer. Both male and female scientists viewed female applicants as less desirable or less competent. Researchers found that science faculty members, regardless of gender, equally discriminated against female applicants.[5] Biases are a result of stereotypes we have, such as, "Women are not well-suited to science."[6] Researchers also found that "a belief in one's objectivity may increase biased behavior."[8] Acknowledging that we all have biases is a vital step in understanding how it impacts our interactions with young women.

Paula consistently scores as high as her male classmates in her upper-division mathematics courses. One day during a math workshop Paula and her classmate Alex are reviewing concepts; Paula continues to help her peer understand the material at hand. When the workshop comes to an end, the organizing professor asks Alex to compete in a math contest. As a lover of math, Paula asks if she can participate in the contest also. The professor overlooks Paula and says that he doesn't think it is something she will be interested in. Although Paula is a mathematics major and scores just as high on exams as her male classmate Alex, her professor only extends the opportunity to Alex.

Paula and Alex's professor is exhibiting bias. This professor may not be aware of his bias towards female students. You can take Harvard's Implicit Bias Test online to find out what preferences you have and then reflect on the potential implicationsof these preferences. You may find that you, too, have a bias towards males in science or for females in humanities.

The first step in striving for equity is to acknowledge our biases as parents, as educators, and as humans. One strategy educators can employ to promote inclusive practices is conducting blind grading sessions. This is a process where the names of students are hidden, either written on the back of exams or concealed through the use of a random assigned code. The professor grades the exam and it is not until the very end that she finds out to whom the exam belonged.

Parents or caretakers can reduce gender bias by offering opportunities to their female and male children alike and praising choices based on interest rather than on gender. For example, when Marie came home to tell her dad that she wanted to major in engineering, her dad smirked and said, "What are you doing in a man's field?" This statement can be a deal breaker for girls in Marie's position. For her it became a challenge,

a goal that she was striving even harder to achieve. Her father's bias did not stop her. However, he could have used supportive words such as, "How exciting! I bet you will have to work very hard, but I'm sure you can do it. I'm so proud of you for leading the way for other female students to follow."

In addition to parents, counselors play a vital role in communicating expectations for girls. When discussing career options with young women, counselors may inadvertently dissuade girls from entering STEM pathways by not offering those pathways as possibilities. The National Alliance for Partnerships in Equity (NAPE) has developed a counselor toolkit to get people started with messaging that will improve outcomes for students considered non-traditional in certain career paths (see Box 5.1).

BOX 5.1. IN THE SPOTLIGHT:

National Alliance For Partnerships In Equity (NAPE)

The National Alliance for Partnerships in Equity (NAPE) is a consortium of state and local agencies, corporations, and national organizations. Through its four lines of business—professional development, technical assistance, research and evaluation, and advocacy—NAPE strives to achieve its mission of building educators' capacity to implement effective solutions for increasing student access, educational equity, and workforce diversity. Project areas include:

- Strategies for special populations' success
- Nontraditional career preparation programs
- STEM Equity Pipeline™ focuses on STEM, including STEM-related career and technology education (CTE) through:
  - ✦ Program Improvement Process for Equity in STEM (PIPE-STEM™): Promoting institutional change program that improves enrollment, retention, and completion of students in STEM.
  - ✦ Micromessaging to Reach and Teach Every Student™: Training teachers to use pedagogy to improve enrollment, retention, and completion of STEM students.
  - ✦ Focus on Counselors Initiative: Coaching counselors to encourage girls and under-represented populations in STEM careers.
  - ✦ STEM Equity Tools and Resources: Providing tools to support the three programs including webinars, research-based materials, and resources.

To learn more about NAPE visit http://napequity.org/

Bias, coupled with societal expectations for women and their sense of belonging, can make some women feel inadequate in certain STEM professions. Women may feel they don't belong. Building a cadre of support and joining affinity groups may help women learn from people who may be experiencing similar situations. Teachers and professors as well as employers benefit from training to identify bias in the classroom and in the workplace. Strategies used to combat bias include blind review for selecting employees to work in labs or in permanent positions as well as developing inclusive spaces.

IMPOSTOR SYNDROME

Impostor syndrome or impostor phenomenon refers to a fear that accomplished women have that they may be "found out," because they think that they do not deserve the success they've worked hard to achieve. This fear may sometimes be accompanied by self-sabotaging behavior that may hurt women's advancement in their chosen field.[9] In the following example, Aryiah's doubt about her acceptance to graduate school has pushed her thoughts to a space where she feels like an impostor.

Aryiah was recently accepted into a PhD program for Theoretical Physics. The university she was admitted to offered her full-tuition funding; medical, vision, and dental insurance; a departmental fellowship; and a teaching assistantship to pay for housing and living costs during her first year of graduate school. After visiting the university, meeting professors and students, and being welcomed into the university, Aryiah still thinks that she does not deserve such a generous offer and continues to not let her current professors know that she was accepted into a program. She is afraid that the university will realize they made a mistake and withdraw their offer. Only when she finally receives the list of incoming physics graduate students from the department does she believe she was truly accepted into the program.

Aryiah is afraid to express her successes because she is struggling with impostor syndrome. She fears she may be "found out" and the school might figure out she is a "fraud." Aryiah can benefit from several strategies to counter these negative emotions. She can definitely "fake it 'til she becomes it."[10] By pretending to be more confident and knowledgeable than she perceives herself to be, she will gain the tools that will help her develop the skill set she needs and eventually recognize her own abilities as well. Increasing her confidence translates to a belief that she really does belong. In addition, the more Aryiah is recognized by her peers and the community of scholars once she is in graduate school, the better her self-concept will be and she will begin to embrace a stronger science persona. As Aryiah builds her skill set and her reputation, people respected in her field will also begin to recognize her abilities and she will feel a greater sense of belonging.

SELF-CONCEPT

Self-concept refers to the belief we have about our own abilities, including academic abilities.[11] Research has shown a strong correlation between academic self-concept and academic achievement. In other words, students who believe they are strong at math, for example, tend to perform better than those who have a low self-concept for that discipline.[12]

When Mayra was working on her undergraduate degree in computer science (CS), her experience included many setbacks and negative encounters that left her feeling demotivated. When she found herself to be the only woman in

her CS courses, she felt isolated, doubted whether she belonged in these classes, and wasn't sure if she would complete her degree. One professor reached out to her and pointed out the strengths he saw in her work which helped her make a 180-degree turn toward a more positive experience. As a student, Mayra also volunteered for an afterschool coding camp for children. She felt very confident in teaching computer skills to young children. She also became an upper class ambassador to talk to incoming students about her experience. She performed really well and took challenging classes with a more positive attitude.

Mayra's low self-concept regarding her ability to perform well in her undergraduate computer science courses was a self-fulfilling prophecy. She didn't believe she could do it, so she did not perform well. Her professor's positive reinforcement helped change Mayra's perception of her abilities. She was able to perform well and successfully finish her degree program.

Educators can encourage young women by focusing on what they are doing well and build on their strengths. The messages that professors send can help or hinder young women's performance. Encouraging messages can lead to positive changes and help them develop a more confident and capable self, thus increasing their self-concept. Over time, this strategy can add affirmations that often help girls persist in these environments. In turn, young women in these programs can start to build up the value of self as a STEM professional. If a young woman does not see herself as belonging in these careers, she might not complete the program. It is imperative that the professionals who work with young women create opportunities for them to be part of these learning spaces to change the representation to be inclusive of our diverse society.

TOOLBOX

Helping Young Women Develop Strong Self-Concept

Women may have different motivating factors for pursuing STEM careers than their male counterparts. To create inclusive environments for women to feel a sense of belonging and to develop a belief that she has the skills and abilities to succeed, practitioners can take advantage of the research in motivation for women and men (Beier & Rittmayer, 2008).[13] The following list includes strategies helpful for developing strong self-concept in young women:

- ✓ Educators can help create learning environments where women's interests are reflected in her environment and where education is engaging.
- ✓ Educators and workplaces can value women's contributions.
- ✓ Both educators and women benefit from understanding causal attributions (i.e. whether a student attributes her success to internal or external actions, how students perceive others' attitudes towards them, and how students perceive their capabilities compared to others).
- ✓ Educators can develop interventions which include classroom management.
- ✓ Educators and workplaces can increase access to and affordability of STEM-focused summer programs.

The next issue that we will discuss connects self-concept with the idea that no matter how good a woman is at a particular skill, her professors or colleagues do not quite believe it, so she has to prove her abilities over and over again.

PROVE IT AGAIN...AND AGAIN

Lisa was ecstatic! She was awarded a three-year fellowship by a scientific organization to complete her doctoral degree. When Lisa shared the news with her department chair, the department chair replied, "How did you get that fellowship?" Lisa was dumbfounded. She could not believe she had just been asked that question.

Lisa's hard work, excellent grades, and dedication to her research were not enough proof that she had earned this honor. She had to constantly prove her merit every time it was questioned or doubted. In a survey administered to 557 scientists, close to 65 percent of Latinas, and 77 percent of Black women report having to provide more evidence of competence than their colleagues.[14]

For women, spending extra energy proving their competence over and over can eventually lead to a subtle push out of the system. Another factor that can push women out is impeded performance as a result of stereotype threat.

STEREOTYPE THREAT

Stereotype threat refers to an anxiety or "a fear of confirming a negative stereotype about your group."[15]

The day before a chemistry exam, Kesha was in a review session with her peers and the professor of the class. Near the end of the session, Kesha approached her professor and asked a question about an area to be tested on the exam. The professor responded by saying that she shouldn't worry about it, so Kesha asked if the concept in question had been removed from the exam. The professor responded by saying that it hadn't been removed, but that Kesha shouldn't worry because she likely wouldn't do well on the exam anyway since, "Girls just aren't very good at chemistry." Kesha walked away discouraged. The next day when she went in to take her test, all she could think about is the comment her professor made about girls being bad in chemistry. She focused all of her energy on her negative emotions and could not focus on the test itself. As a result, Kesha scored below the class average on the exam.

This constant tax on performance places women at a serious disadvantage compared to their male counterparts. A reduction in stereotype threat can lead to positive achievement in young women. Therefore, educators, including counselors, can benefit from professional development focused on creating supportive learning environments for female students.[16]

TIGHT ROPE

Supportive learning and workplace environments can offer opportunities to create more inclusive spaces for women. Some women are walking a tight rope between their own gender identities, being perceived as too feminine to be competent and taking on traditionally male characteristics as a means of workplace survival.

BALANCING A TIGHT ROPE

Defined masculine and feminine characteristics are often both societal and subjective. The story below of Larissa's experience in a mathematics department is just one illustration of how such norms may be perceived.

Larissa began her first day of classes by wearing jeans and no makeup, although she personally prefers to wears dresses. She also loves to wear fun eyeshadow colors and take time to do her hair. However, when she entered graduate school for mathematics, she thought her professors and peers would not take her seriously if she showed up on the first day of classes wearing a dress and eyeshadow to match. Larissa continued to silence her expression of femininity throughout graduate school because she wanted to be respected as a mathematician. She felt that if she embraced her feminine side, her professors and peers would view her as less credible. As time passed, she connected with more females in mathematics, and realized that she could embrace her authentic self; as a result her confidence improved.

Larissa feels she has to take on more stereotypically masculine characteristics for her work to be respected. This type of bias can be very damaging to the development of a positive STEM identity where being a female STEM professional is widely accepted. Norms and expectations can change as more women enter and remain in STEM fields and as young women have more opportunities to connect with female STEM role models. Research shows, however, that if female role models are perceived as overly feminine it can backfire.[17] Girls may not perceive combining stereotypical femininity and STEM success as plausible options for their future.

The issues presented above are detailed in a way that assumes that women have already entered a STEM space. This is not the case for many women ages 19-30. The second half of the chapter focuses on access to STEM careers and offers strategies for personal advocacy for women, for their parents, and for community organizations serving early-career women.

ACCESS AND EQUITY

By the time women reach age 19, they may have opted to pursue a STEM pathway, self-selected out of a STEM pathway, or realized that they did not have enough information to understand the benefits of entering a STEM career. In certain circumstances, they may also have been unconsciously pushed into non-STEM career pathways. Self-selection out of STEM pathways can occur due to a lack of preparation, including courses unavailable in high school or early college years. Women might not be aware of the opportunities offered through STEM careers. However, because women enter the workforce at multiple stages (i.e., out of high school, after college, somewhere in-between, or as a career change) there are opportunities to re-engage even if a STEM career was not necessarily on their initial career plan.

CAN WOMEN ENTER A STEM CAREER IF THEY DID NOT GRADUATE FROM HIGH SCHOOL?

Employment choices in STEM are available for women who did not graduate from high school, including construction manager, bus and truck mechanics, wholesale and manufacturing jobs, electricians, machinists, maintenance and repair workers, and home health aides.[18] Over a lifetime, women who did not graduate from high school will make an average of $973,000.[19] The top earning occupations with less than a high school diploma are in middle-skill STEM jobs (Figure 5.1). All of these employment options would result in higher pay if a worker completes high school and even bigger salary boosts after additional post-secondary education. For more information on STEM salaries and career resources visit https://www.bls.gov/careerout-look/subject/stem.htm.

FIGURE 5.1. FIVE TOP-EARNING OCCUPATIONS FOR PEOPLE WITH LESS THAN A HIGH SCHOOL DIPLOMA[20]

Lifetime earnings in 2009 dollars		
Less than High School	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	$1,741,000
Less than High School	Construction Managers	$1,549,000
Less than High School	Industrial and Refractory Machinery Mechanics	$1,494,000
Less than High School	First-Line Supervisors/Managers of Production and Operating Workers	$1,474,000
Less than High School	Construction Equipment Operators, except Paving, Surfacing, and Tamping Equipment Operators	$1,435,000

ENTERING STEM CAREER WITH A HIGH SCHOOL DIPLOMA OR ITS EQUIVALENT

A high school diploma increases the potential for higher pay, but the lifetime salary range is about half of what women could make in a lifetime if they pursue additional post-secondary education. Careers include work in construction trades and as electricians. Figure 5.2 highlights the top five occupations for people with a high school diploma.[21]

FIGURE 5.2. FIVE TOP-EARNING OCCUPATIONS FOR PEOPLE WITH A HIGH SCHOOL DIPLOMA

Lifetime earnings in 2009 dollars		
High School Diploma	General and Operations Managers	$2,156,000
High School Diploma	Construction Managers	$2,004,000
High School Diploma	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	$1,975,000
High School Diploma	Miscellaneous Managers, including Engineering, Funeral Directors, Postmasters and Mall Superintendents	$1,876,000
High School Diploma	Electricians	$1,834,000

EDUCATIONAL AND CAREER PATHWAYS

The variety of STEM occupations creates many opportunities for women in STEM. To take advantage of these opportunities, women need to know about and understand on- and off-ramps for STEM careers. For example, a young woman who did not complete high school can enter a STEM occupation, but staying at an entry level may not provide a livable wage. When women enter STEM occupations at this level, they benefit from understanding the steps they can take to learn additional skills and access opportunities to secure better wages.

Women can access middle-skill STEM jobs with various types of post-secondary education including certificate programs, associates degrees, and on-the-job training. They can also access STEM opportunities through four-year bachelor's degree programs and post-graduate education. The combination of experience and training can pave the way for stackable credentials that help women achieve industry certifications. The term 'stackable credential' refers to a component of a sequence of
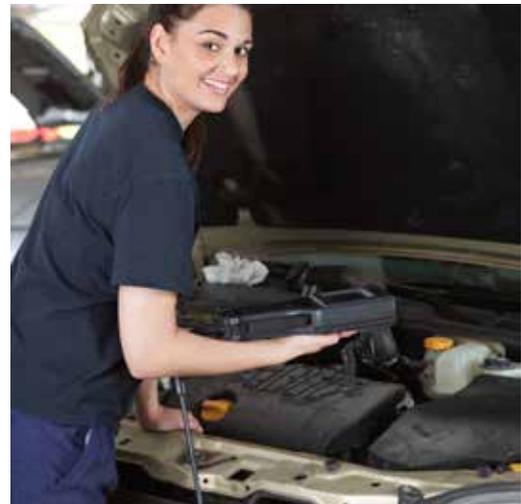
credentials that can be attained to build up an individual's qualifications to help them advance in a career pathway to access different and potentially higher paying jobs.[22] Industry certification refers to programs developed by various industries with specific objectives determined by industry professionals to meet the needs of that particular industry. This type of certification shows workers' skills, abilities, and competencies. This can be in the form of course completion, examinations, and the issuing of professional licenses in the given field.[23]

Women can earn money on their way to completing a four-year post-secondary degree.[24] Those who have some college training or have finished short degree or certificate programs can access middle-skill STEM jobs and can choose to continue to learn more skills to access additional opportunities. On-the-job training, which can take a year or more, is also an option.[25] Understanding the many paths women can take on their way to earning a bachelor's degree can help them make better career decisions. For example, women can take advantage of apprenticeships and internships. They can earn an associate degree and earn industry-based certifications or post-secondary certificates.

There are middle-skill STEM career pathways that would be a good fit for those who choose these paths. Earning an associate degree takes approximately two years when attending full-time and can lead to high-paying STEM job opportunities. STEMJobs.com published a list of job possibilities. We acknowledge that those pathways also offer a good way to have on-the-job learning opportunities while continuing to work towards a bachelor's degree if a woman so chooses.

Bachelor's degrees are typically four-year degree programs offered at colleges and universities. STEM jobs like petroleum engineer, computer and information research scientist, marine architect, and business intelligence analyst require bachelor's degrees. For most advanced degrees in STEM, a bachelor's degree is a required prerequisite for graduate school.

Women continue to be under-represented in STEM majors in college. Only 6 percent of women entering college after high school graduation intend to major in engineering, 1 percent of women pursue majors in chemistry, 1 percent in computer science, 1 percent in mathematics/ statistics, and 0.3 percent intend to major in physics. The highest percentage of women intending to major in a STEM field after high school is in biological and life science at 16 percent.[26] The largest gap between genders is in engineering (6 percent female vs. 19 percent male) and computer science (1 percent female vs. 6 percent male).[27]

Students who entered a STEM field at a highly selective school are more likely to complete a four-year degree program. On average, the national retention rate is 60 percent for engineering and 40 percent for computing. While an increased number of women have completed engineering degrees, going from 1 percent in the 1970's to 19 percent in 2013, we have a lot of work to do to better understand why women stay in a given field and why they leave. For an in-depth exploration of gender bias that impacts women, read *Double Jeopardy?: Gender Bias Against Women of Color in Science*.[28] Among the list of 10 best colleges for females in STEM is Harvey Mudd. This school increased female participation in computer science fourfold, from less than 10 percent to close to 39 percent. Harvey Mudd has taken steps to make learning more relevant to female students and to place them in workplace environments where they can thrive.

This includes offering an introductory Computer Science course to all entering students that counts towards their general requirements, which solidifies a foundation for success in later courses.

Some of the best opportunities for women, including women of color, with bachelor's degrees in STEM fields are in engineering and computer science. These fields offer a higher return on investment and numerous high-quality job opportunities where women can earn family-sustaining wages. See Figure 5.3 for a list of the top five earning occupations for people with a bachelor's degree. The gender pay gap in these professions is also much smaller than in non-STEM professions with women earning 88 to 91 percent of what men make, compared to 78 percent for the female workforce outside of STEM.[29]

FIGURE 5.3. FIVE TOP-EARNING OCCUPATIONS FOR PEOPLE WITH A BACHELOR'S DEGREE

Lifetime earnings in 2009 dollars		
Bachelor's Degree	Chief Executives and Legislators	$4,843,000
Bachelor's Degree	Computer and Information Systems Managers	$3,721,000
Bachelor's Degree	Aerospace, Biomedical, Agricultural, Chemical, Computer Hardware, Environmental, Marine, Materials, Petroleum, Mining, Geological Engineers	$3,558,000
Bachelor's Degree	Computer Software Engineers	$3,554,000
Bachelor's Degree	Marketing and Sales Managers	$3,494,000

Careers in natural resources have entry points at multiple educational levels. To learn more about careers in natural resources, see Box 5.2.

BOX 5.2. IN THE SPOTLIGHT:

A How-To Guide For Pursing A Career In Natural Resources (College And Young Adults)

Considering a natural resource career? The "How-To Guide for Pursuing a Career in Natural Resources" provides: (1) an exploration of the variety of fields and careers available in natural resources, (2) outlines of the education and training needed for those careers, (3) detailed instructions for navigating the federal application process and tips for applying for a federal job, and (4) insight into state and local natural resource careers, where and how to apply for open positions, and how to be a successful candidate.

http://www.getoutdoorscolorado.org/jobs/career-planning-resources

ADVANCED DEGREES

No matter what the entry point to a STEM career, women benefit from understanding opportunities to advance and pursue leadership positions. This can be through on-the-job training opportunities or opportunities for women to continue to pursue and complete post-secondary degrees. Many companies offer tuition reimbursement programs where employees can pursue advanced degrees, such as business administration, or even bachelor's degrees, such as Starbucks' College Achievement Plan. As women enter the workforce, they should consider if their employers offer these types of benefits in addition to other benefits commonly offered, such as health and dental plans.

There are many ways for women to pursue advanced degrees without creating a financial burden. Many scholarships and fellowship programs seek to increase the participation of women and women of color in STEM fields. For example, the National Science Foundation's Graduate Research Fellowship Program (GRFP) and individual fellowships through the National Institutes of Health (NIH) are good options for women seeking to have a broader impact in their communities through STEM occupations. Graduate students can also seek teaching assistantships or research assistantships to help pay for advanced studies.

> **"When young women understand the expectations of their positions and the performance indicators that will be used to gauge their progress, they are more likely to meet those expectations and to be compensated in an equitable manner."**

WHAT ARE OPPORTUNITIES FOR CAREER ADVANCEMENT IN STEM FIELDS?

Opportunities for advancement in STEM occupations come as a result of advanced training, whether on the job, through formal post-secondary degrees, or certificate programs. Advancement opportunities can also be achieved by pursuing training in complementary fields, such as a master's degree in business administration. This type of degree can help a medical professional, consulting engineer, or anyone looking to start a business. It is not necessary, but it is certainly helpful.

To advance in STEM fields, it is also important to have a clear understanding of performance indicators on the job. For example: Do women have a clear understanding of performance indicators that will be used to rate their progress? Are they written down in the performance plan? Are these measures or indicators reasonably attainable? When young women understand the expectations of their positions and the performance indicators that will be to gauge their progress, they are more likely to meet those expectations and to be compensated in an equitable manner.

WHAT ARE SPECIAL CONSIDERATIONS FOR EARLY CAREER WOMEN? HOW CAN WE BEST SUPPORT THEM?

The issues presented at the beginning of this chapter trickle into the workplace. Bias, for example, is an issue that we all know needs to be addressed, but poses uncomfortable conversations among colleagues. Often, women, especially women of color, feel isolated in workplaces that are dominated by values and interests that may be different than their own. Stereotypes, feelings of isolation, and having to prove their abilities over and over take a toll on women. Therefore, creating inclusive workspaces is an essential step if we want to retain women once they enter the STEM workforce.

Inclusive spaces are those where women feel welcome and a sense of belonging, where women feel they are part of the team, their ideas are valued, and their expertise is recognized. In inclusive spaces, women are provided with opportunities to lead just as often as their male counterparts. They have mentors and sponsors who can help them navigate the system. Their supervisors have set clear performance review expectations. All of these components are essential to supporting women and increase the chances of retaining them in the STEM workforce.

The following toolboxes have been created for specific groups: women, parents or guardians, and community organizations. They offer ideas so that we can, together, change the representation of women in STEM occupations.

TOOLBOX

Be Your Own Best Advocate

- Know what you want and need.
- Ask for what you want and need.
- Take risks. Create your own path if one does not yet exist.
- Embrace empathy. Listen to others and create a different culture, one that is more inclusive of women, including women of color, in STEM fields. People want to be heard. Acknowledge people's contributions, especially contributions by other women, so you and others can see their value and bring it to the forefront.
- Find mentors: Because a large percentage of the STEM workforce is comprised of white men, chances are you will have a man as a mentor. Take the time to get to know them. Also consider seeking out female mentors when possible. You may find that having role models who look like you will help to enhance the belief that you can achieve what you set your mind to and develop the skills you need to succeed.
- Treat men as allies. Don't discount efforts by men to help you on your path to success.
- Know how to accept praise. Practice saying, "Thank you so much for recognizing my hard work." or "Thank you, I worked hard to accomplish these results." Don't downplay your accomplishments by dismissing them.
- Be sure you understand the performance indicators to which you will be held accountable.

TOOLBOX

Parents/Guardians of Young Women

- Talk with your daughter about her accomplishments and her struggles. Serve as a cheerleader to support her efforts and offer your emotional support even if you might not understand the technical aspects of her educational program or future career.

- Ask questions to learn more about your what daughter does or what she is training for.

- Ask for a tour to see what she does at school and at work.

- Teach your daughter how to thrive and then let her use those skills. In the post-secondary space, it is her turn to put life skills into practice. Let her manage her own time, plan long-term projects, etc.

TOOLBOX

Community Organizations Serving Young Women (Ages 19-30)

- Train mentors and mentees embarking on a mentoring relationship.

- Train staff on best practices to create inclusive spaces for women and girls.

- Connect women to STEM opportunities.

- Connect young women to mentors or role models.

- Showcase the work of female STEM professionals through your communication channels.

- Provide tools for parents and educators to spread the message of the importance of girls pursuing STEM careers.

EDUCATORS

Counselors and instructors at all levels can benefit from learning about the wide range of STEM career options. All the vignettes presented at the beginning of the chapter highlight an important need: to create awareness that an issue exists (i.e., gender and/or racial bias) and to provide tools and trainings to change behaviors.

Counselors can help young women explore careers that are nontraditional for their gender. They can help young women by connecting their individual interests and passions with opportunities to pursue them through STEM careers. To do this, counselors can familiarize themselves with messaging that works to engage female students in STEM. Counselors and instructors can also examine their own perceptions and take the Implicit Bias Test so they understand their own biases and consider if they are behaving in ways that marginalize certain students. Check out the resources at the National Center for Women & Information Technology, Counselors for Computing (C4C), and the National Alliance for Partnerships in Equity Focus on Counselors Initiative.

Educators can also help young women identify the skill set needed for different occupations and how those skills translate into a degree program that they can pursue. Organizations like Skillful can help educators understand what employers are looking for.[30] When young women know the skill set needed in a given field, they can identify gaps in their learning and focus on the specific skills they need to master. Take Pia's story for example (Box 5.3). Pia was able to identify the gaps in her learning and gain those skills with the help of online resources and specialized programs. MotherCoders is not yet available in Colorado at the time of this writing, but it offers an inspiring example of an organization helping mothers pursue careers in information technology.

BOX 5.3. IN THE SPOTLIGHT:

MotherCoders – Pia's Story

Two years ago, I was one of six women picked to be part of MotherCoders, a tech orientation program for moms. For six Saturdays, we learned the basics of web development and gained an understanding of the tech landscape through female speakers from different sectors of the industry. That experience gave me the courage to start a new career as a web developer.

As a mom I was looking for flexibility in my work schedule so that I could be more available to my children. I also wanted to do something that made use of my creative flair, technical propensity, and passion for fashion. So I set out to gain the skills and experience necessary to be a web developer in the fashion e-commerce space. And now I am a web content developer at Gap Inc., where I get to work from home most days of the week. This gives me the flexibility I need to care for my family and I get to work on exciting things with smart and creative people.

It took me two years to transition into this new career. I was pregnant with my third child during my time at MotherCoders. I also had to keep my full-time job as a clinical lab scientist in order to afford living in San Francisco. I learned HTML and CSS in my spare time through online classes like Skillcrush, Code School, Code Academy, and Treehouse. I started making websites for my family, small organizations, and for myself. I also networked through Facebook groups and attended local Women Who Code events.

Last year, I was accepted into TechSF's front-end web development bootcamp for women at no cost. For three months, I attended class every weeknight. At this point, I reduced my hours at work so I could manage my class load and still have time for my family. There, I strengthened my skills in HTML, CSS, and learned JavaScript. Shortly after graduation, I started working for a local startup and then at Gap Inc.

This journey has been full of obstacles, yet it was not impossible. I am truly grateful for the resources, opportunities, guidance, and support given by friends, families, and the tech community.

Visit http://www.mothercoders.org/ **to learn more about MotherCoders.**

Counselors and other educators can also help connect women to mentors, near-peer mentors, and role models, so early career women can explore the various pathways to access STEM careers. Young women benefit from seeing and interacting with women who are in the occupations they aspire to pursue.

MENTORING PROGRAMS

Mentors serve as windows to the future for young women. With adequate preparation, mentors can connect young women to many future career opportunities. Access to training for mentors and mentees and selecting mentors (including professionals who have work/life integration) that portray a positive image of females in STEM is important to the success of mentoring programs.[31] Young women can find mentors by connecting with professionals in their local communities or by going through a formal organization, such as Million Women Mentors.

Every community has different opportunities. One of the best ways for young women to get to know what's happening in their local community may be through networking events at their school or throughout the community. Educators can share information about these events with their students or seek out local employers and work with them to connect their employees with local students. Employers can encourage their employees to engage with the community and spread information about the impact of STEM work in their industry.

When professionals become part of young women's networks, young women will see that it is important for them to give back, too, once they enter the workforce or the next stage in their educational continuum. STEM Connect aims to link role models to younger girls of color interested in STEM careers (see Box 5.4).

BOX 5.4. IN THE SPOTLIGHT:

STEM Connect

STEM Connect creates opportunities for role models, mentors, and STEM professionals to support the Dr. Justina Ford STEM programs. Exposing girls of color to STEM careers boosts representation of diverse women in the workforce.

Girls who participate in the Dr. Justina Ford STEM Institute and summer program have the opportunity to strengthen their understanding of math and science concepts.

Mentors in STEM fields interact with participating girls to build awareness of careers and career pathways so that all girls can reach their full potential and pursue STEM occupations.

To learn more about getting involved in the Dr. Justina Ford STEM Institute and become a STEM Connect Mentor or Role Model, visit http://www.jfsteminstitute.com/.

Long-term mentoring relationships benefit young women early in their careers. However, if young women can't have mentoring relationships, they can certainly benefit from shorter interactions with role models and hearing their stories. Careergirls.org has over 7,000 profiles of female role models, most of them in STEM careers.

Women veterans face unique challenges as they integrate into the civilian workforce, so it is especially important that they find opportunities to meet women mentors who have entered and persisted in STEM careers (see Box 5.5). You can read about inspiring Latina women in military service, both active and civilian in this Latina Style feature.

BOX 5.5. IN THE SPOTLIGHT:

Women Veterans Of Colorado

Theresa Z. Blumberg, co-founder of Women Veterans of Colorado, recognized that there is a distinct adjustment women have to make as they move from military to civilian lives. As a result, she created a space where women can connect with resources, including ways to utilize their well-earned benefits, prevent homelessness, and assist them to enter career paths where women veterans can realize their full potential. This volunteer organization partners with community resources such as Salute Colorado, government agencies, and nonprofits to realize their mission. For more information, visit Women Veterans of Colorado at http://womenveteransofcolorado.org/.

Salute Colorado is a two-year program intended to provide veterans of the U.S. Armed Forces with specialized services to meet their individual needs. Veterans are assigned a mentor who provides personalized advice and helps them with the transition to civilian life. The mentor helps the assigned veteran with career development, including exploring entrepreneurial career paths. At the time of this writing, Salute Colorado serves Boulder and Denver residents with plans to expand in the future.

Young women can meet mentors through internship or research experiences at organizations such as UCAR/NCAR (see Box 5.6) and other national labs. Another way to connect with a mentor is through professional organizations in the specific discipline of study such as the American Physical Association's Women in Physics program or through professional organizations seeking to advance under-represented students in STEM (see Start Here! - Professional Organizations & Networks on page 152)

BOX 5.6. IN THE SPOTLIGHT:

NCAR/UCAR

The University Corporation for Atmospheric Research (UCAR) is a nonprofit consortium of more than 100 North American member colleges and universities focused on research and training in the atmospheric and related Earth system sciences. UCAR manages the National Center for Atmospheric Research (NCAR) with sponsorship by the National Science Foundation. Through its community programs, UCAR supports and extends the capabilities of our academic consortium.

UCAR/NCAR offers a wide range of opportunities throughout the year, including summer programs for college, university, and graduate students.

For full details on undergraduate opportunities at NCAR/UCAR, visit https://www2.ucar.edu/opportunities/undergrads.

Organizations focused specifically on creating awareness, inspiring, and preparing students from demographics historically under-represented in STEM careers can be beneficial. Some of these organizations address issues relevant to students with intersectional identities, such as being African American and female or being Latina and first generation. For resources pertaining to women with special abilities, visit the AbilityLinks.org blog.

START HERE!

Professional Organizations & Networks Serving Women, Including Women From Under-Represented Groups, In STEM

- American Association of University Women (AAUW)
- American Indian Science and Engineering Society (AISES)
- Association for Women in Science (AWIS)
- Association of Black Psychologists (ABPsi)
- Black Data Processing Associates (BDPA)
- Black Engineer of the Year STEM Conference (BEYA)
- Great Minds in STEM (GMiS), formerly Hispanic Engineer National Achievement Awards Conference (HENAAC), promotes Science, Technology, Engineering, and Math careers especially in underserved communities.
- Latinas in STEM (LatinasInSTEM)
- Latinos in Science and Engineering (MAES)
- National Action Council for Minorities in Engineering (NACME)
- National Association of Multicultural Engineering Program Advocates (NAMEPA)
- National Consortium for Graduate Degrees for Minorities in Engineering & Science, Inc. (GEM)
- National Society for Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS)
- National Society of Black Engineers (NSBE)
- National Society of Black Physicists (NSBP)
- National Society of Hispanic Physicists (NSHP)
- SACNAS: Advancing Chicano/Hispanics and Native Americans in Science (SACNAS)
- Society of Women Engineers (SWE)
- Society of Hispanic Professional Engineers (SHPE)
- Women in Engineering ProActive Network (WEPAN)
- Women of Color STEM Conference (WOC STEM)
- Women in STEM Knowledge Center (WSKC)

Young women can find entry points into STEM careers while in high school, after earning a high school diploma, during college, after earning a two or a four-year degree, or upon completion of a graduate degree. At all stages, women need to examine where they are in their educational trajectory, to know what skills they possess, and to consider where they have gaps.

Yuliya's story is a good example of a single mom entering a health career after she divorced and needed to find a way to sustain her family (see Box 5.7). A conversation with a doctor sparked her interest in the medical field. She then had to figure out what her on-ramp to a STEM career would be and how to prepare for the occupation she wanted.

BOX 5.7. IN THE SPOTLIGHT:

Project Self-Sufficiency – Yuliya Mozgova's Story

My name is Yuliya Mozgova. I am originally from Ukraine. I am now a U.S. citizen. I came to the U.S. in summer 2006 for an internship in the business office at YMCA of the Rockies. I fell in love, got married, and had a handsome child who means the world to me. But things did not work out as I planned and I got separated from my husband. Later, I divorced and became a single mother in a foreign country with a 2-year-old boy and very limited resources for support. It was tough. I worked as a nurse's aide in a local hospital in Estes Park, CO, and later as a medical assistant/phlebotomist in an urgent care. I had a really hard time emotionally, socially, and financially. I had no support system.

Following the divorce, I found myself in debt and working three jobs just to pay my debts and support my family. One evening, while assisting the doctor to suture a patient, I mentioned that I enjoyed the medical field and he said to me, "You should become a nurse." That day, I came home and began researching nursing schools and decided to apply to Front Range Community College (FRCC). I met with nursing school advisors and things were looking good for me to start school in the fall of 2011, but I soon realized that driving from Estes Park to Fort Collins and having reliable child care was a problematic issue. I postponed my school until the next semester and then later pushed it back again. I was ready to give up on the idea of becoming a nurse.

My nursing school advisor was concerned that I did not start right away. I mentioned that I was not in a good spot and I did not know if I would ever be in a good spot to start nursing school. She told me about Project Self-Sufficiency (PS-S), a nonprofit in Larimer County, that supports single parents in becoming financially independent. The focus of PS-S is on improving the quality of life for parents and their children. I filled out the application and was accepted. I started in the PS-S program in July 2012. Working with my PS-S advisor, we built a solid career plan. I wanted to continue to work in the medical field as a medical assistant/phlebotomist and to go to school full-time, pay my debts, and apply for scholarships. My goal was to become a registered nurse and earn a self-sufficient wage for my son and myself.

PS-S helped me with scholarships, child care, and back-to-school clothes and extracurricular activities for my son along with Christmas gifts, a bike, dental care, counseling, and other unexpected expenses so that I could focus on school. In the fall of 2013, I moved from Estes Park to Loveland to be closer to school and got a job with UCHealth/Poudre Valley Hospital as a nursing assistant. In May 2015, I graduated from FRCC with an associate degree in nursing.

BOX 5.7. IN THE SPOTLIGHT: *CONTINUED*

I am now employed as a float nurse at UCHealth – Northern Region and I absolutely love what I do. My new career has made me more financially stable and secure; for the first time in my life I have a savings account and retirement plan and I can plan for my son's college education. At six years old, he wants to be a veterinarian. I am now going on to get my bachelor's degree in nursing from the University of Northern Colorado.

My motto in life: Have confidence in yourself. Have a strong sense of purpose. Always try your hardest for perfection. Never consider the idea of failing. Work extremely hard towards your goals. Be strong, and never give up.

-Contribution by Susan Polis Schutz

For more information about Project Self-Sufficiency, visit http://www.ps-s.org.

Other women, including women graduating with degrees from Ivy League universities, may not know what their options are post-graduation. Arete's Bridge (Box 5.8) has developed a training program to meet the needs of businesses that want a specific skill set in their employees, but are unable to find employees with that skill set. Businesses then hire Arete's Bridge to train recent graduates to match the skills needed in their particular field.

BOX 5.8. IN THE SPOTLIGHT:

Some students are so excited to get into college that they may not think about what next steps may be. When they graduate from college, there may be a disconnect between fields of study and skills employers need. This is what prompted Arete's Bridge to develop continuous training programs adaptable to changing technologies in real time for recent grads and for mid-career changers.

To learn more about Arete's Bridge, visit http://www.aretesbridge.com/index.html.

SOLVING DAILY CHALLENGES IN THE WORKPLACE USING STEM SKILLS

STEM graduates have problem solving, communication, and critical thinking skills. Even if women who major in STEM disciplines work in non-STEM fields, they bring a special skill set that may not always be found in graduates outside of these disciplines.

Women trained in STEM fields practice a set of competencies until they reach mastery. In the workplace, this translates to the ability to solve problems on a day-to-day basis and the ability to take large, complex problems and break them down into manageable pieces. The ability to apply the design process is very helpful when trying new ideas, seeing if they work, and quickly moving on to improve the idea if it does not work on the first try. Women apply what are commonly referred to as 21st-century skills in the design thinking process.

WHAT ARE 21ST-CENTURY SKILLS?

Twenty-first-century skills are a collection of skills that students need to be successful in life and in the workforce. The Framework for 21st Century Learning was developed with input from various community stakeholders and describes these skills:[32]

Life skills: flexibility, adaptability, initiative, self-direction, social and cross-cultural skills, productivity, accountability, leadership, and responsibility.

Learning and innovation skills: creativity, critical thinking, communication, and collaboration.

Information, media, and technology skills: information literacy, media literacy, and information, communications, and technology literacy.

For an in-depth description of each of the skills mentioned above, visit the link to the Framework for 21st Century Learning site.

Entrepreneurship is closely connected to STEM opportunities. As such, it is important that STEM training introduce young women to pitching ideas and launching projects.

WHAT DOES IT TAKE TO BE AN ENTREPRENEUR?

Entrepreneurship coupled with 21st-century skills creates opportunities for women to create, innovate, and lead their own business ventures. The start-up world is yearning for female talent. To learn more about starting a business, visit SCORE for free small business advice, and contact an innovation hub, such as The Commons on Champa or Innovation Pavilion to learn about startups in their innovation spaces. Boulder and Fort Collins were recently listed in the top 10 of America's most innovative hubs by nerdwallet. Sometimes innovation is born out of old ideas with a twist. Read about Brittany's venture in glass recycling (Box 5.9).

BOX 5.9. IN THE SPOTLIGHT:

Brittany Evans, Founder And President of Clear Intentions

Brittany is a trailblazer in Adams County, CO. She is a 27-year-old Millennial who had a vision to change glass recycling. She identified a problem: Glass is not recycled in single stream recycling processes. Brittany and her co-founder, Todd, have created a specialized waste management service focusing on glass. Their goal is to recycle all glass in Denver and greater Colorado. If glass is separated properly, all of it can be recycled. She has designed a solution that diverts glass from the landfill, creates a product called cullet, and sells that product which can be used as an aggregate for road base or for sidewalks. Brittany and her company aspire to change people's vision of recycling.

You can learn more about Brittany's company at http://www.clearintentions.glass/.

Issues of bias, stereotype threat, societal expectations, workplace culture, and impostor syndrome are very real to young women as they enter the post-secondary space or workforce. Mitigating the messages that women encounter that tell them that they do not belong in STEM fields is critical during this formative time. Educators and employers have to identify the ways in which their spaces perpetuate these negative messages and then work to create inclusive spaces where women feel they belong and their ideas matter. Young women can use tools, like the ones found in this chapter, to persist and lead change in this evolving STEM landscape.

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