# THIS IS WHAT **STEM** LOOKS LIKE!



HOW TO GET AND KEEP GIRLS ENGAGED IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

THE WOMEN'S FOUNDATION OF COLORADO



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- Arrow Electronics, co-chair
- CH2M
- Goodbee & Associates
- Lockheed Martin
- MWH, now part of Stantec, founding co-chair
- QEP Resources
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- Stephanie Copeland
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OUR MISSION

Building resources and leading change so that every woman and girl in Colorado achieves her full potential.

#### LETTER FROM THE PRESIDENT AND CEO

In the 1960s and 1970s, when almost 5,000 children across three countries were asked to draw a picture of a scientist, only 28 girls and no boys drew a female scientist, indicating that children don't think scientists look like girls or women. Children still don't see women and men equally in STEM. When the study was repeated in the U.S. in 2009, 35 percent of children depicted a woman scientist. While this progress is encouraging, biases that diminish girls' opportunities to explore STEM begin early and are deeply rooted. This is why The Women's Foundation of Colorado aptly named this guide, "This Is What STEM Looks Like!"

As the only community foundation in Colorado focused on improving economic outcomes for women and girls, we work in many ways to help girls and women advance their earning potential through learning. Careers in science, technology, engineering, and mathematics (STEM) offer high wages and are multiplying here in Colorado, but women and girls are under-represented in STEM education and careers. Although women comprise nearly half of Colorado's workforce, they make up less than a third of the STEM workforce in our state. Girls' and young women's interests in these fields must be nurtured from a young age and they must have access to engaging learning experiences to develop the skills necessary for success.

We developed **"This Is What STEM Looks Like!"** to help parents and families, formal and informal educators, and community role models for girls and young women learn how to encourage and inspire girls from birth to adulthood to explore the world around them. This guide will also give you tools to motivate and expose girls to experiences to develop STEM skills and build confidence in their abilities so they will be prepared to pursue STEM careers.

The Women's Foundation of Colorado is also working with leading STEM employers in our state to cultivate more inclusive workplaces where women are welcomed, valued, and supported in their success. Together, we can build on girls' natural curiosity, connect them to diverse role models, and prepare them to lead Colorado's innovation industries in the future.

We hope this guide sparks and cultivates passion for STEM exploration with the girls and young women in your life so they may achieve a lifetime of economic security through exciting careers in STEM!

Lauren Y. Casteel President & CEO The Women's Foundation of Colorado

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The Women's Foundation of Colorado (WFCO) created this guide as a resource for parents and caregivers, educators, and community organizations striving for equitable representation of women and girls in science, technology, engineering, and mathematics. The guide includes strategies and activities for educators and families so that they can help girls, including girls of color, stay on track and be inspired, motivated, and prepared to pursue careers in STEM.



#### **Executive Summary**

#### Why STEM?

Nationally, and in Colorado, the demand for a skilled STEM workforce is growing and STEM jobs offer higher salaries than non-STEM jobs.<sup>1</sup> Women working in STEM jobs earn, on average, 33 percent more than those in other fields,<sup>2</sup> yet women account for only 29 percent of the STEM workforce.<sup>3</sup> In Colorado, women earn more than 50 percent of two-year and four-year degrees,<sup>4</sup> but less than a third of Colorado graduates in STEM are women.<sup>5</sup> Women's under-representation in STEM fields starts early, with gender gaps in STEM interests beginning in middle school and growing throughout high school, college, and career. Far too many girls and women are discouraged from pursuing success in STEM fields. Now is the time for change.

#### **Resource Guide**

We've created this guide to introduce parents, caregivers, and educators to the many opportunities that STEM can provide for girls and women. You'll find resources to help girls explore and prepare for those opportunities and tools to inspire, motivate, and prepare young women to thrive in STEM careers. In addition to tools for creating exciting, hands-on learning experiences, the guide includes: an overview of the status of girls and women in STEM in Colorado, definitions of STEM-related terms, and a call to action. Each chapter includes strategies that are specific to a certain age group, as well as benchmarks to strive for in each stage of girls' lives to prepare them for future STEM opportunities. You might also see some repetition in concepts as they are relevant for girls of many ages. We've included a sampling of the many STEM resources available locally, statewide, and from across the nation.



#### for Engaging Girls and Young Women in STEM

By going deeper into this guide, you can learn how to put 12 strategies into practice:

#### **STRATEGY 1**:

#### Provide opportunities for mastery experiences.

- Girls underestimate their abilities, especially as they get older. Help them recognize what they can do and recognize their work.
- Have girls take ownership of their decisions and help them with language so that they can advocate for themselves.

#### **STRATEGY 2:**

### Provide opportunities for girls to learn by observing others.

- Female role models and mentors can help girls see themselves as future STEM professionals.
- Seeing female role models and mentors in action inspires girls.

#### **STRATEGY 3**:

Provide opportunities for girls to be recognized as innovators by their peers and their community.

• Empower girls to lead teams so boys and girls alike recognize them as creators.

#### **STRATEGY 4:**

#### Take a holistic approach. Help girls cope with the misconceptions and biases that stand in the way of STEM engagement.

- Teach girls about growth mindset and how it impacts their sense of self.
- Educators and caregivers can be mindful of their own behavior and challenge biases that can stand in the way of STEM experiences and engagement for girls.



#### **STRATEGY 5:**

Educators and community organizations can provide opportunities for parents/caregivers to see their daughters practicing science, technology, and engineering skills and solving problems using math.

- Design events, such as family STEM nights, and put girls in charge. Parents will feel proud of their girls and expand their understanding of what their daughters are capable of doing.
- Put girls in the spotlight whenever parents come to school. This can be through community nights, in design or science labs, in school gardens, or by integrating STEM into other parent-related activities in which girls take the lead.

#### **STRATEGY 6**:

## Give parents/caregivers ideas about how they can continue STEM learning at home with their children.

- Parents/caregivers can influence a girl's career trajectory and expose their daughters to a variety of STEM learning opportunities.
- Teachers can provide tools for parents to continue working on STEM learning at home.
  Develop age-appropriate STEM learning idea sheets to get them started.
- Community organizations should make a commitment to reach out to parents to continue STEM learning at home. Extracurricular opportunities can set the foundation for girls to explore STEM opportunities.

#### STRATEGY 7:

# Educate parents/caregivers on how best to advocate for advanced STEM opportunities for their daughters.

- Parents need tools to understand different types of STEM opportunities that may be available so that they can advocate for schools and community organizations to bring those opportunities to their community, if they are not yet offered.
- Invite parents to connect with teachers and school leaders about implementation of the latest educational policies as they pertain to women and girls.
- Parents can also build relationships with elected officials to share their thoughts about STEM education and career opportunities for women and girls in their communities.
- Parents and community members can advocate for internships and apprenticeships with STEM employers.

#### **STRATEGY 8:**

### Show parents/caregivers where they can find STEM opportunities for their girls.

• Community organizations can work together to have one database to list all programs by location and type of opportunity, such as <u>The</u> <u>Connectory</u>, and keep information current.

#### **STRATEGY 9**:

Educators and community organizations can provide multi-faceted communications about how STEM relates to students' daily lives and everyday experiences.

• Offer opportunities for families to engage in citizen scientist programs and develop programs for families with multiple touch points. These can include field studies, family STEM nights, and community share-out days.

#### STRATEGY 10:

#### Help educators access and share STEM resources.

- Educators need resources that build their understanding of integrated STEM education, such as the chance to see what a great STEM classroom looks like and how great STEM teaching can tap into their students' potential.
- Teachers can find funding opportunities for professional development through resources like the National Science Teachers Association.

#### **STRATEGY 11:**

Provide training and resources for educators to develop curriculum that is inclusive of girls, including girls of color.

- We all have hidden biases. Uncovering our hidden biases can help us discover steps to take so that we do not unintentionally exclude certain students from STEM experiences.
- Parents can examine how they treat girls and boys and thoughtfully consider if they offer different types of toys or experiences to girls that do not foster STEM skills.



#### STRATEGY 12: Link educators with industry partners so they can see and experience the work of STEM professionals.

- Educators can use STEM professionals and their experiences to create meaningful, engaging units of studies for students.
- Girls then benefit from hands-on learning and educators can help their students explore authentic problems in STEM.

WOMEN WORKING IN STEM Jobs Earn, on Average,

33%

MORE THAN THOSE IN OTHER FIELDS,<sup>2</sup> yet women account For only 29 percent of the Stem workforce.<sup>3</sup>

#### Chapter Summaries

#### INTRODUCTION

The introduction sets the stage for the issues that pertain to girls and women in science, technology, engineering, and math careers. We present data about why STEM careers matter and how severely under-represented women, especially Latinas, African American women, and Native American women, are in these fields.

#### CHAPTER 1

**By age 5, keep me curious!** This chapter focuses on the innate curiosity of girls in early childhood. Their drive to ask questions and explore their natural world is something to cultivate and develop. Caretakers, whether parents, grandparents, teachers, or community members, can foster that sense of curiosity, expose girls to opportunities for exploration, and teach them how to utilize tools to solve everyday problems. By age five, girls should begin to understand the role of STEM professionals in the community, see STEM professionals as problem solvers, and begin to see themselves in that role as well. This chapter presents strategies and activities for caregivers and educators to expose toddlers and preschoolers to STEM experiences.

#### **CHAPTER 2**

**By age 10, I can ask!** This chapter focuses on further developing girls' abilities to ask questions of relevance to their lives. Strategies and activities include ways to foster the natural inquirer within young girls. We explore common challenges for girls in this age span that could keep them from pursuing STEM careers in the future, such as negative perception of abilities and lack of awareness of opportunities. Parents, caregivers, and formal and informal educators will learn strategies to build girls' STEM skills and confidence and discover how to counter messages that tell girls they do not belong in STEM.

#### **CHAPTER 3**

**By age 13, I am shaping my future.** In this chapter, we explore issues that are relevant to this age group such as girls' perception of STEM abilities, societal pressure, and teacher biases that may hinder girls from pursuing STEM pathways. We explore strategies such as building self-efficacy both for teachers and for girls and exposure to real-life, hands-on opportunities in STEM that continue to prepare girls for STEM pathways. Activities include girls learning about and meeting STEM professionals like themselves, understanding issues regarding representation in these fields, and exploring the contributions they can make to these fields. With these strategies, girls move from being consumers of information to creators and contributors who make a difference.

#### **Chapter Summaries**

#### **CHAPTER 4**

**By age 18, I am preparing to solve 21st-century challenges.** This chapter focuses on opportunities that help girls see themselves as STEM professionals in the near future. We present research-based strategies to provide greater access to opportunities that prepare, inspire, and motivate young women to become problem solvers and pursue careers in STEM. We also describe the potential that STEM careers provide for girls to earn family-sustaining wages, as well as the economic benefits to their communities.

#### **CHAPTER 5**

**Beyond age 19, I am thriving; I am changing the world.** This chapter presents issues that young women face when entering the workforce or pursuing post-secondary education and strategies for overcoming those challenges. We present research on current trends for this age group. We also explore strategies to mitigate the micromessages that women encounter, including educator bias, and workplace climates that may not be inclusive of women. We provide tools that young women can use to persist in STEM fields and lead change.

#### CONCLUSION

The Concluding Recommendations for Action summarize the need for equitable representation of women, including women of color, in STEM careers. We present a vision of what it will be like as girls become equally represented in STEM careers and provide a summary of actions everyone can take to support systems-level change for women and girls in Colorado.



"Women's under-representation in STEM fields starts early, with gender gaps in STEM interests beginning in middle school and growing throughout high school, college, and career. Far too many girls and women are discouraged from pursuing success in STEM fields. **NOW IS THE TIME FOR CHANGE.**"

**EXECUTIVE SUMMARY** 

#### Contributors

WFCO developed this guide through the collaboration of more than 30 partners. We are grateful to these partners and to the lead author and co-authors, all of whom you can read about in the Contributors section.

This guide was made possible by generous contributions from **Xcel Energy**, **XTO Energy**, **an ExxonMobil subsidiary**, and members of the WFCO STEM Coalition:

- Arrow Electronics, co-chair
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- MWH, now part of Stantec, founding co-chair
- QEP Resources
- SSG MEP
- Stephanie Copeland
- Suncor
- Zayo Group

The need for equitable representation of women, including women of color, in STEM careers is an economic imperative, an innovation catalyst, and an issue of equity and inclusion. Gender parity in STEM will give us access to much-needed STEM employees to help businesses grow. In addition, bringing in the perspective of women and communities of color boosts creativity and innovation. Equity, access, and inclusion of women, including women of color, are simply the right thing to do. Jobs in STEM fields provide an opportunity for women to earn family-sustaining wages and to bring their unique ideas and perspectives to STEM solutions that can address the complex challenges facing us in the 21st century. By implementing the ideas and strategies in this resource guide, we can ensure women and girls of Colorado have the chance to build STEM skills and pursue STEM careers.

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#### How To Use This Guide

#### This guide can be read from cover to cover, and chapters can also be utilized independently. Suggestions and resources to help girls explore are included throughout the guide. Ideas are sometimes introduced in one chapter, and then explored in more depth in another chapter.

The ideas presented are organized into "Try This," "Start Here," and "Spotlight" boxes, and "Read All About It," "Activity," and "Toolbox" sections. "Read All About It" sections are ideas for books to explore different STEM topics. "Start Here" sections provide professional development information or resources for formal and informal educational settings. Parents and caregivers can also benefit from these resources. "In The Spotlight" segments feature organizations that are helping girls advance through STEM opportunities. These groups, from Colorado and across the nation, are using best practices in STEM. "Try This" sections are meant to get your ideas flowing. The ideas in this guide are meant to be a starting point. We encourage you to try your own ideas, too.





#### DEFINITIONS OF KEY TERMS USED THROUGHOUT THE GUIDE

**STEM:** The acronym stands for science, technology, engineering, and mathematics. STEM learning experiences embed 21st-century skills and engage a girl in real-world, relevant experiences that are problem-based in which she can solve problems that matter to her, to her community, and to her world.

**Under-Represented Groups:** Groups whose membership in the STEM workforce is less than their total representation in the U.S. workforce as a whole. This includes women in many fields, such as engineering and information technology, and people of color (see definition below). Under-represented groups also include groups historically marginalized, such as the Lesbian, Gay, Bisexual, Transgender, Queer, Intersex, and Asexual (LGBTQIA) community; women veterans; women with disabilities; and women from rural areas who may not have access to the same opportunities as those who live closer to major metropolitan areas.

**People of Color (POC):** "Refer[s] collectively to African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, Hispanic/Latino Americans, multiracial individuals, and all other persons who are not categorized as white by the U.S. Census."<sup>1</sup>

**Design Thinking Process:** A systematic approach to problem solving that is similar to the Engineering Design Cycle but is focused on what the learner experiences as she identifies and thinks through problems. Stanford's <u>d.school</u> describes design thinking<sup>2</sup> with the user first defining the problem and then implementing solutions. The user's needs are at the core of concept development. The five steps, which can be sequential, but can also be revisited and cyclical, are as follows:

• EMPATHIZE: Work to fully understand the experience of the user for whom you are designing. The designer does this through observation, interaction, and immersing herself in the client's experiences.

- **DEFINE:** Process and synthesize the findings from your empathy work in order to form a user point of view that you will address with your design.
- **IDEATE:** Explore a wide variety of possible solutions through generating a large quantity of diverse possible solutions, allowing you to step beyond the obvious and explore a range of ideas.
- **PROTOTYPE:** Transform your ideas into a physical form so that you can experience and interact with them and, in the process, learn and develop more empathy.
- **TEST:** Try out high-resolution products and use observations and feedback to refine prototypes, learn more about the user, and refine your original point of view.<sup>3</sup>

**Engineering Design Process:** A series of steps that engineers use to solve problems. This process is cyclical. On many instances, it must also be repeated and engineers make improvements and test possible solutions along the way. There are many versions of the engineering design process, but most include identifying the need or problem and the constraints, researching the problem, imagining possible solutions, selecting a promising solution, building a prototype, trying or testing it out, and improving design based on results from testing a prototype.<sup>4</sup>

**21st-Century Skills:** "A broad set of knowledge, skills, work habits, and character traits that are believed—by educators, school reformers, college professors, employers, and others—to be critically important to success in today's world, particularly in collegiate programs and contemporary careers and workplaces. Generally speaking, 21st-century skills can be applied in all academic subject areas, and in all educational, career, and civic settings throughout a student's life."<sup>5</sup> These skills and behaviors include critical thinking and reasoning, information literacy, collaboration, self-direction, and invention.<sup>6</sup>

HOW TO USE THIS GUIDE

#### **ADDITIONAL COMMENTARY**

Throughout the guide, you will notice that some of the chapters have co-authors. These contributors were willing and able to dedicate their own time and resources to write specific sections of that given chapter. We appreciate their commitment to advancing girls in STEM.

The guide contains stories to help the reader ground examples in practice. Any similarities to actual persons, living or dead, are purely coincidental. At times, the authors may have used examples inspired by a real occurrence; however, pseudonyms were used to protect peoples' identities.

#### REFERENCES

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