

## VAI EDUCATION SPOTLIGHT

## Girl Power: Powerful Strategies to Motivate Girls in STEM



Although there have been strides to reduce the STEM gender gap over the last 50 years, progress has been slow. Women constitute almost half of the entire workforce, but are drastically underrepresented in STEM fields, making up only 28% of the STEM population. Recent career assessments have found that female students' aptitude for STEM careers is remarkably higher than their interest in these fields. How do we boost their interest to mirror their aptitude? How can we help alleviate this definite gender disparity and inspire our future female scientists, engineers, and mathematicians of all ages?

### Why it Matters

On June 23, 1972, Title IX was written into law which prohibits discrimination in ALL areas of education. Thanks to this monumental legislation women now make up 56% of America's college students, hold 48% of tenure track positions, and have increased athletic participation tenfold since the 1970s ([The American Association of University Women](#)). Although there have been incredible gains, there is still work to be done. According to research from [Glassdoor](#), men dominate 9 of 10 college majors with the greatest earning potential — all 10 are in STEM fields. Additionally, 7 out of those 10 majors are in computer science and engineering.

Those women that do pursue careers in STEM are heavily represented in social (65%) and life sciences (48%) and greatly underrepresented in computer and mathematical sciences (26%) and engineering (16%), according to the [National Girls Collaborative Project](#).

We need women in these careers. We need diversity of thought and diversity of experiences. According to the [U.S. Bureau of Labor Statistics](#), STEM jobs will increase by at least 8% each year through 2029. We need to fill instrumental positions that have not even been created yet!

But the true reason for why this matters has to do with who might be sitting in your classrooms every day. Your future problem-solvers. Your future world-changers. You may have an Ann Makosinski, who at 16 years old developed a thermo-electric flashlight. Or a Gitanjalie Rao, the first ever Time Kid of the Year, who at 12 years old used technology to tackle issues such as contaminated drinking water and cyberbullying. These problem-solvers are among us; let's help unleash their potential!

“I still remember asking my high school guidance teacher to take a second year of algebra instead of a fifth year of Latin. She looked down her nose at me and sneered, ‘what lady would take mathematics instead of Latin?’”

— Nancy Grace Roman  
Astronomer/Mother of Hubble”  
1925-2018

## The Big 3 Problems

Before we can talk solutions, we need to address the underlying problems. There are three big issues that seem to rise above the rest when it comes to girls in STEM:

1. **The Stereotype:** Even in this more progressive time, gender stereotypes in math and science still exist. Researchers at Northwestern University [analyzed fifty years](#) of the “Draw a Scientist” test and found that in the 1960s and 1970s less than one percent of children drew a woman. This rose to 28% between the 1980s and present day.
2. **The Loss of Interest in STEM:** According to a recent study from [YouScience](#), female 11th and 12th grade students’ aptitude for STEM careers is remarkably higher than their interest in these fields. Career assessments have shown that these female students have an aptitude 4 times higher than their interest in math and computer science and an aptitude 10 times higher than interest in engineering and architecture.
3. **The Absence of Role Models:** A 2016 study from the University of North Carolina and Duke found, “...a positive and significant association between the proportion of female math and science teachers in high school and young women’s probability of declaring a STEM major.” We need to make sure our female students have access to diverse, female STEM role models both in-school and out.

Although historical stereotypes are not necessarily in our purview to solve, teachers can take simple and powerful steps to address the lack of role models and waning interest in STEM careers for our female students. Here are 6 ways with practical strategies you can share with your teachers to motivate and encourage their future problem-solvers..

## What We Can Do

1. **Redefine STEM:** STEM is more than just a career choice. It is more than an acronym. It is a way of thinking. STEM is being able to ask questions, think critically, and creatively. Problem solving is at the heart of STEM. So start there...at the heart! The best way to start at the heart of STEM is to focus on the scientific Habits of Mind. These are the skills that scientists would argue are more important than science content to be a

successful scientist.

### Strategies:

- **Habits of Mind: Which Did You Choose?** Encourage metacognition and deep reflection by asking students to think about which [Habit of Mind](#) they think will most support their work during a project or investigation. Afterward, ask students to determine if that was the Habit of Mind they needed most or if they would change their choice. Often students are surprised by which habits they used most in the investigation!
  - **Question STEMs:** Use these [sentence stems](#) to promote creative thinking. Allow students to choose two starters to encourage student ownership and see where their creative ideas take them. To encourage critical thinking, use these [sentence stems](#) to get started.
  - **Data Your Way:** Help students take ownership of their learning by allowing them to choose how they represent their data from an investigation. They may stretch in their abilities and learn a new way to graph or chart data. They may observe other students’ representations and want to learn that method. Or you may want to share a variety of graph choices to spur their thinking, such as those presented in this [Data Choice Chart](#).
2. **Connect to Girls’ Lives:** Connect the content you need to teach to the lives of students to promote motivation, perseverance, and ultimate success. By connecting to the lives of our future female scientists, you can help give them a science identity and build confidence that they are truly a “science person.”

### Strategies:

- **Project-based Learning:** PBL is all about the heart. True PBL experiences connect the content students learn to work that matters to them. Use PBL opportunities grounded in STEM to engage in experiences outside the classroom walls. Show your female students that STEM is not about memorizing facts but a way of thinking to solve the world’s problems. The Dirty Truth, Prevent the Spread, What’s in Your Water, High Energy, and State of Sustainability are a few STEM-inspired [Blue Apple projects](#) that not only teach the content you need to

teach, but will also make a difference.

- **After/Out of School Opportunities:** Share various STEM opportunities for your female students to be a part of. Here are just a few examples to get you started:

- [Future Problem Solvers](#)
- [Girls Who Code](#)
- [Girl Scouts](#)
- [Summer Engineering Experience for Kids \(SEEK\)](#)
- [Science Olympiad](#)
- [First Robotics](#)

3. **Establish an Inquiry Approach:** Help build curiosity, creativity, critical thinking, and confidence by adding more inquiry into your science lessons. This shows your students that there is not necessarily always one right answer, or one way to solve a problem.

#### **Strategies:**

- **4 Small Changes:** Identify ways you can infuse more inquiry into your science investigations where students...
  - 1) don't know the answer they are supposed to get
  - 2) play a driving role in the process for learning
  - 3) construct meaning through journaling
  - 4) are working as hard as the teacher.
- **Messing About:** Before moving directly into an investigation, allow time for students to “mess about” with materials and supplies to begin exploring and building interest in phenomena. During this experience, students can brainstorm questions they are interested in exploring later, while also building the prerequisite knowledge and experience they need to be successful in the investigation. Messing about builds curiosity and engagement.

4. **Promote the Power of Collaboration:** STEM is not done in isolation. No new discovery will ever come from just one individual. [Recent research](#) has found that females find social interactions more rewarding than males. Promote the importance of social connections, belonging, and collaboration to STEM success.

#### **Strategies:**

- **H.E.A.R. Protocol:**
  - HALT — pause your own words and really listen.
  - ENGAGE — give the other person your full attention.

- **ANTICIPATE** — remind yourself that by really hearing the other person, you will likely learn something new.
- **REPLAY** — summarize what you're hearing to make sure you understand correctly.

- **Engineering Norms:** Co-develop team norms through “low stake” collaborative activities such as [engineering challenges](#). Ask students: What made your team successful? What were your challenges? Use those norms to develop collaboration rubrics.

5. **Foster Perseverance:** Research has shown that [girls believe that perfection is the key to success](#) which hinders risk-taking and learning from mistakes. Create a mistake-friendly culture to build confidence and risk-taking.

#### **Strategies:**

- **Change the Conversation:** Teach students that success is controllable by praising controllable characteristics. With this strategy, praise progress and effort instead of talent and achievement. Instead of saying, “You're so talented at science,” say, “I can tell you've really worked hard to understand how the rock cycle connects to plate tectonics.”
- **My Wonderful Mistake:** Encourage a failure-friendly culture in your classroom — have students [record and reflect](#) on their wonderful mistakes and what they learned from them in their journals, or use them as an exit slip at the end of a lesson.

6. **Provide Access to Diverse, Female STEM Role Models:** When girls see scientists and engineers like them represented in the workforce, it will motivate and give them the self-confidence to pursue something that they may never have considered.

#### **Strategies:**

- **Connect with a Female Scientist/Engineer:** Bring those role models into your classroom! Consider using the [Skype a Scientist](#) program (FREE!) or using [Blue Apple's Real World Connection List](#) to connect with a female STEM expert.
- **Stock Your Library:** Having access to books that highlight and celebrate the remarkable contributions women have made to STEM is incredibly important. Use this [book/resource list](#) to help in your hunt for the best women in STEM books.
- **HerSTORY:** Help your students deepen their appreciation for incredible historical pioneers with the Women in STEM activity found [here](#).

# GIRL POWER AND PROJECT-BASED LEARNING



If your teachers would like to try project-based learning to connect to their female future scientists, have them check out the Blue Apple Project, [What's in Your Water?](#), where students learn about all things water; from watersheds to water pollution. They will investigate water samples to determine what's in their water, develop ways to improve water quality, and share what they've learned by creating a fundraiser to raise money for a water-specific charity.

- This [Project Overview](#) provides a lesson-by-lesson summary of this project.
- Here is a [Recommended Book List](#) of rich, diverse literature on the topic of water and watersheds.
- Check out [K-8 Content Standard Connections](#) for this project.
- To see this project in action, check out the [project video](#).

## Conclusion

Although there have been incredible gains over the past 50 years, there is still work to be done. By intentionally taking small, but powerful steps in our classrooms, we can ensure that our future female problem-solvers have the confidence, encouragement, and motivation to change the world, one STEM field at a time!

**[Click here](#) if you would like to see a 30-minute webinar presentation of this content:  
Girl Power: Powerful Strategies to Motivate Girls in STEM Spotlight**

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