Gender Equity in STEM

**Program Type:** Training  
**Audience Type:** Adult

**Goals:**
- Participants will examine the ways in which girls are subconsciously excluded from science.
- Participants will learn to recognize gender bias and discuss strategies that promote a culture of gender equity in STEM.

**Topics:**
Gender equity, inclusion, implicit bias, engineering

**TIME REQUIRED**

<table>
<thead>
<tr>
<th>Advance Preparation</th>
<th>Set Up</th>
<th>Activity</th>
<th>Clean Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 min</td>
<td>10 min</td>
<td>60-120 min</td>
<td>5 min</td>
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</table>

**SITE REQUIREMENTS**

- Projector and screen for showing the PowerPoint presentation
- Tables and chairs for participants

**SUPPLIES**

<table>
<thead>
<tr>
<th>Supplies</th>
<th>Amount</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projector, computer, and screen</td>
<td>1</td>
<td>For displaying PowerPoint</td>
</tr>
</tbody>
</table>
This document is meant to guide professionals in delivering trainings/workshops for educators and caregivers. The content and length of the training can be adapted to fit the needs of the participants and the facilitator’s personal presentation style. It is important to approach the topic with sensitivity; participants may have strong opinions and emotions regarding the topics of education, parenting, and gender. Making space for personal reflection and small-group discussion may encourage participants to engage more deeply. You can download the PowerPoint presentation by going to http://www.omsi.edu/educator-resources and searching “Designing Our World.” A suggested script for the facilitator appears below. The facilitator should become familiar with the content and present it in a way that works for them and their audience.

**INTRODUCTION**

**AGENDA**

This agenda is meant to be used as a guide to organize the content of your session. Feel free to adapt it to meet the needs of your session/group. The times listed at the top of each section are approximate. Some discussions can take longer due to the group’s background/interests.

- Introduction
  - Brainteaser – 5-10 minutes
  - Welcome group/housekeeping – 5-10 minutes
  - Purpose of the session – 1 minute
- Implicit bias
  - Introduction to Implicit Bias – 5-10 minutes
  - Unconscious bias test – 5–20 minutes
  - Reflect and share – 5-15 minutes
- Gender bias in science
  - Studies and scenarios – 10-20 minutes
  - Discussion – 5-15 minutes
- Break – 5-10 minutes
- Creating a girl-friendly environment
  - Growth mindset – 10-15 minutes
  - Strategies for engaging girls – 5-10 minutes
  - Discussion – 5-10 minutes
- Closure/questions – 1-5 minutes
### Gender Equity in STEM

<table>
<thead>
<tr>
<th>Slides</th>
<th>Description</th>
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</table>
| 1 | **Brainteaser Time!**  
A father and his son are in a car accident. The father dies on the spot. The son, badly injured, is taken to the hospital. In the ER, the attending surgeon looks at the boy and says, “I can’t operate on this boy. He’s my son!”  
Who is the surgeon?  
This brainteaser can be done in small groups or individually. If possible, present this slide without alerting participants to the fact that this training covers women in science. Ask participants to refrain from shouting out the answer if they know it or if they have seen it before.  
Facilitator reads brainteaser aloud and gives participants 2-3 minutes to reflect.  
After a few minutes, ask groups/individuals to share their responses.  
Ask:  
- What experiences or biases may condition our responses?  
- What careers/professions are associated with men?  
- Where do we see these messages?)  
Note, the answer to the brainteaser: The boy’s **mom** is the surgeon. |
| 2 | If you pictured a middle-aged white man when you heard the word “surgeon,” you are not alone. These pictures come from the top results of a Google image search of the word.  
This brainteaser is a perfect example of unconscious, or implicit, bias. Even though we all know and fully believe women can be great surgeons, when we hear the word, most of us will subconsciously picture a male.  
**How can these images impact how girls view...** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th>careers in science?</th>
</tr>
</thead>
</table>
| 3 | 4 | The purpose of this workshop is to help participants:  
- Examine the ways in which girls are subconsciously excluded from science  
- Learn to recognize gender bias and promote a culture of gender equity in science.  

We will cover the unconscious biases we all have around women in science and provide concrete steps to take to address these biases. |
| 5 | Implicit Bias | [Before revealing definition] Who has heard of implicit bias before?  
Participants share thoughts.  
Implicit bias refers to the attitudes or stereotypes that unconsciously affect our understanding, actions, and decisions.  
These biases, which encompass both favorable and unfavorable assessments, are activated involuntarily and without an individual’s awareness or intentional control. Residing deep in the subconscious, these biases are different from known biases that individuals may choose to conceal for the purposes of social and/or political correctness. |
More to know about implicit bias:

- **We all have implicit biases.** Implicit biases are pervasive. Everyone possesses them, even people with avowed commitments to impartiality, such as judges.
- **They do not necessarily align with our declared beliefs** or even reflect stances we would explicitly endorse.
- We generally tend to hold implicit biases that favor our own group, although research has shown that we can still **hold them against our own in-group.**
- **They can be unlearned.** Implicit biases are malleable. Our brains are incredibly complex, and the implicit associations that we have formed can be gradually unlearned through a variety of de-biasing techniques.

Source:
http://kirwaninstitute.osu.edu/research/understanding-implicit-bias/

People do not always say what is on their minds. One reason for this trend is unwillingness. For example, someone might report smoking a pack of cigarettes per day because he or she is embarrassed to admit about smoking two. Another reason is inability. A smoker might truly believe that she smokes a pack a day or might not keep track at all. The difference between being unwilling and being unable is the difference between purposely hiding something from someone and unknowingly hiding something from yourself.

The Implicit Association Test (IAT) measures attitudes and beliefs that people may be unwilling or unable to report.
If allowing time for participants to complete the test, allow them to do so now on any mobile device, using the following instructions:

- Select your preferred language
- Select keypad or touchpad
- Select the module called “Gender-Science IAT.”

The IAT is an imperfect tool, but it helps reveal implicit biases that we may not have known we had. For example, you may explicitly believe that men and women are equally equipped to excel in science, math, humanities, and arts, but implicitly you automatically, and unconsciously associate men with math and science and women with humanities and arts.

That begs the question: how are implicit biases developed? Why do we say we believe one thing but implicitly believe another thing?

Invite participants to reflect on their own for a minute, and then share in small groups:

- Think about yourself when you were 10 years old. What messages did you hear about careers? About science? About humanities?
- Where do these messages come from?

Invite a few participants to share with the larger group, if desired.
Implicit bias can have real-life consequences. Corinne Moss-Racusin, a social psychologist at Skidmore College, recently spoke at the Stanford University School of Medicine to describe her research on implicit gender bias among university faculty. She performed an experiment that had scientists evaluate identical resumes of a candidate named either “Jennifer” or “John.”

In their study, Moss-Racusin and her colleagues created a fictitious resume of an applicant for a lab manager position. Two versions of the resume were produced that varied in only one very significant detail: the name at the top. One applicant was named Jennifer and the other John. Moss-Racusin and her colleagues then asked STEM professors from across the country to assess the resume. Over one hundred biologists, chemists, and physicists at academic institutions agreed to do so. Each scientist was randomly assigned to review either Jennifer or John’s resume.

The results were surprising—they show that the decision makers did not evaluate the resume purely on its merits. Despite having the exact same qualifications and experience as John, Jennifer was perceived as significantly less competent. As a result, Jennifer experienced a number of disadvantages that would have hindered her career advancement if she were a real applicant. Because they perceived the female candidate as less competent, the scientists in the study were less willing to mentor Jennifer or to hire her as a lab manager. They also recommended paying her a lower salary. Jennifer was offered, on average, $4,000 per year (13%) less than John.

Implicit bias can also cause women to assess themselves more harshly.

Research by Dr. Shelley Correll at Stanford University finds that women are “harder on themselves” compared to their male peers when assessing their abilities in math and science.

Dr. Correll first became interested in gender differences in self-assessment when she taught chemistry to high school students. She realized that no matter how well the girls in her classes did, she had trouble convincing them that they had any scientific ability. At the same time, she found that no matter how poorly the boys in her classes did, they continued to believe that they were very good at chemistry.

In a lab experiment on gender differences in self-assessment, Dr. Correll found that women assess themselves as less competent in supposedly “male” fields, even when the “male” field is fictitious.

Here we have an example from this experiment. See if you can answer this question: Does this rectangle have more black or more white?

We won’t spend too much time here because it’s not actually important how much black or white there is, but what the results of the study showed.

In Dr. Correll’s experiment, she identified this fictitious ability to detect correct proportions of black and white as “contrast-sensitivity ability”. When participants were told that men were more likely to have high levels of “contrast-sensitivity ability,” women tended to underestimate their own ability and men tended to overestimate their own ability.

When this ability was described as equally strong in
men and women, gender differences in self-assessment were not found.

This gender difference in self-assessment is shown here in the chart on the left.

*Explanation of charts:*
The chart shows women’s self-assessments in green and men’s self-assessments in purple.

- When subjects were told that men are better at this task, men assessed their “contrast-sensitivity” abilities much higher than women. *(Indicate first pair of bars from left).*
- When subjects were told that there is no gender difference in performing this task, however, there was essentially no difference between how men and women assessed their abilities. *(Indicate second pair of bars).*

At the same time, girls held themselves to a higher standard than boys when told that men are better at “contrast-sensitivity” but men and women’s standards were nearly identical when told that there is no gender difference.

- When subjects were told that men are better at this task and then asked “how high would you have to score to believe that you have high ability in this area”, women said they would have to score around 89%. Men, in contrast, said they would have to score around 79%. *(Indicate third set of bars).* This is a full 10 percentage point difference!
- When subjects were told that there is no gender difference in performing this task, however, there was essentially no difference between the standard that men and women held themselves to. *(Indicate fourth set of bars).*

If you think about this finding as it relates to math and science, fields in which men are considered to excel,
it suggests two things:
1. Girls are less likely to believe they are good at math and science.
2. Girls believe that in order to excel, they have to be really good at math and science, while boys believe that in order to excel, that just have to be pretty good.

There are many elements to choosing a career, but researchers agree that one element is believing that you can be successful at it.

Poor self-assessment may account, in part, for why women are underrepresented in certain science fields, especially engineering.

So, how can we help girls assess their ability more positively?
Girls’ lower self-assessment of their math ability, even in the face of good grades and test scores, along with their higher standard for performance in “masculine” fields, helps explain why fewer girls than boys aspire to science and engineering careers. So what can be done to reduce gender differences in self-assessment?

- **Set clear performance standards.** First, as many of you know, extremely low average test scores are common in many college science and engineering courses. Low scores increase uncertainty in all students, but they have a more negative effect on students who already feel like they don’t belong, as many women in science and engineering majors do. The same letter or number grade on an assignment or exam might signal something different to girls than it does to boys. **Female students may need to be reminded that a B in a difficult course is a grade to be proud of.** The more that teachers and professors can reduce...
uncertainty about students’ performance, the better.

• **Help girls recognize their career-relevant skills.** Girls are less likely than boys to interpret their academic successes in math and science as an indication that they have the skills necessary to become a successful engineer or computer scientist. Encourage girls to see their success in high school math and science for what it is: not just a requirement for going to college but also an indication that they have the skills to succeed in a whole range of science and engineering professions.

Now I will share a few scenarios in which gender bias has been observed. As I share these scenarios, think about whether you have ever experienced or witnessed similar situations. Next, we'll assemble in groups and discuss how these messages and situations can affect girls’ interest in science and engineering.

Situation #1: Girls are often assigned to passive roles such as reading instructions, recording results, or taking notes while boys use equipment and complete the tasks (Scaife & Baker, 2007).

Situation #2: Teachers often give girls less meaningful and less critical praise than boys. Boys' work is praised for content, while girls' work is often praised for its appearance (Liu, 2006).
| Situation #3: Males talk 2.5 times longer than females in classrooms but are viewed as talking the same or less.

Listener Bias:
Males talk 2.5 times longer than females in classrooms but are viewed as talking the same or less (Krupnick, 1985).

| Situation #4: In one study, boys called out answers 8 times more than girls and were likely to be listened to.
Girls who shouted out answers were instructed to raise their hands.

In one study, boys called out answers 8 times more than girls and were likely to be listened to.
Girls who shouted out answers were instructed to raise their hands.

| Situation #5: Parents and teachers interrupt girls twice as often as boys.

Parents and teachers interrupt girls twice as often as boys.

| Situation #6: Boys are three times more likely than girls to hear explanations of science from their parents (Crowley, 2001).

Boys are three times more likely than girls to hear explanations of science from their parents (Crowley, 2001).
Situation #7: Boys are more likely to jump in and play, while girls are more thoughtful in their approach.

Instruct participants to break into small groups and have each group consider one or more of the scenarios just addressed. (If desired, you can print out a few copies of slides 16-22 and pass them out as reference).

Here’s what it comes down to: Girls’ achievements and interests in math and science are shaped by their environment.

We’ve seen how gender bias can create a toxic environment that discourages girls from achieving in STEM. However, the good news is, the opposite is true, too; we can create a culture that promotes science achievement for men and women.

One way to create a girl-friendly environment in science culture is by promoting a growth mindset.

The research of Carol Dweck, a psychologist at Stanford University, provides evidence that a “growth mindset” as opposed to a “fixed mindset” is likely to lead to greater persistence in the face of adversity and ultimately success in any realm.

The table shown here lays out the differences...
between a fixed mindset and a growth mindset. Individuals with a fixed mindset believe that intelligence is static and inborn. In contrast, individuals with a growth mindset believe that intelligence can be developed through effort. Individuals with a fixed mindset are susceptible to a loss of confidence when they encounter challenges because they believe that if they are truly “smart,” things will come easily to them. If they have to work hard at something, they tend to question their abilities and lose confidence, and they are likely to give up because they believe they are “not good” at the task and, because their intelligence is fixed, will never be good at it.

Individuals with a growth mindset, on the other hand, show a far greater belief in the power of effort, and in the face of difficulty, their confidence actually grows because they believe they are learning and getting smarter as a result of challenging themselves. These research findings are especially important for women in science and engineering, because encountering obstacles and challenging problems is in the nature of scientific work.

When girls and women believe they have a fixed amount of intelligence, they are more likely to lose confidence and disengage from science and engineering when they inevitably encounter difficulties in their course work. This is true for all students, but it is particularly relevant for girls in STEM subjects, where negative stereotypes persist about girls’ abilities.
There are a number of steps we can take to foster a growth mindset in children:

- **Parents and teachers should teach children that intellectual skills can be acquired.** When girls are taught that their intelligence can expand with experience and learning, girls do better on math tests and are more likely to want to continue to study math in the future.

- **Praise children for effort.** Rather than saying “Oh, you’re so smart!”, when children do something well, say “Wow, you worked really hard at that and you did it!” It is especially important to praise the most able students for their effort. These students have often coasted along, gotten good grades, and been praised for their intelligence and may be the very students who opt out when the work becomes more difficult.

- **Highlight the struggle.** Parents and teachers can communicate to students that we value and admire effort and hard work. This will teach children the values that are at the heart of scientific and mathematical contributions: love of challenge, love of hard work, and the ability to embrace and learn from our inevitable mistakes.

- **Talented and gifted programs should send the message that they value growth and learning, not just being “gifted” with intelligence.**

Here’s an example of somewhere we can apply the idea of growth mindset.

One of the largest gender differences in cognitive abilities is found in the area of spatial skills, with boys and men consistently outperforming girls and women, especially on measures of mental rotation, an example of which is shown here.

See if you can answer this question.  

*The correct*
Spatial skills are considered by many people to be important for success in engineering and other scientific fields and are often considered to be “innate.” But are they really?

Research conducted by Sheryl Sorby over a decade with first-year engineering students at Michigan Tech, however, documents that individuals’ spatial skills consistently improve dramatically in a short time with a simple training course.

If girls grow up in an environment with opportunities to develop their spatial skills, they are more likely to consider a future in a science or engineering field.

Recommendations
• Playing with building toys as well as drawing can help children develop their spatial skills.
• Again, adopting a growth mindset helps dispute the idea that boys are “naturally” better at math or science skills, and reminds us that children of all genders can develop these skills, given the opportunity.

Now we will discuss even more specific ways to engage girls in science:
• **Use inclusive language**: Watch the pronouns you use. When speaking about a scientist, do you say “he” or “his”?
• **Feature female role models**: Feature images and stories about women. Showcase real female scientists and engineers.
• **Make it social**: Encourage sharing and discussion of the activity with friends or family. Consider assigning roles so that every student has an active role to play.
30 Strategies for Engaging Girls

- Engage the senses
- Tell a story
- Highlight altruism

- **Engage the senses**: Use a variety of colors, sounds, smells, and textures.
- **Tell a story**: Tell a story students can relate to. For example, the story of the person who discovered the technology in the activity or a story of someone who might use this technology. Encourage students to tell their own stories.
- **Highlight altruism**: Feature ways science and engineering has been used to help people or ways that it may one day be used to help others.

31 Discussion

What can YOU do to better engage girls in science?

Now we’ll take 5 minutes to reflect about what we can do to better engage girls in science and engineering. Think about the discussions we had today and the strategies we just shared and write down 1–2 ideas.

*After 5 minutes, ask the group members to share their thoughts.*

Encourage participants to write ideas down and take them with them as a reminder of actions they want to take.

32 Final comments and questions?

Do you have any final questions/comments?

*Discuss questions/comments for 5 minutes.*

Facilitator: Thank you so much for coming and participating!
• **SciGirls** is a PBS Kids show that encourages girls in science, technology, engineering and mathematics or STEM [http://pbskids.org/scigirls/home](http://pbskids.org/scigirls/home)

• The EngineerGirl website is designed to bring national attention to the exciting opportunities that engineering represents for girls and women [http://www.engineergirl.org/](http://www.engineergirl.org/)
Brainteaser Time!

A father and his son are in a car accident. The father dies on the spot. The son, badly injured, is taken to the hospital. In the ER, the attending surgeon looks at the boy and says, "I can’t operate on this boy. He’s my son!"

Who is the surgeon?
Girls in Engineering: A Matter of Equity

Designing our World: An Oregon Museum of Science and Industry project, in partnership with Boys and Girls Club, Girls Inc., and Adelante Mujeres

Designing Our World is made possible with funding from the National Science Foundation
Purpose

- Examine the ways in which girls are subconsciously excluded from science.
- Learn to recognize gender bias and promote a culture of gender equity in science.
Implicit Bias

Definition:
The **attitudes** or **stereotypes** that unconsciously affect our understanding, actions, and decisions.
Implicit Bias

- We all have implicit biases.
- They do not necessarily align with our declared beliefs.
- We can hold them *against* our own in-group.
- They can be unlearned.
Implicit Bias

Take a test to learn about your unconscious bias at
https://implicit.harvard.edu
Implicit Bias

Most people associate...

Science and math with “male”

Humanities and arts with “female”
Implicit Bias

Reflect and share:

Think about yourself when you were 10 years old.

- What messages did you hear about careers? About science? About humanities?
- Where do these messages come from?
Gender Bias in Hiring

Identical resumes were sent to science faculty at research universities. They differed only in name.

Results:
The male applicants were:

- Rated as much more competent
- Rated as more hirable
- Offered a higher starting salary
- Offered more career mentoring
Gender bias in Self-assessment

Women are “harder on themselves” in terms of assessing their abilities in math and science fields.
Gender bias in Self-Assessment

Does this rectangle have more black or more white?
Gender bias in Self-Assessment

**Figure 16. Self-Assessment of Ability, by Gender**

<table>
<thead>
<tr>
<th>Average Self-Assessment Rating</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Men are better at this task&quot;</td>
<td>41.1%</td>
<td>55.3%</td>
</tr>
<tr>
<td>&quot;There is no gender difference in performing this task&quot;</td>
<td>47.1%</td>
<td>47.2%</td>
</tr>
</tbody>
</table>

*When Subjects Are Told ...*

**Figure 17. Students’ Standards for Their Own Performance, by Gender**

<table>
<thead>
<tr>
<th>Score Required to Indicate High Ability</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Men are better at this task&quot;</td>
<td>88.5%</td>
<td>79.3%</td>
</tr>
<tr>
<td>&quot;There is no gender difference in performing this task&quot;</td>
<td>82.4%</td>
<td>83.1%</td>
</tr>
</tbody>
</table>

*When Subjects Are Told ...*
Gender bias in Self-Assessment

There are many elements to choosing a career, but researchers agree that one element is believing that you can be successful at it.
Gender bias in Self-Assessment

Promoting Positive Self-Assessment

- Set clear performance standards
- Help girls recognize their career-relevant skills
Gender Bias in the Classroom

Girls are often assigned to passive roles such as reading instructions, recording results, or taking notes, and boys use equipment and complete the tasks (Scantlebury & Baker, 2007).
Gender Bias in the Classroom

Teachers often give girls less meaningful and less critical praise than boys. Boys' work is praised for content, and girls' work is often praised for its appearance (Liu, 2006).
Gender Bias in the Classroom

Listener Bias:

Males talk **2.5 times** longer than females in classrooms but are viewed as talking the same or less (Krupnick, 1985).
Gender Bias in the Classroom

In one study, boys called out answers 8 times more than girls and were likely to be listened to.

Girls who shouted out answers were instructed to raise their hands.
Gender Roles in Communication

Parents and teachers interrupt girls twice as often as boys.
Gender Roles at the Museum and at Home

Boys are three times more likely than girls to hear explanations of science from their parents (Crowley, 2001).
Gender Roles at the Museum and at Home

Boys are more likely to jump in and play, and girls are more thoughtful in their approach (Wohre & Harrasser, 2011).
Discussion

Consider one or more of the scenarios just presented:

- How might this scenario affect girls’ interest in science or engineering? How could you change this scenario?

- Where else have you witnessed gender bias, either explicit or implicit?
Girls’ achievements and interests in math and science are shaped by their environment.
### Growth Mindset

<table>
<thead>
<tr>
<th>Fixed Mindset: “Intelligence is static.”</th>
<th>Growth Mindset: “Intelligence can be developed.”</th>
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</thead>
<tbody>
<tr>
<td>Leads to a desire to <em>look smart</em> and therefore a tendency to</td>
<td>Leads to a desire to <em>learn</em> and therefore a tendency to</td>
</tr>
<tr>
<td>• avoid challenges</td>
<td>• embrace challenges</td>
</tr>
<tr>
<td>• give up easily due to obstacles</td>
<td>• persist despite obstacles</td>
</tr>
<tr>
<td>• see effort as fruitless</td>
<td>• see effort as path to mastery</td>
</tr>
<tr>
<td>• ignore useful feedback</td>
<td>• learn from criticism</td>
</tr>
<tr>
<td>• be threatened by others’ success</td>
<td>• be inspired by others’ success</td>
</tr>
</tbody>
</table>
Growth Mindset

Recommendations:

- Teach children that intellectual skills can be acquired.
- Praise children for effort.
- Highlight the struggle.
Growth Mindset

Do you have the spatial skills to solve the puzzle?
Growth Mindset

Spatial skills (like other science skills) are not innate and can be improved with training.
Strategies for Engaging Girls

- Use inclusive language
- Feature female role models
- Make it social
Strategies for Engaging Girls

- Engage the senses
- Tell a story
- Highlight altruism
What can YOU do to better engage girls in science?
Final comments and questions?