Girls in STEM

ESC Region 12 GEAR UP Grant

Janna Delany & Vanessa Williams
What Do Scientists Look Like??

- With the paper and markers at your table, draw or make notes about what you think a scientist looks like.

- Once finished, compare notes with your table.
What Research Says...

Young people have an image of scientists as eccentric old men with wild hair, smoking cigars, deep in thought, alone. Basically, they think of Einstein.

We need to change that image and give our children a much richer, nuanced view of who scientists are, what scientists do, and how they work.

Jacquelynne Eccles, 2005
Professor of Psychology
University of Michigan
How Do We Get Students From...
To This...
Why So Few? Women in Science, Technology, Engineering, and Mathematics
Women are underrepresented in many science and engineering occupations.

Percentage of Employed STEM Professionals Who Are Women, Selected Professions, 2008

Eight research findings in three areas:

• How social and environmental factors shape girls’ achievement and interest in math and science

• The climate of college and university science and engineering departments

• Continuing influence of bias
Girls’ achievements and interests in math and science are shaped by the environment around them.
Negative stereotypes about girls’ and women’s abilities in math and science adversely affect their performance in these fields.

- Expose girls to successful female role models in math and science.
- Teach students about stereotype threat.

Performance on a Challenging Math Test, by Stereotype Threat Condition and Gender

<table>
<thead>
<tr>
<th>Condition</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereotype threat</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>No stereotype threat</td>
<td>17</td>
<td>19</td>
</tr>
</tbody>
</table>

In math and science, a growth mindset benefits girls.

<table>
<thead>
<tr>
<th>Fixed Mindset</th>
<th>Growth Mindset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence is static.</td>
<td>Intelligence can be developed.</td>
</tr>
<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>

- Teach children that intellectual skills can be acquired.
- Praise children for effort.
- Highlight the struggle.
- Gifted and talented programs should send the message that they value growth and learning.
Spatial skills are not innate and can be improved with training.

One of the largest and most persistent gender gaps in cognitive skills is found in the area of mental rotation, where boys consistently outperform girls.

Playing with building toys as well as drawing can help children develop spatial skills.
Women are “harder on themselves” in terms of assessing their abilities in math and science fields.

Does this rectangle have more black or more white?
• Set clear performance standards
• Help girls recognize their career-relevant skills
The climate of science and engineering departments at colleges and universities is especially important for women—both students and faculty.
At colleges and universities, small changes can make a big difference in attracting and retaining women in STEM.

- Actively recruit female students.
- Emphasize broad applications of science and engineering in introductory courses.
- Review admissions policies to ensure that departments are not unintentionally “weeding out” potentially successful students.

STEM departments in colleges and universities should focus on “fit” to improve female faculty satisfaction.

- Provide mentoring for junior faculty.
- Implement effective work-life balance policies to support faculty.

Bias, often unconscious, limits women’s progress in scientific and engineering fields.
Bias against Women in Nontraditional Fields

• Women in “male” jobs are viewed as less competent than their male peers.
• When women are clearly competent, they are often considered less “likable.”

- Raise awareness about bias against women in STEM fields.
- Create clear criteria for success.
Why So Few? Women in Science, Technology, Engineering, and Mathematics

To download the report: www.aauw.org

To contact the researchers: aauw-research@aauw.org
So, what does this look like at ESC Region 12?

- Sci Girls
- Girl Scouts
- Camps
Sci Girls

- PBSKids.Org
  - Television series where girls undergo the scientific process to resolve a problem.
    - Provides interaction with a Female Role Model in the Career field
  - Has a set of lesson and videos that can be used in a classroom, after school club, summer camp, etc.
    - Great with all students to encourage them to investigate and solve a problem.
The SciGirls Seven: Proven Strategies for Engaging Girls in STEM

The SciGirls approach – for the TV show, website, and educational materials – is rooted in research about how to engage girls in STEM. A quarter of a century of studies have converged on a set of common strategies that work, and these have become SciGirls’ foundation. Download: SciGirls Seven: Proven Strategies for Engaging Girls in STEM (1M PDF)

1. Girls benefit from collaboration, especially when they can participate and communicate fairly. (Fancsali, 2002; Parker & Rennie, 2002) | Download Tips
2. Girls are motivated by projects they find personally relevant and meaningful. (Eisenhart & Finkel, 1998; Liston, Peterson, & Ragan, 2008; Thompson & Windschitl, 2005) | Download Tips
3. Girls enjoy hands-on, open-ended projects and investigations. (Burkam, Lee, & Smerdon, 1997; Chatman, Nielsen, Strauss, & Tanner, 2008; Fancsali, 2002) | Download Tips
4. Girls are motivated when they can approach projects in their own way, applying their creativity, unique talents, and preferred learning styles. (Calabrese Barton, Tan, & Rivet, 2008; Eisenhart & Finkel, 1998) | Download Tips
5. Girls’ confidence and performance improves in response to specific, positive feedback on things they can control—such as effort, strategies, and behaviors. (Blackwell, Trzesniewski, & Dweck, 2007; Haierberg et al., 2007; Mueller & Dweck, 1998; Zeldin & Pajares, 2000) | Download Tips
6. Girls gain confidence and trust in their own reasoning when encouraged to think critically. (Chatman et al., 2008; Eisenhart & Finkel, 1998) | Download Tips
7. Girls benefit from relationships with role models and mentors. (Evans, Whigham, & Wang, 1995; Liston et al., 2008) | Download Tips

Applying the SciGirls Seven and Reading

Download Activity Makeover: Applying the SciGirls Seven (740K PDF)
Download References and Reading (993K PDF)
Sci Girls

www.pbs.org/teachers/scigirls/
Sci Girls

Video-Enhanced Activities in Engineering
Engineering is a hot topic today in schools across the country. The videos and activities in this section offer hands-on, minds-on introduction to the design-build process.

- **Puppet Power**: The SciGirls engineer a giant puppet with moving parts for a parade.
- **Blowin' in the Wind**: SciGirls design and build their own miniature wind farm.
- **Turtle Mania**: The SciGirls design ways to increase the turtle population in their neighborhood wetland.

Video-Enhanced Activities in Technology
These days the idea of digital natives — kids who have grown up using technology — is commonplace. So it might surprise people to know that computer science and engineering are some of the STEM careers in which women still lag behind men. The videos and activities in this section are designed to help curb that trend, with girl-friendly, hands-on projects that serve as gateways to the tech world.

- **High Tech Fashion**: The SciGirls create a dress with LEDs and electro-luminescent materials.

More SciGirls for Teachers

- Overview
- Video-Enhanced Activities
  - Bilingual Activities
  - brainSTEM Game
  - Educational Philosophy: SciGirls
  - Find a STEAM Club
  - About the Series
  - Meet the Characters
  - Episode Descriptions
  - About the Site
  - Series and Site Credits

Support for pbs.org provided by:

Downton Abbey Season 4
Sci Girls

Episode: Puppet Power
SciGirls engineer a giant puppet with moving parts for a parade.
Izzie joins Anna and her friends to engineer a giant pig puppet for a May Day parade, complete with blinking eyes and a wriggling tail. The SciGirls create and test prototypes that use simple machines to make the pig's eyes blink, its tail spin, and "smoke" (talcum powder) blow out its nose. In addition, their mentor introduces the girls to careers in engineering.

Episode Related Activity
- Puppet Power (3.48M PDF)

Additional Engineering Activities:
- Bouncing Balloons (877K PDF)
- Parachute Parade (783K PDF)

Watch the full episode or select video clips

Overview

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Visit PBS KIDS and PBS Parents to extend the learning with SciGirls.

Support for pbs.org provided by:
Girl Scouts

- GirlScouts.org
  - Tech Bridge program
    - Several programs to choose from, each containing several lessons.
    - Can be adapted to your needs
      - Facilitator provided or you can run yourself
Girl Scouts

www.techbridgegirls.org

Overview

See Girls Go Techbridge in action in this video produced by one of our funders, American Honda Foundation.

"I learned that this science thing is very fun and educational at the same time. I LOVE IT!" – Girl Scout

"I learned that engineering is not just for men." – Girl Scout

"I love Techbridge. We don’t have to develop programs any longer. This organization has done it for us." – Role model

Launched in 2008, the Girls Go Techbridge partnership offers science and engineering programming to Girl Scout councils. With generous support from the Noyce Foundation and the Gordon and Betty Moore Foundation, Girls Go Techbridge has grown into a nationwide program that has sparked interest in engineering and science for Girl Scouts from California to Connecticut.

Central to Girls Go Techbridge are the programs-in-a-box that offer engaging hands-on projects and career exploration activities for girls. Developed especially for Girl Scout partners, the programs-in-a-box are portable, easy-to-use kits that introduce girls to engineering and science. The projects highlight the Engineering Design Process and invite girls to brainstorm, design, build, test, and re-design. This experience gives girls a flexible, practical approach to problem solving that they can apply to a wide range of subjects. Training and follow-up
Girl Scouts

Sample topics of Programs in a box:

• Make it Green
• Design Time
• Power it up
• Engineers to the Rescue
• Thrill Builders
Sally Ride Science Foundation

- SallyRideScience.com
  - Great online resources
  - Key Concepts in Science Series:
    - *Key Concepts in Science* is a 36-book series that covers the "Big Ideas" in science.
    Developed by the science education experts at Sally Ride Science, the books and teacher
    guides will help you spark students’ natural curiosity while building science literacy. Your
    students will respond with a resounding, "Now I Get It!"
  - Host events around the country
  - Career Books available for purchase
Camps

- Girl Genius Day Camp
  - 3rd – 8th grade girls are invited to a day camp with science/technology focused sessions
  - Participants get to choose 4 different sessions to rotate through. All sessions involve hands on activities and many provide a take away for the student.
GIRL GENIUS WORKSHOP LIST - MARCH 23, 2013

1. **Mind Your Math: Neurons to the Rescue!** Don’t let math get you down! Wake up your hidden talents and discover the power you have over your difficulties in math. Join this adventure and flex your brain with fun and challenging mini-games and puzzles.

2. **Compute For Your Passion: Compute For You!** The world needs you! Use computing to change your life and benefit the lives of others by making computational power your friend. Smartphones, laptops, Facebook, Google, iTunes, and Twitter all have one thing in common: Someone created each of these cyberspace tools and services with a computer and this changed all of our lives for the better. So can you!

3. **All Robots to the Pool!** Who says robots and water don’t mix? Come learn how to design and build a “WaterBot” using LEGO®s, your imagination, and some teamwork. You will have the chance to test and show off your team’s work while navigating your robot through an obstacle course set up in a pool. LEGO®, pools, robots, OH MY! (No swim attire needed)

4. **Lotions and Potions:** Yes, chemistry can be fun! Yes, chemistry is for girls! Come mix the chemicals needed to concoct your very own potions—lip gloss to slime.

5. **Bubble Pack:** What is “blister packing” and what does it have to do with a pharmacy? Girls will play the role of pharmacists while packaging their own “medicine”.

6. **Creations with Welding!** Learn how a blank piece of metal can be transformed into a hand-made work of art! Girls will use automation to create a plaque to take home. Come dressed in closed toe shoes and pants and be ready to make some sparks!!

7. **Girls Can Fly Too!** Do you dream of soaring through the sky? Learn from the experts what it takes to fly a plane from the ground to the sky.

8. **Girls Get Wired!** Love talking on the phone and emailing friends? Come explore and learn how your “wireless” world is connected. Girls will explore what makes communicating so easy!

9. **Powder Puff Automotive:** Already dreaming about getting your license and a car? Learn how to give your car a health check. Girls will check fluids, perform lubricant evaluations, and much more, as they master the skills to be a great car owner.

10. **Flower Power!** Have you ever wondered if you have a green thumb? Now’s your chance to find out! Take a trip to the TSTC Golf Course and Landscape Management greenhouse where you’ll learn about plant production, landscape techniques, and create your own hanging basket of flowers to take home.

11. **Magical Metal!** Do you have nerves of steel? Then come and learn how to make metal run like water. Girls will make molds from sand and then a beautiful eagle will take form out of smoke and flames.

12. **Calling All Builders!** Like working with your hands? Build a house for a feathered friend as you learn to use tools of the trade in Building Construction Technology.
Texas A&M Engineering Summer Camp

- Residential week long summer camp for middle school girls interested in engineering and science
Camps

- TSTC Developed Camps
  - APEX
    - 9th – 12th grade girls will design, build, and deploy a near space object to collect data
  - SRC
    - 9th – 12th grade girls will design and build a scale NASCAR race car
So, how will this look for me?

- Help teachers gain an understanding of how simple it can be to maintain female interest!
  - Be mindful of the classroom climate/environment
  - Don’t follow stereotypes
So, how will this look for me?

- Build girl focused camps, activities, clubs, etc.
  - Resources:
    - Texas Girls Collaborative Project!!!
      - Txgcp.org/stemresources
    - National Girls Collaborative Project
      - NGCPproject.org
    - Sci Girls
      - Scigirls.org
    - Engineering Go For it
      - Egfi-k12.org
    - Women in Engineering at University of Texas
It’s suicidal to create a society that
depends on science and technology . . .
in which no one knows anything about
science and technology.

- Carl Sagan