How to run an IMAGINE ENGINEERING workshop

www.girlscouts.org/engineering
Why Imagine Engineering?

African-American, Hispanic, and Native-American young adults are not being prepared to enter the workforce at the same rate as women from other ethnic groups, such as whites and Asian Americans. Yet the available jobs in engineering are increasing, and the pay is higher than in most fields. Young women of color are missing out on exceptional opportunities. By supporting girls at an early age, they will succeed in math and science and see engineering as a career choice.

The Imagine Engineering workshop encourages girls ages 13–17 to pursue careers in engineering. Even though young girls and boys are exposed to identical coursework, women are far less likely to choose careers in engineering than men are. By eighth grade, girls are half as likely to show an interest in engineering careers, and their confidence in math is lower than that of boys, despite similar abilities.

This handbook accompanies three handbooks for girls (Native-American Girls Imagine Engineering, African-American Girls Imagine Engineering, and Hispanic Girls Imagine Engineering) and gives you everything you need to host an Imagine Engineering workshop. And don’t worry if you’re not an engineer yourself, because this handbook guides you through every step with ease!

Involving Parents/Guardians

Involving parents/guardians will improve the chances that girls will follow through as they prepare for engineering careers. As you invite parents/guardians, welcome them and encourage them to get involved during the workshop. Make sure you tell parents/guardians that you want them to be active participants during the workshop, and will call on them as well as the girls. You can encourage involvement by asking questions directly to the parents/guardians. While the girls are involved in activities, you may want to ask parents/guardians to think about ways they can support their daughters in engineering. That way, they’ll be prepared for their participation in the workshop’s closing activity.

Including Spanish-Language Participants

Hispanic Girls Imagine Engineering and this handbook are available in Spanish from your local Girl Scout council and at www.girlscouts.org/engineering.
Activity 1: What Engineers Do

Showcase an Engineer (15–20 minutes)

Find a female engineer who matches your target audience (African American, Hispanic, or Native American) and invite her to speak at your event. Consider checking with the Society of Women Engineers (www.swe.org) for potential speakers.

Help prepare the speaker by providing her with a copy of the Imagine Engineering materials (available at www.girlscouts.org/engineering) and encourage her to refer to the handbook during the presentation. Also ask her to address the following topics:

- A description of her work and how it impacts the community
- How she decided to become an engineer and the path she took to success, including the people who inspired her
- A description of a school or after-school experience that influenced her career choice or helped her be successful
- Stories that explain how she overcame barriers in school or on the job
- Advice for girls and their parent/guardians
- Suggestions to parents/guardians to help their daughters succeed in school

Show Videos of Engineers (10–15 minutes)

Show one or some of the following videos from the Internet to help explain engineering. (You can also search YouTube, TED.com, and other Web sites for fresh, up-to-the-minute talks from female engineers.) Once you select your video(s), you can download it to your laptop, netbook, CD, thumb drive, or iPad, which will allow you to show it at the workshop without an Internet connection.

**Engineers Are Cool:** This video showcases the various engineering disciplines and the projects each engineer might work on: www.egfi-k12.org/whats-new/e-tube (3:25 minutes).

**Design Our Future—A Career in Engineering:** Looking for a video that explains what engineers do and promotes engineering careers? Check this one out. California is the focus, but the video applies to any state, as it explains the need for more engineers: http://content.asce.org/asceville/designourfuture.html (4:15 minutes).

**NOVA Science Now Profile:** When injuries ended Yoky Matsuoka’s athletic ambitions, she turned to another early interest: robotics. Today, she’s a leader in the emerging field of neurobotics, creating robot technology that helps people with disabilities: www.pbs.org/wgbh/nova/tech/yoky-matsuoka.html (12 minutes).

**NOVA Science Now Profile:** As a biomedical engineer at Massachusetts Institute of Technology, Sangeeta Bhatia builds microlivers to study disease and test drugs, and her work may someday lead to artificial organs for transplant: www.pbs.org/wgbh/nova/body/profile-bhatia.html (11 minutes).
Show Videos of Engineers (continued)

Engineer Your Life: Multiple videos at this site showcase various engineering disciplines. Select “Meet Inspiring Women” to view an assortment of engineers to choose from:


Design Squad Nation profiles: The Web site of this TV show hosts hundreds of video clips about innovative solutions to real-world challenges, checking in with everyone from skateboarders to Project Runway contestants. Design Squad Nation continually updates the site with new content and videos, and there is no shortage of profiles of female engineers. Here are some recommended engineering features:

- Jennifer Chua is a packaging engineer who works for Method, a San Francisco company that specializes in nontoxic, biodegradable household products that look and smell good: http://pbskids.org/designsquad/video/profiles.html?pid=PjpNXj_YH6MjnYACH_ON_GjOEF7__iNQ (2 minutes).

- Leila Hasan gets creative with technology as the lead engineer for the gigapan, a robotic device that takes high-resolution panoramic imagery: www.iptv.org/kids/story.cfm/video/desq_20091109_gigapan_camera/video (1 minute).

Discuss the Many Kinds of Engineers (30 minutes)

Divide the group into teams of two to four people and assign each team an engineering discipline. Using the “What Do Engineers Do?” section of the Imagine Engineering girls’ handbook (pages 4–10), have teams read about their assigned engineer, and then plan a skit that represents what their engineer does. It will take only a few minutes for teams to come up with an idea and practice it a bit. (10 minutes)

Each team then presents its project, and the other groups guess which engineering discipline they are representing. A team member then uses information from the handbook to give the group highlights that explain more about that type of engineer. (20 minutes)

Tip: Take a short break before moving on to the next activity.
Activity 2: Diving In

Depending on the size and personalities of the group, select one or more of the following four interactive activities:

“Harmless Holder” (60 minutes)

Prior to the workshop, go to this Design Squad URL: http://pbskids.org/designsquad/parentseducators/guides/invent_guide.html. After downloading the PDF (available in English and Spanish), see the “Harmless Holder” instructions, starting on page 20. Provide copies for participants, as well as the materials listed there.

Read this to participants: “Can you think of a better way to carry six-packs of soda, one that doesn’t use plastic rings and won’t harm animals? Invent a holder for six cans that’s animal-safe, sturdy, convenient, and easy to carry.”

“Wanted: Women in Engineering” (30 minutes)

Make copies of the Karen Panetta (“Engineering Serving Humanity with Creativity and Imagination”) page from Girl Scouts’ Justice journey girls’ book (also included at the end of this handbook). Distribute one copy to each participant. Call on girls to read the text aloud.

Read this to participants: In early 2010, women became the majority of the workforce for the first time in U.S. history. Most managers are now women, too. And for every two men who get a college degree in 2010, three women will do the same. In a country where women are more educated than men—and in a world being transformed by technology—less than 17% of college engineering majors are female.

Lead with the following discussion questions, but also allow the conversation to wander to additional topics: Do you want to go to college? If so, what would you like to major in? Have you ever thought about engineering? Do you ever feel like smart girls get a bad rap? If so, how can girls overcome this?
“Stack ‘em Up!” (30 minutes)

Work in teams of 4 to 6 to stack cups into a pyramid using only a string and a rubber band. Each team receives a thick rubber band and 6–8 plastic cups, as well as a pre-cut string about 3 feet long for each team member.

As each team gathers around a table, mention that engineers are problem solvers, and here’s the problem at hand: how to stack these cups into a pyramid. It may sound easy, but let the teams know they can’t touch the cups with their hands once the competition begins. Instead, they’ll create a cup-stacking tool from the string and rubber band.

Allow 10 minutes for teams to make their tools and practice the activity. Then, ask everyone to stop working. As you go to each table to scatter the cups, explain that the competition will be timed. Then, signal the start of the task and walk around to offer encouragement and remind the participants to talk to each other. As each team finishes, tell them their time. Repeat for as many rounds as possible within the time allotted for the activity.

Draw the activity to a close by giving all the teams a round of applause for their creativity and problem-solving abilities. You might want to ask the group:

- How well did your team work together to stack the cups?
- If you had another round, what would you do differently?
- How did you come up with the design of your device?
- How might this be like the work of an engineer who designs cars, airplanes, or cell phones?
“What Would You Invent?”
(30 minutes)

Work individually or in groups to brainstorm ideas for inventions. Dream it up—if you could create anything (anything!), what would it be? Then share your invention idea with the larger group.

If you are doing this activity virtually or are able to provide girls with Internet-connected computers, visit Design Squad Project XChange (http://pbskids.org/designsqu/Xchange/index.html). Here, girls around the world have posted their invention ideas—ranging from “I wish there were a device that tuned musical instruments” to “I wish that I could make seeds that will give you anything.”

Closing (10 minutes)

Ask participants to turn to the “3-2-1 What Steps Can You Take?” (page 20) of the Imagine Engineering handbook. Girls should work with their parents/guardians or another girl to discuss and complete the 3-2-1 worksheet. From there, ask each girl to share one thing she wrote and ask parents to share one thing they can do to support their daughters to learn more about engineering.

Conclude by saying something like, “A number of sites and publications can help you explore the world of engineering. You can watch videos of engineers in action, get ideas for hands-on activities in science and math, and learn how to apply for scholarships for college.” Remind girls and parents/guardians to check out the many other fun, educational, and exciting opportunities offered by their local Girl Scout council.

3-2-1: What Steps Can You Take?

Directions: Use the information and resources in this handbook as you begin to explore the incredible world of engineering. Complete the 3-2-1 with your parent/guardian.

1. What is one of the first steps you will take to discover more about engineering?

2. What two types of engineering would you like to learn more about?

3. What three things about engineering interest you?
Engineering: Serving Humanity with Creativity and Imagination

Karen Panetta dreams of seeing Engineer Barbie on toy shelves. Then she laughs and adds, “But no glasses or lab coat!” The reason, says Panetta, the worldwide director of Women in Engineering for the IEEE, the world’s leading professional association for engineers, is that engineering has a bad rap.

Less than 17 percent of college engineering majors are female. “Part of the problem is that they don’t see engineering as a way to serve humanity,” Panetta says. “Girls think engineering is narrow and boring and that you sit in cubicles all day solving math problems and staring at a computer. But to be a great engineer, you need imagination, you need creativity, and you need to be well-rounded.”

To change the stereotype, Panetta founded Nerd Girls, a network of female engineering students who show girls that it’s cool to be an engineer. The Nerd Girls have designed and installed a renewable energy system to power twin lighthouses on Thacher Island, off the coast of Rockport, Massachusetts. Getting fuel and other resources to coastal islands is difficult and expensive, says Panetta.

Islands need practical, low-cost, efficient power. “The U.S. Coast Guard is now adopting our design for other lighthouses. A bunch of teenage girls are now driving the way lighthouses are powered!”

Nerd Girls were also the first all-female solar car racing team in the World Solar Challenge. The project is fun and a great challenge, says Panetta, and it lets girls explore how solar power can be used for transportation.

Nerd Girl power, says Panetta, “makes a connection to a project that serves a greater purpose so that girls can see how their contribution really makes a difference.”