



ADULT HOW-TO GUIDE

Designing Robots Badge Activities For Girls in Grades K-3

ROBOTS AND NATURE ACTIVITY

Follow the **list below of new vocabulary words** introduced during this badge activity.

Biomimicry – the design and creation of materials or systems that are modeled on how humans and other parts of nature, like animals or plants, look and function.

Pollinate – to move or deposit pollen on a plant or flower to allow fertilization.

Algorithm – a set of step-by-step instructions for how to do something.

Program – an algorithm that has been coded into something that can be run by a machine.

Prototype – a quick way to show an idea to others or to try it out. It can be as simple as a drawing or it can be created with common materials such as cardboard, paper, string, rubber bands, etc.

Debugging – finding and fixing issues in code.

A lot of the time, when we think of robots, we think about shiny metal figures that kind of look like humans. Robots have heads, bodies, arms, and legs, just like us: this is called biomimicry. Biomimicry is when someone makes a machine that looks or acts like a human, animal or plant.



Supplies Needed

- Computer and Wi-Fi to play video
- Open space to move

Time to Complete

- 10 minutes

Act out a scene to better understand Biomimicry.

1. Your role is the engineer and your girl will play the machine.
2. Call out the name of something you would have used as inspiration to create the machine and have your girl act out what that would look and sound like. For example, tell your girl that she is a machine that can fly like a bird. How about a machine that can eat leaves off the tops of trees like a giraffe?
3. Now have your girl pretend to be a machine that operates like a human. For example, how would a robot sound and move if it were a figure skater? How about a basketball player?

Engineers look at how humans and animals do certain actions when they're deciding what they want their robot to do. That helps engineers think of creative ways to design their robots.

Check out how scientists and engineers use biomimicry to study insects and create miniature flying robots here.

Here is what Boston Dynamics had to say about next generation robots.

BUMBLEBEE BOT

Learn the parts of a robot!

1. Work with your Girl Scout to design a robot inspired by the bumblebee.
2. Have a discussion with your girl about bumblebees and why they are important.
 - a. What do bumblebees do? Do they fly, make honey, sting you, etc.?
 - b. How do bees pollinate flowers?
 - c. What would happen to our fruits and vegetables if there were fewer bees around?

Put your Girl Scout in charge of the solution!

1. Hand out blank paper and markers, crayons, or pencils.
2. Have your girls create a robot inspired by the bumblebee that can help us to pollinate plants.
 - a. What would the robot look like?
 - b. What would the robot have to be able to do?
 - c. How could a robot pollinate a plant?



Supplies Needed

- White paper
- Markers/crayons

Time to Complete

- 15 minutes

- d. Allow your girl to be creative when designing her bee (shape, color, wings to help the robot move, a stinger to carry pollen, etc.)
3. After about ten minutes, have your girl share her robot design.
4. Explain to her how she just used biomimicry to brainstorm a solution to a problem. Not only does your robot look like a bumblebee, it helped to do the job of the bumblebee, too!

DESIGN A ROBOT

Now it is time to plan your robot!

1. Ask your Girl Scout to think of some other creative ways robots are used. For example, can they clean the house? Go to other planets?
2. Now have your girl think of something humans or animals may need help with and have her design her own robot that can assist.
3. Give your girl 30 seconds to focus on one problem to solve.
4. Have her put on her engineer hat and create lots of sketches using a pencil and paper to bring the robot to life!
5. Explain that these first sketches should be “quick” so they can draw all of their ideas before choosing one to build into a prototype.
6. As she draws, remind her that her robots need to have special parts.

Some of the most important robot parts they can include are:

- a. Gears to move the larger parts of the robot in one direction or the other
 - b. Levers to open and close parts of the robot
 - c. Pulleys to help the robot to lift things
 - d. Wheels to move the robot around
 - e. Nuts, bolts, and screws to keep the different pieces together
 - f. Sensors to give the robot information about its environment
7. Remind your girl that she needs to answer the question: How does my robot help other people or animals?
 8. Once she has several different ideas on her paper, encourage her to share to get suggestions on how to make it better
 9. Explain to her how, like a true engineer, she brainstormed a device that would help solve a problem, drew sketches, and got feedback on how to make it even better!
 10. Have your Girl Scout choose one design to start building



Supplies Needed

- Paper
- Pencils

Time to Complete

- 15 minutes

MAKE A PROTOTYPE

Your Girl Scout will now build a 3D prototype of her robot.

Create a Program – 15 minutes

1. In order to make your girl's robot move, she will have to program it. Have her create a program so it can follow her instructions to move and act.
2. Have your girl draw 3-5 simple movements your robot will make. For example, if our robot was washing the dishes, it might:
 - 1) Turn on the sink
 - 2) Pick up a plate
 - 3) Soap and rinse the plate
 - 4) Dry the plate
 - 5) Put down the plate

Get Feedback on Your Robot – 25 minutes

Test, share, and improve their robot prototypes

Once engineers create the first prototype of their robot, they have to test it to make sure it works like they planned. For this activity you will work as a pair.

1. Your girl will be the “Programmer” (since she created the prototype) and the “Robot” will be someone who did not create the prototype.
2. The Programmer tests her prototype by giving their program (list of instructions) to the “Robot” to follow, one step at a time.
3. If the Programmer finds an error in her program, she should add (draw) in the steps where they belong on her list.
4. Have your Girl Scout share her robot and program, using her last partner to help move the robot as she gives the program (instructions) aloud.
5. After she goes, encourage her to ask people to give one thing they like about the robot and one thing she could improve. Remind her that gathering feedback is an important part of being an engineer.

Closing – 10 minutes

Ask your girl what they liked/learned



Supplies Needed

- Construction paper
- Pipe cleaners
- String
- Toilet Paper rolls
- Straws
- Cardboard
- Construction Paper
- Tape
- Scissors
- Glue
- Markers, pens, or pencils

Time to Complete

- 50 minutes



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NOT A PROBLEM!
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ONCE YOUR GIRL SCOUT COMPLETES THESE ACTIVITIES, THEY HAVE EARNED THE DESIGNING ROBOTS BADGE!

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Girl Scouts of Greater Chicago and Northwest Indiana
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