Activity 4

Grab and Go

DESIGN AND BUILD A MECHANICAL ARM TO GIVE A SMALL ITEM A LIFT.

Robotic arms were first used in manufacturing in the 1950s. These arms were developed to help with dangerous jobs such as heavy duty welding, painting, and lifting large equipment. Today they are also used in scientific research, medical surgery, and to help people who have had amputations.

You'll Need:

For each small group

- Styrofoam plates, Styrofoam trays (check your local grocery store), or craft foam
- craft sticks, wooden dowels, or wooden skewers in varying sizes and lengths
- plastic drinking straws
- string
- scissors
- permanent markers
- pencil and paper
- rubber bands
- tape
- 8 oz. paper cup
- ruler

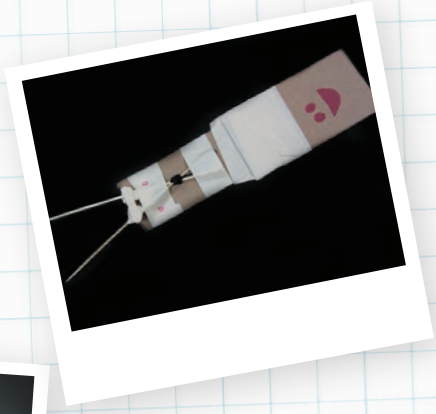
Here's how:

1. Research. Divide your girls into small groups[1] and ask them to research different types of robotic/mechanical/assistant arms on the Internet.[2] Have them create a table to compare the designs they find; they should include sketches or print out pictures. How do the designs differ? What kinds of designs are suitable for different purposes? What problems might arise with some of the designs?

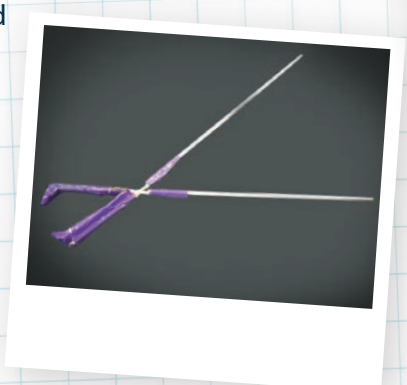
Watch SciGirls research and design an underwater robot on the *SciGirls Invent* DVD. (Select Aquabots: Research and Brainstorm.)

2. Brainstorm. Deliver the **SciGirls Challenge**: Using the materials available, build an arm that can lift a paper cup from one foot away.[3] Share the following design constraints:

- Only one person can operate the arm.
- The mechanical arm is the only thing that can touch the cup.
- The cup must be set back down and the arm removed when done.
- The cup can't be damaged in the process of picking it up.



Examples of arms



For more activities, go to scigirlsconnect.org!

SciGirls PBS KIDS GO!

Grab and Go continued

3. Plan and design. Be sure to give the girls ample time to plan and design before they start to build.

POINTER: If groups are having difficulty, ask them to revisit the examples they researched. Suggest they break each design into simple pieces and build a similar version.

4. Build and Test. Throughout the building process groups should be testing their design and revising based on their results.

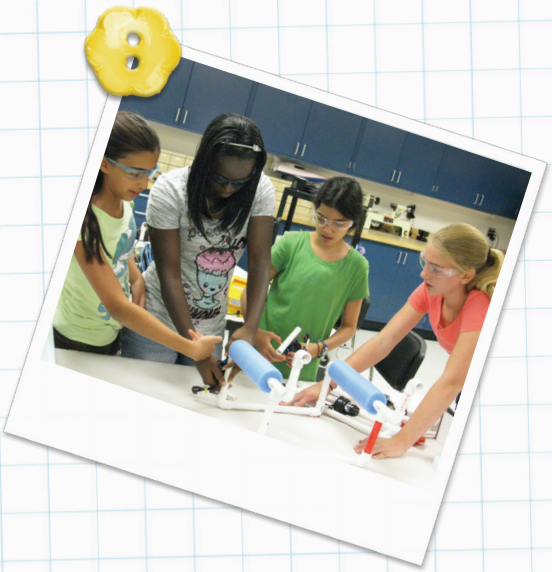
5. Share. Have each group share their design and demonstrate how it works by lifting the cup. What were the challenges? How did you overcome them? [6]

6. Continue exploring. Try adding weight to the cup and see if the arm still works. Brainstorm other things you can try picking up (stuffed animals, popcorn, pencils). How might you modify your design to address these new challenges? [6]

This activity is adapted from *The Case of the Physical Fitness Challenge* educator guide that is available in electronic format. A PDF version of the educator guide for NASA SCI Files™ can be found at the NASA SCI Files™ web site: scifiles.larc.nasa.gov. NASA SCI Files™ is produced by NASA's Center for Distance Learning, a component of the Office of Communication and Education at the NASA Langley Research Center, Hampton, VA. NASA's Center for Distance Learning is operated under cooperative agreement. Use of trade names does not imply endorsement by NASA.

Mentor Moment

Commander Angela Schedel spent nine years flying helicopters for the U.S. Navy and discovered her passion for teaching while working as a helicopter flight instructor. She is now an ocean engineering instructor at the U.S. Naval Academy. Angela is also the faculty advisor for the Academy's Concrete Canoe Team, which designs and builds a canoe entirely out of concrete to race against other universities!



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[1-7] See **SciGirls Seven** strategies on page 3.