

STRETCH YOUR SKILLS TO BUILD A ROBOTIC ARM

Learn the mechanical similarities between robotic and human arms.

Robotic and human arms are similar. Both use flexible parts (string or muscle) to move rigid parts (cardboard or bone). The string's or muscle's pull is directed by a guide (straw or tendons), and the guide's position affects the arm's efficiency. Finally, the brass fasteners mirror our joints. This activity challenges students to re-create their arms using everyday materials.

MATERIALS

- One large strip of corrugated cardboard (about 2 x 8 inches) with a hole punched in one corner
- One small strip of corrugated cardboard (about 1 x 4 inches) with a hole punched in one corner
- One medium (1-inch) brass fastener
- One straw, cut into 1-inch sections
- Smooth string or fishing line (about 3 feet)
- Two large paper clips
- One 3-ounce cup
- Tape (any kind)

METHOD

1. Set out materials and challenge students to think about how their arm works. Have students brainstorm and design a mechanical arm that mimics their own using the materials provided. A more detailed procedure is outlined below.
 - a. Connect the large cardboard strip (upper arm) to the smaller strip (lower arm) using a brass fastener (elbow joint) through the corner holes.
 - b. Tape straw guides (tendons) to the cardboard strips to create a path for the string to follow.
 - c. Insert string (muscle fibers) through the straw guides. Tape one end of the string to the smaller cardboard strip (lower arm). The free end of the string is used to control the arm. Adjust the brass fasteners so the arm moves freely when the string is pulled.

2. Use the robotic arm to play “kick the cup,” a game where students keep their robotic arms flat on the table and quickly pull the string to activate the lower arm and “kick” the cup. This will help make sure the sections pivot properly and demonstrate how to use the string and guides to move the lower arm.
3. Next, challenge students to add a hook to their robotic arms to pick up an object.
4. Unbend paper clips to form hooks and poke them into one of the robotic arm's corrugation tubes.
5. Attach a second paper clip hook to a cup and use the robotic arms to hook this “target” cup.

LEARN MORE

What other devices could you attach at the end of your robotic arm to help you move objects?

How can robotics designers and mechanical engineers help people accomplish everyday tasks?

Your arm also has a joint at the wrist. Can you modify your robotic arm to have another section (upper arm, lower arm and hand)?

Can you modify your robotic arm to contract and extend?

NOTES
