

These ideas are provided so you can guide students who are struggling to think of a design. Do not spell out for students, or expect students to come up with these exact designs.

Design 1—The Extendable Grabber

Guiding Questions:

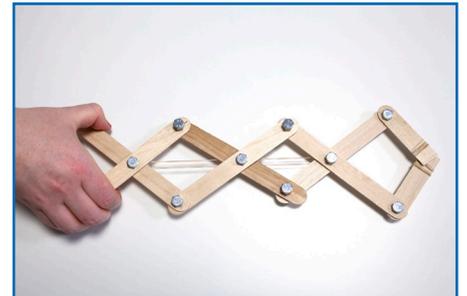
- *How could you make sure the grabber extends and retracts?*
- *What materials would be strong enough to lift a bottle but flexible enough to extend?*
- *Would the grabber need to be controlled with one or two hands?*

Resources:

- 7 jumbo craft sticks (or 14 to double up for extra strength)
- Hole punch
- 9 hex bolts
- 9 hex nuts
- 1 rubber band
- Masking tape

Steps:

1. Punch three holes in each of the jumbo craft sticks—one hole close to each end, and one in the center of the stick. Be careful not to punch too close to the edge, or the craft stick may split.
2. Take one stick and carefully snap it in half. If the edges are sharp, they can be taped up with masking tape.
3. Lay the remaining six sticks out in pairs, then use the hex bolts to connect each pair together through the centre hole. You should have three 'X's at this point.
4. Next, lay the 'X's in a row and use four hex bolts to connect them together through the end holes.
5. Use the two remaining hex bolts to attach the halved craft sticks to the end of the grabber. Tighten the nuts so they remain still.
6. Loop the elastic band around the middle three bolts in the center of the 'X's.
7. Test your grabber! It should extend from 20 cm to 40 cm.



Design 2—Extendable Grabber with Lever Mechanism

Guiding Questions:

- *Could you create a handle to control the grabber?*
- *What materials could you use to create a lever mechanism?*

Resources:

- 8 jumbo craft sticks
- Hot glue gun
- Glue sticks
- Craft knife
- Hole punch
- 6 hex bolts
- 6 hex nuts
- 2 wooden dowels
- 2 cardboard sheets

Steps:

1. Shorten five of the jumbo craft sticks to a third of their length. Score across the craft stick with a craft knife, then snap.
2. Punch two holes in each of the five shortened craft sticks, one at each end. Punch a hole in one end of a full sized craft stick.
3. Take one of the shortened craft sticks and punch an additional hole 1 inch along from one of the holes.
4. Take the full-sized craft stick and punch an additional hole 1 inch along from the other hole.
5. Use six hex nuts and bolts as shown in the diagram in order to attach the mechanism to the grabber.
6. Lay the grabber and mechanism on a sheet of cardboard as shown in the diagram on the next page.
7. Use the hot glue gun to attach two full-size craft sticks, one above the other, to the piece of cardboard as shown. The space between them should be wide enough to fit a hex bolt.
8. Position the grabber on the card. Check that the bolt can slide along between the two glued craft sticks. Use a pencil to mark the cardboard with the position of the two holes in the craft sticks.
9. Push the wooden dowels through the cardboard at the pencil marks, and glue them into position. These can be reinforced by gluing cut-offs from the craft sticks to the outside of the mechanism.



Design 2—Extendable Grabber with Lever Mechanism (Continued)

10. Place your mechanism and grabber onto the wooden dowels. Draw a design of how you would like the handle to look.
11. Cut out your design using scissors or a craft knife. Use this cutout as a template for another piece of cardboard, so there is cardboard on each side of the mechanism. Press down on the second piece of cardboard firmly onto the dowels. You may need to use the craft knife to make a small hole in the cardboard first.
12. When you are happy with how the handle looks, glue the head of the bolt at the end of the sliding mechanism, as shown in the diagram.
13. Replace the cardboard and wait for the glue to set. The design can be modified with finishing touches, such as adding more craft sticks to strengthen the mechanism, or gluing off-cuts of cardboard between the sides of the handle to strengthen it.

