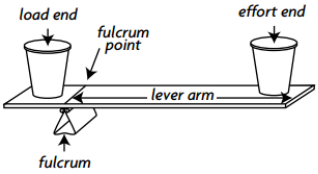
Science Experiment:
Leave It to Levers
Projects: Models, Small Engines, Design

Supplies (for each group of 4-5 students):

- One-Inch Binder Clip
- 3-oz paper cups (6 per group)
- Pennies (200 per group)
- Tape
- Foam Board Strips (3 strips, each 1 inch wide)
    - 8 inches long
    - 14 inches long
    - 20 inches long

**Prior to the activity, measure 2 inches from the end of each strip and draw a line across the strip. This will be the fulcrum point & the line used to measure lever arm.*



Time: 30 minutes (10 pre-explanation, 20 minute test and debrief)

What to Do:

1. Lead a short discussion on levers and how they work (a simple machine used to lift/move a load). Give examples of levers students have likely seen (hammer removing a nail, see-saw, dolly/hand truck, etc.)
    a. Describe the terms *fulcrum*, *lever arm*, *effort end*, and *load end*. Make sure you use these terms so that students will remember them and get used to utilizing them as well.
2. Divide the participants into groups of 4-5. Each group will test 3 different sized levers.
3. Explain that groups are to test each lever to determine how many pennies can be lifted (for each level) with one penny. (For each lever, one penny will be placed on the effort end of the lever. The load end will vary for each lever.)
4. Have participants put one penny into the cup at the effort end and explain that this single penny represents how much downward push they will use to lift a load of pennies at the other end.
5. For each lever, have participants drop pennies into the load end until they make the lever tip down.
    a. To find the number of pennies that the lever can lift, remove one penny from the load – the lever should lift up again – then count how many pennies are in the cup.
6. Before moving on to a new lever, make a prediction – based on the lever arm length – if the new lever will lift more or less.

Reflect:

1. **Which lever lifted the most? Which lever lifted the least?**
   Longer the lever arm, the more you could lift.
2. **Did you see a pattern in the amount of pennies lifted and the length of the lever arm? How did your numbers change?**
   Doubling the lever length should – roughly – double the number of pennies you can lift. Multiplying the length of our lever will (similarly) multiply the weight you can lift.

Apply:

3. **How many pennies do you think you could lift with a 24-inch lever arm? A 36-inch lever arm?**
   When the 6-inch arm was doubled, the lever was able to lift double the amount. Since 24-inches is 4 times longer than 6 (and 36 is 6 times longer), you should expect to lift 4 and 6 times the amounts, respectfully.
4. **Why is it important for engineers to know how lever arm lengths affect lifting power?**
   Depending on the load they need to move or lift, engineers can ensure that they can provide the needed power with the energy and effort that they can give – in relation to the length of the arm. A longer arm means not as much energy/effort is needed to lift heavier items.

Sources: PBS Kids "Cyberchase Builders' Math" & DiscoverE Website www.discovere.org/content/leave-it-to-levers

PURDUE EXTENSION | LOCAL FACES COUNTLESS CONNECTIONS