Balancing Pole

Summary

Balance a pole on your finger. Change how easy it is to balance by adding mass along the pole's length.

Current Physical Science Curriculum links

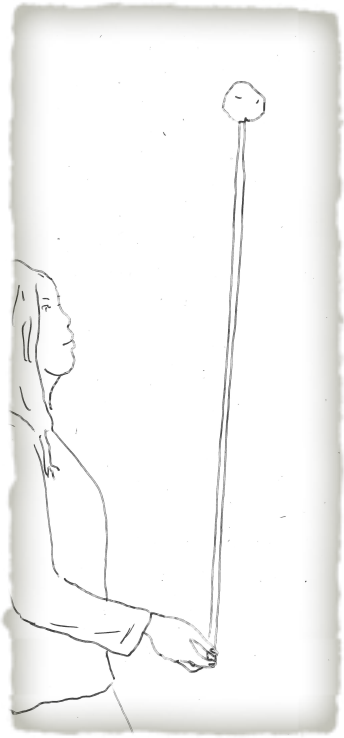
Force + Motion (gr 1), Forces (gr 5)

Draft Physics Curriculum links

Forces + Motion (gr 2), Energy (gr 4), Newton's Laws of Motion; Gravity (gr 6)

Processes of Science/Curricular Competencies

Curiosity, observation, manipulation, questioning, measuring, recording data, classifying data, interpreting data, inferring, controlling variables and fair testing, hypothesizing, concluding, consideration of alternatives



Materials

- open classroom space, or outdoor space
- straight poles of different lengths e.g. dowels of different diameters and lengths, including one at least a metre long
- big lump of play dough for each student (size of your fist)
- optional: stop watch

Materials Cost

A couple of dollars for the play dough, or make your own. Use recycled poles, or purchase for a couple of dollars each from the hardware store.

Procedure

Ask students to balance a pole on their fingers. They should do a few trials and count evenly, to see how long they can balance it, on average. Optional: use a stop watch and work in pairs to record more accurately how long the pole stays balanced. Record the data and calculate the average time a pole stays upright.

Give each student a lump of clay.

Ask them to attach the play dough to the pole so that they can balance the pole for longer (several trials also needed). Younger students can be shown how to push the play dough ball on to the top of the pole; older students can simply be given the play dough and asked to attach it as they wish.

Once they get a sense of how the play dough makes a difference to how long the pole can be balanced, they can try different pole lengths/different sizes of play dough balls/different positioning of the play dough on the pole.

Give students some time to experiment, exchange ideas and to start formulating their own ideas to test, before asking students to think about the forces involved in keeping the pole upright, and why the play dough makes a difference.

Gather as a group to discuss the students' discoveries and ideas, including discussions of their ideas about the forces involved.

If it won't kill the students' questioning and curiosity, explain how the clay makes balancing easier: When the pole has no play dough attached, the top end of it tips over quite fast. Our hand has trouble moving fast enough to adjust to this to keep the pole upright. With play dough at the top of the pole, it tips over more slowly giving you more time to adjust your hand underneath it, so you can hold the pole upright for longer. The top of the pole moves more slowly with the play dough attached because with the extra mass more energy is needed to move the top of the pole. (Explanation in more advanced terms: the further the mass is from the pivot point, the more energy it requires.)

More details, references and further experiments

- This activity at www.ingridscience.ca/node/100, with links to other balancing activities.

ProD Day Oct 24th 2014
Hands-on Science
with Ingrid Sulston