Beaten

Objectives

Applying knowledge of:
- Gears and/or pulleys
- Energy efficiency
- Evaluating efficiency
- Applying principles of fair testing and product safety

Other materials required

- Ruler
- Stopwatch
- Cups or small bowls half full of warm water and a few drops of washing-up liquid
- Trays to stop spills
- Volunteers from another group to test the mixers
- Towels to dry up

Fair testing and fun

- Safety first: How close are your hands to the beaters?
  Hold the mixer and turn the handle. Measure the closest distance from hand to beater with a ruler. It should be at least 10 cm (≈ 4 in).

- How fast do the beaters turn?
  Turn the handle once. Count how many turns of the beaters – the more the better. Your beaters should be able to turn at least five times faster than the handle.

- How well does the mixer work? How efficient is it?
  Each mixer must mix the same amount of soapy water for the same time to constitute a fair test. Place your test volunteers in front of the test bowls (with NO BUBBLES on top). Start the stop watch and start the mixers. Stop after one minute.
  Quickly measure the depth of bubbles – the more the better.

- How comfortable, easy, and safe to use is it?
  Check the volunteer's hands. Count the marks left from gripping the mixer – the more there are, the more uncomfortable it is to use. Ask them to rate how easy it was to use (1 for hard; 5 for very easy). How many accidents did they have – the less the better!
  The most efficient mixer will make more bubbles, more quickly with greater comfort and ease of use.

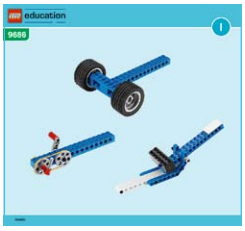
Extra challenges

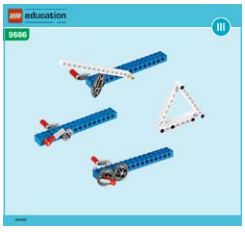
- Make a super-safe mixer with a drive mechanism that slips if you get a finger or a tie stuck in the beaters.
- Turn it into a dough mixer! The beaters should turn as slowly as possible compared to the handle. Try it for real with flour and water.
- Can you adapt your mixer to become a washing machine? Make a top-loading washing machine in a cup. Use tiny squares of cloth with sauce as the test clothes. As you turn the handle one way, the beaters should rotate back and forth.

Need help?
Look at:

Sweeper

Flywheeler





Principle Models Building Instructions booklet for gears and pulleys

Suggested model solution