"HOW HIGH?" (quick version)

Date: MM/DD

Teacher Name

M T W R F

Summary

One important question for the single-filter purifier design is, how tall should the legs be? Too low and flow is restricted, too high and the filter is tippy. In our recommended design, we just made a guess! This activity estimates air flow for a lot of different heights between zero (obviously too short) and one foot (too tall) above the floor. Rather than constructing legs, raise and lower the fan by hand and measure air speed vs. height.

For this quick version, air flow vs. leg height can be estimated by leaving the anemometer fixed in place closer to the center of the fan (see third reflection question to see why), and recording the air speed at different heights. The data will be cleaner if the fan is kept level during measurement, which is why a bulls-eye level is recommended but not required.

Connection(s)

Previous Learning:

Students are familiar with asymptotes of functions.

Future Learning:

Does an elementary function fit the flow vs. height data? If exponential, the height that gives 1/e of the maximum flow tells us about a fundamental property of the box fan filter (its resistance to air flow), but a lot of physics and modeling would be required to extract that.

Instructional Plan

(Note: WC…whole class; CL…cooperative learning structure; PR…cooperative learning pair; IND…individual work)

- Introduction to the problem: how tall should the legs be? WC CL PR IND
- Students guess the height above which flow doesn't increase WC CL PR IND
- Measurements of speed vs. height WC CL PR IND
- Graphing, analysis, discussion WC CL PR IND
- Reflection questions WC CL PR IND
- WC CL PR IND
- WC CL PR IND

Instructional Resource(s)

- Box fan filter
- Anemometer
- At least 8 square feet of cardboard, scissors
- Duct tape, ruler or tape measure
- Bulls-eye level (recommended, not required)

Reflection…

So, what is the best leg height anyway?

Can you invent a more efficient way to conduct this experiment and collect a higher density of data points?

When the fan is sitting on the ground, where does the air come from? Use the anemometer to find out!