

## The Sailboat Extension

To extend the boat study, students repeat the exploration, this time building sailboats.

This is a more challenging project for the students because there are more variables (mast, sail, unlimited pennies, and where they can be placed on the craft). It is also very difficult to balance the boat with the wind hitting the sail. The mast and sail are also more difficult to secure to the hull of the boat. However, it is much easier for the teacher as it doesn't involve a pulley system and instead uses a large fan for propulsion.

As before, students create a sailboat journal, and I provide them with a set of rubrics and the parameters for the sailboat, which are slightly different than those of the speedboats:

- Length between 18–24 cm,
- Width between 5–12 cm,
- Height—no restrictions,
- Each boat has to have a name and the students name on it, and
- Each boat has to carry a cargo of 10–20 pennies, but not in a film canister

The fact that students do not have to keep the pennies in a film canister, and that they can move the pennies around in the craft really opens possibilities for them as they observe how the crafts deal with the wind in their sails.

Students quickly realize they need to approach the challenge from a different angle than they had with the speedboats. The strength of materials, balance and ballast, and proportions come into play to a greater degree. These concepts are introduced as students design their boats and problem-solve during discussions informally as we watch the various boats on the course. Some students have prior knowledge of sailing, and they often share these terms and their meanings with classmates. It is very interesting to witness how some students are able to process what they learned about speedboats (shape, materials, distribution of weight) but then expand upon their craft with a new understanding of force, weight, and balance. Informally, students share observations and discoveries, such as the connections between the size and shape of a sail and how much wind it captures and how if the weight isn't correct the boat will tip over.

Here again, students make the boats in class after finding materials at home and creating a blueprint. To set up the course, a large fan is placed at the end of the gutter, and as before, the boats are timed as they travel the distance. Students display much creativity in

the design of the hull, mast, and sails. Here again a set of rubrics and journal entries are required. We end, again, by having a race day in which they can bring in a final sailboat made at home.