

Puff-mobiles (this lesson adapted from <http://clearinghouse.starnetlibraries.org/engineering/1111-puff-mobiles.html>)

The goal of this lesson is for students to create a vehicle powered by wind (really, their breath). We will also learn design strategies and think about the process of engineering.

Intro:

What is wind? (Moving air) What causes it? (The sun warms the air, hot air rises, and cool air moves in to take its place.)

<https://www.youtube.com/watch?v=uBqohRu2RRk>

What are some ways that we use wind power to do work? (Wind turbines generate electricity; windmills pump water or grind grain.)

How can we use wind power for transportation? (Sailboats, sail cars)

Since they discussed the engineering design process last week, ask if they remember what steps are involved. Review as needed.

Design Process Steps

1. Define: Find the need and define the problem.
2. Brainstorm: Come up with ideas.
3. Design: Select the most promising design you've created.
4. Create: Build a prototype of your design. What's a prototype?? Preliminary model that can be copied or improved. Why do we use these? So we can see if they work without manufacturing 1 million defective rubber duckies (test)
5. Test: Identify if there are failure points or modifications.
6. Improve: Optimize!

Communication!

Place students in breakout rooms with tutors.

Part 1. Design

Have students draw out their designs. Some questions to help get them thinking:

- What is the best size and shape for the sail?
- How many wheels (mints) will they use?
- Should they have one large sail or several small sails?
- What shape should their car be?
- What materials will they use?

Encourage them to be creative! They may not need to use all of their supplies. Do they need a sail? What shapes might capture the wind best? You can give them feedback on their design, but it's okay if they have flaws that they need to correct as they build and evaluate.

Part 2. Create

Have students build their designs. Some build problems that may come up:

- Tape around the straws can prevent the mints from falling off the 'axles'- generally make sure the wheels can move though
- It can be challenging to keep a sail up - experiment with ways of using the tape, or cut into the base of the car to allow a straw or popsicle stick to remain in one location
- Make sure there aren't gaps or holes in the sail/car that could prevent the car from catching
- Index cards can be flimsy - how can they reinforce their cars or sails (popsicle sticks, extra straws, double up on index cards)

Part 3. Test/Evaluation

This may depend on their remote learning set up, but if they have an open desk/table area have them test their cars. How far does it move on one breath? It may help to have them mark a starting line with tape so they can compare tests.

- What parts of their design worked? What parts didn't work? How could they be improved? If there's time, allow them to make improvements. Parts 2 and 3 may end up being more interchangeable, and you could cycle through the build and evaluation phases to improve their design.

Outro:

Bring students back from break out rooms and have them show their designs. In non-virtual years, it'd be great to have a group competition at the end, but for this year we can ask them some of the same questions as in Part 3 if there's time, and share one thing each group learned with the class.