

Professional Development Situation: Activity Guide

Skill Focus: Reflecting and Processing STEM Experiences

Time Required: 60 minutes

WIND TUNNEL

In this activity, youth explore the challenges of designing various aerodynamic contraptions.

Framing Question

- How can I design something that...
 - Flies out of the wind tunnel?
 - Hovers in the wind tunnel?
 - Bobs up and down in the wind tunnel?

Learning Objectives

- Youth will be able to identify components of aerodynamic contraptions.
- Youth will be able to identify differences between contraptions that accomplish different goals
- Youth will be able to develop, test, and refine a design

Key Terms

- *Engineering design process*: problem-solving process consisting of seven stages: define, research, ideate, prototype, choose, implement, and learn
- *Aerodynamics*: the study of the properties of moving air, especially the interaction between air and solid bodies moving through it
- *Gravity*: the force that attracts a body toward the center of the earth
- *Lift*: an upward acting force on objects such as an aircraft wing
- *Wind*: current of air

Materials

- For wind tunnel setup:

- Wind tunnel
 - Extension cords, if needed
- For activity:
 - Coffee filters
 - Strawberry baskets
 - Plastic cups
 - Toilet paper rolls
 - Pool noodles, cut into 1" sections
 - String
 - Plastic bags, cut into 4" squares
 - Crepe paper, cut into 3-4" strips
 - Pipe cleaners
 - Cardstock or other stiff paper, cut into fourths
 - Small weights-army men, large beads, plastic animals
 - Masking tape
 - Scissors

Advanced Preparation

- Select a place with enough room for one or two wind tunnels, power outlets, and tables, such as a cafeteria.
- Gather the materials and arrange by type on a table.
- Place the scissors and tape on a separate table for youth to work on.

Activity Instructions

Introduction (5 minutes)

- Discuss gravity, lift, and wind
 - Gravity is the force that keeps us on the ground instead of floating into space.
 - Lift is a force that is the opposite of gravity. It is what makes airplanes fly and certain objects fall down slowly
 - Wind is something that can create lift.
- Ask youth:
 - *What things can catch the wind, or what things can float in the air?*
 - *How do you think that happens?*

Possible Answers: In nature, many types of seeds have unique shapes that catch the wind, like maple trees, dandelions, and elms. Man-made objects that catch the wind include parachutes, paper airplanes, and kites.

- Define the problem with youth for the design challenge. Tell youth that they will use the provided materials to create something that flies out of the wind tunnel. They must use at least 3 different materials, and tape does not count. The contraption must be able to fly out of the wind tunnel.

Optional: Once the first challenge is complete, challenge youth to design something that hovers, and then something that bobs up and down.

Go Over Safety (5 minutes)

- Make it clear that youth should not hit or prod the sides of the wind tunnel.
- If a contraption is stuck, an educator will retrieve it for them.
- Up to 3 youth at a time can test the wind tunnel.

Build Contraption (30 minutes)

Give youth 30 minutes to use the available materials and build a contraption that flies out of the wind tunnel.

- Encourage testing prototypes, observing how their contraption works, and changing various aspects of their contraptions.
- Encourage making multiple contraptions and trying different designs.

Redesign, Rebuild, and Retest Contraptions (10 minutes)

Ask the youth questions about their work, and use scaffolding language to help guide them through the process.

- Point things out by saying *"I notice..."* or *"I wonder..."*
- Avoid giving youth direct answers. Encourage them to test their ideas rather than giving up.
- Encourage youth to observe how others' contraptions work, and use that knowledge to make their own contraption.

- New designs that fulfill the challenges are created each time this activity is done. Keep an open mind and prepare to be surprised.

Reflection and Discussion (10 minutes)

Ask youth to reflect by asking questions.

- *What things can catch wind?* Parachutes, wings, kites, etc.
- *What do they look like, or what shapes do they have?*
- *How can you change your contraption so it...*
 - *Catches more wind?*
 - *Weighs more?*
 - *Flies straight up?*
- *I notice/wonder...*
 - *How the wind is flowing around a contraption*
 - *How parts of a contraption are moving*
 - *Compare and contrast different designs*

Introduce the Concept of Plussing

Explain that plussing is a way of sharing designs that encourages new ideas. Instead of critiquing a design, think of something to add to it. That is called a plus.

- The designer should think about the plus, but can decide whether or not to use it in a future design.
- Emphasize that youth can ADD to a design, but otherwise not change it.

Share Designs

Give several youth the opportunity to share their design. Ask them:

- *What was your design process?*
- *What worked/didn't work?*
- *What was challenging?*
- *What would you do differently?*

Plussing

After a youth has shared their design, ask for plusses.

- Remind youth that they can ADD to a design, but not change it. Ask them to say “You could add...” rather than “You should change...”

As a group discuss,

- *What sort of designs worked for ___? For ___?*
- *What sorts of designs didn't work for ___?*
- *Why do you think they worked?*
- *Why do you think they didn't work?*

Tip: Use observations from the hands-on activity to help answer the questions.

Additional Resources

Click2Science Video

<https://youtu.be/bEooHT8I-Sw>

Build your own Wind Tunnel

http://www.exploratorium.edu/pie/downloads/Wind_Tubes.pdf

<http://www.instructables.com/id/Wind-Tube/?ALLSTEPS>