Science

A Windy Lift

Grade Level
2-6

Length of Lesson
60 minutes

Objective
By the end of this lesson, students will have a better understanding of force, air friction, and mechanical engineering.

Materials Needed
- Copy of *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer
- Scissors
- Hole Punches
- Small binder clips
- String
- Pipe cleaner-cut into thirds (3 per student)
- Pipe cleaner-cut into halves (1 per student)
- Pencils (1 per student)
- 16oz disposable cup
- 6oz disposable cup
- Crayons, colored pencils, markers
- Copies of student worksheet

Standards
NGSS
K-PS2-1; K-PS2-2; 3-PS2-1; 3-PS2-2; 5-PS1; MS-PS1

Lesson Summary
This lesson is a fun, hands-on activity designed to help students understand motion and what causes objects to move. This is also a great lesson to introduce renewable energy and how farmers around the world rely on various machinery and energy sources to grow their food and raise their animals.

Suggested Sequence of Events:
1. Set Up: Cut the pipe cleaners into thirds and halves so that each student has three (3) thirds and one (1) half. For younger students or to save time, hole punch the small, 6 oz disposable cup so that there are two holes on opposite sides of the cup. Finally, print enough copies of the student worksheet so that each student has one. It is better to print on cardstock, but normal printing paper will work.
2. Read through the IAITC Renewable Energy Ag Mag to learn more about renewable energies! Interactive online versions can be found on our website.
3. Complete the activity following the procedures:
    - Read *The Boy Who Harnessed the Wind* aloud to your class. You can use our suggested pre-activity questions on the teacher resources page.
    - Give each student their own windmill blade template and have them decorate it. Then have them follow the directions to cut it out.
    - Carefully push the pencil through the center hole and then bend each corner backwards onto the pencil. Don't crease the paper during this stage! It is easier to have the pencil sharpened and to put the pointed side of the pencil through the holes.
    - Carefully push the blades to the other end of pencil. The pencil will be slightly larger that the holes, so be careful not to rip the paper. You now have a pinwheel!
    - Place the 16 oz cup upside down and lay the pencil pinwheel on top. Use the three (3), 1/3 pieces of pipe cleaner and create an arch shape with them. Push each arch over the pencil to hold the pinwheel in place. Now you have a windmill!
    - Hole punch two holes in your small cup, one on either side. Slide the one (1), 1/2 piece pipe cleaner through the holes, forming a small bucket handle. Bend the sides upward to hold the handle in place.
    - Tie one end of your string around the pencil, and the other end around the bucket handle.
    - Attach the binder clip to the end of the sharpened end of the pencil to keep the string in place.
    - Now blow on the blades and lift the small cup!
4. Whole class discussion and reflection of activity.

TEACHER RESOURCES

Pre-Activity Discussion Questions:

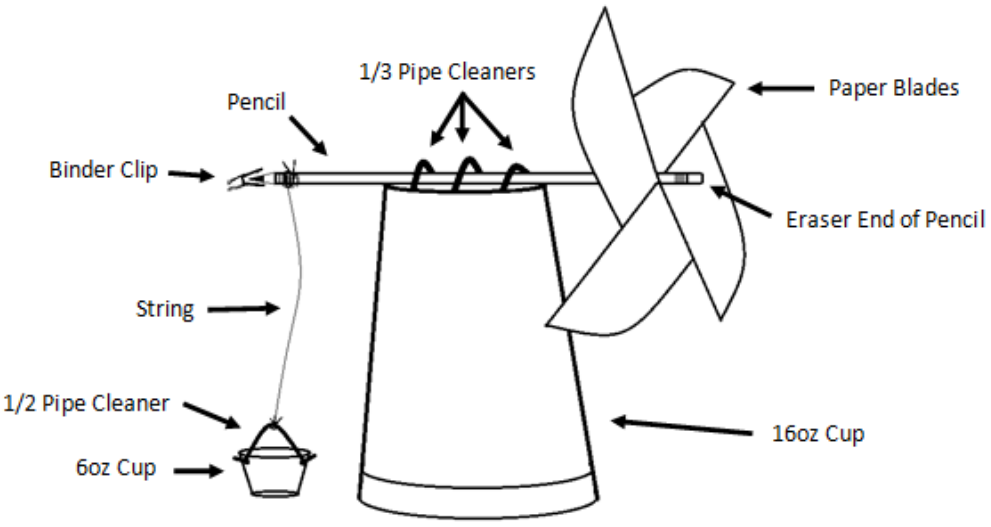
- Ask students what caused the mill to start moving?
- Why did the wind cause the blades to start moving?
- What was the purpose of building the windmill?

Post-Activity Discussion Questions:

- What was the maximum number of pennies your windmill lifted?
- How much time did it take to lift your bucket with no pennies? What about with eight pennies? Why would there be a difference?
- What improvements could be made to help your windmill be stronger or lift the bucket faster?
- What type of motion caused the windmill to start moving? Was it balanced or unbalanced?

Extension Ideas:

- Have students add a penny to their small cups and see if their windmill will lift it. Continue adding pennies and see whose windmill will lift the most! If you don't have pennies, use popcorn kernels, dry beans, etc.
- Use a timer to record how long it takes for the bucket to be lifted with a different amount of pennies. Does it take longer to lift no pennies, four pennies, or eight pennies?
- Use the pennies to learn about the life of Abraham Lincoln.
- Use a fan to move the blades. Does this make a difference in the amount of weight the windmill can lift? Does it make a difference on how quickly the bucket is lifted?
- For higher level students, have them work backwards and draw a blueprint of the windmill before construction.
- Go to agintheclassroom.org to contact your County Literacy Coordinator for free classroom sets of our Ag Mags!



Science

A Windy Lift

Student Worksheet

Directions:

1. Decorate!
2. Cut on all **solid** lines.
3. Use the hole punch to make a hole on all of the black dots.
4. Wait for your teacher for further instructions.