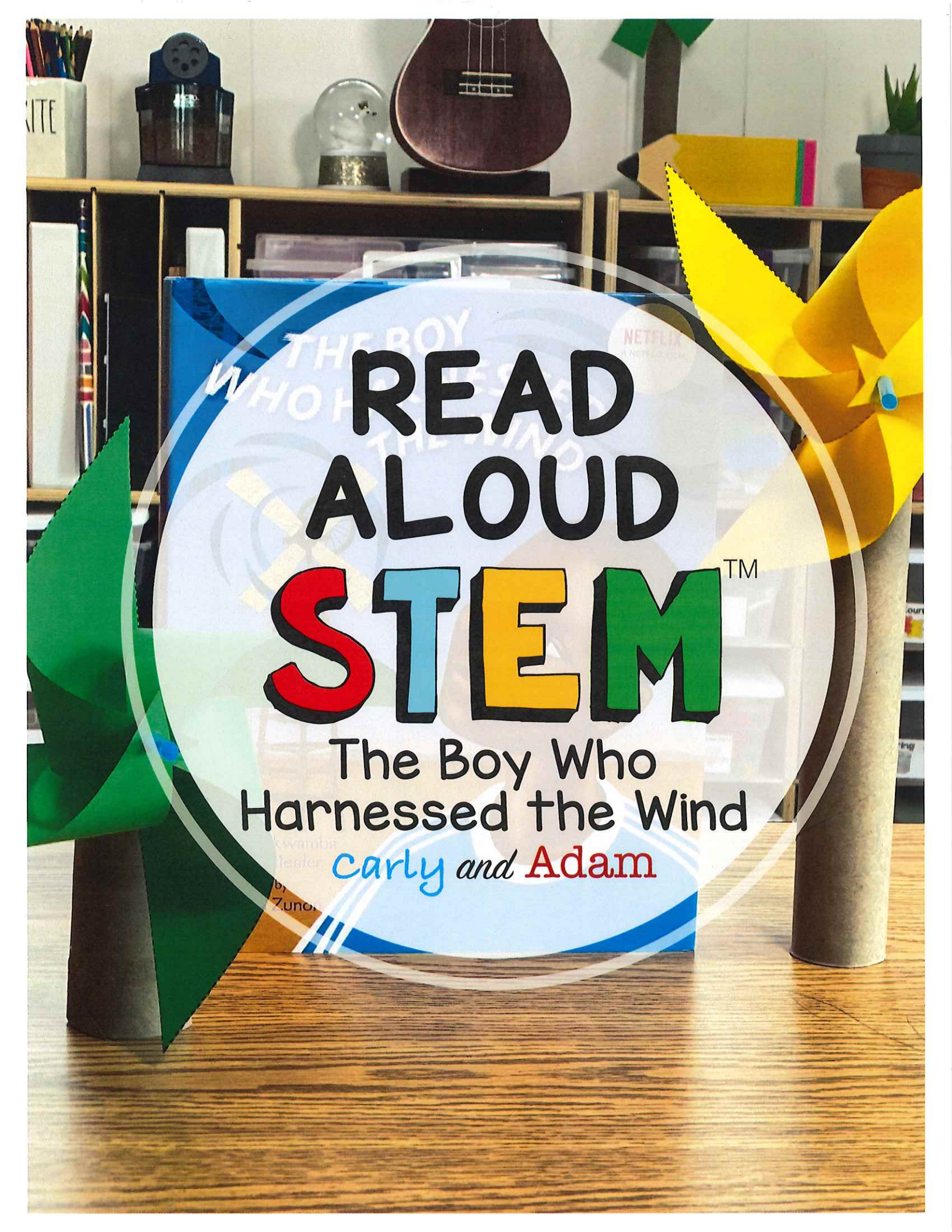




NETFLIX
A NETFLIX FILM

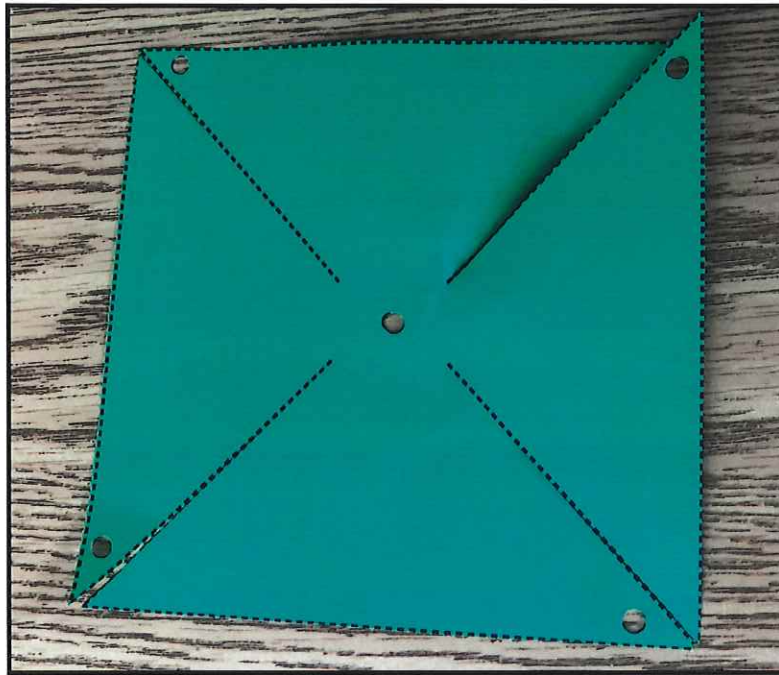
READ ALoud STEM™

The Boy Who
Harnessed the Wind

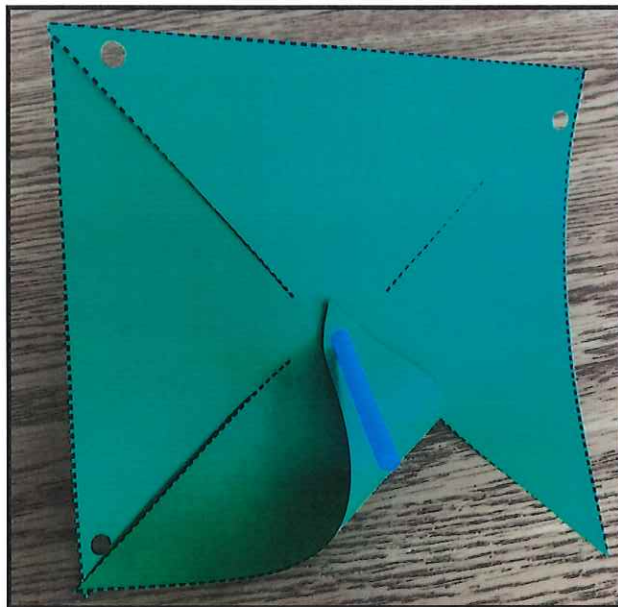
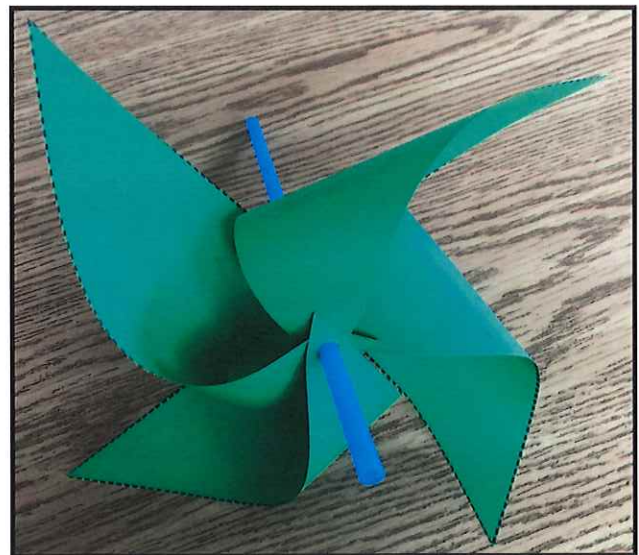
Carly and Adam

WINDMILL INSTRUCTIONS

Teacher Instructions: EXAMPLE



Cut around the outside of the windmill template. Cut along all of the dotted lines. Punch a hole through all of the black circles.



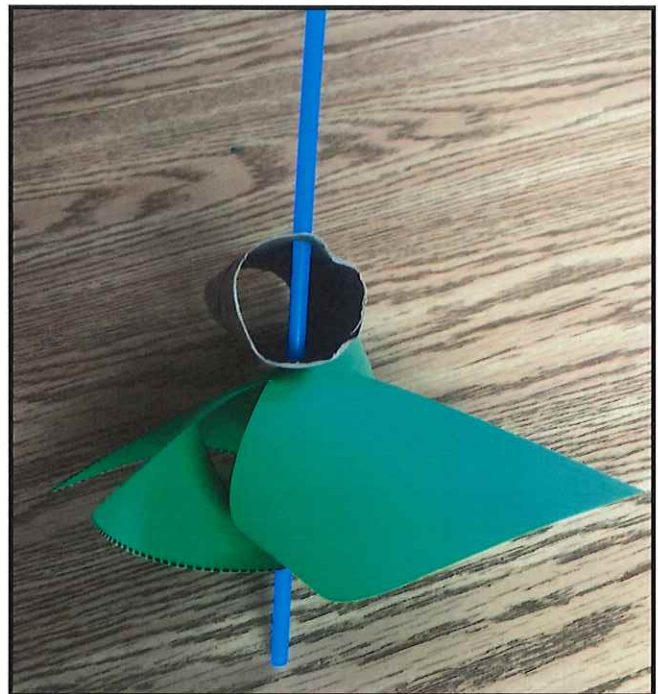
Push a straw through the middle hole. Then slide each windmill blade through the straw using the hole punched circles.

WINDMILL INSTRUCTIONS

Teacher Instructions: EXAMPLE



Punch two holes in the top of a paper towel or toilet paper roll. Then slide the straw through the holes.



WINDMILL STEM

Teacher Instructions: **EXAMPLE**

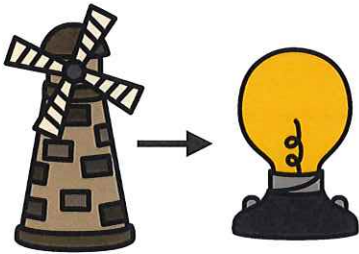


Vocabulary

Directions: Use the vocabulary cards to pre-teach the vocabulary words before completing the activities.



Windmill: a machine that harnesses the power of the wind.



Harness: to control something and use it to make energy.



Blades: the parts of a windmill that rotate.

Vocabulary

Directions: Use the vocabulary cards to pre-teach the vocabulary words before completing the activities.



Rotate: to move in a circle around the center.



Wind Power: an alternative energy source where wind is used to produce electricity.



Rotational Symmetry: when parts of an object are equally spaced around a central point.

Name: _____

PURPOSE

People in your village do not have enough money for electricity.

The village has decided to build a windmill to generate electricity and pump water from the ground. Since you are an engineer, you have been sent to research how windmills work.

The village is trying to decide how many blades they should put on their windmill. As part of your research you will test different designs to see which one is the most efficient at harnessing the power of the wind.

After collecting all of your data you will write a letter to your village letting them know the best way to design their new windmill.

RESEARCH



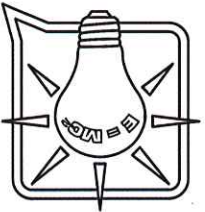
A **windmill** is a machine that harnesses the power of the wind. **Harness** means to control something and use it to make energy. The energy generated by a windmill may be used to grind grain into flour, to pump water, or to produce electricity. Windmills have **blades** that **rotate** or spin around in a circle.

Name: _____

The blades are arranged **symmetrically** meaning that they are evenly spaced around the center. The wind pushes on the blades causing them to spin. The energy from their movement generates electricity.

Wind power is an alternative energy source. This means that the power of the wind can be used instead of other energy sources such as coal or oil. Alternative energy sources are better for the environment.

HYPOTHESES

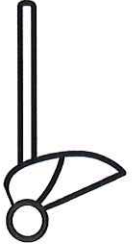


Make a prediction. How many blades should a windmill have in order to be the most efficient (one, two, three or four)? Explain your thinking based on your research.

EXPERIMENT



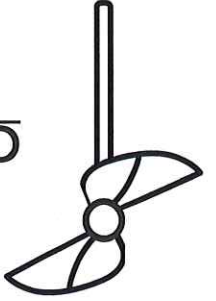
Follow the instructions to design your windmill. Then place your windmill in front of the fan. Collect data about how close each windmill design needs to be to the fan before it starts spinning.



Observations:

How close does the windmill need to be to the fan in order to start spinning? _____

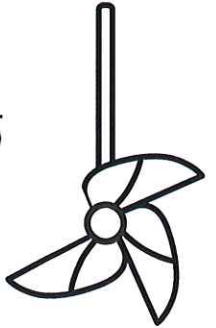
Windmill with One Blade



Observations:

How close does the windmill need to be to the fan in order to start spinning? _____

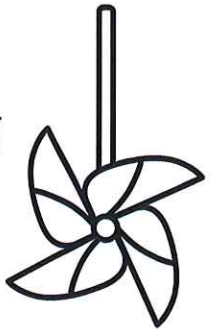
Windmill with Two Blades



Observations:

How close does the windmill need to be to the fan in order to start spinning? _____

Windmill with Three Blades



Observations:

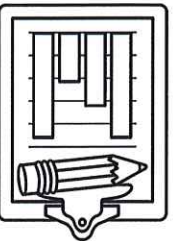
How close does the windmill need to be to the fan in order to start spinning? _____

Windmill with Four Blades

Name: _____

Name: _____

ANALYSIS

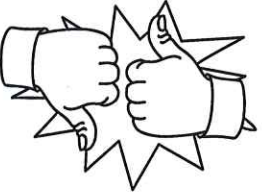


Did the number of blades affect how easily the windmill rotated? Explain your results.

Did the windmill spin more easily when the blades were symmetric or asymmetric?

How many blades should the village use in their windmill design? Explain your thinking.

CONCLUSION



Write a letter to the village about your findings. Talk about the results of your experiment in the letter and give them advice on how to design their new windmill.