

Space and Time Mobius Strip

For this activity, students explore patterns and make predictions. Discussions center on challenging what students believe to be true about simple geometry (sides, edges, faces) and what happens when different factors are changed.

I. About the lesson

1. Mathematics content and process learning objectives
 - a. Asking questions
 - b. Conjecturing
 - c. Error analysis
2. Related creativity traits
 - a. Making connections
 - b. Questioning norms
 - c. Being inquisitive
3. Other disciplinary connections including to everyday life
 - a. When are Mobius strips needed in real life situations?
 - b. What do you do when the results of an experiment differ you're your predictions?

II. Preparing for the lesson

1. Materials
 - a. 1 piece of plain paper
 - b. Several strips of long poster size paper (sticky on one end)
 - c. Scissors
 - d. Can with no top or bottom
 - e. Marker pens
2. Preparation
 - a. Cut enough strips of poster paper so that each person/group receives at least 3 strips.

III. Conducting the lesson

1. Setting up for the exercise.
 - a. Students work individually or in pairs.
 - b. Students are asked how many sides the plain piece of paper has.
 - i. Ask students to elaborate on their responses. (Common response is 2 sides).
 - ii. How did they determine the number of sides of the paper?
 - iii. How do you get from one side of the paper to another (front to back)?
 - iv. How many edges does that paper have?

- v. Can you imagine a piece of paper that has 2 edges?
- c. Create a cylinder with the piece of paper.
 - i. How many sides does the cylinder have?
 - ii. How did they determine the number of sides?
 - iii. Does it have a top or bottom? Inside or outside?
 - iv. How do you get from one side of the paper to another?
 - v. How many edges does the cylinder have?
- d. Each person/group receives
 - i. 3 strips of paper
 - ii. Scissors
 - iii. A recording sheet

2. Give the following instructions to perform the experiment:

- a. Think of a poem, saying, or song with at least 6 words.
 - i. Write the saying on one side of the paper. Repeat it as many times as necessary to fill up the strip.
- b. Flip the paper (on the long edge)
 - i. Write the saying on the other side of the paper. Repeat it as many times as necessary to fill up the strip.
- c. Take the two ends of the strip and introduce **one** twist. Connect the edges and secure with tape.
 - i. Have students read their saying from the beginning and discuss what they found.
 - ii. Can you get from one side to the other without flipping the strip of paper over?
 - iii. How many sides? Edges?
 - iv. What have you created?

3. Using a second strip of paper, make another Mobius strip.

- a. Examples of possible cuts to the 2nd Mobius strip (allow students to be creative and come up with their own ideas for cuts, twists etc. these are meant to be examples to get started):
 - Cut the Mobius strip down the center length-wise until you reach the starting point.
 - Cut 1/3 of the way from one of the edges until you get to the starting point.
 - Make two twists in the paper then connect the ends and make a cut through the middle.
- b. Ask students to predict what they think is going to happen when they make the cut(s)? Record predictions.
- c. Have students make the cuts. Discuss what they found and compare the results of the experiment to their predictions.

4. Making connections

- a. What can you use a Mobius strip for?

- a. Examples – conveyor belt (loop allows the belt to last longer because both sides are being used), recycling symbol
- b. What did you learn from this activity?
- c. How are Mobius strips useful in everyday situations?

IV. Assessment

The lesson can be assessed by the following means:

- a. The discussion questions could be given as a homework assignment
- b. You could conduct similar experiments where students are asked to make predictions for various cuts of their choice and record results.

V. Modifications to this lesson