

MOBIUS STRIP AND RECYCLING SYMBOL

Grades:

3 – 4

Time Allotment:

Teacher Preparation: 20 minutes (includes time for Internet research)

Lesson and Activity: 1 or 2 45-minute class periods (depending on depth of content that teacher decides to pursue)

Vocabulary:

Recycling

Integrated Curricular Areas and Corresponding Core Curriculum Content Standards:

Science: **5.2:** (G4) A1, B1

Social Studies: **6.2:** (G4) A5

Language Arts: **3.1:** (G3) A1, G13 (G4) G13

Mathematics: **4.2:** (G3) B1 (G4) A1

Technology: **8.1:** (G4) B5-7

Content Objectives: Students will be able to –

1. Identify the recycling symbol and describe what it represents;
2. Describe how the recycling symbol closely resembles a mobius strip;
3. Identify a mobius strip; and
4. Describe the history of the mobius strip and the recycling symbol in terms of who designed them, why and when.

Process Objectives: Students will –

1. Read two short narratives and respond to questions about the readings; and
2. Create a mobius strip.

Materials:

For teacher's presentation:

- Chalkboard and chalk or large paper and markers
- List of symbols (drawings) and what each represents
- Index cards
- Picture of the recycling symbol with cardboard to mount it on
- Covering for recycling symbol (cloth or paper) with a “question mark” symbol on top
- Scissors – 1 pair for each student
- Glue or glue sticks – 1 per student or enough to share
- Legal-size paper cut into three equal strips per page, one strip per student
- Roll of tape
- Blank paper – one sheet per student
- Copies of “Mobius Strip and Recycling Symbol” handouts – one per student
- Copies of the “Recycling Symbol” worksheet – one per student

For each student:

- One strip of paper
- One piece of blank paper
- Pencil
- Piece of tape
- Scissors
- Glue
- Copy of the “Mobius Strip and Recycling Symbol” handout
- Copy of the “Recycling Symbol” worksheet

Anticipatory Set:

- Review background information for the mobius strip, symbols and glyphs by visiting the Web sites listed in this lesson under “Resources”
- Assemble a list of symbols that students should be familiar with and draw them on index cards or on the chalkboard one at a time during the presentation to students. Examples include “stop sign,” “peace symbol,” “heart,” “math symbols - =, - and +, the Nike swoosh, pedestrian crossing, skull and cross bone, red cross, etc.
- Ask students the following questions:
 - *What does the word “symbol” mean?* Write their ideas on the board. The term “symbol” means “an object representing something often immaterial; or, a letter, figure or a combination of letters used to represent an object or idea”
 - *What do these symbols represent?* Refer to the list of symbols (or index cards) and show them to the students one at a time, asking what they think each one represents
 - *Can you think of other symbols? If so, come up and draw it on the board and see if the class can guess what it represents* – allow this a couple times if there are ideas

Teacher’s Presentation or Modeling:

- Teacher should ask students: *What does the word “glyph” mean to you? Have you heard of it before?* Write their ideas on the board – they probably have not heard of it. The definition for this term that applies to this lesson is as follows: “A symbol, such as a figure or arrow on a public sign, that imparts information non-verbally”
- *Which of the symbols we just examined might be a glyph?* These would include math symbols, stop sign, peace symbol, etc.
- In advance of the presentation, cut out a copy of the recycling symbol provided in this lesson and mount it on cardboard. Drape a cloth or paper towels over the symbol to cover it. Draw a “question mark” on the cloth or towel with a black marker and set this off to the side in the front of the classroom. Bring this out now in front of the students. Ask them what the “?” symbol means to them (it implies something unknown; a mystery; to guess at something). Tell them you have a “mystery symbol” beneath the covering. Unveil the recycling symbol and ask them to identify it
- Explain that during this lesson students will learn about the recycling symbol
- Ask students what the symbol represents and where they have seen it being used. (The symbol is used on packaging, signage and storage containers. It represents that a package can be recycled or that it is made with recycled materials. When used on signage or

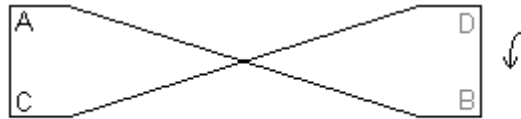
containers it usually means that materials to be recycled should be delivered at that location or placed into that container.)

Guided and Independent Practice:

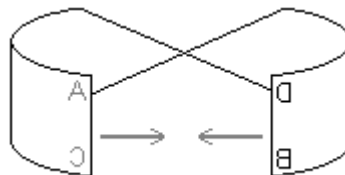
- Distribute the “Mobius Strip and Recycling Symbol” handouts to students and ask them to read Section I about the Mobius Strip. Allow time for quiet reading in class – ask them to put the handout down when they have finished reading Section I
- While they are reading walk around the room and put a 1-inch piece of tape onto the edges of each student’s desk
- Give each student a paper strip. Ask them to use their pencils to label the four corners of the strip with the letters A, B, C and D, like below:



- Demonstrate the following actions and have them imitate each action with their strips:
 - A. Pinch and hold the right edge of the paper with “Corner A” and “Corner C” marked on it. Twist the other edge (with “Corner B” and “Corner D”) ½-way around (180 degrees) like below:



- B. Pull the 2 edges together, so that you can put “Corner B” on top of “Corner C” and “Corner D” on top of “Corner A.” Hold the two edges together tightly.



- C. Have them use the piece of tape to secure the two edges together with only a slight overlap
- Ask students to use their pencil to draw one line around the mobius strip they just constructed. They should not have to lift their pencil up from the paper but should be able to go from the inside to the outside of the strip and back to the beginning of their pencil line, in one continuous motion
 - Have the students flatten their mobius strip so that it resembles the recycling symbol. Next, have them put the strips down on their desk and quietly read Section II on the handout about the recycling symbol. When they are finished reading have them put the handout down on their desks

- Distribute a copy of the “Recycling Symbol” worksheet to each student. Ask them to glue their mobius strip to the bottom of the worksheet, below the recycling symbol

Closure:

- Ask students the following questions:
 - *Do you think the mobius strip has become a recognized symbol to most people? Based on the reading, what would many people think it represents or resembles? Does the mobius strip resemble the recycling symbol?*
 - *Do you think the recycling symbol is a glyph? Based on the reading, what information does it share non-verbally?*
 - On the back of the “Recycling Symbol” worksheet ask them to describe if they agree or disagree that the recycling symbol is a good symbol for recycling. They must support their opinion with sound reasoning, at least 5 – 6 sentences

Assessment:

- Responses to questions from teacher;
- Creation of the mobius strip and related activities; and
- Response to question about if recycling symbol is a practical symbol for recycling

Extensions:

- Have students bring in items or packaging from home that have the recycling logo on it. For each item have them discuss if it can be recycled or if it is made from recycled materials (or both)
- Challenge students to create a new symbol or design for something that does not have a universal symbol. Suggestions related to solid waste and recycling include:
 - The bundling or bagging of newspaper stacks for pick-up;
 - The separation of recyclable materials into separate containers (i.e., glass, metal and plastic);
 - No littering; and
 - The rinsing of containers before recycling them.

Safety/Clean Up:

- Be sure that any items or packages brought in from home are empty, clean and without sharp edges

Resources:

“*Recycling Topology*” – Ivars Peterson. *Science News Online*; Week of April 26, 2003; Vol. 163, No. 17.

<http://www.sciencenews.org/articles/20030426/mathtrek.asp>

The History of the Recycling Symbol

http://home.att.net/~DyerConsequences/recycling_symbol.html

August Ferdinand Mobius

<http://www-groups.dcs.st-and.ac.uk/~history/Mathematicians/Mobius.html>

Section I: The Mobius Strip

The Mobius Strip was discovered in 1858 by German mathematician and astronomer August Ferdinand Mobius, who was born in 1790 and died in 1868.

Mobius was a pioneer in a study of geometry that became known as topology. Topology explores the properties of a geometrical shape (like a circle), that do not change when the shape is stretched or bent.

The mobius strip is a two-dimensional surface with only one side. To make a mobius strip, take a rectangular strip of paper, twist it 180 degrees, then join the two ends together.

This geometric shape came into existence through mathematical research and is now recognized as an important symbol of modern times. To many it represents something continuous, like the continuity of a finite resource or entity.

Section II: The Recycling Symbol

In 1970 the Container Corporation of America, based in Chicago, Illinois, sponsored a contest in celebration of Earth Day and involving art and design students at colleges and high schools throughout the United States. Students were asked to design a symbol that stood for the recycling of paper.

Gary Dean Anderson, a student of architecture in California, submitted the winning entry. His original design was of three twisting and turned arrows in the shape of a Mobius loop. William Lloyd, the manager of graphic design with the company, modified the winning design and the current-day recycling symbol was created.

This simple symbol eventually became widely recognized and used world-wide and has appeared with some modifications. Sometimes the three arrows appear against a background, sometimes they are in a circle or without a circle, and sometimes the arrows are upside down or reversed. Sometimes the symbol is part of a larger logo that includes words and other pictures or symbols.

Regardless, this basic symbol is recognized as the designation for recycled and recyclable materials.