# Manual Popsicle Fan Project

**Standard**: NGSS MS-PS2-2: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

---

**A. TEACHER**:
**B. GRADE LEVEL**: 5th–7th Grade
**C. SUBJECT**: STEM/Science
**D. DATE**:
**E. DURATION**: 60 minutes
**F. LESSON FOCUS**: Circular Motion and Simple Machines

---

**G. MATERIALS**:

- Plastic bottle
- Hot glue gun and glue sticks (adult supervision required)
- Popsicle sticks (2 per student)
- Barbeque stick (1 per student)
- String or yarn
- Scissors
- Markers or paint for decoration

---

**H. LESSON OBJECTIVES**:

1. Understand the concept of circular motion through hands-on activity.
2. Identify how simple machines, like wheels and axles, work.
3. Apply scientific principles to design a working manual fan that generates airflow.

---

**I. PROCEDURES**:

**1. INTRODUCTION** (10 minutes):
Begin by discussing the concept of circular motion and simple machines. Explain how circular motion occurs when an object moves along a circular path and how simple machines, like wheels, can help convert applied force into work. Discuss how the manual fan project will help students observe these principles in action.

**2. EXPERIMENT** (30 minutes):
Guide students through the steps of building the manual popsicle fan.

- **Step 1**: **Make the Fan Blades**
  - Have students carefully poke a hole at the center of each popsicle stick to serve as fan blades.
  - Allow students to decorate their popsicle sticks with markers or paint.
- **Step 2**: **Assemble the Blades**
  - Students attach the decorated popsicle sticks to the barbeque stick, securing them with hot glue. Remind them to cut off any sharp edges on the barbeque stick.
- **Step 3**: **Prepare the Bottle**
  - Instruct students to poke a hole on the side and another at the bottom of the plastic bottle.
- **Step 4**: **Assemble the Fan**
  - Students tie the string around the barbeque stick and insert it through the bottle, securing it so that the stick can rotate when the string is pulled.
- **Step 5**: **Test the Fan**
  - Guide students in pulling the string to observe the rotation of the fan blades.

**3. OBSERVATION** (10 minutes):
Ask students to observe and describe what happens as they pull the string to rotate the fan blades. Prompt them to think about how the circular motion of the blades creates airflow and how the direction and speed of their pull affect the fan's rotation.

**4. GENERALIZATION** (5 minutes):
Discuss how the activity demonstrates the principles of circular motion and simple machines. Ask students to think about how this mechanism could be applied in real-life devices that create airflow, like electric fans or windmills.

**5. ASSESSMENT** (5 minutes):
Have students answer the following questions:

- What role does the barbeque stick play in the fan's construction?
- How does pulling the string affect the motion of the blades?
- What safety precautions did you follow while assembling the fan?

---

**Note 1**:
**Safety**: During the project, ensure that students handle scissors and the barbeque stick carefully to avoid cuts. An adult should supervise the use of hot glue, as it can cause burns. Remind students not to pull the string too forcefully to avoid damaging the fan or injuring themselves with the rotating blades.

**Note 2**:
**Accommodations**: For ELL (English Language Learners) students, provide visual aids and step-by-step instructions with illustrations. Use clear, simple language during explanations, and encourage peer support to facilitate understanding. For ESE (Exceptional Student Education) students, offer hands-on assistance where needed, and allow additional time for each step.