Weather Watcher's Workshop: Build Your Own Weather Station

Materials Needed:

- **For the Rain Gauge:**
  - 1 clean, empty 2-liter plastic bottle
  - Scissors or a craft knife (adult supervision required)
  - A handful of small pebbles or marbles
  - Waterproof permanent marker
  - Ruler
  - Tape
- **For the Weather Vane (Wind Direction):**
  - 1 drinking straw
  - 1 straight pin
  - 1 pencil with an eraser on the end
  - Cardstock or a thin piece of cardboard (like from a cereal box)
  - Compass (or a compass app on a phone)
- **For the Anemometer (Wind Speed):**
  - 5 small paper cups (like bathroom cups)
  - 2 drinking straws
  - 1 straight pin
  - 1 pencil with an eraser on the end
  - Hole punch
  - Stapler
- **For the Weather Journal:**
  - A blank notebook or stapled paper
  - Pencils, colored pencils, or markers

Lesson Plan Details

Subject: Science (Earth Science, Engineering)

Grade Level: 3rd-4th Grade (Age 9)

Time Allotment: Approximately 90 minutes

1. Learning Objectives

By the end of this lesson, the student will be able to:

- **Design and construct** three simple weather instruments: a rain gauge, a weather vane, and an anemometer.
- **Explain the purpose** of each instrument (what it measures and how it works).
- **Use the created instruments** to observe and record basic weather data in a journal.
- **Apply scientific observation skills** to describe daily weather conditions.

2. Introduction: The Meteorologist's Mission (10 minutes)

- **Engage:** Start with a question: "If you were a weather detective, what clues would you look for to predict tomorrow's weather? We can feel the wind and see the rain, but how do scientists (called meteorologists) actually *measure* it?"
- **Connect:** Explain that meteorologists use special tools to gather data. Today, the student's mission is not just to learn about these tools, but to become an engineer and build their very own weather station.
- **Introduce the Journal:** Present the blank notebook. "This is your official 'Weather Watcher's Journal.' You will use it to record the data you collect from the instruments you invent today." Have the student decorate the cover.

3. Activity Part 1: Make a Rain Gauge (20 minutes)

Goal: To create a tool that measures precipitation.

1. **Prepare the Bottle:** With adult help, carefully cut the top third off the 2-liter bottle.
2. **Create Stability:** Place the pebbles or marbles in the bottom of the bottle. This will keep it from tipping over in the wind.
3. **Make the Funnel:** Flip the top part of the bottle you cut off upside down and place it into the opening of the bottom part. This acts as a funnel to collect rain and prevent evaporation.
4. **Calibrate the Scale:** Tape the ruler to the outside of the bottle, making sure the "0" mark is level with the top of the pebbles. Use the permanent marker to draw measurement lines (e.g., every centimeter or half-inch) directly onto the bottle. Explain that this turns a simple bottle into a scientific measuring tool.
5. **Discuss:** Ask, "Why is it important for a farmer or a gardener to know how much it has rained?"

4. Activity Part 2: Construct a Weather Vane (25 minutes)

Goal: To build a tool that shows the direction the wind is coming from.

1. **Create the Arrow:** From the cardstock, cut out a triangle for the arrowhead and a larger square or trapezoid for the tail.
2. **Assemble the Vane:** Cut small slits in each end of the drinking straw. Slide the arrowhead into one slit and the tail into the other.
3. **Find the Balance Point:** Balance the straw on your finger to find the center. This is a critical step for it to spin freely.
4. **Mount the Vane:** Carefully push the straight pin through the balance point of the straw and then into the eraser on the end of the pencil. Make sure the straw can spin easily without wobbling too much.
5. **Test and Discuss:** Blow on the tail of the weather vane. Ask, "Why does the arrow always point *into* the wind?" (Explain that the wind pushes on the larger tail surface, causing the smaller arrowhead to point in the direction the wind is coming *from*).

5. Activity Part 3: Build an Anemometer (25 minutes)

Goal: To build a tool that spins to show wind speed (qualitatively).

1. **Prepare the Cups:** Take four of the paper cups. Use the hole punch to make one hole in the side of each, about half an inch from the rim.
2. **Prepare the Center Cup:** Take the fifth cup and punch four evenly spaced holes around its side, about an inch from the rim. Then, punch a hole in the very center of the base.

3. **Create the Rotor Arms:** Push one straw through a hole in the center cup and out the opposite hole. Do the same with the second straw, forming an "X".
4. **Attach the Cups:** Attach one of the other four cups to the end of each straw, making sure the cups all face the same direction (all openings facing clockwise or counter-clockwise). Staple the straw to the inside rim of the cup for security.
5. **Mount and Finish:** Push the pencil (eraser-end up) through the hole in the bottom of the center cup. Carefully push the pin through the intersection of the two straws and into the eraser. Make sure it spins freely!
6. **Test and Discuss:** Take it outside or use a small fan. Ask, "What do you notice when the wind is gentle versus when it is strong?" (It spins faster).

6. Conclusion and Application (10 minutes)

- **Set Up the Station:** Find a good, open spot outside to place the new weather instruments. Use a compass to help orient the weather vane (e.g., place a rock to mark North).
- **First Journal Entry:** Guide the student to make their first entry in the Weather Watcher's Journal. It should include:
    - Date and Time
    - A drawing of the sky (sunny, cloudy, etc.)
    - Wind Direction (from the weather vane)
    - Wind Speed (described as "calm," "breezy," or "windy" based on the anemometer's speed)
    - Rainfall (Check the gauge - it will be zero for now, but they know how to read it!)
- **Reflect:** Ask, "Which instrument was the most fun to build? Which do you think will be the most useful for our daily weather reports?"

7. Differentiation and Extension

- **For Extra Support:** Pre-cut the cardstock shapes for the weather vane. Help the student with balancing and pinning the moving parts, as these require more fine motor control.
- **For an Advanced Challenge:**
    - **Calibrate the Anemometer:** Have the student count how many times the anemometer spins in one minute on a breezy day versus a very windy day to create their own "wind speed scale."
    - **Build a Barometer:** Challenge the student to research and build a simple barometer using a jar, a balloon, and a straw to measure air pressure.
    - **Long-Term Tracking:** Encourage the student to record the weather every day for a month and then create a graph to look for patterns.

8. Assessment

Assessment is informal and performance-based:

- **Product:** Are the three weather instruments complete and functional?
- **Demonstration:** Can the student explain what each instrument does when asked? (e.g., "Show me how you know the wind is coming from the west.")
- **Application:** Is the first entry in the Weather Watcher's Journal complete and does it accurately reflect the day's observations using the new tools?