The Walking Rainbow Experiment

Florida Benchmark: SC.8.P.8.4 – Classify and compare substances on the basis of their physical and chemical properties.

A. TEACHER:
B. GRADE LEVEL: 5
C. SUBJECT: STEM/Science
D. DATE:
E. DURATION: 45 minutes
F. LESSON FOCUS: Understanding capillary action through the Walking Rainbow experiment.

G. MATERIALS:

- Clear cups or glasses (6)
- Water
- Food coloring (red, blue, yellow)
- Paper towels
- A tray to hold the cups
- Measuring cup
- Stirring sticks (optional)

H. LESSON OBJECTIVES:

1. Students will understand the concept of capillary action and how it allows liquids to move through materials.
2. Students will observe and describe how colors mix and spread through the paper towels.
3. Students will explain the scientific principles behind capillary action and diffusion.
4. Students will enhance their observation and critical thinking skills.

I. PROCEDURES:

1. **INTRODUCTION:**
    - Start with a brief discussion on capillary action. Ask students if they've ever noticed how a sponge absorbs water or how plants take up water through their roots. Explain that in this experiment, they will observe how water moves through paper towels.

- Introduce the concept of diffusion and how it relates to the mixing of colors in this experiment.

2. **EXPERIMENT:**
   - Arrange six clear cups in a row on the tray. Fill the first, third, and fifth cups with water and add a few drops of food coloring (e.g., red, yellow, and blue).
   - Cut strips of paper towel and place one end in each colored water cup, making sure the other end touches the empty cups.
   - Instruct students to observe what happens over time as the colored water travels along the paper towel.
3. **OBSERVATION:**
   - After a few minutes, have students share their observations. Ask them to note the movement of the colored water, the height it reaches, and any color changes they see.
   - Discuss how capillary action is causing the water to move up the paper towel and how diffusion allows the colors to blend.
4. **GENERALIZATION:**
   - Guide students to connect their observations to the concepts of capillary action and diffusion. Ask reflective questions:
     - What did you notice about how the colors moved?
     - How does this relate to how plants absorb water?
     - Can you explain the difference between capillary action and diffusion?
5. **ASSESSMENT:**
   - Have students write a brief reflection or answer questions about what they learned regarding capillary action and diffusion.
   - Evaluate their understanding based on their written reflections and participation during the experiment.

Note 1: Safety is important during this experiment. Students should be careful when handling liquids to avoid spills. If spills occur, they should clean them immediately to prevent slipping. Ensure that all materials used, such as food coloring, are non-toxic, and remind students to wash their hands after the experiment.

Note 2: For English Language Learners (ELL) and Exceptional Student Education (ESE) students, provide visual aids and diagrams that explain capillary action. Use clear and simple language during instructions, and encourage peer collaboration so students can support each other. Additionally, offer hands-on guidance throughout the experiment to ensure all students can participate and understand the concepts being taught.

g the scientific principles that govern the movement of objects.

At the heart of the Paper Roller Coaster project are the concepts of potential and kinetic energy. Potential energy is the energy stored in an object due to its height above the ground. In this project, when a marble is placed at the top of the coaster, it possesses potential energy that will be converted into kinetic energy as it rolls down the track. Kinetic energy, on the other hand, is the energy of motion, which increases as the marble descends and speeds up.

As students construct their coasters, they learn how various factors influence the motion of the marble. For example, the height of a hill directly affects the potential energy available to the marble; the higher the hill, the more potential energy it has. Conversely, friction between the marble and the paper track can slow the marble down, demonstrating how opposing forces impact motion. This interplay between energy types and forces provides a practical illustration of Newton's laws of motion, particularly the principle that an object in motion will remain in motion unless acted upon by an external force.

Additionally, the project fosters critical thinking and problem-solving skills. Students must plan their designs, test them, and make iterative adjustments based on observation. This mirrors the real-world engineering design process, where prototypes are tested and refined to achieve desired outcomes.

The Paper Roller Coaster project not only makes abstract scientific concepts tangible but also encourages creativity and teamwork. As students collaborate to overcome design challenges, they develop a deeper understanding of the principles of physics while having fun in the process.

References

- Giancoli, D. C. (2014). *Physics: Principles with Applications*. Pearson Education.
- Serway, R. A., & Faughn, J. (2013). *College Physics*. Cengage Learning.
- Science Buddies. (n.d.). "Roller Coaster Physics: Kinetic and Potential Energy." Retrieved from Science Buddies.