Balloon Rocket Science – Exploring Newton's Third Law of Motion

Florida State Standard: SC.6.P.13.3 – Investigate and explain that Newton's Third Law of Motion states that forces act in pairs and for every action, there is an equal and opposite reaction.
Florida State Benchmark: SC.6.P.13.3 – Investigate and explain that forces cause objects to move or change their motion.

A. TEACHER:
B. GRADE LEVEL: 6th–8th Grade
C. SUBJECT: STEM/Science
D. DATE:
E. DURATION: 45–60 minutes
F. LESSON FOCUS: Understanding Newton's Third Law of Motion through the Balloon Rocket Experiment.
G. MATERIALS: 1 balloon (any size), 1 long piece of string (3–5 meters), 1 plastic straw, Tape (scotch or masking tape), 2 chairs (or other sturdy objects to tie the string to), Stopwatch (optional), Ruler or measuring tape (optional)
H. LESSON OBJECTIVES: Students will conduct a balloon rocket experiment to observe Newton's Third Law of Motion. Students will document the motion of the balloon rocket along the string. Students will explain how action and reaction forces result in motion.

I. PROCEDURES:

1. **INTRODUCTION (10 minutes):** Introduce the concept of Newton's Third Law of Motion: "For every action, there is an equal and opposite reaction." Ask students to recall any previous experiences with balloons or rockets and how they think air pressure and motion are related. Present the objectives of the experiment and define key terms: action, reaction, force, and motion.
2. **EXPERIMENT (25–30 minutes):** Step 1: Set up the string. Tie one end of the string to the back of a chair and feed the straw onto the string. Tie the other end to a second chair, making sure the string is taut. Step 2: Inflate the balloon but do not tie it off. Hold the open end of the balloon shut. Step 3: Attach the balloon to the straw using tape. Make sure the balloon is parallel to the string, with the open end facing away from where it will travel. Step 4: Release the balloon and observe how it moves along the string as air escapes. Step 5: Record observations on the distance traveled and time taken (using a stopwatch if possible). Use a ruler to measure the distance.
3. **OBSERVATION (5–10 minutes):** Have students share their observations. Ask them how the balloon moved and what caused it to travel. Discuss factors such as the amount of air in the balloon and how it might have affected the balloon's speed or distance.
4. **GENERALIZATION (5–10 minutes):** Review the key concept: Newton's Third Law of Motion states that the action of air rushing out of the balloon creates an equal and opposite reaction, propelling the balloon forward. Ask students to identify other real-life examples of Newton's Third Law (e.g., rocket launches, swimming, jumping).

5. **ASSESSMENT:**

5.1 **Comprehension Questions:**

- What happens to the balloon when you release it?
- How does the balloon demonstrate Newton's Third Law of Motion?
- How does the size of the balloon or the amount of air in it affect its movement?
- Why does the balloon move in the opposite direction to the escaping air?
- What are some real-world applications that demonstrate Newton's Third Law of Motion?

5.2 **Reflection:** Have students write a short paragraph explaining how the experiment demonstrates Newton's Third Law of Motion and discuss the factors they believe affected the balloon's speed and distance.

Note 1 (Safety): This experiment involves handling a balloon that may burst if overinflated. Students should be reminded to hold the balloon at the open end until they are ready to launch it to avoid sudden air escapes. Ensure that the chairs or objects used for holding the string are stable, and students should be positioned at a safe distance from the balloon's release path to avoid accidents.

Note 2 (Accommodation for ELL, ESE, etc.): For students with limited English proficiency (ELL), provide visual aids such as diagrams of Newton's Third Law, simplified vocabulary lists, and bilingual instructions if possible. For ESE students, ensure the task is broken down into smaller, manageable steps. Consider providing one-on-one assistance or pairing students with peers for additional support during the experiment. Use a hands-on, active approach to ensure all students are engaged in the learning process.