The Balloon-Powered Car Project: Exploring Propulsion and Motion

Florida State Standard:
SC.5.P.13.1: Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity, friction, and magnetic force.
Florida State Benchmark:
SC.4.P.12.1: Recognize that an object in motion always changes its position and may change its direction as a result of the application of force.

A. TEACHER:
B. GRADE LEVEL: 4-6
C. SUBJECT: STEM/Science
D. DATE:
E. DURATION: 1-2 class periods
F. LESSON FOCUS:
Understanding propulsion, motion, and Newton's Third Law of Motion through hands-on experimentation with a balloon-powered car.
G. MATERIALS:

- 1 standard-sized balloon
- 4 bottle caps (as wheels)
- 1 clean, empty plastic water bottle (500 ml recommended)
- 2 barbecue sticks (as axles)
- Tape or glue
- Scissors
- 1 straw (optional, for smoother axle rotation)
- 1 straw (optional, for a better connection between the balloon and the water bottle)

H. LESSON OBJECTIVES:

1. Understand the principles of propulsion and motion through hands-on experimentation.
2. Demonstrate Newton's Third Law of Motion.
3. Explore the effects of thrust, friction, and weight distribution on car performance.
4. Develop critical thinking and problem-solving skills through design and testing.

I. PROCEDURES:
1. INTRODUCTION:

- Introduce students to the concepts of propulsion and motion.
- Explain Newton’s Third Law of Motion: "For every action, there is an equal and opposite reaction."
- Discuss how the balloon-powered car will serve as a demonstration of these principles.

2. EXPERIMENT:
Preparation:

- Clean the water bottle and lay it horizontally on a flat surface.
- Create small holes for axles on both sides of the bottle.

Wheels and Axles:

- Poke holes in the center of each bottle cap to serve as wheels.
- Push the barbecue sticks through these holes to create axles.
- Insert the axles into the prepared holes in the water bottle.

Attach the Balloon:

- Securely tape the balloon to the top of the bottle. Use a straw if necessary for a tighter connection.

Testing the Car:

- Inflate the balloon, place the car on a smooth surface, and release the balloon's neck to observe its movement.

3. OBSERVATION:

- Have students document how far and fast their cars travel.
- Note any challenges with the car's performance, such as misalignment or friction issues.
- Encourage students to record their observations in a table or chart.

4. GENERALIZATION:

- Discuss the results of the experiment.
- Help students draw conclusions about propulsion, thrust, and friction based on their observations.
- Relate these findings to real-world vehicle motion and engineering.

5. ASSESSMENT:

5.1 Comprehension Questions:

- What materials did you use to build the car?
- How does the balloon provide propulsion?
- Why is free rotation of the wheels important?
- What challenges did you face, and how did you address them?

5.2 Project Report:

- Students write a summary of their experiment, observations, findings, and any adjustments made.

Note 1: Safety

Ensure safety during the activity by supervising the use of scissors and other sharp objects. Students should work on flat, clear surfaces to avoid accidents. If using small parts such as bottle caps and barbecue sticks, remind students not to put them in their mouths to prevent choking hazards.

Note 2: Accommodation

- **ELL (English Language Learners):** Use visuals and diagrams to demonstrate the steps. Provide instructions in students' primary languages, if possible, or use simple, clear language.
- **ESE (Exceptional Student Education):** Allow extended time and offer hands-on assistance as needed. Pair students with peers for collaborative work.
- **Advanced Learners:** Challenge them to modify their car designs for greater speed or stability.