Community in the Classroom Presentation Plan

Lesson name: Balloon Rocket Cars (Newton's 3rd Law)
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Grade Level: 2nd grade physical science
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Abstract:
Our classroom lesson involves the concepts of Newton's 3rd Law: For every action, there is an equal and opposite reaction. We will first introduce the topic with a simple demonstration with a student sitting on a skateboard pushing against a wall. Then we will discuss other real-life examples of the 3rd Law. In the next demonstration we will release a balloon on a string that will move like a rocket across the classroom, showing how Newton's 3rd Law can propel objects. For the rest of the lesson, we will help the children build their own balloon rocket cars. Throughout our presentation, we will reinforce the idea of action and reaction. We will also encourage the students to develop and test their own hypotheses.

Vocabulary/ Definitions:
force - a push or pull
hypothesis - educated guess
motion - movement
model - simpler version of something that we can easily study
action/ reaction – something that happens and the response to that something

Materials:
We will bring bottle caps, skewers, cardboard, balloons, straws, string and tape. We will also bring a skateboard.

The teacher/class should have scissors.

Classroom setup:
We will need an open area in the classroom to perform a demonstration using skateboards (see Learning Experience section below for more details). Ideally, we will need about 4 ft by 12 ft.

We would also like the students to be separated into 3 groups for building the balloon rocket cars at their desks/ tables.

Personal Intro (2 min):
We will discuss our names and that we are UC Berkeley students studying science and engineering.

Topic Intro (5-7min):
(Drop object on floor) "Does anyone know what made the object fall on the ground?" If no one answers, give clues to the word "gravity." For example: "It's the force that keeps

you on the ground so that you don't fly into space, where there is none of this."

Once they call out the correct force (gravity), then begin talking about forces: "Gravity is a one type of force. A force is a push or pull." Demonstrate force by performing some kind of push or pull on an everyday object.

"A man named Isaac Newton once saw an apple fall to the ground just like how we saw the (object) fall. Besides gravity, Newton began to think about all kinds of forces and made several rules about them. Today, we will talk about one of his rules. This rule shows what happens when you apply a force to an object. You'll learn more about Newton and his other laws when you learn more about physics."

Learning experience(s):
Ask for 1 child to sit cross-legged on a skateboard. Ask the class what will happen when the student pushes against the wall. Inform the class that this educated guess is a "hypothesis". Encourage the children to use the word "force" in their hypotheses. Next, have the child push off against the wall. Ask the class if their hypothesis was correct. Have them identify what the action and reaction is. (5min)

Next, lead a discussion so that the children understand the 3rd law. Ask the class for other examples of how an action produces an equal and opposite reaction. Some examples include swimming, paddling, being thrown back on a roller coaster, track starting blocks, and rockets. Have them identify what the action and reaction are for each example.

Compare a rocket to a balloon with air escaping. In a rocket, the burning fuel and expanding gas shoots downwards (action) and propels the rocket up (reaction). Likewise, in a balloon, the released air shoots in one direction (action), and the balloon flies in the opposite direction (reaction). Demonstrate this by releasing a balloon on a string: Blow up a balloon, holding the end closed, and tape a piece of straw to it. Thread a string through the straw and tape the ends of the string to the sides of the room, or two sturdy objects, so that the string is taut. Before releasing the balloon, ask the children which way the balloon will go. Let it go and then ask the class if their hypothesis was correct. Have them identify what the action and reaction is. (5-10 min)

Now, have the class build balloon rocket cars: toy cars that will be propelled by the air released from a balloon. Divide the class into 3 groups. One of us will supervise each group and the 4th person will walk around checking on the groups while keeping track of time. Each child will get four pre-drilled bottle caps, 2 wooden skewers, 2 straight straws, 1 bent straw pre-taped to a balloon, and a piece of cardboard. First the skewers will be threaded through the straight straws and bottle caps pushed onto either end. These are the axles of the cars. Next the cardboard piece will be taped across as the body of the car. Finally the balloon taped to a straw will be taped onto the body to be the "rocket engine". The car is now complete. By blowing the balloon up and allowing it to deflate, the air exiting the balloon will propel the car forward. (20 min)

When the students are done building their cars, they can come to an empty area of the

room and race them. With time permitting, we may have a distance competition to see whose car travels the furthest.

Wrap up (7 min):

"Now that we have built our cars, what was your hypothesis? Was it correct? What was the action and reaction?"

Time permitting, ask students how they hypothesize that different sizes/amount of inflation will affect the car's performance. Using a sample car, you can investigate their hypotheses. Emphasize that since we are essentially changing the force that the balloon makes (the action), we must also change the motion of the car (the reaction).

Review vocabulary words.

Close (3 min):
If there is a rocket launch soon, tell them when. There is one scheduled for October 10th at 9:33pm, and another on November 12th at 5:43pm.
(http://www.nasa.gov/missions/highlights/schedule.html)

Children can also play online games that involve rocket propulsion. Examples include:
Newton's 3rd Law: The Game (http://www.gamebrew.com/game/n3wton/play)
Rocket Car (http://www.gamesforwork.com/games/play-5004-Rocket_Car-Flash_Game.html)

The first one is actually very good for understanding how Newton's 3rd law works for propulsion and collisions.

Follow-up: (suggestions for teacher)

Link for building balloon rocket cars:
http://www.life.uiuc.edu/boast1/sciencelessons/rocketcar.htm

Some other online links and videos for other rockets:

How to build a water-powered bottle rocket:
http://www.youtube.com/watch?v=20QvsHZw5WM
A video of a water-powered rocket car:
http://www.youtube.com/watch?v=CDDI5h8JQE0