Forces
4th Grade
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Benchmarks:

SLC 12: A.) Students will apply concepts of Newton's Laws in scientific explorations. B.) Students will explore the relationships among force, mass, direction and speed on moving objects.

Objectives:

To understand forces as pushes and pulls.

Materials:

- Chairs
- A book
- A wall

Initial Demonstration:

If we wanted to move our chairs what could we do to them? What is it called when we push or pull another object by touching it?

Target Observations:

To move the chair,

- We could push the chair
- We could kick the chair
- We could pull the chair
- We could slide something over to hit the chair
- We could tie something to the chair and pull
- All of the above answers use either a push or a pull to move the chair
- All of the above answers require a force to be used

Target Model:

-*A force is a pushing or pulling of another object.*

Procedure:

There are lots of ways that we can push or pull a chair. Is there anything else that is pushing or pulling (other than us) when we push or pull the chair?

Target Observations:

- Gravity is pulling the chair down and the floor is pushing the chair up

Target Model:

-A force is a pushing or pulling of another object.
-*When a chair is pushed, gravity is pulling down and the floor is pushing up.*

Demonstration:

Are we sure that nothing else is pushing? Have the students try this: have everyone stand up, get a partner, face each other with their hands, palms out by their shoulders. Each student presses their hands against the other student's hands and makes an upside-down V with their bodies. Have each kid take a step back with his or her right foot, then left, then right, then left. They should be leaning pretty far, but not falling or moving one way or another. Have each them slowly step back together and sit down. Who was using a force and what kind was it?

Target Observations:

- Student A was using a force because he/she could feel themselves pushing
- Student B was using a force because he/she could feel themselves pushing
- Student A was pushing opposite to student B
- Students A and B felt like they were being pushed

Target Model:

-A force is a pushing or pulling of another object.
-When a chair is pushed, gravity is pulling down and the floor is pushing up.
-*When something is pushed, even if it doesn't move, it pushes you back.*

Procedure:

We have just discovered Newton's 3rd Law: when something is pushed or pulled, it pushes or pulls back.

Place a book on a table and ask what forces are acting on it. Draw a diagram of the book on the table, and use arrows to show the direction the forces are acting. What is similar about this to the upside-down V the students just made? Why isn't the book moving?

Target Observations:

- Gravity is pulling down on the book
- The table is pushing up on the book
- The forces are balanced

Target Model:

-A force is a pushing or pulling of another object.
-When a chair is pushed, gravity is pulling down and the floor is pushing up.
-*Newton's 3rd Law:* When something is pushed or pulled, even if it doesn't move, it pushes or pulls you back.
-*When the forces on an object are balanced the object doesn't move.*

Demonstration:

If you were to push the wall, would the wall push back? Try this: stand a few inches from the wall, feet together, standing up straight. Push the wall with both hands. What happened? Now try this: stand as if you are about to run towards the wall (one leg behind the other, legs bent). Push the wall with both hands. What happened? What is

different this time? If you're not moving, what are the forces doing? Where is the other force coming from?

Target Observations:

- When you stand with your feet together, the wall pushes back on you and you get pushed backwards.
- When you stand with your feet apart, the wall pushes back on you but you don't move.
- The second time is different because your legs are apart and bent
- If you are not moving, the forces on you must be balanced
- The other force is coming from your legs pushing against the ground.

Demonstration:

Have a volunteer come up. Have them hold 1 hand out, and push against it so they move backwards, without falling. Who is doing the pushing? Who has an "extra force"? Why? Now, pull their arm, pulling the student towards you, and ask the same types of questions.

Target Observations:

- When you push the student's hand, the hand pushes back
- The teacher has an "extra force" that balances the push from the student's hand
- When you pull the student's arm, the arm pulls back
- The teacher has an "extra force" that balances the pull from the student's arm
- The "extra force" comes from friction on the ground.