

Force and Motion – Tug-of-War

3rd Grade

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Benchmarks & Objective:

- PS-4: Predict the changes when an object experiences a force (e.g. pushing, pulling)

Materials:

- Gym mats (to prevent students from falling on the floor and hitting their head)
- Gym rope (preferably with knots for better grip)
- Science journals

Target Concept:

The application of a force (equal to mass times acceleration) can create movement and unequal forces will result in movement, too.

Initial Introduction:

Force is a phenomenon that can cause movement. Gravity is a force that keeps everything on Earth from floating off into space. A heavy wind creates a force that can blow a person over. Basically, force is a thing that's applied to an object in order to move the object.

Procedure:

1. Break the class into two, equal groups.
 - a. Have the students guess which team will win the game.
 - b. Have the two groups play Tug-of-War until one team wins.
 - c. Ask the students to explain why the winning team won in terms of size and strength.
 - d. Ask the students how they can change the teams to make one team clearly more likely to win and then have them explain their reasoning.
 - e. Repeat step b. until the groups are equal and no team wins.
 - i. Ask the students why no team won in terms of the force each side created.
2. Break the class into two, unequal groups (i.e. the larger, stronger kids on one team)
 - a. Have the students make their guess about which team will win.
 - b. Play the game.
 - c. Ask the students to explain the reasoning behind their guess and whether or not their guess was correct.
3. If possible, put the kids on one team and put the teacher and a very large adult on the other team.

- a. Ask the students which team will win.
- b. Play the game.
- c. Ask the students to explain the reasoning behind their guess and whether or not they were correct.

Target Observations:

- Equal, but opposite forces will not cause movement
- Unequal forces will cause movement in the direction of the larger force
- A larger mass is more difficult to move

Final Target Concept:

A force pushing or pulling on an object can cause movement. More specifically, force is equal to the mass being moved and the acceleration at which that mass is moved. Given equal forces the acceleration on a mass can be changed by changing the mass.

Summary & Discussion:

A force pushing or pulling on an object can cause movement. A good example of force is gravity. Gravity is a force that acts on our bodies and in the direction of the Earth. Force is equal to mass times acceleration. For a given force, a larger mass will experience a smaller acceleration.