Friction
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 help students understand that friction is a force that surrounds us and helps us do lots of things.

Materials:

- Ball
- Rug
- Table
- Wood dowel rods
- Sandpaper
- Fur
- Wood
- Cardboard
- Rubber band
- Styrofoam
- Table

Initial Model (from Forces lesson):

-A force is a pushing or pulling of another object.
-When something is pushed, even if it doesn't move, it pushes you back.
-When the forces on an object are balanced the object doesn't move.

Initial Demonstration:

Roll a ball across a table or other smooth, hard surface, and have a student stop the ball. Why did the ball stop? What did the student have to do to stop the ball? Now roll a ball across carpet, but don't have a student stop it. Why did the ball stop? What had to have been exerted on the ball to stop it?

Target Observations:

- The ball stopped because the student stopped it
- The student had to exert a force (push) on the ball to stop it
- The ball stopped because it was being pushed
- The carpet was exerting a pushing force on the ball as it rolled

Target Model:

-A force is a pushing or pulling of another object.
-When something is pushed, even if it doesn't move, it pushes you back.
-When the forces on an object are balanced the object doesn't move.
-*When a ball is rolled over a surface a force pushes against the ball and slows it down.*

Procedure:

Do different surfaces have different forces when things are rubbed/rolled over them? To test this, everyone will receive a wooden dowel rod to rub over several objects passed out shortly. Before the students begin their tests, have them make predictions about whether rubbing the wooden cylinder over the material will be easy, average, or hard, and recording their prediction into a chart similar to the one below. Once each table has made their predictions, they will receive one of each object listed (sandpaper, fur, wood, cardboard, rubber band, Styrofoam, table), and may begin the test.

Object	**Prediction (**Easy, Average, Hard)	**Actual**
Sandpaper		
Fur		
Wood		
Cardboard		
Rubber band		
Styrofoam		
Table		

After all the measurements have been made, discuss the findings.

Target Observations:

- The sandpaper was the hardest
- The table was the easiest
- The rubber band has pretty hard

Target Model:

-A force is a pushing or pulling of another object.
-When something is pushed, even if it doesn't move, it pushes you back.
-When the forces on an object are balanced the object doesn't move.
-When a ball is rolled over a surface a force pushes against the ball and slows it down.
-*The force that pushes against the ball is different for different surfaces. Rough surfaces like sandpaper have more, while smooth surfaces like a table have less.*

Demonstration:

Have the students look really close to the sandpaper and draw a picture of what the surface looks like. Have the students draw a picture of what the table looks like. What is the difference? Why do you think that the sandpaper has a greater pushing force? Why doesn't the table have a large pushing force?

Target Observations:

- The surface of the sandpaper is bumpy and rocky
- The surface of the table is smooth
- The sandpaper has a greater pushing force because it has a lot of bumps, while the table doesn't have a whole lot.

Target Model:

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

-When something is pushed, even if it doesn't move, it pushes you back.
-When the forces on an object are balanced the object doesn't move.
-When a ball is rolled over a surface a force pushes against the ball and slows it down.
    -The force that pushes against the ball is different for different surfaces. Rough surfaces like sandpaper have more, while smooth surfaces like a table have less, *because sandpaper has lots of bumps but a table does not.*

Procedure:

What is this pushing force called? What kind of surface would you expect there to be no or little friction? Can you run very good on ice? Look at the bottom of your shoes – is it similar to the sandpaper in any way? Why would you want to have friction on the bottom of your shoes?

Target Observations:

- This pushing force is called friction, the force that comes from two objects rubbing against each other
- Ice or a rollerskating rink have very little friction
- It is very hard to run on ice because it is so slippery (it doesn't have a lot of friction)
- The treads on the bottom of shoes acts like the little bumps on sandpaper
- Friction is good for running because without it you wouldn't get anywhere (like on ice)

Target Model:

-A force is a pushing or pulling of another object.
-When something is pushed, even if it doesn't move, it pushes you back.
-When the forces on an object are balanced the object doesn't move.
-*When an object rubs or rolls against another object, the friction force slows the moving object down.*
    -*Friction* is different for different surfaces. Rough surfaces like sandpaper have more *friction*, while smooth surfaces like a table have less *friction*, because sandpaper has lots of bumps but a table does not.