

The Great Shoe Slide

Adapted from STEMscopes

- Students conduct an investigation comparing the amount of friction between different types of shoes.
 - *Grade Band Endpoints for PS2.A (Motion and Stability)*
 - **By the end of grade 2.** Objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. An object sliding on a surface or sitting on a slope experiences a pull due to friction on the object due to the surface that opposes the object's motion.
 - PS2.B: TYPES OF INTERACTIONS
 - *What underlying forces explain the variety of interactions observed?*
 - All forces between objects arise from a few types of interactions: gravity, electromagnetism, and strong and weak nuclear interactions. Collisions between objects involve forces between them that can change their motion. Any two objects in contact also exert forces on each other that are electromagnetic in origin. These forces result from deformations of the objects' substructures and the electric charges of the particles that form those substructures (e.g., a table supporting a book, friction forces).
 - *Grade Band Endpoints for PS3.D*
 - **By the end of grade 2.** When two objects rub against each other, this interaction is called friction. Friction between two surfaces can warm of both of them (e.g., rubbing hands together). There are ways to reduce the friction between two objects.
 - **Cross Cutting Concepts-** Patterns
 - **Science and Engineering Practices-** Analyzing and Interpreting Data

Target Grade: 3rd

Teacher Prep Time: 20 minutes

Lesson Time: 1 hour

Materials Needed:

- **Printed Material**
 - 1 *Student Journal: The Great Shoe Slide* (per student)
 - 1 *Student CER* (per student)
- **Reusable**
 - 24 Metric rulers, meter sticks, or tape measures(cm) (1 per student)
 - 24 Shoes (1 from each student)
- **Consumable**
 - 1 Pencil (per student)

Teacher Prep:

- Arrange a time to conduct the investigation in the gym or another area with a smooth floor.
- Find a line in the area where you are conducting the investigation and tell students that they will need to push and release their shoe right at the line, not in front of it. Students may not throw the shoe.
- Model the sliding and measuring with your own shoe.
- If necessary, allow students to help each other measure the distance their shoe travelled.
- *If you know students will all have the same type of shoe (i.e. tennis shoes) you could bring a few examples of sandals or dress shoes from thrift stores to try. Alternatively, you may be able to compare tread thickness depending on the variety of shoes your class has. Feel free to modify the categories as you need.

- Create a chart to hold each students' data (middle numbers, medians, only).

<p>20 minutes</p>	<p>Part 1: Conducting the Test</p> <ul style="list-style-type: none"> ● Take their recording sheet and pencils to the gym or other open area with a smooth floor. ● Students sit side by side along a visible line (i.e. base-line or half court). ● Students watch the teacher demonstrate how to slide a shoe, and then measure it in centimeters and record the data. ● Students then measure how far their shoes slide along the gym floor. Remind your students: <ol style="list-style-type: none"> Let go of the shoe at the line, not in front of it. Don't throw your shoe through the air. It is very important for this experiment that you try and slide your shoe with the same amount of force (push) each time you slide it. ● Use metric rulers or meter sticks to measure. ● Student Instructions: <ol style="list-style-type: none"> Begin investigation by sliding shoe from the line and measuring the distance it travels in centimeters. Every time you slide your shoe, record the distance in the data table in centimeters. Test your shoe three times.
<p>40 minutes</p>	<p>Part 2: Analyze the Data</p> <ul style="list-style-type: none"> ● Students order their numbers from least to greatest, and circle the middle number. ● Have students get into groups by what type of shoe they are wearing (tennis shoes, flats, sandals). If all your students have closed toe shoes, separate into tennis and non-tennis shoes. ● Have students tell you their middle number or let them record it on the class data table. Together, have the students list all of the middle numbers in order from least to greatest to find the middle number among their whole shoe type group. ● Students then record their group's middle number on the class data table. ● Students should then line up the actual shoes from least to greatest distance traveled. Divide the line into thirds so the students can see the bottom, middle, and top thirds. These groups will be referred to when discussing the patterns the students see when comparing the shoes. ● Optional As a class, convert the data table to a bar graph to easily compare the results. ● Discuss: <ul style="list-style-type: none"> o What did we measure (dependent variable)? o What did we change (independent variable)? o What made it fair (controlled variables)? o Which shoe slid the farthest? The sandals (could also be shoe with least amount of tread) o Which shoe slid least of all? The tennis shoes. <p>Math Moment</p> <p><i>Extend this learning task by connecting it to math standard 2.MD.D.10 Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four</i></p>

categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

In the Student Journal, students create a **data table** showing the distances that each kind of shoe traveled on the floor. Ask students to create a corresponding **bar graph** as well. How do the bars **compare**?

Could also have students weigh the shoes and make correlations between shoe weight and distance travelled with line graphs.

ELD Strategy

Sentence Stems

For Emerging ELDs, have the materials translated into their native language as a reference for them to use during the activity.

The students can complete the following sentence stems in their journals or as an exit ticket after they have completed the activities.

Emerging:

Have students draw pictures to show the results of the investigation.

The _____ (type of shoe) slid far away.

The _____ (type of shoe) did not slide very far.

Friction _____ (slows/speeds) things _____ (up/down).

Expanding/Bridging:

Have students draw pictures to show the different shoes and their varying levels of friction. Students can make a chart to organize their information.

The _____ (type of shoe) slid the farthest distance.

The _____ (type of shoe) slid the shortest distance.

Friction _____ (slows/speeds) things _____ (up/down). I know this because _____.