

Project 2.4 Changing Pushes and Pulls Teacher Notes

Introduction

A force is a push or a pull. We use pushes and pulls to move objects or to get them to change directions. How much force do you think is needed to push an empty box across the floor? How much more force would it take to move a box that was filled with books?

In this project you will explore different amounts of force needed to push or pull objects.

Equipment

- Launch Log
- iPad® tablets
- Various objects for students to use to test pushes and pulls. Ideas include
 - Books of various weights and sizes (dictionary, small story book)
 - Blocks (varying sizes)
 - Shoe box
 - Boxes (one empty box and one box filled with objects)
 - Ramp (Option: Use a board or other sturdy flat surface. If your school purchased a ramp for the Energy Collisions module, this ramp would work well.)
 - Goldie Blox™ and the Spinning Machines
- Cardstock
- String

Procedure

1. Use the introduction to Project 2.4 to set the stage for the project. Students may access the introduction through the Canvas app on a tablet, or the teacher can project the introduction as they read it to the class.
2. Student groups will explore different strengths and directions of pushes and pulls using a variety of materials.
3. The project can be set up as three learning centers for students to rotate through, or groups can work through the three stations on different days. Set up two of each learning center. The three learning centers are described below:
 - **Goldie Blox™ and the Spinning Machines:** Allow students to create a design and test the direction and strength needed to pull the ribbon.

Students may create their own design or test two of the designs found throughout the book that goes with this activity.

- Questions for students to consider:
 - Which designs require a stronger pull to turn the wheels?
 - Do both designs require a pull in the same direction or in different directions?
 - Students should take two pictures using the camera app on a tablet to share with the class. The images should show different directions or strengths of pulls.
 - **Blocks Station:** Students will compare the strength of pushes or pulls needed to move an empty shoe box and a shoe box filled with varying numbers of blocks across a distance. After pushing and pulling the empty shoe box, students explore the difference in the strength of a push or a pull to move the box as blocks are added. Provide string for students to use if desired for pulling. They should try different amounts of blocks to compare the strength of the force needed to push or pull the box. Students take two pictures using the camera app on a tablet to illustrate a push and a pull that requires less force and one that requires more force.
 - **Books Station:** Students will test the strength of the force needed pushing and pulling different size books across a surface. After the initial test, challenge students to design a way to pull a heavy book (a dictionary would work well) over a distance. After they have explored pushing or pulling on a flat surface, introduce moving a heavy book up a ramp. Allow students to determine the best way to move the book up the ramp by selecting a push or a pull. They may add string for pulling if desired. Have students take a picture or record a video of moving the heavy book up the ramp.
4. Lead a class discussion about what students discovered as they explored the strength and direction of pushes and pulls in the learning centers. Use the following to guide the discussion:
- At the Goldie Blox™ station, share a design that needed an easy pull to turn the wheels. Share a design that took a stronger pull to turn the wheels. Did any of your pulls show a change in direction?
 - At the blocks station, how did the strength of the push or pull change as you added blocks?
 - At the book station, share how you were able to move a heavy book up the ramp. Did it take more or less force to move the book up the ramp or across the flat surface?

5. In the Launch Log, students draw an example of an object that needs a small amount of force to push or pull and an object that needs a large amount of force to push or pull. An example could be a toy car and a real car.

Conclusion Questions for Discussion

1. Describe a time when you needed a lot of force to push or pull an object.
2. Which requires a stronger pull, a wagon filled with empty shoe boxes or a wagon filled with bricks? Explain your answer.