Problem 2.5 Push and Pull Design Problem Teacher Notes

Introduction

You have explored how pushes and pulls are used to move objects. A push is a force that moves an object away from the object that is applying force. A pull moves an object closer. You have discovered that it takes different amounts of force to push or pull different objects. You have also tested pushes and pulls in collisions.

You will now use what you have learned to solve the problem of designing a model that could be used to move a load of rocks up a ramp.

Equipment

- Launch Log
- iPad® tablets
- Tablet applications
    - Instructure by Canvas
    - Educreations™
    - Stage™
- *Newton and Me,* by Lynne Mayer
- Various materials for students to choose from:
    - String
    - Cardstock
    - Wiffle® balls
    - Blocks (varying sizes)
    - Boxes
    - 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

Procedure

1. For the design problem, students will design a model of a structure that uses pushes and/or pulls to move “rocks” up a ramp. Introduce the idea of a model to students. A model is often smaller than the original and is used to test ideas, make changes to a design, and learn more about what would happen to a similar, real object. Rocks may be represented by blocks, balls, or other objects. Students will test their design to determine whether a push or pull would be better for moving the load.

2. Students access the introduction for Problem 2.5 using the Canvas app on a tablet. You may also choose to project the introduction for the class to view as you read.
3. Use *Newton and Me* to set the stage for the problem that students will solve. In the story, the character's mom calls for her son to move some rocks for her. Read this section to the class.
4. Before students work on developing a solution to the design problem, explain to students that the people who design products to solve problems are engineers and designers. Engineers follow a step-by-step process to help them solve problems or to design new things. Students will act as an engineer to solve the problem of moving the rocks.
5. Introduce students to a step-by-step design process for solving a problem using the Design Process presentation found in Problem 2.5. You may project the presentation for whole class viewing or allow groups of students to watch the presentation on a tablet. The presentation gives an overview of the steps of the design process. As you facilitate student work in this problem, you will refer to the steps of the design process as they are used. After viewing the presentation, have students fill in the blanks of the design process in the Launch Log for Problem 2.5. An option is to print a list of the steps of the design process and allow students to cut and paste them onto the chart.
6. Follow the guide below for facilitating student work on solving the design problem:
    a. The first step of the design process is **Ask.**
        - Review the design problem for the students. Share the materials that they may use in their design.
        - If appropriate for your students, have students answer this question in their Launch Log: What is the problem? Students may respond simply by telling that they need to move rocks up a hill or a ramp. Other options for responding to the question are to record the answer to this question on a class chart or to allow students to draw a picture of what they have to do.
    b. The second step in the design process is **Explore**.
        - Allow students to **explore** ideas by talking in small groups or as a class about possible ideas for building a model that can move the rocks up the ramp. Remind students that during this part of the process there are no ideas too silly.
    b. The third step in the design process is **Model**.
        - Ask the students to work as a group to pick the design they think will work best for moving the rocks. Guide students to talk about whether they think pushes or pulls will work best. The teacher facilitates the building of the models.
        - Students add a drawing of their model or print a photograph of their model in the Launch Log.

c. The fourth step in the design process is **Evaluate**.
    - Students test their models by using pushes or pulls to move the “rocks” up the ramp.
    - As the students test their models, use the camera app on a tablet to video their work. If possible, capture students describing their model and how it uses pushes or pulls.
    - As the students work through the evaluate step, ask questions that guide them to consider what is working/not working, how much force is needed, and whether pushes or pulls are more effective.

d. The final step of the design process is **Explain.**
    - Allow students to share their solution with the class.
    - Options for sharing include loading the recordings or photos of student work into an app like Stage or Educreations. A presentation could be made for each group or for the entire class. Another idea is to print images of student work to be displayed.

7. The teacher leads a discussion of the conclusion questions.

Conclusion Questions for Discussion

1. How did you use a push or a pull to solve the design problem?

2. Now that you have seen other designs for solving the problem, what would you do differently if you were allowed to start all over again?

3. What other materials do you think would help you to make a better model to solve this problem?