A Wild Ride! Week 2

Day 2: I Push, You Pull!

Teacher/Parent Background:

Examples of force and motion are all around us! In science, motion describes the change of an object's position and a force describes a push or a pull. Forces cause motion and can be applied by pushing and/or pulling on objects. Factors such as the weight of the object and the strength of the force can impact an object's speed.

Overview:

In this activity, students will engage in a hands-on investigation to explore how forces (pushes or pulls) affect the motion of various household objects! Students will return to their week-long challenge: *How can we design a roller coaster using force and motion concepts?*, in order to reflect upon what they have learned that will help them address the challenge and what they still need to know to move forward.

Related Standards:

- Obtain, analyze, and communicate evidence of the effects that balanced and unbalanced forces have on the motion of objects.
- Define problems and design solutions pertaining to force and motion.

Key Terms:

- Position: the location of an object
- Force: a push or a pull
- Motion: change of position
- Speed: the measurement of how far an object moves in a certain amount of time

Materials List:

- Internet access
- Journal
- Pen/pencil
- Colored pencils/crayons
- Various household objects - tables, floor spaces, books, doors, chairs, balls
- *Student Resources - Pages 6-7*
    - *Investigation Data Table*
    - *Learned Chart*

- Computer/phone with audio - optional for *Extensions*

Activity Description:

- Ask students to review the "Ask" step of the Engineering Design Process from *Day 1: Are You Up For a Challenge?*. Briefly discuss with students:
    - How do engineers begin to solve a problem they are faced with?
    - Just like engineers, you have been given a problem to solve! What is your challenge for the week? What do you need to know to help you solve the problem?
- Explain to students that they are going to investigate what force and motion is in order to begin answering their "need to knows". Ask students to discuss the following:
    - What do you think of when you hear the word "force"?
        - Possible student responses may include:
            - Being made to do something.
                - "I was forced to clean my room."
            - Using strength to break something open or set something free.
                - "The lid was stuck, so I had to force the pickle jar lid open."
    - In all of these descriptions, there is something they all share or have in common. All of these descriptions result in an action taking place, something has to change. Let's investigate these ideas with some objects around the house to see if "force" does in fact refer to an action taking place, resulting in something changing.
    - Review the following investigation directions with students:
        - Using various objects (books, chairs, balls, etc.) around the house, do something to the objects/make an action take place to make something change. Record your observations.
            - Show students an example:
                - For example, I will slide a book across the table using my hand.
                - In this situation, sliding the book with my hand was the action taking place and the book moving to the other side of the table was the result; the book's *position* or location changed.
                - Let's record this example in a data table, to represent our observations of the action taking place and the result.
                    - Show students what to record in the ***Example*** row of the *Investigation Data Table*:

- Draw a diagram of this example to show to students. Show students how to use arrows to show an action taking place and its result.
- Ask students to record this in the ***Example*** row of the *Investigation Data Table*. See example below:

Objects	Action	Result	Diagram of Action and Result
Example: Hand and book	Hand slides the book across the table	The book moves to the other side of the table.	

  - Then, ask students to discuss:
    - How could we bring the book back to it's first position by doing something to the book/making the book undergo an action?
    - Ask students to discuss. Possible student ideas may include:
      - We could move to the other side of the table and slide the book back.
      - We could stretch our arm out and drag the book back to our side of the table.
    - Ask students to explore their ideas with the book and record their results in the ***1*** row of the *Investigation Data Table*. Then, ask students to find two more objects around the house and record observations.
    - Once students have completed their investigation and recorded their observations, regroup.
- Tell students that when we first started this investigation, we were attempting to see if a "force" did in fact refer to an action taking place, resulting in something changing. Facilitate a discussion by asking:
- In our investigation, did we see something similar: Did we see actions taking place or changes as a result of the actions? What is an example of this?
  - Ask students to share their investigation observations. Possible student responses may include:
    - Yes, when actions took place, changes happened. For example, when I pulled the book it changed its position and moved closer to me.

        - Yes, actions made changes happen. I pushed a rolling chair and it slid really fast across the floor!
- Based on the observations you are sharing, you seem to be using the words "push" and "pull" to describe the actions taking place that are causing a change.
- In fact, in the science community, we describe a *force* as a push or a pull. Forces like pushes or pulls can cause *movement/motion*, or a change of an object's position. A "pull" moves objects closer to you and a "push" moves objects farther away from you.
- Let's return to our data tables to determine if a push or a pull was used to cause the motion of objects that we observed in each of our investigation examples.
    - Ask students to revisit their data tables and determine if a push or a pull was used in each example from their investigation to cause the motion of objects. Show students an example by returning to the ***Example*** row:

Objects	Action	Result	Diagram of Action and Result
Example: Hand and book	Hand ~~slides~~ **pushes** the book across the table	The book moves to the other side of the table.	

- Although a push or a pull caused the motion of objects during our investigation, let's compare and contrast the details of the actions/results.
    - Ask students to engage in a discussion. If students need more experience with the main ideas of the discussion questions, provide time for them to re-investigate. Key questions and possible student responses include:
        - Did you push and pull the same way each time?
            - No, sometimes I pushed or pulled harder or lighter.
        - How did pulling or pushing differently affect the motion of the object?
            - Pushing or pulling harder made objects move faster or travel farther, while pushing or pulling lighter made objects move slower or travel less far.
                - When I pushed hard on the book, it quickly reached the other side of the table! But, when I pushed on the book lightly, it took longer to reach the other side of the table.
        - In the science community, we use the word *speed* to describe the measurement of how far an object moves in a certain amount of time. How does how hard/soft you push or pull on an object affect its speed?

- When pushing very hard on an object, its speed increases.
- When pushing softly on an object, its speed decreases.

Closure:

- Now that we have conducted an investigation and discussed our results, what have we learned about force and motion?
    - Ask students to discuss and record what they have learned in the *Learned Chart*.
    - Significant student learnings should include:
        - A force is a push or a pull.
        - Forces cause the motion of objects.
        - Motion is a change of an object's position/its location.
        - The way I push or pull on an object affects its speed.
- Looking back at the "Ask" step of our challenge, what else do we need to know to move forward?
    - Ask students to revisit the "Ask" step and update/add new ideas to their tables. Possible student responses may include:
        - I need to know...
            - How does a roller coaster work?
                - I already learned what force and motion is, but how does force and motion make a roller coaster work?
            - What materials do we have to build the roller coaster?
            - How much time will we have to build the roller coaster?

Extensions:

Watch & Play: BrainPOP jr. *Pushes and Pulls*

Continue the investigation by providing students with objects of various weights (a light ball, a heavy ball, etc.) and prompt them to investigate what happens to objects of different weights when the same strength of force is applied. Prompt students to try their best to push/pull the same way each time; not much harder or softer!

- The lighter the object, the greater the speed.
- The heavier the object, the less speed.

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Student Resources

Investigation Data Table

Objects	Action	Result	Diagram of Action & Result
Example:			
1:			
2:			
3:			

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Learned Chart

I Have Learned...
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