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Teaching for Learning Capstone
Forces and Interactions Unit

Lesson #1

Lesson Standards
NGSS Grade 3, Physical Science, PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. (3-PS2-1)

NGSS Grade 3, Physical Science, PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Purpose
- The purpose of today's lesson is to assess student's prior knowledge about forces and interactions. The students will be introduced to forces, pushes, and pulls through hands-on experiences, discussion, and a video. The students will be recording information about these topics on a T-chart.

Lesson Objectives
- Students will be able to define that a force is a push or a pull on an object.
- Students will be able to recognize that every force has a strength and a direction.
- Students will be able to explain that every time an object moves, a force is acting on it.
- Students will be able to differentiate between a push and a pull on an object.

Focus Questions
- What is a force?
- What two things does a force have?
- What is the difference between a push and a pull?

Materials & Resources
- Pencils
- Chairs
- Desks
- Rug
- Projector
- Document Camera
- Science Folders
- Exploring Science, Grade 3, Teachers Guide
- 24 Pre-Assessments
- 23 Privacy Folders
- Hardcover Textbook

- 24 T-Charts
- 1 Guided T-Chart
- YouTube Video: (2:32-3:25) https://www.youtube.com/watch?v=mEg5GOVpUlE

Vocabulary

- Force → A push or a pull on an object. Every force has a strength and a direction.
- Push → Moving an object away from you.
- Pull → Moving an object towards you.
- Strength → Quantity of a force (strong force = a lot of strength, weak force = very little strength)
- Direction → The course in which an object moves.

Differentiation

- I will cross out one option in the multiple-choice section of the pre-assessment for two students.
- I will read the directions, questions, and possible answers of the pre-assessment out loud to the students. This is beneficial to students with learning disabilities, students who are auditory learners, and students that benefit from concentrating on one question at a time.
- I will give one student an outlined T-chart with words missing to guide them as they write the definitions of the vocabulary terms.
- I will ask higher-level thinking questions to challenge students to use higher-level thinking strategies.
    - Example: Do you think you can move an object without using a force?
- Paraprofessional support for one student throughout the lesson.
- The paraprofessional may offer support by scribing for the student during the pre-assessment and T-chart vocabulary review.
- Including movement in the lesson benefits kinesthetic learners.
- Spelling out the words in the definition section of the T-chart while projecting it on the white board benefits both visual and auditory learners.
- I will implement turn and talks into the lesson. These conversations allow me to converse with students who need an additional prompt to get their thinking started or need the question re-worded using simple student-friendly terms. Turn and talks also allow me to observe conversations and ask higher-level thinking questions to challenge the students.

Lesson Procedure

Pre-Assessment:

- I will have the students clear their desks and take out a pencil and their privacy folder.
- I will administer the pre-assessments.
    - First, I will have the students write their names on the pre-assessment and wait for further directions.
    - I will then read each question one by one, so the students understand what is being asked.
- I will call students by rows to place their pre-assessment in the turn-in tray and find a spot on the rug.

Engage:

- Once all students are seated and quiet, I will tell them we will be starting a unit on forces and interactions.
- **Ask:** "Have you ever pushed a shopping cart?"
    - Yes
- **Ask:** "Have you ever pulled a wagon?"
    - Yes
- **Say:** "Turn and talk with your neighbor about how these two scenarios are alike and different."
    - Alike: Both the cart and the wagon are moving.
    - Different: You push a cart and pull a wagon.
        - Acknowledge all responses and lead them toward the words push and pull.

- **Say:** "Observe what I do next."
- I will push a chair two feet in front of me.
- I will then **ask:**
    - "What made the chair move?"
        - Me pushing the chair with my arms.
    - "What direction did the chair move?"
        - It moved forward.
    - "How could the chair move toward the whiteboard? How could the chair move toward the desks?"
        - Push it from the right side.
        - Push it from the left side
    - "Is there another way I can make the chair move without <u>pushing</u> it?"
        - By pulling it.
    - "Does anyone know what it is called when a person applies a push or a pull on an object?"
        - *A force.*

- **Say:** "Today we will be exploring pushes and pulls and recording their definitions and examples on a T-chart. A T-chart is a simple way to record the definitions of words."

Explore:

- As I call on rows to return to their desks:
    - I will **tell** row 1 and row 4 to stay standing at their desk and pull their chair out from under their desk.
    - I will **tell** row 2 to sit at their desk and take out a pencil.
    - I will **tell** row 3 to sit at their desk and take out a hardcover textbook from their desk.
- **Say:** "The definition of a push is moving an object away from you."
- **Say:** "Row 1 and row 4, push your chair away from you."
  "Row 2 push your pencil away from you."
  "Row 3 push your textbook away from you."
- **Say:** "Here we applied the force of a push to move the object away from us."

- **Say:** "The definition of a pull is moving an object towards you."
- **Say:** "Row 1 and row 4, pull your chair towards you."
  "Row 2 pull your pencil towards you."
  "Row 3 pull your textbook towards you."
- **Say:** "Here we applied the force of a pull to move the object toward us."
- **Say:** "Push your object in a different direction."
  - **Ask:** "How did you change your direction?"
- **Say:** "Pull your object with a stronger strength."
  - **Ask:** "What changed when you pulled your object with a stronger strength?"
    - It moved faster
- Explain that a force is a push or a pull acting on an object AND every force has a strength and a direction.

- **Ask:** "Is there any way to move an object without using a force? Try making your object move without applying a force to it."
- **Say: "**Do you think you can move an object without using a force? Turn and talk with your neighbor.**"**
  - No; Blowing air = pushing on the air with your lungs
- **Explain: "**Every time an object moves, a force is acting on it.**"**

Explain:

- **Say: "**Please be seated at your desk with a pencil."
- **Say: "**We will now record the definitions for the words we learned today."
- I will distribute T-charts to the students.
- I will place a blank T-chart under the projector.
- **Say:** "What is a force? Turn and talk with your neighbor."
  - Call on students.
  - Answer: A force is a push or a pull on an object.
- Write that on the T-chart under the projector.
- **Say:** "The T-chart says that a force has a _____ and a _____. Turn and talk with your neighbor. What are the two things that every force has?"
  - Demonstrate if necessary
  - Answer: A strength and a direction
- Write that on the T-chart under the projector
- **Say:** "Raise your hand if you can demonstrate a push for the class."
  - Student demonstrates
- **Say:** "A push is moving an object away from you."
- Write that on the T-chart under the projector
- **Say:** "Raise your hand if you can demonstrate a pull for the class."
  - Student demonstrates
- **Say:** "A pull is moving an object towards you. Let's write that next to pull in the definition box."
  - Write that on the T-chart under the projector**.**

- If time remains, show the YouTube video below and record examples in the T-chart. If not, **say:** "please place your T-chart in your science folder."

Elaborate:

- Project the YouTube video showing real-world examples of pushes and pulls
    - https://www.youtube.com/watch?v=mEg5GOVpUlE
    - Start: 2:32 → End: 3:24
- If time remains, **ask:** "What real-world examples of push and pull did you see in the video?"
- Record these examples in the definition section of the T-chart.

Evaluate:

- I will evaluate and grade the pre-assessments. I will assess what areas the class was strong in, and what areas received the most incorrect answers. The results of this pre-assessment will guide my instruction towards what they do not know, decreasing the time spent instructing topics they already know.
- I will create an Excel Document to graph each student's score of the pre-assessment. I will create an additional Excel Document to graph how many students received a certain score.

Lesson #2

Lesson Standards

NGSS Grade 3, Physical Science, PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (3-PS2-1)

NGSS Grade 3, Physical Science, PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Purpose

- Students will review vocabulary introduced on day 1 by determining if a photograph is indicating the force of a push or a pull. Students will be introduced to balanced forces by analyzing the textbook, acting it out, and recording vocabulary definitions in their T-Charts.

Lesson Objectives

- Students will be able to define balanced force, net force, and gravity.
- Students will be able to recognize that objects in contact exert forces on each other.

Focus Questions

- What is a balanced force?
- What is net force?
- How does gravity act on objects?

Materials & Resources

- Pencils
- Chairs
- Desks
- Rug
- Projector
- Document Camera
- Science Folders
- White Board
- Push/Pull Flash Cards
    - Source: Teachers Pay Teachers, Number Two Pencils, Force & Motion: Push & Pull Sorting Cards
    - https://www.teacherspayteachers.com/FreeDownload/Force-Motion-Push-Pull-Sorting-Cards-421544
- Exploring Science, Grade 3, Student Textbook
- Classroom Set of Name Sticks
- 24 T-Charts
- 1 Guided T-Chart
- 23 Sticky Notes

- Exit Slip Questions
- Exit Slip Sticky Note Model

Vocabulary

- Force → A push or a pull on an object. Every force has a strength and a direction.
- Push → Moving an object away from you.
- Pull → Moving an object towards you.
- Balanced Force → Forces that do not cause an object to move because they are equal in size and opposite in direction.
- Net Force → Overall forces acting on an object. Found by adding together the forces acting on the object.
- Gravity → A force that pulls objects toward the center of the earth.
- Strength → Quantity of a force (strong force = a lot of strength, weak force = very little strength)
- Direction → The course in which an object moves.

Differentiation

- Paraprofessional support for one student throughout the lesson.
- The paraprofessional may offer support by scribing for the student during the T-chart vocabulary review and the exit slip.
- I will give one student an outlined T-chart with words missing to guide them as they write the definitions of the vocabulary terms.
- Including movement in the lesson benefits kinesthetic learners.
- Reading the textbook out loud while projecting the text on the white board benefits both visual and auditory learners.
- Spelling out the words in the definition section of the T-chart while projecting it on the white board benefits both visual and auditory learners.
- I will implement turn and talks into the lesson. These conversations allow me to converse with students who need an additional prompt to get their thinking started or need the question re-worded using simple student-friendly terms. Turn and talks also allow me to observe conversations and ask higher-level thinking questions to challenge the students.

Lesson Procedure

Engage

- I will call students by rows to find a spot on the rug.
- **Say:** "Before we start our lesson, think to yourself. How would you define the word push?"
- **Say:** "Turn and talk with a partner and define the word push."
    - Students will turn and talk.
        - A push is moving something away from you
- **Say:** "Think to yourself. How would you define the word pull?"
- **Say:** "Turn and talk with a partner and define the word pull."
    - Students will turn and talk.
        - A pull is moving something toward you.
- We will review the vocabulary terms introduced on day 1 using the push/pull flash cards.

- **Say:** "To review what we learned yesterday; I will place an image under the projector. The image will either be a push or a pull scenario. Please don't say the answer right away, as I will be calling on those who are sitting quietly that volunteer to answer."
- Place the push/pull flash cards under the projector one by one.
    - Repeat x8:
        - **Ask:** "What is this image showing? A push or a pull? Think to yourself to decide."
        - **Say:** "Turn and talk with your neighbor."
        - **Say:** "Give me a thumbs up if you and your partner thought the same force was happening."
        - Call on 2 students to share what force they believe the picture is showing.

Explore

- I will explain to the students that today we will be learning about balanced forces.
- **Ask: "**Think to yourself, based on what we learned about forces, what would a balanced force mean?"
    - Have students turn and talk
    - Allow two students to share what they think a balanced force is.
- I will place the Exploring Science, Grade 3, Student Textbook page 6-7 under the projector.
- I will cover up the text on the page with a blank sheet of paper.
- **Say:** "Analyze the photograph."
- **Ask:** "What is happening in this picture?"
    - The boards are resting still, and when the hand hits the boards, they split.
- **Ask:** "Are there any forces acting on the boards in the top picture?"
    - Students answer
- **Say:** Let's read to find out.

Explain

- Call on a student to read the first paragraph.
    - **Ask:** "What force is pulling the boards down?"
        - Gravity
    - **Ask:** "What force is pushing up on the boards?"
        - The cement blocks
- Point to the top image and **say:** "the force of gravity and the force of the cement blocks are balanced forces, meaning they balance eachother out."
- Point to the word net force. **Say:** "the net force is the overall force, meaning it is all the forces acting on an object."
- Explain that if the force of gravity was stronger than the force of the cement blocks, the boards would fall to the ground.
- Call on another student to read the second paragraph.
- **Ask:** "From what we just read, are there forces acting on an object even when it is still?"
    - Yes
- **Say:** "An object at rest typically has multiple objects acting on it. But they add up to produce Zero net force on the object. Remember that net force is the overall force found by adding all the forces acting on an object."

Elaborate

- Explain that we will be experimenting with classroom objects to find balanced forces.
- **Say:** "Please stand up."
- If chattering arises during this transition, I will say Salami and the students will listen to my next prompts.
- I will **ask,** "As we are standing on the floor, are there any forces acting on us?"
    - Yes. Gravity is pulling us down and the floor is pushing us up.
- **Say:** "These forces are balanced because we are not moving."
- **Say:** "I will be drawing sticks for two volunteers. If you do not want to volunteer, please say pass."
- I will draw two name sticks.
- I will have the two students stand in front of the other students on the rug.
- **Say:** "Please face eachother and put your hands out flat in front of you like you are giving a high five."
- **Say:** "Place your hands against eachother and apply a gentle pressure at the same time.
- **Say:** "Because the students are both applying the same amount of strength, this is a balanced force."
    - **Ask:** "What is the net force of this scenario? Turn and talk with a partner."
        - The net force is zero because the strength being applied in opposite directions is equal.
- **Say:** "_____ (student) please apply a little more pressure."
- **Say:** "Students here you see _____ applying more pressure, resulting in movement. This does not show a balanced force because _____ is applying more pressure."

- I will call by rows to return to your desk. When you return to your desk take out a pencil and your T-chart."
- **Ask:** "What should you take out?"
    - A pencil and our T-chart

- Place T-chart under the projector and point to balanced forces.
- **Ask:** "Do objects with balanced forces move?"
    - No
- **Ask:** "In balanced forces, what are the forces equal in?" (Demonstrate with my hands pushing against eachother.)
    - Strength
- **Ask:** "In balanced forces, what are the forces opposite in?" (Demonstrate with my hands pushing against eachother.)
- **Say:** "Balanced forces are forces that do not cause an object to move because they are equal in strength and opposite direction."
    - Students will write.
- Point to net force
- **Say:** "Net force is the overall forces acting on an object."
    - Students will write.
- Point to gravity
- **Say:** "Gravity is a force that pulls objects toward the center of the earth."
    - Students will write.

- **Say:** “Please put your T-chart in your science folder and keep out your pencil.”

Evaluate

- **Say:** “I will place a sticky note on your desk. When you get a sticky note please place your name on the top and wait for further directions.”
- **Say:** “Label your sticky note with 1, 2, 3, 4, and 5, like this”
    - Model under projector
- **Say:** “For the first three questions I will place an image under the projector, and you will write if it is a push or a pull.”
    - Show image
    - Students will write
        - X3
- **Say:** “For the next two questions, I will say a definition and you will write the vocabulary term. I will also place the question and possible answers under the projector. Choose the best answer and write it on your sticky note. ”
- Place question number 4 under the projector.
- **Say:** “Number 4. The overall forces acting on an object. Is it absolute force, net force, full force or rapid force?
    - Students will write answer.
- Place question number 5 under the projector.
- **Say:** “Number 5. A force that pulls objects toward the center of the earth. Is it pushes and pulls, the downward force, zero force, or gravity?
    - Students will write answer.

- **Say:** “Check that your name is on your sticky note. I will come around and collect them.”
- As I am collecting the sticky notes, **ask:** “How confident do you feel with the concepts of push, pull, balanced forces, and net force? Please place a 5 in the air if you feel confident, place a 4 or a 3 in the air if you are starting to understand the concepts, and place a 2 or a 1 in the air if you would like more time spent working on these concepts or if you have questions about the concepts.”
    - This fist of five will be a quick formative assessment to gauge where students would assess their level of understanding with the concepts that have been covered.

Lesson #3

Lesson Standards

NGSS Grade 3, Physical Science, PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (3-PS2-1)

NGSS Grade 3, Physical Science, PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Purpose

- Students will review vocabulary through an engaging hands-on activity. The students will be introduced to unbalanced forces and learn how to draw diagrams to represent balanced and unbalanced forces. I will evaluate what students learned throughout the lesson by distributing an exit slip that the students will complete independently.

Lesson Objectives

- Students will be able to match vocabulary words with their definitions.
- Students will be able to define unbalanced forces.
- Students will be able to draw diagrams to represent balanced and unbalanced forces.

Focus Questions

- What is an unbalanced force?
- What is the difference between a balanced force and an unbalanced force?
- How does the net force change when a force changes from balanced to unbalanced?

Materials & Resources

- Pencils
- Chairs
- Desks
- Rug
- Projector
- Document Camera
- Science Folders
- White Board
- Dry Erase Marker
- Buzzer
- Classroom Set of Name Sticks
- Eraser
- Exploring Science, Grade 3, Student Textbook
- Slates
- Markers
- 24 T-Charts

- 1 Guided T-Chart
- Balanced and Unbalanced Forces Exit Slip

Vocabulary

- Force → A push or a pull on an object. Every force has a strength and a direction.
- Push → Moving an object away from you.
- Pull → Moving an object towards you.
- Balanced Force → Forces that do not cause an object to move because they are equal in size and opposite in direction.
- Net Force → Overall forces acting on an object. Found by adding together the forces acting on the object.
- Gravity → A force that pulls objects toward the center of the earth.
- Strength → Quantity of a force (strong force = a lot of strength, weak force = very little strength)
- Direction → The course in which an object moves.
- Unbalanced Forces → A force that causes a change in motion because there are unequal forces acting on the object.

Differentiation

- Paraprofessional support for one student throughout the lesson.
- The paraprofessional may offer support by scribing for the student during the T-chart vocabulary review and the exit slip.
- I will give one student an outlined T-chart with words missing to guide them as they write the definitions of the vocabulary terms.
- Including movement in the lesson benefits kinesthetic learners.
- Reading the textbook out loud while projecting the text on the white board benefits both visual and auditory learners.
- Spelling out the words in the definition section of the T-chart while projecting it on the white board benefits both visual and auditory learners.
- I will implement turn and talks into the lesson. These conversations allow me to converse with students who need an additional prompt to get their thinking started or need the question re-worded using simple student-friendly terms. Turn and talks also allow me to observe conversations and ask higher-level thinking questions to challenge the students.

Lesson Procedure

Engage

- Before instruction begins, I will write these vocabulary terms on the white board.
    - Force
    - Push
    - Pull
    - Gravity
    - Net Force
    - Balanced Forces

- Call students by rows to come to the rug.

- **Say:** "Before we start the review activity, let's review the vocabulary terms listed on the board."

    - Point to a word, say it out loud, have students turn and talk, then have students share what they think the definition is.
        - Force
        - Push
        - Pull
        - Gravity
        - Net Force → (Explain to the students that they can think of the NET force as a basketball net that catches the total amount of forces put into it.)
        - Balanced Forces

- **Say:** "For today's warmup, we will be reviewing vocabulary words by playing the vocabulary buzzer game. I will draw two names from the name sticks. The two players will walk up to the front desk and stand on opposite sides. The players will place their hands behind their back and wait for me to read a definition. I will read the definition of one of our vocabulary words. The goal is to be the first to tap the buzzer and state the vocabulary word that matches the definition. Everyone will get a chance to be a contestant in the game and because we only have a few vocabulary words, the words will be repeated, so listen closely."
    - Model how to walk up to the desk, place hands behind my back, and tap the buzzer.
- **Say:** "Here are the rules: there is no blurting out answers. If someone blurts an answer, they must return to their desk and they will not be able to be a contestant.

- **Say:** " ____ and ____ will model the first round. Stand up, come to the desk, place hands behind your back, and get ready to listen to the definition."

    - I will say a definition from the vocabulary cards.
    - The students will tap the word.
    - I will either say correct or incorrect, then state the word and the definition.
    - I will draw the next two players and they will walk up to the desk.
        - This will be repeated until all players have had a turn.

- I will have all students find a square on the rug.

Explore

- **Say:** "You all did an excellent job matching the definition with the vocabulary word. We will continue to review the words, so they are locked in our memory."
- I will erase the words on the white board.
- **Say:** "Yesterday we learned about balanced forces. Balanced forces are forces that don't cause an object to move because the forces are equal and strength and opposite in direction."
- **Ask:** "What do you think happens when forces are not balanced? Turn and talk with a partner."
    - Cause a motion or there is a change in motion.
- I will turn the projector on to show pages 8 and 9 in the Exploring Science, Grade 3, Student Textbook.
- **Say:** "Raise your hand if you would like to read this first paragraph about unbalanced forces."
    - Call on a student

    - Student reads
- **Say:** "Raise your hand if you would like to read the next two paragraphs about unbalanced forces."
    - Call on a student
    - Student reads

Explain

- **Ask:** "From what we just read, what happens when the forces acting on an object go from balanced to unbalanced?"
    - An object that was not moving starts moving.
- **Ask:** "What does it mean to say that the forces acting on an object are unbalanced?"
    - All the forces acting on the object do not add up to zero. There is a stronger force in one direction than the others.
- **Ask:** "What happens to the rope when both teams pull in opposite directions with the same amount of force?"
    - The rope does not move
        - **Ask:** "What would the net force be? Remember the net force is the total of all the forces acting on an object."
            - Zero
- Point to the picture and **ask:** "It appears that the forces on this rope are balanced. How can the forces on this rope become unbalanced?"
    - If one team pulls with stronger force than the other team, the forces will become unbalanced.

Elaborate

- Send students by rows to get their slates, a marker, and an eraser and return to the rug.
- **Say:** "We will be learning how to draw diagrams to show balanced and unbalanced forces."
- **Say:** "Let's first draw a diagram to represent a balanced force."
    - Draw a line on the white board and the students will draw a line on their slate. Above my line I will write balanced forces.
- **Say:** "Now let's draw a dot in the center of the line to represent the middle of the rope."
- **Say:** "To represent balanced forces, we will draw two equal length arrows above our rope starting at the center dot and going outwards. Watch as I draw my lines."
- **Say:** "Your turn to draw."
- **Say:** "These arrows represent that the forces are the same strength in opposite directions. Resulting in balanced forces."
- **Ask:** "What would be the net force of this balanced forces diagram. Turn and talk with a partner."
    - Zero. The forces are equal in strength and opposite in direction so the net force (the total number of forces acting on an object) is zero.
- **Say:** "Erase the arrows. Let's draw a diagram to represent an unbalanced force.
- **Say:** "Think to yourself, how could we draw a diagram to represent unbalanced forces. (Wait 5 seconds). Turn and talk with a partner."
    - Students raise their hand to answer.
- **Say:** "To make a diagram for an unbalanced force, we will make one arrow longer than the other."

- Draw another line with a dot in the center to represent the middle of the rope. Then add arrows above, with one arrow visibly longer than the other.
- **Say:** "Draw this on your slate."
- **Say:** "The longer arrow represents that a stronger force is being applied.
- **Ask:** "Would the net force still be zero?"
    - No. The net force will be to the (right/left) – whatever side the longer arrow is.
- **Ask:** "How could we switch the diagram to represent that the other direction is the stronger force?"
    - Make the opposite arrow longer to represent a stronger force.

- **Say:** "Clear your slates. I will call by rows to return to your desk. When you return to your desk take out a pencil and your T-chart."
- **Ask:** "What should you take out?"
    - A pencil and our T-chart

- Place T-chart under the projector and point to unbalanced forces.
- **Say:** "Unbalanced forces cause a change of motion because there are unequal forces acting on the object. Let's write that in the definition box next to unbalanced forces."
    - Students will write.

- **Say:** "Please put your T-chart in your science folder and keep out your pencil."

Evaluate

- Check to make sure all T-charts are put away.
- **Say:** "Now you will complete an exit slip. This exit slip will tell me what you have learned throughout our lessons on forces and interactions. This exit slip is not graded but try your best because it will show me what you do and do not know. When you are done, place it in the turn in tray. Then go back to your desk and read silently to yourself until everyone has finished.**"**
- Distribute exit slips.
- Read the directions.
- Monitor classroom while the students complete the exit slips.

- I will review the exit slips to evaluate student learning throughout today's lesson.

Lesson #4

Lesson Standards

NGSS Grade 3, Physical Science, PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (3-PS2-1)

NGSS Grade 3, Physical Science, PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

NGSS Grade 3, Physical Science, 3-PS1: Motion and Stability: Forces and Interactions:

- Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. (3-PS2-1)

Purpose

- The purpose of today's lesson is for the students to apply their knowledge about pushes and pulls and identify if a scenario is representing a push or a pull. The students will brainstorm with classmates and elaborate to describe why the scenario represents either a push or a pull. The students will also observe what happens when the forces on a ball change from balanced to unbalanced, and how the net force is affected by these changes. Then the students will explore how forces can change an objects speed and direction. The students will then evaluate their confidence level by comparing it with a stoplight. Red shows that the students are confused and not ready for the test, yellow shows that they have questions before they take the test, and green shows that they understand the content and are ready for the test. The exit slip includes one question that we covered throughout todays lesson that the students will answer.

Lesson Objectives

- Students will be able to identify balanced and unbalanced forces in real-world scenarios.
- Students will be able to recognize that forces can change an objects speed or direction.

Focus Questions

- What is the difference between a balanced force and an unbalanced force?
- What happens when balanced forces become unbalanced?
- How can forces change an objects speed and direction?

Materials & Resources

- Pencils
- Chairs
- Desks
- Rug
- Projector

- Document Camera
- Balanced and Unbalanced Flash Cards
- White Board
- List of Balanced and Unbalanced Scenarios
    - Teachers Pay Teachers, Educate, Communicate, Collaborate, Balanced/Unbalanced Forces
    - https://www.teacherspayteachers.com/FreeDownload/BalancedUnbalanced-Forces-3554852
- Exploring Science, Grade 3, Student Textbook
- Ball
- 24 Exit Slips
- 24 T-Charts
- 1 Guided T-Chart
- Exit Slip
    - Clipart: http://cliparts.co/cliparts/zcX/eRy/zcXeRygdi.png

Vocabulary

- Force → A push or a pull on an object. Every force has a strength and a direction.
- Push → Moving an object away from you.
- Pull → Moving an object towards you.
- Balanced Force → Forces that do not cause an object to move because they are equal in size and opposite in direction.
- Net Force → Overall forces acting on an object. Found by adding together the forces acting on the object.
- Gravity → A force that pulls objects toward the center of the earth.
- Strength → Quantity of a force (strong force = a lot of strength, weak force = very little strength)
- Direction → The course in which an object moves.
- Unbalanced Forces → A force that causes a change in motion because there are unequal forces acting on the object.

Differentiation

- Paraprofessional support for one student throughout the lesson.
- The paraprofessional may offer support by scribing for the student as they complete the exit slip.
- Including movement in the lesson benefits kinesthetic learners.
- Reading the textbook out loud while projecting the text on the white board benefits both visual and auditory learners.
- I will implement turn and talks into the lesson. These conversations allow me to converse with students who need an additional prompt to get their thinking started or need the question re-worded using simple student-friendly terms. Turn and talks also allow me to observe conversations and ask higher-level thinking questions to challenge the students.

Lesson Procedure

Engage

- I will call students by rows to find a spot on the rug.
- **Say:** "We will be reviewing what we have learned about balanced and unbalanced forces."
- **Say:** "Before we start, will someone explain what a balanced force is?"
    - Students will answer.
        - A balanced force is forces that do not cause an object to move because they are equal in strength and opposite in direction
- **Say:** "Give me a thumbs up or a thumbs down if you agree with _____ explanation of a balanced force."
- **Say:** "Will another student explain to the class what an unbalanced force is?"
    - Students will answer.
        - An unbalanced force causes a change in motion because there are unequal forces acting on the object.
- **Say:** "Give me a thumbs up or a thumbs down if you agree with _____ explanation of an unbalanced force."
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- "**Say:** "Please get into partners."
    - Count down from five to ensure that students are speedy with their selection.
- **Say:** "I will distribute the flash cards once I state the directions. One partner will hold the balanced forces flash card and the other partner will hold the unbalanced forces flash card. I will read a scenario and you and your partner must decide if you think that scenario represents a balanced or an unbalanced force. When you decide, the person with that card must hold it up for me to see. Please don't say the answer right away, as I will be calling on those who are sitting quietly that volunteer to answer."
- Distribute flash cards.
- State scenarios one by one.
    - Students will turn and talk with their partner to decide what the scenario is representing.
    - Students will be called on to share.
        - Repeat for all scenarios.
- **Say:** "I will call you by rows to put your flash card in your mailbox and return to the rug. I would like you to show your parents/guardians/friends/ and family your flash card and explain to them what the force means."
- I will call students by rows to place their card in their mailbox.
- While the students are doing this, I will place Exploring Science, Grade 3, Student Textbook page 10 and 11 under the projector.
- Students will return to the rug.

Explore

- Call on a student to read page 10.
    - Student will read.
- Call on a student to read page 11.
    - Student will read.

Explain

- **Say: "**Forces that do not add up to zero cause changes in the objects speed or direction of motion."

- **Ask:** "How is the player on page 10 applying an unbalanced force to the ball?"
    - His foot is coming in contact with the ball and pushing it as he kicks.
- **Say:** "Today we will be learning about how forces can change an objects speed and direction."
- **Ask:** "How is the ball's speed changing as it contacts the player's foot?"
    - It is slowed down by the foot, stopped by the foot for a split second, then sped up again as it is pushed away.
- **Ask:** "How is the ball's direction changing as it contacts the player's foot?"
    - The ball was moving in a direction toward the player, and now the ball is moving in a direction away from the player.

Elaborate

- **Say:** "Please sit in the purple, blue, or green row."
- I will place the ball on the ground in front of my foot.
- **Ask:** "Right now, what two forces are being exerted on the ball?"
    - Gravity is pulling it down and the floor is pushing it up.
- **Ask:** "Is the ball is moving?"
    - **No**
- **Say:** "Because the ball is not moving, this is a balanced force."
- **Ask:** "What would the net force be of this balanced force?
    - Zero
- **Say:** "If I kick the ball, my foot exerts a force on the ball, therefore making it move. I could change the strength of my kick to change the balls speed."
    - Demonstrate.
- Now we will evaluate what happens when the ball is rolling toward my foot.
- **Say:** "_____ you will be my assistant. Please roll the ball slowly toward my foot."
    - Student rolls the ball.
- I will tap the ball with my foot, rolling it back to the student.
- **Say:** "Here we saw the ball make contact with my foot. My foot applied a greater force than the ball, resulting in a change in direction."
- **Ask:** "Is this a balanced or unbalanced force?"
    - Unbalanced.
- **Ask:** "How could I change the speed and direction of the force I exert on the ball?"
    - Kick it harder and kick it at an angle.
- **Say:** "_____ please roll the ball toward my foot again."
    - Student will roll the ball.
    - I will kick it slightly harder and at an angle.
- **Say:** "Here we saw that my force changed the balls speed and direction."

Evaluate

- Before sending the students back to their desks I will explain the exit slip.
- I will tell the students that they will rate their confidence of the concepts and vocabulary terms using the stop light. They will circle the color that they are feeling.
- Next, I will read the second part. They must circle the two ways that forces can change an objects motion. I will say that we discussed the ways in todays activity.
- I will tell the students that they will place their exit slips in the turn-in tray and review the vocabulary words on their T-chart for the test tomorrow.
- I will send students back to their desks by rows.

- I will distribute the exit slips.
    - Students will complete the exit slips.
    - I will monitor the classroom while the students complete the exit slips.

Lesson #5

Lesson Standards

NGSS Grade 3, Physical Science, PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (3-PS2-1)

NGSS Grade 3, Physical Science, PS2.B: Types of Interactions

- Objects in contact exert forces on each other. (3-PS2-1)

Purpose

- The student's will Student's will complete a post-assessment to evaluate what they learned throughout the unit. The post-assessment scores will be compared to the pre-assessment scores to determine student academic achievement.

Lesson Objectives

- Students will be able to identify vocabulary terms using key words and actions given by their classmates.
- Students will be able to complete the post-assessment.

Materials & Resources

- Pencils
- Chairs
- Desks
- Rug
- Projector
- Document Camera
- T-Chart
- Name Sticks
- Headbands
- White Board
- Marker
- 23 Privacy Folders
- 24 Post-Assessments

Vocabulary

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Differentiation

- I will cross out one option in the multiple-choice section of the pre-assessment for two students.
- I will read the directions, questions, and possible answers of the pre-assessment out loud to the students. This is beneficial to students with learning disabilities, students who are auditory learners, and students that benefit from concentrating on one question at a time.
- Paraprofessional support for one student throughout the lesson.
- The paraprofessional may offer support by scribing for the student during the post-assessments.
- Including movement in the lesson benefits kinesthetic learners.

Lesson Procedure

Engage

- I will call students up to the rug by desk rows.
    - Students will come to the rug.
- **Say:** "Today we will be taking our forces and interactions assessment. Before we take the assessment, we will review our vocabulary terms by playing a review game of headbands."
- **Say:** "Let's review our T-chart of vocabulary terms."
    - Place T-chart under projector.
    - Go through each term one by one.
    - Turn off projector.
- **Say:** "I will draw name sticks, if your stick is called, you will walk up to the front and get your headband. If your name is not called, you will stay seated and stay quiet. If you blurt the vocabulary term you will return to your desk and you will not have the chance to get your name stick drawn."
- **Say:** "The person with the headband on will choose three people to give her a clue to her vocabulary word. For the clues, you may say one word, or you may do an action to represent the vocabulary word."
- **Say:** "Give me a thumbs up if you understand the directions."
- **Ask:** "Does anyone have any questions before we begin?"

- Draw name stick
- Place headband on the student.
- The student will call on three people to give them a clue to solve the vocabulary word.
- If a student does not know what the word is, I will offer them another clue.
    - Repeat x7

- **Ask:** "Every force has a ____ and a ____ ?"
    - Turn and talk
        - Strength and a direction

- **Ask:** "In what ways can forces change an objects motion? Hint: there are 2 ways."
    - Turn and talk
        - Speed or Direction
- **Ask:** "Who would like to come up to the whiteboard and draw a diagram for a balanced force?"
    - Call on student
        - **Say:** "Draw a line for a rope with a dot in the middle to represent the center of the rope. Use arrows to represent the forces."
- **Ask:** "Who would like to come up to the whiteboard and draw a diagram for an unbalanced force?"
    - Call on student
        - **Say:** "Draw a line for a rope with a dot in the middle to represent the center of the rope. Use arrows to represent the forces."

- Call by rows to have students go to their desk and get out their privacy folder and a pencil.
    - **Ask:** "What should you get out?"
        - Our privacy folder and a pencil.

Post-Assessment

- Distribute an assessment to each student.
- **Say:** "Please write your name at the top when you get your assessment. Please wait to start the assessment."
- Place a post-assessment under the projector.
- Read the directions out loud to the students. Read every question out loud. Allow for think time while students answer the questions.
- **Say:** "Double-check to make sure all questions are answered and that your name is at the top of the first page. I will call by rows to turn the assessments into the turn-in tray."