

Problem Solvers Activity SE 19: Pull, Pull, Pull!

CHILDREN ARE LEARNING...¹

Science Content:

- Pulls can have different strengths and directions.
- Pulling an object can change the direction and speed of its motion.
- A bigger pull makes things speed up more quickly.
- Heavier objects require more force to pull than lighter objects.

CHILDREN ARE DOING...

Science Practices:

- Explore cause and effect
- Make predictions
- Make observations
- Plan and carry out investigations

MATERIALS NEEDED:

1 wheeled vehicle toy (for example, dump truck) per child

String, ribbon, or yarn—about 15-20 feet total

Scissors

10 shoeboxes (or other similar-sized boxes)

Cotton balls

Feathers

Wooden Blocks

Canned food – 4 cans

Shredded paper OR 4 filled water bottles

1 piece of chart paper

Marker

Masking Tape or Painter's Tape

Handout 1: Stars to Show "Force"

¹ Adapted from the Next Generation Science Standards (kindergarten): <https://www.nextgenscience.org/>

PREPARATION:

- **For the EXPAND activity:**
 - Cut a 12-18-inch length of string for each child.
 - Tie the end of the string to the front of each vehicle. Repeat until all 4 vehicles have a string that children can pull. **Note:** These pull strings—if left unsupervised—could pose a safety issue. Be prepared to remove the pull strings immediately following the activity or place the prepared vehicles out of children's reach.
- **For the EXPLORE activity:**
 - Prepare 10 pull-boxes:
 - Fill two boxes with cotton balls. Using a marker, mark each of these boxes with a CT.
 - Fill two boxes with feathers. Using a marker, mark each of these boxes with an F.
 - Fill two boxes with wooden blocks. Using a marker, mark each of these boxes with a B.
 - Fill two boxes with canned food. Using a marker, mark each of these boxes with a CF.
 - For the final two boxes, you can choose whether to make them heavy or light. For a light box, fill each with shredded paper. For a heavy box, fill each with 1-2 filled water bottles. Using a marker, mark each of these boxes with a letter indicating its contents.
 - Cut a 18-24 inch length of string for each box. Firmly tape down or staple a piece of string to the short end of each box. The children will pull the box using this pull-string so it must be secured well.
 - Tape down the tops of the boxes. Keep in mind that children will be taking the lids off at the end of the activity so avoid using a lot of tape. One piece over each side is plenty.
 - Set the boxes aside in pairs until needed. Hint: The easy way to store and move them is to use an empty laundry basket.
 - Use tape to make 2 lines on the floor, each about 4-5 feet in length. A pair of children will be pulling a box along this line so place the lines about 3-4 feet apart, so pairs have space to work.
 - Make 3 copies of **Handout 1**. Cut out 3 of the large stars and 3 of the small stars. (You can skip the medium stars unless you are choosing to make the activity more challenging – see the note under *Individualizing the Activity*.)
 - Keep the stars aside, along with the chart paper, the tape, and the marker until the **EXPLORE** activity.

Activity Instructions

ENGAGE

Gather a group of 4 children at a table or in a circle on the floor. (Note: Groups of 6 children work well if you are teaching 4-year-olds. Adjust materials as needed.)

ASK: Can anyone show me what it looks like to **PULL** something? *(Let children demonstrate this motion. If they are unsure, you can model it yourself and encourage them to copy.)* Can you think of anything that you pull? What about a door—can you pull a door to open it? Is there anything else we pull? Maybe we pull a rope, or pull a toy, or pull our zippers up to close our jackets!

ASK: Let's think, Problem Solvers. When we pull something, does it come closer to us *(demonstrate a pulling motion)* or does it move farther away from us? *(If children have difficulty with this question, you can demonstrate with a prepared toy—ask children again if the toy is getting closer or farther from you.)*

EXPLAIN: When we **PULL** something, we use force to bring something closer to us. *(Demonstrate.)* A **PUSH** is different. A **PUSH** is when we use force to move something away from us. Let's do a **PUSH** movement. We're pushing away. *(Demonstrate.)*

TRY IT: Now let's do a **PUSH**, **PULL** pattern with our bodies. First, we'll pretend to **PUSH** and then we'll pretend to **PULL** *(demonstrate the pattern and have children join in as you do it slowly)*. Okay, everyone, stand up! Are you ready? Let's: Push, Pull. Push, Pull. Push, Pull. Push...what comes next? Pull! Then what comes next? Push and pull!

EXPLAIN: Today we're going to explore pulling and pushing, using different types of force. Are you ready, Problem Solvers?

STEM TIP

This push/pull movement activity is an example of a **pattern**. Patterning is an important early math skill. This pattern is called an A/B Pattern because there are two parts to it (the Push and the Pull).

Children usually need to repeat the pattern three times before they can predict what comes next.

EXPAND

SHOW: Take out the toy vehicles you have prepared with pull strings. Place the string in front of each child and extend the string so the vehicle is at the other end, about 12 inches from the child.

EXPLAIN: Let's do some pulling with our toys today. Why don't you see what happens when you pull on the string attached to your car? *(Give children the opportunity to engage in some free play with the vehicles on pull strings. After they have had an opportunity to explore, gather the group together again.)*

TRY IT: There are different ways we can pull. First, let's try pulling with *gentle* force. Who remembers what *gentle* force means? Can you show me? *(Demonstrate for children, if they are unsure.)* What do we think will happen when we pull the toy with gentle force? Let's see! *(Pull the string gently.)*

ASK: Use questions like the ones below to explore the ideas of force and the motion of pulling:

- What happened to the toy when we pulled it with gentle force?
- When we used a gentle force to pull, did the vehicle move quickly or slowly?
- What do you think will happen to the vehicle if we don't pull it? Will it still move? Why/Why not? *(Because it needs force in order to move!)*

EXPLAIN: Let's *push* our toy back to where it started. Hold on to the string and get ready. Now we're going to pull with a *strong* force. Who remembers what a strong force means? Can you show me? Alright, let's try it: Everyone, pull your string with a *strong* force!

ASK: Use questions like the ones below to explore the ideas of force and the motion of pulling:

- What happened to the toy when we pulled it this time?
- When we used a strong force to pull, did the toy move quickly or slowly?
- Did the toy move differently when we used a strong force instead of a gentle force? How did it move differently?
- What do you think made the toy move faster this time?

SUMMARIZE: It sounds like we learned some important things when we explored pulling. We learned:

- Pulling brings an object closer to you. Pushing moves an object away from you.
- If you use more force to pull, the object moves toward you faster.
- If you don't push an object or pull an object, it doesn't move. An object needs some kind of force in order to move.
- Now let's play some more pulling games! (**Collect the vehicles and place out of reach from children until you can remove and discard the strings.**)

EXPLORE

PREPARE: Organize children into two groups – ideally two pairs (or 4 children total). Larger groups—3 children per group, or 6 total—will work too. It will just take a bit longer to run through the activity.

EXPLAIN: Let's try another activity with pulling. We're going to pull boxes. Let's look at our boxes. *(Take out the boxes you have prepared. Hold one up.)* We are going to pull these boxes using this string. I wonder how much force we'll need to pull these boxes. What kind of force do you think each box will need for us to pull them? Some of these boxes will just need a *little bit* of force to pull. That means it will be easier to pull the box. Some of these boxes will need a *lot* of force to pull. That means it will be harder to pull the box.

Give each pair of children the box marked CT (the box filled with cotton balls).

ASK: Can one of the partners pick up the string and pull the box along your line? When you get to the end of the line, let your partner pull it back. *(Wait for children to finish pulling.)* Did that box need a LOT of force to pull or just a LITTLE force to pull it? *(Take children's responses/observations. Validate that it only took a little force to pull this box.)*

DISCOVER: Ask children to predict what is in the box. Support their critical thinking by asking questions like: *If the box is light, whatever is inside must be light too. What are some things you know are light, or not heavy?* Take children's responses. Then prompt children to take the lid off of the box. Discover together that it is filled with cotton balls. You might ask children: *Are cotton balls heavy or light? Oh, they're light. That's why you don't need a lot of force to pull the box, even though there are so many cotton balls in there!*

DOCUMENT: Hang a piece of chart paper at children's height. Explain that you will use this chart paper to record how much force each box needs in order to pull it. Draw a cotton ball on the chart paper.

ASK: Who remembers: Does the box filled with cotton balls need a lot or a little force to pull it? Yes, a little. Do you see these stars? *(Hold up a large and small star symbol you have prepared.)* We are going to use a BIG star if our box needs a lot of force to move. We will use a little star if our box only needs a little force to move. So our box of cotton balls only needed a **little** force to move so we will post the little star right here *(tape next to the cotton ball drawing).*

REPEAT: Repeat the activity above with the remaining boxes: Wooden blocks (a lot of force), feathers (a little force), cans of food (a lot of force), and paper scraps (a little force) or water bottles (a lot of force).

- For each box, ask children to pull it and assess whether it requires *a lot* or *a little* bit of force to pull.
- For each box, encourage children to guess what is inside and then remove the lid.
- For each box, draw an image of what's inside on the chart paper and ask children if they think the box needs the little star (little force) or the big star (a lot of force).
- Give children a turn to tape the appropriate star on the chart paper.
- When you are done with all boxes, review the children's findings.

REFLECT

To close the activity, bring the children back together. Use a reflective question/s - like those below - to prompt children's thinking about force, motion, and pulls.

- What did you learn about pulling today?
- What makes these boxes different?
- What was it like to pull these boxes?
- What box just took a little bit of force to pull? What was inside that box? Was the box heavy or light?
- What box took a lot of force to pull? What was inside that box? Was the box heavy or light?
- What did you discover about force and pulling today?

SUMMARIZE: We discovered some important information about force and pulling today. We learned:

- We have to use force when we are pulling something.
- When something is heavy, we have to use more force to pull it. It's harder to pull so we use a strong pull to move it.
- When something is light, we use less force to pull it. It's easier to pull, so we can use gentle pulling.

Individualizing the Activity

Make it more challenging:

- If children are pulling toy vehicles that are dump trucks, consider putting items like blocks in the back of the dump truck to increase the weight of the truck. You can also tape wooden blocks to the vehicle to make it heavier. Help children observe how they need to change how much force they use, based on how heavy the toy truck is.
- When comparing the amount of force needed to pull the boxes, offer 3 options: a little bit of force, medium force, and a lot of force. Use the third (optional) medium-sized star from **Handout 1** if you choose this adaptation.
- Let children empty the current boxes. Offer children some open-ended materials from the classroom/playground—plastic silverware, leaves or mulch from the playground, magazines/catalogs, books or other items—to prepare their own mystery boxes for peers.
- Let pairs work as a team to chart their own data. Provide each pair with chart paper, tape and stars to report the amount of force needed to pull each box.

Make it less challenging:

- Focus on just three key learning messages in both activities: (1) A pull is used to move an object toward you. (2) You can pull with a lot of force or a little force. (3) The object you're pulling will move differently based on how much force you use.
- Use fewer boxes (such 2 light and 1 heavy) in the box-pulling activity. Do the activity as a large group, rather than as pairs. This approach will help younger children focus their attention and engagement. Ensure each child has a chance to pull each box so they can experience the weight differences.
- Leave the tops of the boxes off so children can see what's inside and use that visual information to predict whether the box will be heavy or light, requiring more or less force to pull.
- Omit the chart paper component of the activity.

MAKING CONNECTIONS ACROSS THE DAY:

- Notice when you use a pull to move objects across your day—for example, pulling open a door, pulling a broom toward you as you sweep, pulling a cot or cushion across the floor, pulling zippers up on children's jackets. Talk about how your pull moves these objects.
- When children are playing with toy cars or trains, you can use the concept of force to redirect behaviors: *I need you to use less force. Try pulling gently.*
- Have a push/pull dance party. Play music and do the "push/pull" dance to help children learn and practice these concepts (and this pattern).
- Involve children in classroom housekeeping routines, such as putting objects away. Place items to put away in boxes/baskets and have children push/pull these boxes to the appropriate place in the room. Ask/observe how much force children need in order to push/pull these boxes.

Song: Pull, Pull, Pull (That Little Red Wagon)

Materials Needed: 1 or more “wagons” – could be an actual wagon or a box/laundry basket with a pull string attached; children’s gardening tools such as a shovel, watering can; pictures of flowers

Directions: Model actions suggested and invite children to do what you do. Allow children to take turns pulling the wagon or box around the room.

Verse:

We’re gonna plant some flowers today.
First clear the weeds by the handful.
Let’s take our wagon, it’s very light;
With just a little force, it’s easy to pull.

(Hold up picture of a flower)
(Pretend to put on some work gloves)
(Pull the wagon or box with nothing in it)

Chorus:

Pull, pull, pull that little red wagon.
Pull the weeds in the flower bed.
Pull, pull, pull that little red wagon.
Across the yard to the garden shed.

(Children take turns pulling wagon around the room)
(Pretend to pull weeds)
(Pull wagon around the room)

Verse:

Put all the flowers in the wagon.
Take a little shovel and a watering can.
Feel how heavy that wagon is now.
Use lots of force; pull as hard as you can!

(Place flower pictures in the wagon)
(Place tools in the wagon)
(Children take turns pulling wagon)

Chorus:

Pull, pull, pull that little red wagon.
Yellow daisies, and violets
Pink petunias and purple snapdragons
Plant those flowers in the flower bed.

(Children take turns pulling wagon)
("Plant" flowers by placing pictures on the floor)
("Plant" flowers by placing pictures on the floor)
("Plant" flowers by placing pictures on the floor)

Bridge:

Flowers in the garden, the garden is full.
The wagon is empty, it’s easy to pull!
Let’s clean our tools, put our wagon away.
It’s fun to plant flowers on a sunny day!

(Pretend to look over the garden)
(Pull wagon)
(Park the wagon)
(High five the children)

Chorus:

Pull, pull, pull that little red wagon.
Pull it fast and pull it slow.
Pull, pull, pull, that little red wagon.
A little force and watch it go.
A little force and watch it go.

(Pretend to pull wagon)
(Pull fast, pull slow)
(Pretend to pull wagon)
(Wave good-bye)
(Wave good-bye)

Making Literacy Connections

Share the following book with children as an opportunity to deepen their understanding of pulling, force, and motion. The literacy extension activity below suggests another play-based experience to explore these concepts.

Suggested Book: *My Truck Is Stuck!* by Kevin Lewis and Daniel Kirk

AS YOU READ:

- On the first two-page spread, point to the hole in the road. Ask children to predict what might happen to the truck when it rolls over the hole.
- On the page where you see “beep beep!” in green font, point to these words and ask children to help you make this sound. (Continue this routine on each page where these words appear.)
- In this story, a series of trucks get stuck. Each one tries to help the one behind by pulling it, but then gets stuck too. First the green car comes and tries to help the dump truck. Point to the rope connecting the two cars. Explain the green car is trying to PULL the red truck. Do the children think this plan will work?
- On each page when a new vehicle is added to the link, point to the rope connecting them. Talk about how they are trying to PULL the cars behind. Count each vehicle as well.
- There are many details in the illustrations to talk about with children. You might pause on a page and simply ask children what they observe.
- On the page with the school bus, notice how big it is. Do children think the school bus can pull this line of vehicles?
- When the tow truck finally arrives, point out the hook on a long cable. What do children think the mechanic (a person who fixes vehicles—cars, trucks, and buses) will do with his tow truck? Can children predict whether the tow truck can pull all of the vehicles in the line?

BUILD ON THE BOOK: MY STUCK TRUCK

Materials: 5 toy vehicles, string/ribbon/yarn

Preparation: Tie an 18-24 inch piece of string to the front of one of the vehicles. Cut an additional 4 pieces of string (each about 8-10 inches long) for the activity.

Gather a group of 4 children. In this activity, you'll be acting out *My Truck Is Stuck*. Show children the first vehicle (with the string tied to it) and explain, “This truck is stuck.” Ask a child to choose another vehicle to help out. Using a length of string, tie these two vehicles together. Let the child pull the two vehicles in a circle around the group and then stop and say, “This truck is stuck.” Repeat by giving 3 more children an opportunity to add a truck to the line. Observe how much force is needed to pull the trucks as more and more vehicles are added. ***Remove pull-strings from all vehicles when the activity is complete.**

Handout 1: Stars to Show "Force"



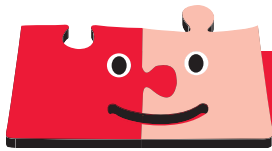
A Lot of Force



A Little Force



**OPTIONAL:
Medium Force**

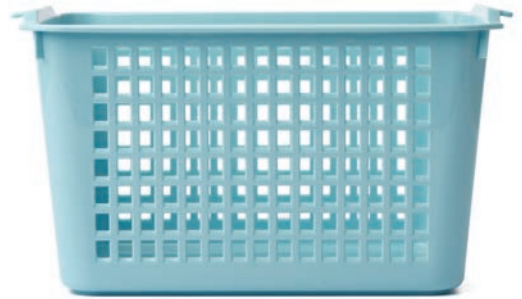


Learning About Push and Pull

This week, children are learning how a pull brings an object closer to us and a push moves an object farther away. Have fun with push-and-pull at home using these activities:

- **Let your child help you put away groceries.**

Put items in a laundry basket and show your child how to either PUSH it or PULL it to where these items belong. Ask your child if the basket is easier to pull (or push) if it's full or empty. (A heavier basket will need more force in order to move it.)

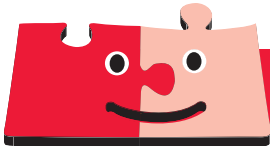


Ask your child how much force—a lot or a little—they need in order to pull the basket. Notice together that when the basket is heavier, you need more force to pull it. When the basket is lighter, you can use less force to pull it.

- **Make a shoebox train.** Take the top off the shoebox and let your child decorate the box with crayons, markers and/or stickers. Tape a small length of string, yarn or ribbon (about 12-18 inches) to the short side of the box. Show your child how they can use the string to pull the “train” around your house. You can even put little toys or stuffed animals inside the train and take them for a ride.

Ask your child what happens when they use a lot of force to pull the train: Does it move slower or faster? If they just use a little bit of force to pull the train, does it move slower or faster?

Safety Note: Be sure to carefully supervise this activity. When you're done, remove the pull-string or put the shoebox train out of your child's reach.

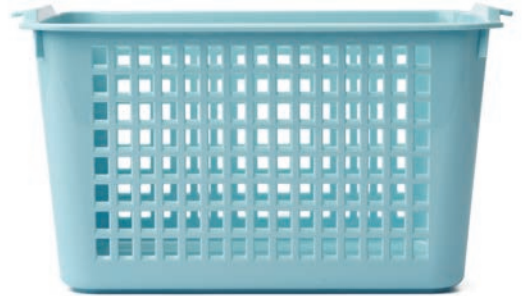


Solo para familias

Aprender acerca de empujar y halar

Esta semana los niños están aprendiendo que si halamos un objeto lo acercamos a nosotros y si lo empujamos lo alejamos. Diviértase empujando y halando objetos en casa con estas actividades:

- **Deje que su niño le ayude a guardar lo que compraron en el supermercado.** Ponga la compra en una cesta y muéstrela al niño cómo EMPUJARLA o HALARLA hasta el lugar donde se guardarán los artículos. Pregúntele si es más fácil empujar o halar la cesta dependiendo de si está llena o vacía (una cesta más pesada necesitará más fuerza para moverla).



Pregúntele a su niño cuánta fuerza mucha o poca necesita para halar la cesta. Observen juntos que si la cesta pesa más, se necesita más fuerza para halarla. Cuando la cesta es más liviana, se necesita menos fuerza para halarla.

- **Haga un tren con una caja de zapatos.** Quite la tapa de la caja de zapatos y deje que su hijo la decore con lápices de colores, marcadores o calcomanías. Pegue un trozo de cuerda, hilo o cinta corto (de unos 30 cm) en el lado más angosto de la caja. Enséñele a su niño cómo puede utilizar la cuerda para tirar del "tren" por toda la casa. También puede poner juguetes o peluches pequeños dentro del tren y llevarlos de paseo.

Pregúntele al niño qué ocurre cuando utiliza mucha fuerza para halar el tren: ¿Se mueve más despacio o más rápido? Si aplica solo poca fuerza para halar el tren, ¿se mueve más despacio o más rápido?

Nota sobre la seguridad: Asegúrese de supervisar cuidadosamente esta actividad. Cuando terminen, retire el cordón o ponga el tren de caja de zapatos fuera del alcance de su hijo.