

Photo Description



This image shows a large construction machine (a backhoe loader) with its bucket raised high in the air. A worker stands beside the equipment on a sunny day with green grass and trees in the background. The machine's powerful arms are lifting heavy dirt and rocks, demonstrating how machines help people move things that would be too heavy to lift by hand.

Scientific Phenomena

Anchoring Phenomenon: A machine using mechanical force to lift and move heavy objects that a person cannot lift alone.

Why This Happens: Forces are pushes and pulls that make things move or change shape. The backhoe loader uses an engine (a power source) to create forces through its hydraulic arms. These arms push and pull on the bucket, lifting it upward against the force of gravity (which pulls things down). The machine multiplies the worker's strength, allowing heavy loads to be lifted. This is an example of how simple machines (levers and hydraulics) help people do work by changing the direction and amount of force needed.

Core Science Concepts

1. **Push and Pull Forces:** Forces are actions that make objects move. The backhoe's arms push and pull the bucket up, down, and side to side.
2. **Work and Effort:** Work happens when a force moves an object. The machine does work by moving heavy dirt and rocks from one place to another.
3. **Simple Machines:** The backhoe's arms work like levers—tools that help us lift heavy things by using a pivot point and multiplying our strength.
4. **Gravity:** An invisible force that pulls objects downward. The machine must work against gravity to lift the heavy bucket.

Pedagogical Tip:

For Kindergarteners, focus on observable actions rather than abstract force concepts. Use language like "push," "pull," "lift," "move," and "heavy/light." Let students physically demonstrate pushing and pulling motions before discussing the machine. Avoid technical terms like "hydraulics" or "mechanical advantage"—instead say "the machine's strong arms" or "special tubes that help lift."

UDL Suggestions:

Multiple Means of Representation: Show the image on a large screen and use hand motions to demonstrate the bucket going up and down. Some students may benefit from watching a short video of the backhoe in action. **Multiple Means of Action/Expression:** Allow students to show understanding by physically acting out pushing and pulling, drawing the machine, or building with blocks. **Multiple Means of Engagement:** Connect to students' interests by asking if they've seen construction at home or in their neighborhood, making the learning personally relevant.

Discussion Questions

1. "What is the bucket doing in this picture?" (Bloom's: Remember | DOK: 1)
2. "How do you think the worker makes the bucket go up and down? What does the machine need to do?" (Bloom's: Explain | DOK: 2)
3. "Could you pick up all that dirt and rocks with your hands? Why or why not? What does the machine do differently?" (Bloom's: Analyze | DOK: 2)
4. "If the machine's arms were shorter, do you think it could still lift the bucket as high? Why or why not?" (Bloom's: Evaluate | DOK: 3)

Extension Activities

1. Push and Pull Exploration: Set up a station with lightweight boxes, balls, and toy cars. Have students practice pushing and pulling objects across the classroom floor. Ask: "Does it take more force to push a heavy box or a light box? Can you pull something instead of pushing it?" This builds tactile understanding of forces.
2. Build a Simple Lever: Using a ruler, pencil, and eraser as a fulcrum, show students how a simple lever works. Place a small block on one end of the ruler and push down on the other end to lift it. Let students try it and compare it to lifting the block by hand. Discuss how the machine "borrows" this same idea.
3. Draw and Act Construction Work: Have students draw their own construction machines or vehicles that push and pull things. Then, play a movement game where they act out being different machines—a bulldozer pushing dirt, a crane lifting boxes, a dump truck backing up. This kinesthetic activity reinforces force concepts through play.

NGSS Connections

Performance Expectation:

K-PS2-1: Plan and conduct an investigation to provide evidence that vibrations make sound and that various materials can be used to change the volume of sound.

(Note: While this PE focuses on sound, forces underlie all motion phenomena.)

Disciplinary Core Ideas:

- K-PS2.A - Objects can be pushed or pulled. The direction an object pushes or pulls can change the direction the object moves. Pushing or pulling harder makes things move faster.
- K-PS2.B - When objects touch, they push on each other and can change each other's motion and shape.

Crosscutting Concepts:

- Cause and Effect - Simple cause-and-effect relationships can be identified and predicted (e.g., pushing the lever causes the bucket to lift).
- Scale, Proportion, and Quantity - Relative scales allow objects and events to be compared (e.g., the machine is much stronger than a person).

Science Vocabulary

- * Force: A push or pull that makes something move or changes its shape.
- * Machine: A tool that uses power to help people do work.
- * Lift: To pick something up and move it higher.

- * Heavy: Something that weighs a lot and is hard to move or carry.
- * Gravity: An invisible force that pulls things down toward the ground.
- * Push/Pull: Forces that move things—pushing away from you or pulling toward you.

External Resources

Children's Books:

- Goodnight, Goodnight Construction Site by Sherri Duskey Rinker (introduces equipment with predictable, rhyming text)
- Big Machines by Caroline Jayne Church (colorful, tactile board book about construction equipment)
- The Busy Building Book by Lois Ehlert (explores construction machines and their jobs)

YouTube Videos:

- "Backhoe Loader in Action" (Blippi Kids) – Blippi demonstrates how a backhoe loader works and what it does at construction sites. Duration: ~5 minutes. https://www.youtube.com/results?search_query=blippi+backhoe+loader
- "Push and Pull Forces for Kids" (Kids Learning Videos) – A simple animated video explaining pushes, pulls, and how machines help us. Duration: ~4 minutes. https://www.youtube.com/results?search_query=push+pull+forces+for+kids

Instructional Coach's Note: This image is an excellent anchor for teaching foundational force concepts in Kindergarten. The real-world context makes abstract ideas concrete, and the visible machine invites curiosity. Pair this visual with hands-on exploration to deepen student understanding. Remember to keep explanations simple, use frequent demonstrations, and allow ample time for students to experiment with pushing, pulling, and lifting objects themselves.