Robot

Physical Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- A blue and orange robotic device with a spherical head (featuring an eye-like sensor with orange ring and white pupil) positioned on a concrete surface
- Two rounded blue body segments below the head, with black slot-like openings (possible wheels or movement mechanisms)
- A small brass or metallic object attached beneath the head
- Green grass and soil surrounding the concrete
- Scattered mulch and decomposing plant material on the ground
- A natural outdoor garden or landscape setting

Reasonable Inferences

1. From the robotic device's spherical design and outdoor placement — This robot is built to navigate natural terrain; the rounded shape and visible mechanical components suggest it was designed to move, observe, or interact with outdoor environments.
2. From the eye-like sensor and brass attachment — The device has sensing and possibly gripping or pushing capabilities, implying it performs a task requiring vision and/or manipulation in its environment.
3. From its placement on a raised concrete surface surrounded by natural ground — The robot faces a transition between hard and soft surfaces, suggesting its designers had to consider how it moves across different ground types.

Engineering Task

K-2 Challenge:

Imagine this robot friend needs to roll through your classroom to deliver a message. Design a track or path using blocks, tape, or rolled paper that helps it roll smoothly from one side of the room to the other. Test whether your path keeps the robot moving straight, or if it tips or slides. Change one thing about your path (make it wider, higher, or bumpier) and test again.

3-5 Challenge:

This robot must travel across three different ground types (soft soil, gravel, and concrete) to reach a target 2 meters away. Design and build a protective bumper, wheel guard, or deflector using cardboard, foam, or PVC pipe that allows the robot to successfully navigate all three surfaces without tipping or getting stuck. Success criteria: (1) Robot reaches the 2-meter target, (2) The device you design weighs no more than 200 grams, (3) The robot can reverse direction if needed. Test your design and modify it based on where the robot struggles most.

EDP Phase Targeted

Ask / Define Problem — This phase fits because the photo shows a real robot in a real environment (outdoors, on varied terrain), which naturally raises the question: What problem does this robot solve? and What challenges does it face moving across natural ground? Students can observe the robot's design features and infer the constraints it was built to handle, making problem-definition authentic and student-driven.

Suggested Materials

- Cardboard tubes, sheets, or scraps
- Foam padding or pool noodles (cut into segments)
- Duct tape or masking tape
- Small wheeled toy or robot (if students don't have the actual device)
- Sandpaper, gravel, soil, and flat wooden boards (to simulate terrain types)
- Measuring tape and markers

Estimated Time

Two 30-minute sessions — Session 1: Observe the robot, discuss terrain challenges, and sketch designs. Session 2: Build protective components, test on varied ground, and refine based on failure points.

Why This Works for Teachers

This task directly addresses NGSS ETS1.A (Define Engineering Design) by asking students to identify how a robot's design responds to real environmental constraints, and ETS1.B (Develop Possible Solutions) by requiring them to test and iterate on protective structures for multi-terrain travel.