

## Photo Description



This image shows a small blue robot with a spherical head featuring an orange ring and purple "eye," paired with a rounded, wheeled body base sitting on a concrete surface in an outdoor garden setting. The robot appears to be a programmable device designed to move and respond to its environment, surrounded by natural elements like soil, grass, and plants.

## Scientific Phenomena

Anchoring Phenomenon: How can machines be programmed to move and interact with their surroundings?

This robot demonstrates mechanical motion and automation—the concept that machines can be designed and programmed to move independently and perform tasks without direct human control at every moment. The robot uses internal mechanisms (likely motors and gears) powered by electricity to roll across surfaces. Its design shows how engineers solve problems by building machines with specific features: wheels for movement, sensors (the "eye") to detect obstacles or light, and a body structure that allows it to navigate outdoor terrain. Students can observe that the robot moves through coordinated mechanical parts working together—similar to how living things use muscles and bones to move.

## Core Science Concepts

1. Simple Machines and Motion: Robots use wheels (a type of simple machine) to reduce friction and move efficiently across surfaces. Wheels are circular objects that rotate around an axle, making movement smoother than sliding.
2. Energy Transfer: The robot converts electrical energy (from a battery or power source) into kinetic energy (movement). This demonstrates how energy changes form but is never created or destroyed.
3. Systems and Components: A robot is a system made of many parts (wheels, motor, sensors, shell) that work together to accomplish a goal. Each part has a specific function, similar to how organs work together in living systems.
4. Programming and Cause-and-Effect: Robots follow programmed instructions that create predictable movement patterns. This shows how sequences of commands (causes) produce specific outcomes (effects).

### Pedagogical Tip:

When introducing this robot to fifth graders, avoid overwhelming them with technical jargon. Instead, start by asking students to observe and predict: "What do you think makes this robot move?" and "How is it similar to things in nature?" This activates prior knowledge and builds curiosity before introducing formal vocabulary. Consider having students draw or describe the robot's parts before explaining their functions.

### UDL Suggestions:

To support diverse learners, provide multiple means of representation: (1) allow students to physically interact with the robot or similar devices to experience motion firsthand; (2) use visual diagrams showing robot parts and their functions; (3) create a comparison chart between robot movement and animal movement using pictures, words, and symbols. For students with visual impairments, provide tactile models or verbal descriptions of the robot's components and movement patterns.

### Discussion Questions

1. What do you observe about how the robot moves, and what parts of the robot do you think help it move? (Bloom's: Remember/Understand | DOK: 1)
2. How is the way this robot moves similar to or different from how animals move in nature? Explain your thinking. (Bloom's: Analyze | DOK: 2)
3. If we wanted to change the robot so it moves faster or slower, what parts might we need to modify and why? (Bloom's: Apply/Evaluate | DOK: 3)
4. What problem do you think engineers were trying to solve when they designed a robot with wheels instead of legs? (Bloom's: Analyze/Evaluate | DOK: 3)

### Extension Activities

1. Design Your Own Robot: Provide students with craft materials (paper cups, straws, wheels, markers) and ask them to design and build a simple robot model. Have them identify what each part does and explain how it would help their robot accomplish a task (like moving across the classroom or picking up objects). This connects to engineering design practices and reinforces understanding of systems.
2. Observe and Compare Motion: Take students outside with the robot (or similar programmable device) and have them measure how far it travels, how fast it moves, and what obstacles it encounters. Then compare its movement to a student's walking or running motion, or to an insect's movement. Create a chart showing similarities and differences, reinforcing the concept that different organisms use different strategies for movement.
3. Code a Path: Using simple block-based coding tools (like Scratch Jr. or visual programming apps for robot toys), have students write simple programs that direct the robot through a maze or obstacle course. This hands-on coding experience demonstrates cause-and-effect and sequential thinking while making computer science accessible and fun.

### NGSS Connections

Performance Expectation: 5-PS2-1

Develop a model to describe that matter is made of particles too small to be seen and that these particles are in constant, random motion; the greater the density of matter, the closer together the particles and the greater the friction between the surfaces.

Disciplinary Core Ideas:

- 5-PS2.A Forces and Motion
- 3-PS2.B Types of Interactions
- 5-ETS1.A Defining and Delimiting an Engineering Problem
- K-2-ETS1.B Developing Possible Solutions

Crosscutting Concepts:

- Systems and System Models
- Cause and Effect
- Energy and Matter

### Science Vocabulary

- \* Robot: A machine that can be programmed to do tasks or move on its own.
- \* Motor: A device that uses energy (usually electricity) to create movement.
- \* Sensor: A part that detects or "feels" things in the environment, like light, obstacles, or movement.
- \* Friction: A force that slows down movement when two surfaces rub together.
- \* Program: A set of step-by-step instructions that tell a machine what to do.
- \* Automation: When a machine performs tasks by itself following programmed instructions, without a person controlling it.

### External Resources

#### Children's Books:

- Robots Everywhere by Brienna Rossiter (National Geographic Kids, 2021) — Explores real-world robots and how they help humans in different jobs.
- What Do You Want to Be? Robots by Mary Packard (Scholastic, 2010) — Introduces different types of robots and their functions in an engaging, illustrated format.
- The Way Things Work Now by Macaulay & Sheban (Houghton Mifflin Harcourt, 2016) — Uses cartoons and humor to explain simple machines and engineering concepts.

#### YouTube Videos:

- "How Do Robots Move?" by Crash Course Kids — A 4-minute video explaining the basic mechanics of robot movement and the importance of wheels and motors. <https://www.youtube.com/watch?v=zg1XlbFvNjQ>
- "Simple Machines: Wheels and Axles" by National Geographic Kids — A 3-minute overview of how wheels reduce friction and make movement easier, with real-world examples. <https://www.youtube.com/watch?v=VgdNKWNkhOU>