Robotics Open House Lesson Plan
Lower Elementary

Learning Objective

Students will compare robot shapes and functions, interpreting how different types of robots are useful in society.

Materials

- Projector and computer to play a video.
- Optional: building materials for students to make a model of the robot they design at the end of the lesson, such as popsicle sticks and glue.

NGSS Standards

- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Additional Resources

Boeing’s Educational Resources on a robotic arm
- http://www.boeing.com/principles/education/students-families.page
- https://curiositymachine.org/challenges/86/

Also check these out:
- https://www.khanacademy.org/science/electrical-engineering/robots

Approximate Time: 50 minutes
Engage: Thinking about Robots

Invite the students to share their prior knowledge about robots.

As a class, make a list of robots (real or fictional), describe each one, and determine its relative use in society.

Watch these two videos about USC Viterbi’s research robots:
https://www.youtube.com/watch?feature=youtu.be&v=URNoNtC1H9Q&app=desktop
https://vimeo.com/58507252

Explore: KWL Chart

As a class, make a KWL chart for robots, with what the students know, want to know, and have learned.

As a class complete the “K” and “W” portions of the chart on the board, asking students to volunteer what they know and want to know about:

- Robots
- Remote control vs. independent action (autonomy)
- Computer programming (or coding)
- Senses: How do humans sense the world? What are ways that robots sense the world?

Students follow along and write what is on the board on their own piece of paper, completing an individual KWL chart.

Go over key vocabulary with the class, writing each word and definition on the board:

- **Robot**: A robot is a **system that senses** the **physical world** and can **respond independently** to help people with work, exploration, health, observation, or other actions. (Note: A robot must have all four bolded qualities to distinguish it from a machine.) Robots are useful in situations when it is difficult or time-consuming for humans to do something, especially when tasks need to be repeated over and over again.

- **System**: A combination of **computer code** (or programming) plus physical parts (sensors, moving parts).

- **Computer code, coding, programming**: The instructions a computer uses. A programmer or coder is a person who writes instructions in a computer language that enables the robot to respond independently (autonomously) of human control.

- **Independent response**: The robot is programmed by a human to respond to certain situations without human intervention. A robot is not directed by remote control, which only carries out an action given by a human; a robot can respond independently because a human has programmed or coded it on a computer to
use its sensors to analyze its surroundings and respond independently. (Synonym: autonomous response)

- **Robotics**: Robotics is the study of robots.
- **Research** is the process of discovering or improving a solution to a problem, and involves testing and analyzing results. Researchers work with these robots to build or modify them and program them to function as workers, helpers, explorers.

### Explain: Families of Robots

Explain that robots are classified by their combined ability to physically sense, respond, and independently achieve specific goals for work, health, observation, and more.

Introduce four types of robots from the list below (explaining that there are more types, and they can also be mixed or combined):

- **Humanoid**: These robots have human-like body parts and movements, such as legs that can walk and arms that can grasp.
- **Explorers**: These robots explore places where it can be difficult for humans to go, such as the ocean or the sky.
- **Interactors**: These robots sense human movements or speech patterns and emotions, and respond helpfully, such as coaching people to exercise after a stroke.
- **Learners**: These robots learn as they interact with the environment.

Discuss the difference between a robot and a machine. For instance, a toaster is not a robot because it does not sense the bread or respond independently of humans. Is a microwave a robot? Why or why not? Is a washing machine a robot? Do these machines have sensors? Can they respond independently to their environment? Distinguish between a machine that can mark time (such as when bread is in a toaster for 60 seconds) from a robot that can sense when something is done.

Show pictures of different types of robots (provided at the end of the lesson) and discuss what they do. You can find out more about each robot at [http://rasc.usc.edu](http://rasc.usc.edu).
Elaborate: Be a Robotics Researcher

On the provided activity page (page 9), students will design their own robot, name it, and describe what it senses so that it can help people.

Begin by discussing with the class some simple problems that the student could solve by creating a new robot. What shape would the robot have?

Optional: After completing their design, have students build a model of their robot with materials such as popsicle sticks.

Evaluate: Complete the KWL Chart

As a class, fill in the “L” portion of the KWL chart on the board. Students complete their own KWL chart and hand it in on the back of the activity page (page 9).

Extend: Take a Robot Personality Quiz

Play the robot quiz!
http://www.playbuzz.com/viterbip/which-robot-are-you
Humanoid Robots

These robots imitate human body parts and movements, such as legs that can walk, cameras for eyes, hands that can grasp. They have a variety of functions, including manufacturing, helping people, or working in dangerous environments. Find the sensors on these robots for sight and touch.
Explorer Robots

These robots explore places where it may be difficult or impractical for humans to go, such as the ocean or the sky. They help monitor the environment, search for things, conduct research.

Crazyflie

AR.Drone

EcoMapper
Interactor Robots

These robots sense human movements or speech patterns and emotions, and respond helpfully, such as in coaching people to exercise after a stroke or helping children learn.
Learner Robots

These robots learn as they interact with humans and/or the environment.

Sarcos Arm
Be a Robotics Researcher! Design your own robot.

Robots help people, so how will your robot help people? What problem can your robot help solve?

What sensors and responses will you need to design in your robot to achieve this goal?

What is your robot called?

What shape does it need to be to solve problems and help people? What does your robot look like? Draw it below.

Name: ____________________
Date: ____________________

viterbi.usc.edu/ROH