Robotics Open House Lesson Plan
Upper Elementary

Learning Objective

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

Materials

- Projector and computer to play a video.
- A variety of building materials for students to make a model of the robot they design at the end of the lesson, such as popsicle sticks, cotton balls, foam board, and glue.

NGSS Standards

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Additional Resources

Boeing’s Educational Resources on a robotic arm
- [https://curiositymachine.org/challenges/86/](https://curiositymachine.org/challenges/86/)

Also check these out:

- [http://rasc.usc.edu/robots.html](http://rasc.usc.edu/robots.html)
Engage: Thinking about Robots

As a class, share prior knowledge of robots and computer programming (also referred to as “coding”).

Working in pairs or small groups, students develop a list of robots (real or fictional) and describe each robot’s function, appearance, and “personality.” Students also list what they know about coding.

Watch these two videos about USC Viterbi’s research robots:
https://www.youtube.com/watch?feature=youtu.be&v=URNoNtCIH9Q&app=desktop
https://vimeo.com/58507252

Explore: KWL Chart

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

Have students individually or in pairs complete the “K” and “W” portions of the chart on their own sheet of paper about the following:

- 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/or analyzing results. Researchers work with these robots to build or modify them and program them to function as workers, helpers, interactors, etc.

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**Explain: Families of Robots**

![Diagram of a robot]

Explain that robots are classified by their unique ability to 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 more difficult or inconvenient 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.

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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) and a robot that can sense when something (like bread) 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 are specific aspects of its sensors, physical abilities, and materials that should be considered?

After completing their design, students will build a model of their robot. Challenge them to analyze the proper materials needed to build their robot model.

**Evaluate: Complete the KWL Chart**

Individually or in pairs, students fill in the “L” portion of their **KWL chart**.

**Extend: Take a Robot Personality Quiz**

Play the robot quiz! [http://www.playbuzz.com/viterbip/which-robot-are-you](http://www.playbuzz.com/viterbip/which-robot-are-you)

*Optional: Watch “WALL-E” or “Big Hero 6” and have a class discussion about the different kinds of robots in the movie and what they do.*
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. Although humans can travel by airplane, boat, or submarine, in what types of circumstances might these robots do a better job in terms of materials, time, or cost?

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 the environment.
Be a Robotics Researcher! Design and build your own robot.

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

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

3. What is your robot called? __________________________________________


5. Build a model of your robot based on your sketch. First, write here what materials you will use and why: __________________________________________

Name: ____________________
Date: ____________________