

Introduction to Robotics

45 minutes

Beginner

Introduction to Robotics

Students will define the criteria for teamwork, get introduced to the SPIKE Prime hardware, and learn about the final project.

Questions to Investigate

- How can technology help us solve problems?
- How do engineers plan for the use of hardware in a solution to a problem?
- In what ways can I be an effective team member to finish a project on time?

Materials Needed

- SPIKE Prime sets ready for student use. Prior to the first lesson, please visit the following website for help with set up, kit organization and SPIKE App.
<https://education.lego.com/en-us/start/spike-prime/intro>
- Student journal

1. Engagement

Introduction to the Unit

Engage students in a conversation:

- What do you know about robotics?
- What about robotics interests you?
- What would you like to learn about robotics?
- Explain to students for this unit, they will be learning about different ways we can use technology to help us solve problems through the lens of robotics.

Culminating activity for the unit

Explain that over the course of the next several weeks, students will be working in teams to explore hardware and software relationships, design processes, and documentation ideas through building and programming prototypes.

At the end of the unit, their team will select one of these projects to design, build, test,

KEY OBJECTIVES

Students will:

- Describe characteristics of working on a team
- Describe the function of hardware
- Identify hardware components

and present a possible solution using robotics.

Teamwork

Explain to students that many of the activities in this unit require teamwork.

Ask students:

- What are some benefits of working as a team? (i.e., real-world practice, efficiency, sharing of ideas, distribution of tasks to finish on time).
- what effective teamwork looks like and sounds like. Students will reflect often as to how they contributed as an effective team member throughout the course.

Much of the work over the next few weeks will be project-based. Time management and materials management are important part of working on a project together.

Ask students:

- What are some ways a team can effectively manage their time?

Place students in teams of four. Teams should remain the same over the course of the unit.

Hardware

SPIKE Prime set for the robotics unit used.

Ask students:

- What other types of material do you think engineers use when designing a robot? (i.e., screws, bolts, specially designed plastic pieces, wires, motors, sensors, motherboard)
- Hardware is what you can touch. Software are the applications or apps that make the hardware do things.

Materials will include LEGO® bricks and elements.

2. Explore

Open the box to investigate the types of elements and bricks contained in the set.

Each student to select one brick or element from the set. Have them share with their partner what they think that brick or element is used for.

Have students look in their sets to find each of the following:

- A rubber band
- A 2 x 4 brick of any color
- A black connector peg
- A medium blue frame
- A tire

- An 8-tooth gear
- A 5-hole beam

Next, ask students to work with their partner to find a brick to match the function listed below:

- Allows a design to move
- Secures a piece in place
- Joins pieces together at an angle
- Decorates
- Connects pieces
- Reduces build time
- Controlled by software

3. Explain

Have students share out bricks or elements they matched with each function:

- Allows a design to move (gear, tire, rubber band, motor, tube)
- Secures a piece in place (bushings, pins)
- Joins pieces together at an angle (couplers, biscuits)
- Decorates (minifigs, eyes)
- Connects pieces (axle rods, pins, bricks)
- Reduces build time (technic plate, technic frames)
- Controlled by software (hub, motor, sensors)
- Show students the area on the back of the lid insert that shows how to measure the length of an axle. Then ask students to locate an axle with a length of 5.

Ask students:

- Why do you think it is important to know the names of the pieces when working with the set?
- Why do you think it is important to understand the function of different LEGO® bricks and elements when designing a solution?
- What resources in the kit might help with organization of materials?

Have students place LEGO® bricks and elements into the correct location in the trays.

4. Evaluate

Teacher Assessment

Evaluate students' understanding of element names.

Evaluate students' understanding of how technology can help us solve a problem.

Self-Assessment

students will be responsible for materials management. Parts should not be shared between sets. If a part is missing, the teacher will have limited spare parts. Let the teacher know immediately if you cannot locate something. Every day, students will make a journal entry about the materials management of their set. They will grade themselves using a three-point scale.

- 1) Materials are not all located in their correct tray; some parts are still together.

- 2) Materials are located correctly, but only one person helped put things away.
- 3) Both partners worked together and all parts in the correct locations.

Have students answer the following in their journals:

- What is the name of a LEGO® brick or element you found interesting today?
What is its function?
- What characteristics of a good teammate did you display today?
- Rate yourself on a scale of 1-3 on your time management today.
- Rate yourself on a scale of 1-3 on your materials (parts) management today.

What is a Robot?

45 minutes

Beginner

What is a Robot?

Define a robot and how software and hardware work together.

Questions to Investigate

- What is a robot?
- How can technology help us solve problems?
- How do engineers plan for the use of hardware in a solution to a problem?

Materials Needed

- SPIKE Prime sets ready for student use. Prior to the first lesson, please visit the following website for help with set up, kit organization and software app.
<https://education.lego.com/en-us/start/spike-prime/intro>
- Device with SPIKE App installed
- Images or video clips of different robots
- Student journal
- Sticky notes

Prepare

- Check to make sure SPIKE Prime hubs are charged, especially if connecting through Bluetooth.

1. Engage

What is a robot?

Launch a discussion about robots. Ask students the following questions:

- What is a robot?
- Where might I find a robot? (i.e., manufacturing, storage, at home, e.g., programmable vacuum cleaners and lawnmowers)
- How do these robots help us solve a problem? (i.e., they are fast, accurate, complete repetitive tasks)

KEY OBJECTIVES

Students will:

- Define a robot
- Identify ways we use robotics to solve problems
- Describe the function of hardware and software
- Identify hardware components

STANDARDS

CSTA

2-AP-18 Distribute tasks and maintain a project timeline when collaboratively developing computational artifacts

2-CS-02 Design projects that combine hardware and software components to collect and exchange data.

VOCABULARY

Hub
Robot
Software
USB

Ask students to think of three words that describe a robot, then write words on a piece of paper or sticky note.

Note: Criteria for becoming a robot is suggested at the end of the session.
Encourage students to discuss questions like the following:

- Is it powered?
- Is it programmable?
- Can it sense things?
- Can it move?
- Can it complete a task automatically?

create a definition of a robot, providing examples and non-examples based on their definition.

Have students test their definition by determining if some everyday objects could be defined as a robot based on their definition. These objects could include, but are not limited to a:

- Washing machine
- Toaster
- Television
- Cell phone
- Video game system

Have students make modifications to their definitions. Ask students to think about the pieces and parts that might make up a robot or a robotic system.

Distribute the SPIKE Prime Sets and devices with SPIKE App. Have students select the hub and USB cord (if not connecting Bluetooth).

Tell the students they need to investigate the following:

- What is the function of the hub?
- How does the hub and SPIKE App work together?
- Is the hub a type of robot?

2. Explore

Have students complete SPIKE Prime **Getting Started 1 Start Here** lesson.

Suggest some simple troubleshooting tips if students are having difficulty connecting (i.e., is the device powered, is the device connected properly, does the device software need an update, etc.). Allow students to have 3-5 minutes to change the light pattern and the sounds in an exploration.

3. Explain

Ask students the following questions:

- What do you think is the function of the hub?
- How do the hub and SPIKE App work together?
- Based on your definition, is SPIKE Prime a robot?
 - Is it powered?
 - Is it programmable?
 - Can it sense things?
 - Can it move?
 - Can it complete a task automatically?

Challenge students to think about what they would add to the hub to build a robot to fit their definition of a robot (i.e., additional sensors, motors).

Have a discussion on pair programming. What are some ways the students should work together to ensure both partners have a chance to program, debug, etc.? Ask students why this is important.

- Each team should have a driver and a navigator. The students will switch roles several times during each class.
- A “driver” is thinking about the programming needed and using the computer to type in the code.
- A “navigator” helps direct the driver, making sure all the code is correctly written – the ports are correct, the operators are precise, and so forth.
- Think of it as the driver holds and moves the steering wheel on the car, while the navigator has the map and tells the driver when and where to turn.
- Switch roles several times within a class period.

4. Elaborate

Have students explore ways to change the display on the hub. Ask students to synchronize the lights and the sounds to create a 10-15 second sound and light show. Remember to have them pair program! Have teams share their sound and light show with the class.

5. Evaluate

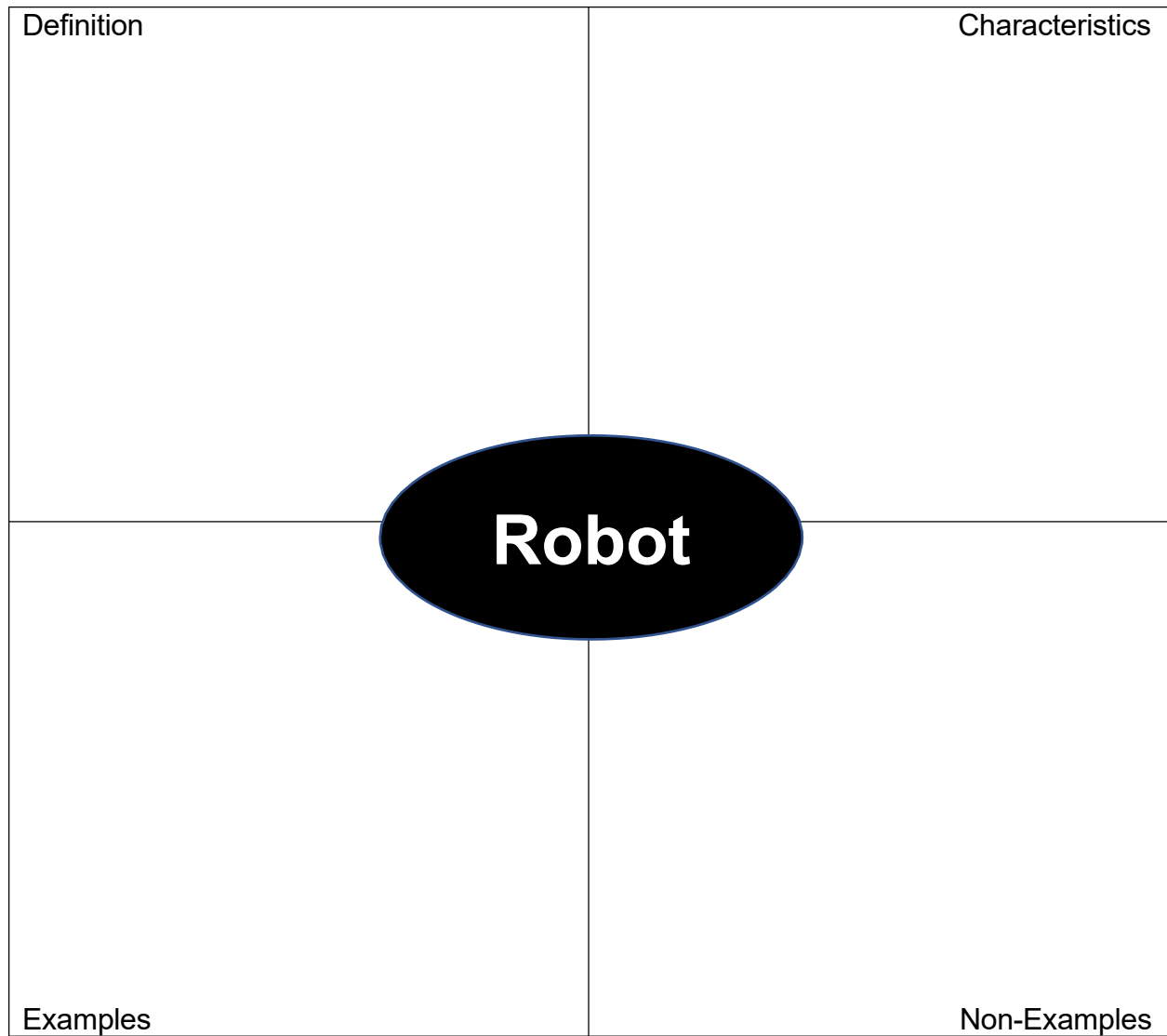
Teacher Assessment

Evaluate students’ understanding of how a robot helps us solve a problem.

Self-Assessment

Have students answer the following in their journals:

- What hardware and software did you use for your project today?
- What different things did you try to create a sound and light show?
- What characteristics of a good teammate did you display today?
- Using a scale of 1-3, rate yourself on time management today.
- Using a scale of 1-3, rate yourself on materials (parts) management today.



Notes: