



The Internet of Things

Objectives

Students will be able to:

- Develop designs for a new Internet of Things product and consider the opportunities associated with this connectivity.
- Evaluate their peers' product designs, assess the security risks that it may present, and provide suggestions for improvement.

Overarching Question

What are the benefits and risks of the Internet of Things?

Activity Summary: In this activity, students will role play that they are employees at a top tech company who have been tasked with adding a new non-tech product to the Internet of Things. After selecting a product that could benefit from Internet connectivity, student groups will brainstorm how their product could evolve if it became "smart." Students will create diagrams of this new product in order to demonstrate its capabilities. They will then review the designs of their peers and will discuss the security aspects that should be considered when connecting this product to the Internet of Things.

Grades

4-6

Timing

60 minutes

Materials

- Device with the ability to project video, one for the teacher
- [What is the Internet of Things?](#) Video (1:41)
- Expanding the Internet of Things handout (2 pages), enough for half the class
- Security Discussion Questions*, enough for half the class

*Cut in half before class begins

Activity Directions

Premise | 10 minutes

- Begin class by showing the [What is the Internet of Things?](#) video until :56, and ask students to listen carefully to the video's description of the Internet of Things.
- Encourage students to summarize the clip with a partner, and then further explain that the Internet of Things (IoT) is a term

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used to describe objects that are connected to the Internet and each other. Many objects in the Internet of Things (like refrigerators and car door locks) were initially created to be “not-smart.” (Unlike, for example, iPhones or tablets that were originally designed to be smart products.) However, through the addition of sensors, software, and other technology, these objects became smart and are now able to collect, analyze, and communicate data. They then use this data to learn about you and figure out how to help you without having to be specifically told or programmed.

- Go on to explain that there are now billions of IoT devices around the world. One popular IoT device used in people’s homes is a special kind of thermostat that tracks when you change the temperature and records when you are home. It eventually learns your patterns and will automatically adjust your home’s temperature based on the data it has collected.
- Ask students: How do you think these “things” know *how* to collect and analyze data? Arrive at the answer that objects in the Internet of Things contain a computer program, and each computer program contains code (or an exact set of instructions) that tells it what to do.
- Once students have an understanding of the Internet of Things, probe the class to brainstorm: Have you heard of, seen, or used any devices that are part of the Internet of Things? Keep a list on the board and encourage students to share not only the device name, but the data it collects, and what it uses this data to accomplish.
- After reviewing the list that the class has developed, tell students that from this moment forward, they will pretend to be new employees at a top tech company. Some of their coworkers have already developed the products listed on the board. It’s now their job to add a new product to the Internet of Things!

Did you know?

The very first IoT device is said to have been made at Carnegie Mellon University in the 1980s, before wireless internet was invented. One student was a long way from the school’s soda machine, and though he wanted a drink, he didn’t want to walk all the way there because he knew the soda was often warm. He therefore took matters into his own hands and installed sensors in the soda machine that were connected to a computer and helped track when the sodas were cold. The student then wrote code that connected this computer to other computers on the university network. Before long, anyone who logged onto the Carnegie Mellon’s Internet could check to see if the vending machine had cold sodas!

Read more [here](#).

Investigate | 30 minutes

- Divide students into groups of two or three and distribute one Expanding the Internet of Things handout to each small group.
- Read through Steps 1 and 2 together. Explain that students will brainstorm ideas for non-tech products that can be tech-i-fied and join the IoT in the first step, and then expand upon their favorite idea in the second step. Then encourage students to begin.

When most groups are ready (or after about 10–15 minutes), review Step 3 on the handout together. Explain that a programmer will use their design and description to write code that will enable their

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device to enter the Internet of Things. In order for the programmer to write this code, the diagrams will need to be as detailed as possible.

Solve: 20 minutes

- As groups are wrapping up their designs, explain that there is one more important factor to consider when creating or using an object that is part of the Internet of Things.
- Play the second half of the [What is the Internet of Things?](#) video (from :57) and instruct students to listen carefully for this concern, as well as why it is a concern.
- When the video is complete, summarize the security concerns that the Internet of Things presents. Lead a discussion about the importance of protecting your privacy when you're online. Privacy includes information about who you are *and* what you do. While you may not directly give this information to an Internet of Things device, it's important to consider the information that it collects!
- Pair each group with another group, and pass out a couple copies of the Security Discussion Questions to each group. Review the handout's instructions, and then allow time for groups to share their devices with each other and answer the security questions together.
- Next, encourage a few groups to share their designs and explain how they will alter them based on the feedback they received.
- Congratulate students on successfully kicking off their very first Internet of Things product. Then guide them in a culminating discussion around the benefits and risks of the Internet of Things.
- Conclude the activity by reminding students that though technology makes lives easier and more connected, it is also always important to be aware of the information that you share online or that shows up on your connected devices and make decisions that protect your personal privacy.

Standards

Next Generation Science Standards:

- Engineering Design
 - 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.
 - Disciplinary Core Idea: ETS1.B: Developing Possible Solutions
 - At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)

Standards for Technological Literacy (ITEAA) Standards:

- Standard 1: Students will develop an understanding of the characteristics and scope of technology. In order to comprehend the scope of technology, students should learn that:
 - E. Creative thinking and economic and cultural influences shape technological development.

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- F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.
- Standard 2: Students will develop an understanding of the core concepts of technology. In order to comprehend the core concepts of technology, students should learn that:
 - P. Technological systems can be connected to one another
- Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology. In order to recognize the changes in society caused by the use of technology, students should learn that:
 - B. When using technology, results can be good or bad.
 - C. The use of technology can have unintended consequences.
 - E. Technology, by itself, is neither good nor bad, but decisions about the use of products and systems can result in desirable or undesirable consequences.

Common Core English Language Arts Standards

- Speaking and Listening:
 - CCSS.ELA-LITERACY.CCRA.SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Step 1: Work with your partner/group to brainstorm some non-tech products that you use in your daily life. Then think about a problem that could be solved if this thing joined the Internet of Things! Record your ideas in the chart below:

Non-Tech "Thing"	What does this product do now?	What problem could be solved if this "thing" joined the Internet of Things? Be creative!
For example: Pencil	Pencils give people a tool to write with. People can use pencils to write on paper and erase their mistakes.	People make many spelling mistakes, so maybe this pencil could help us become better spellers!

Step 2: Choose your favorite idea from above. Below, describe at least one other device that your device could communicate with *and* the information it would share.

Connected Device	What information will it communicate in order to solve your problem?
For example: smartphone	The pencil will keep track of the user's spelling mistakes. It will then send this data to a spelling app on the smartphone, so the user can play games to learn the spelling words.

Step 3: Below, draw diagrams that show how your new Internet of Things device will work and solve your problem. Use words to explain your drawings, and include enough detail so that a programmer could use these diagrams to write code for your device!

My device looks like this:

(Be sure to label all of its important parts!)

When my device is turned on, it...

(What does it do? What data or information about your problem will it need to collect?)

My device then uses the internet to:

(What else does it connect to, and what information does it send? In other words: How does it use the internet to help solve your problem?)

As a result:

What problem is solved *because* your device is able to send information (data) over the internet?)

Security Discussion Questions

It's important to *always* be careful about the type of information that we share over the Internet. Review the Internet of Things device that your peers created. Then discuss and record:

- What data is shared?

- Is it okay for someone else to have access to this data? Why or why not?

- Could you change anything about this object's data collection to make it safer or more secure?

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