

Overview

During this lesson, students will consider the pros and cons of technology for specific individuals. Students will relate their learning to the needs of hearing impaired individuals considering how to optimise a doorbell for their use. Students will integrate and exhibit learning by designing a smart doorbell that features light and sound and can be reset.

Key Information

Level 2: (Ages 9-10) US Grades 3 or 4

Time: 45/90 minutes

Warm-Up	5 minutes
Mini-lesson	10 minutes
Worked Example	7 minutes
Challenge 1	7 minutes
Challenge 1 - Debug	5 minutes
Challenge 2	7 minutes
Tidy Up / Exit Ticket	4 minutes

Lesson Topics

- **Science**
 - A system can be described in terms of its components and their interactions
- **Engineering Design**
 - Constructing explanations and designing solutions
 - 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
 - People's needs and wants change over time, as do their demands for new and improved technologies
 - Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands
- **Computing**
 - Understand that a program is executed by following very precise instructions
 - Variables as containers that can permanently or temporarily hold data of different types of information including linear algorithms
- **English Language Arts**
 - Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text
 - Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided

Learning Objectives

- **As a result of this lesson, students will be able to**
 - Compare factual information to develop an informed viewpoint/s
 - Speak factually and persuasively to support their viewpoint/s
 - Design a smart doorbell which meets a real world need
 - Consider how to optimize their design to meet design constraints

Materials

- SAM Labs Kit
- SAM Labs Student Workbook

Warm Up - Scientific Investigation

5 minutes

Does technology help or hinder people?

Objective: Students consider if technology helps or hinders hearing impaired individuals.

Procedures: The teacher shows a clip from this [video](#) while students gather factual information from the video to support each argument:

- *I believe technology helps hearing impaired individuals...*
- *I believe technology hinders hearing impaired individuals...*

Video



Link forward: The teacher facilitates a discussion which support students to consider whether technology helps or hinders hearing impaired individuals

Mini-lesson

10 minutes

Does technology help or hinder people?

Objective: Students compare viewpoints, considering the most persuasive arguments to the question does technology help or hinder people.

Procedures: The teacher leads the class through a brief discussion asking students to identify the most important facts to support each argument. The teacher then takes a poll, asking students which viewpoint they thought was most persuasive and why. The teacher may also designate a side of the room which represents each viewpoint. Students can orient themselves in the room according to how strongly they agree or disagree with the viewpoint.

At the end of the mini-lesson, students can match or define keywords in their workbooks (2 minutes).

Keywords


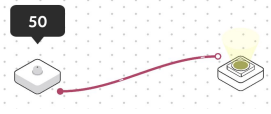
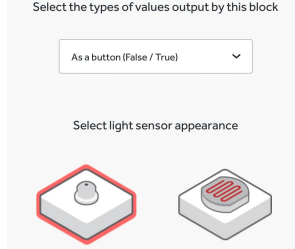
- Deaf
- Culture
- Cochlear implant
- Sign language

Link forward: Students design a smart doorbell for hearing impaired individuals

Worked Example

5 minutes

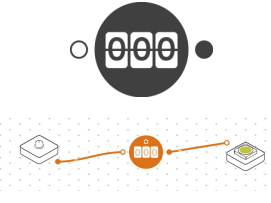
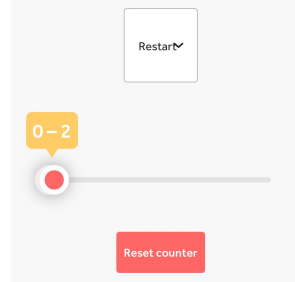
Select a button to activate your smart doorbell

Instructions	Workspace	Notes for Teachers
Step 1. Turn on and pair: <ul style="list-style-type: none"> 1 Light Sensor block 1 RGB LED block 		<p>Teacher says, "What's one way we can alert our hearing impaired friends that someone is at the door?" (Hint: use a light instead of a sound)</p> <p>"Let's set up the basics of our system, activating our doorbell"</p> <p>(This worked example should be familiar to students who have designed systems using SAM Labs)</p>
Step 2. Drag the Light Sensor and RGB LED onto the Workspace and connect them.		<p>Teacher says, "Our Light Sensor needs to act as a button, turning our system on and off..."</p>
Step 3. Select the settings icon and turn the Light Sensor into a button.		<p>Teacher says, "Is there any other way to turn on the system? What other blocks could work?"</p> <p>(At this point, some students may opt for an alternative way to turn the system on--and that's ok! Encourage creativity, trial and error)</p>

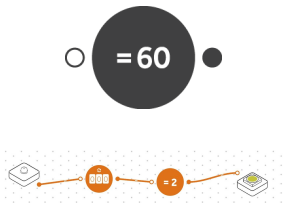
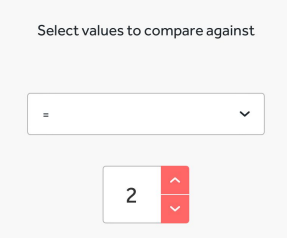
Challenge 1

7 minutes

Design a smart doorbell that can alert a hearing impaired individual that someone has arrived

Instructions	Workspace	Notes for Teachers
Step 1. Add the Counter block between the Light Sensor and the RGB LED.		<p>Teacher says, "Let's optimize our system by adding a Counter Block between the Light Sensor and RGB LED."</p> <p>"The Counter block let's us select a specific number which activates our system... in this case the number of times the doorbell is rang."</p>
Step 2. Set the Counter block to 'Restart' and '2'. Test it!		<p>Teacher says, "Let's set the Counter to 2, ensuring it's on Restart"</p> <p>"Test it.. is it working?" (Sometimes the RGB LED brightness needs to be reset when adding functions to a system)</p>

Lesson 2.5 - Smart Doorbell

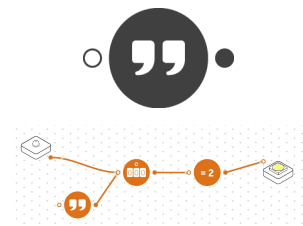
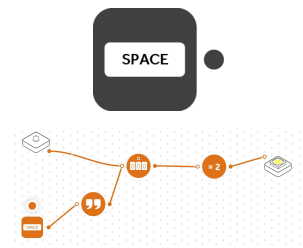
<p>Step 3. Add the Compare block between the Counter and the RGB LED.</p>	<p>Compare</p> 	<p>Adding the Compare block ensures a specific value turns the doorbell on or off, it's also a nice way to incorporate mathematics.</p>
<p>Step 4. Set the Compare block to '=' and '2'. Test it!</p>		<p>Here you can encourage students to set the light to an easily recognizable color. Which color is best?</p> <p>Set students up to debug by asking "How do we reset the doorbell? And, can we make the light more noticeable?"</p>

Checks for understanding: How do the counter and compare blocks work together in our system? What light color is the brightest under most conditions?

Challenge 1 - Debug it

5 minutes

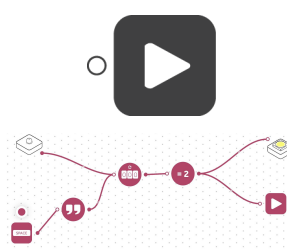
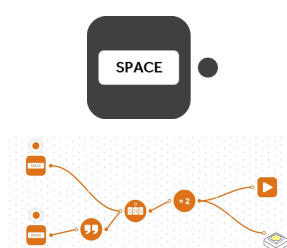
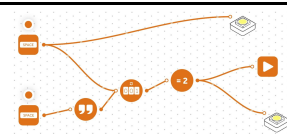
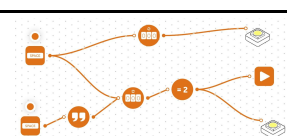
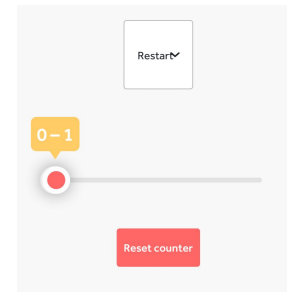
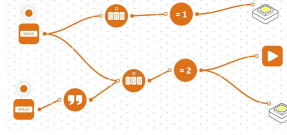
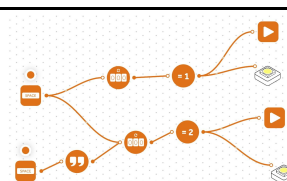
How can we reset the system?

Instructions	Workspace	Notes for Teachers
<p>Step 1. Connect Text block to the Counter block. Open the Text block settings icon. Type the word 'reset' (lowercase) into the field.</p>	<p>Text</p> 	<p>The text block sends a 'text' command to the system. In this case, the text command of 'reset' will resets it.</p>
<p>Step 2. Add a Key Press block as the input to control the system. Test it!</p>	<p>Key Press</p> 	<p>Encourage students to work through the debug individually and to explain their solutions to one another chronologically (as a linear algorithms). You can model this by sharing solutions, "first... second... third..."</p>

Challenge 2

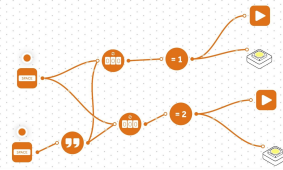
7 minutes

Optimize your smart doorbell to work for both hearing and non-hearing impaired individuals
- be creative!

Instructions	Workspace	Notes for Teachers
Step 1. Add the Sound Player as an output to the Compare block. Test it!	<p>Sound Player</p> 	<p>Teacher says, "Let's assume this doorbell is for our school so it should operate for hearing and non-hearing impaired individuals.... Let's add sound."</p> <p>The doorbell sound is the default sound, you may ask students to choose another school-friendly sound.</p>
Step 2. Replace the Light Sensor with a Key Press. Connect the Key Press to the Counter block.	<p>Key Press</p> 	<p>Teacher says, "For those of you who using the Light Sensor to turn your system on....let's try another input..... Let's replace the Light Sensor with the Key Press."</p>
Step 3. Add a virtual RGB LED to the Workspace. Connect it to the Key Press.		<p>At this point, you can choose to open the remainder of the challenge up to the creativity of your students. You might say, "You have 3 minutes to build a solution that 1) plays a sound and 2) lights up after the doorbell is pressed once and 3) can reset after 1 interval."</p> <p>Alternatively, you can support students to complete the remaining steps which replicate (and solidify) previous learning.</p>
Step 4. Add the Counter block between the Light Sensor and the RGB LED.		
Step 5. Set the Counter block to 'Restart' and '1'.		
Step 6. Add the Compare block between the Counter and the RGB LED. Set the Compare block to "=" and '1'.		
Step 7. Add the Sound Player as an output to the Compare block.		

Lesson 2.5 - Smart Doorbell

Step 8. Connect the Text block to the Counter so you're able to reset the system. Test and present it!



If there's time, encourage students to present their solutions to the class/one another. Encourage them to present their system in a linear fashion using computing terms. Eg. "The doorbell is rang by Key Press which sends a boolean true to the Counter block..."

Checks for understanding: *What is the function of the Text block in our system? What are the main outputs of our system?*

Tidy Up / Exit Ticket

4 minutes

Reinforcing the learning objectives of the lesson, students can reflect on key takeaways by completing and submitting an exit ticket.