



TeachEngineering

Mindful Messages: Engineering Communication Solutions



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EDUCATIONAL 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.

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

3-5.OA- Operations and Algebraic Thinking

LEARNING OBJECTIVES

- **Understand the role of the brain in communication.**
- **Define a design problem related to communication.**
- **Generate and compare multiple solutions.**
- **Plan and conduct fair tests to improve a prototype.**
- **Use a micro:bit to create a communication tool.**

ACADEMIC VOCABULARY

<i>communicate</i>	<i>To send or receive a message.</i>
<i>sound</i>	<i>Noise caused by an object vibrating.</i>
<i>light</i>	<i>Allows us to see objects in the dark.</i>
<i>message</i>	<i>Information that is sent or given to someone.</i>
<i>computer programming</i>	<i>The process of giving a computer instructions in a language it can understand; also called coding.</i>
<i>transmit</i>	<i>To send from one place to another.</i>
<i>microchip</i>	<i>The brains of electronic devices; they send and receive patterns that help our electronics work.</i>
<i>engineer</i>	<i>Someone who designs, builds, and tests things to solve problems.</i>

ACADEMIC VOCABULARY

<i>engineering</i>	<i>Using science and math to creatively solve problems.</i>
<i>design</i>	<i>A sketch, model, or plan for something.</i>
<i>problem</i>	<i>A challenge that needs a solution.</i>
<i>solve</i>	<i>To find a solution to a challenge or problem.</i>
<i>improve</i>	<i>To make something better.</i>
<i>test</i>	<i>To check to see if something is working.</i>

PRE-ACTIVITY ASSESSMENT

- **What happens in our brain when we talk or write?**
- **Why is communication important for solving problems?**
- **Name a tool that helps people with hearing loss communicate.**

INTRODUCTION

- What happens in our brain when we talk or listen?
- What happens in our brains when we read or write?
- Why do you think communication is essential for solving problems?
- Can you think of any examples?

INTRODUCTION

- What challenges do people with hearing impairments face? How do they overcome them?
- What challenges do people with language barriers face? How do they overcome them?
- What challenges do people have in a noisy environment? What do they do in that situation?

COMMUNICATION CHALLENGES AND POSSIBLE SOLUTIONS

Communication Challenge	Possible Solution

QUESTIONS ABOUT HOW THE BRAIN HELPS US COMMUNICATE

- How does sign language work?
- What's the best way to learn a new language?
- How do hearing aids work?
- Other questions:

Videos

OPTIONAL VIDEOS

- **Generation Genius (Subscription required)**
 - **What is Engineering?** - <https://www.generationgenius.com/videolessons/what-is-engineering-video-for-kids>
 - **Engineering Design Process** - <https://www.generationgenius.com/videolessons/engineering-design-process-video-for-kids>
 - **Brain Processing of Senses** - <https://www.generationgenius.com/videolessons/senses-video-for-kids>
 - **Communication Over Distances**- <https://www.generationgenius.com/videolessons/communication-over-distances-video-for-kids>
 - **Information Transfer** - <https://www.generationgenius.com/videolessons/information-transfer-video-for-kids>

OPTIONAL VIDEOS

- **BrainPop (Subscription required)**
 - **Engineering and Design Process (Lower level) -**
<https://jr.brainpop.com/topic/engineering-and-design-process>
 - **Listening and Speaking -** **<https://jr.brainpop.com/topic/listening-and-speaking>**
 - **Engineering Design Process (Higher level) -**
<https://www.brainpop.com/topic/engineering-design-process>
 - **Computer Programming -**
<https://www.brainpop.com/topic/computer-programming>

OPTIONAL VIDEOS

- **YouTube**

- **What's an Engineer? Crash Course Kids #12.1 -**
<https://www.youtube.com/watch?v=owHF9iLyxic&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=1>
- **The Engineering Process: Crash Course Kids #12.2 -** <https://www.youtube.com/watch?v=fxJWin195kU>
- **Defining a Problem: Crash Course Kids #18.1 -**
<https://www.youtube.com/watch?v=OyTEfLaRn98&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=3>
- **Defining Success: Crash Course Kids #18.2 -**
<https://www.youtube.com/watch?v=XyFUqFQfI30&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=4>
- **Got Some Solutions?: Crash Course Kids #26.1 -**
https://www.youtube.com/watch?v=WGESd7O4_Uk&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=5

OPTIONAL VIDEOS

- **YouTube**

- **Try Trials: Crash Course Kids #39.2 -**

<https://www.youtube.com/watch?v=3X9lnUAjIGM&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=10>

- **Succeed by Failing: Crash Course Kids #42.1 -**

<https://www.youtube.com/watch?v=TcUX6eNT2j4&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=11>

- **Fixing Failure Points: Crash Course Kids #42.2 -** <https://www.youtube.com/watch?v=0OtbV8-Mdr4&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=12>

- **Designing a Trial: Crash Course Kids #44.1 -**

<https://www.youtube.com/watch?v=eB7GTjAFaE4&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=13>

- **Testing and Trials: Crash Course #44.2 -**

<https://www.youtube.com/watch?v=8Uznr8uiVh0&list=PLhz12vamHOnZ4ZDC0dS6C9HRN5Qrm0jHO&index=14>

Engineering Design Process

IDENTIFY THE NEED & CONSTRAINTS

Criteria:

- ❑ **Functionality:** The communication tool must effectively perform its intended function.
- ❑ **Clarity:** The message or signal should be clear and understandable.
- ❑ **User-Friendliness:** The design should be easy to use and interact with, requiring minimal instructions.
- ❑ **Creativity:** The solution should be innovative and demonstrate original thinking in addressing the communication problem.
- ❑ **Reliability:** The prototype should work consistently during tests, without frequent failures.
- ❑ **Instructions:** There must be detailed instructions for another person/group to read to be able to use your device. If you use a code, then that needs to be included as well.

IDENTIFY THE NEED & CONSTRAINTS

Constraints:

- Must use a micro:bit.
- Materials: Any of the provided materials that fit within your budget.
- Time: You have ___ hours/minutes to complete the entire project.
- Budget: You have \$___ to use on the provided materials.
- Group size: Must have at least 3 students, with a max of 5.

RESEARCH THE PROBLEM

You may Google or look up background information about your need/problem. You can look up what products or solutions already exist. You can look up what technology is already created that you can modify to fit your needs. You can also research micro:bits and see what code or tutorials are already available. Use this space to keep track of your research.

IMAGINE: DEVELOP POSSIBLE SOLUTIONS

Brainstorm multiple solutions (at least three) to your problem. You will sketch your ideas and discuss the pros and cons of each solution.

PLAN: SELECT A PROMISING SOLUTION

Revisit your need, constraints, criteria, and research from the earlier steps, compare the best ideas, select ONE solution, and make a plan to move forward with it. Do not forget to write out what supplies and materials you will need to build it. You need to draw a diagram of your prototype and label it with what supplies will be used.

CREATE: BUILD A PROTOTYPE

Building a prototype makes your ideas real! These early versions of the design solution help your team verify whether the design meets the original challenge objectives. Push yourself for creativity, imagination, and excellence in design. There should be three parts to building the prototype. Check off each one once it is completed.

- Construction: Build your prototype using the micro:bit and other materials that you purchased for your design.
- Programming: Program the micro:bit to perform the necessary functions for your communication tool.
- Instructions: Create easy-to-understand instructions on how to use your prototype.

TEST AND EVALUATE PROTOTYPE

Test your prototype to make sure it works and solves the need/problem. Have each person in the group test it and give their feedback on how it went. Talk as a group about what worked, what did not work, and what could be improved.

IMPROVE: REDESIGN AS NEEDED

Make revisions. Draw new designs if needed. Try out other materials if the ones you originally had did not work. You may test and improve as many times as needed, or until your time is up.

PRESENTATION,
REFLECTION, EXTENSION,
AND ASSESSMENT

PRESENTATION

Each group will present their problem, solution, and the process they followed to the class. Students can also try out other groups' prototypes, but be sure to be careful with them.

REFLECTION

- What was the biggest challenge you faced during the project, and how did you overcome it?
- How did working with your group members help you in completing the project?
- Describe a new idea or insight you gained about communication and its importance through this activity.
- How did using the micro:bit enhance your design and communication tool?
- If you had more time or resources, what additional features or changes would you make to your prototype?

EXTENSION ACTIVITIES

- **Research Project:** Students could research historical communication tools and compare them to modern technology.
- **Guest Speaker:** You could invite a neuroscientist or engineer to talk about real-world applications of communication technology.
- **Language Diversity:** Explore different languages and how the brain processes them, discussing multilingual communication tools.

POST-ACTIVITY ASSESSMENT

- 1. What is the primary role of the brain in communication?**
 - A) To send signals to the muscles
 - B) To process and understand spoken and written language
 - C) To regulate heart rate
 - D) To control breathing
- 2. Which part of the micro:bit can be used to display text or messages?**
 - A) The LED matrix
 - B) The radio feature
 - C) The buttons
 - D) The sensors
- 3. When designing a solution, why is it important to consider constraints such as materials and time?**
 - A) To make the project easier
 - B) To ensure the design is feasible and realistic
 - C) To limit creativity
 - D) To use up all available resources
- 4. Describe one way you tested your prototype to make sure it worked properly.**
- 5. What is one improvement you made to your prototype based on the testing results? Explain why this improvement was necessary.**