

STORYLINE: 1.3.4 Storyline Title

Strand 1.3:

Sound can make matter vibrate, and vibrating matter can make sound. Objects can only be seen when light is available to illuminate them. Some objects give off their own light. Some materials allow light to pass through them, and still others block light and create a dark shadow on the surface beyond them where the light cannot reach. Mirrors can be used to redirect light. People use a variety of devices that may include sound and light to communicate over long distances.

Standard 1.3.4 Design a device in which the structure of the device uses light or sound to solve the problem of communicating over a distance. Define the problem by asking questions and gathering information, convey designs through sketches, drawings, or physical models, and compare and test designs. Examples of devices could include a light source to send signals, paper-cup-and-string telephones, or a pattern of drum beats. (PS4.C, ETS1.A, ETS1.B, ETS1.C)

Phenomena Statement: A car pulls over when an ambulance drives by.

Expected Student Explanation: Light or sound can be used to communicate messages to other people over distances.

Science & Engineering Practices (SEP)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions. Use tools and materials provided to design a device that solves a specific problem.

Crosscutting Concepts (CCC)

Structure and Function

The shape and stability of structures of natural and designed objects are related to their function(s)

Disciplinary Core Ideas (DCI)

PS4.C: Information Technologies and Instrumentation

People also use a variety of devices to communicate (send and receive information) over long distance

Storyline Narrative	Documents for Storyline
To begin the 1.3.4 storyline, students will be engaged in the phenomenon cars pull over when an ambulance drives by. Students will define the problem and what is <u>causing</u> the cars to pull over. Students then obtain information about different devices and their <u>function</u>, to communicate using light and/or sound. Then they construct explanations about how different devices <u>function</u> to communicate over distances. Students discuss what some of the advantages and disadvantages are to each design. They use this information to construct explanations about the <u>patterns</u> of when light and sound are used to communicate information over a distance. Students then are given a design challenge to send a message over a distance. Students define a problem where information is not getting to another because of distance. They then determine what are the criteria and constraints for this problem. Students then design a solution to the problem they have defined. Students then develop a model of their solution's <u>structure</u> that uses light or sound to communicate a message over a distance. Students then develop an argument for how their <u>structure</u> is a solution to the problem they defined. Students finally communicate their argument for their solution by presenting their device to the class.	Review and/or print out the following documents for this storyline. To edit the following documents you must open, then make your own copy. Links: • Storyboard Slides - episode instructions are in the slide notes • Student Journal - or use composition notebook • Supply List - complete list of supplies needed for each episode • Teacher prep to begin two weeks prior to starting storyline

STORYLINE: Episodes Matrix				
Episode	Phenomenon	Episode Descriptions & Student Performance Prompts	Conceptual Understandings	
			What We Figured Out	Next Questions or Steps
Engage/Explore/Explain Time: 20-25 minutes	Cars pull over when an ambulance drives by.	Gather- 1. Students define the problem and determine what <u>causes</u> the cars to pull over. 2. Students obtain information from videos about the <u>structure and function</u> of the devices used to communicate using light and sound. <i>Teaching suggestions: Show video. Stop the video at 33 seconds. Hold a short discussion using the questions below. Play the remaining portion of the video. Ask students the same questions.</i>	Light and sound are used to communicate messages to other people who are far away.	How can we use light and sound to solve a problem in our classroom?

- *What patterns did you notice in the video?*
- *How did the lights and sound communicate a message?*
- *What problems did the devices solve?*
- *Are there other messages you are familiar with that are sent by sound or light?*

Reason-

3. Students **construct explanations** about the function of devices that use light and sound to communicate over a distance.

(Teaching suggestions: Have the students discuss how they know what a sound means.)

Possible questions to initiate class discussion:

- *How did these devices communicate a message?*
- *How do you know what these messages mean?*
- *How does the device use light or sound to reach across a distance?*

Teaching suggestion: Discuss what are some advantages and disadvantages to each design.

- *When would we want to use a sound instead of light to communicate? Light instead of sound?*

4. Students **construct explanations** for the patterns of light and sound used to communicate information over a distance.

Possible questions to initiate class discussion:

- *How are these devices the same?*
- *How are they different?*
- *What is the purpose of devices like these?*
- *How do these devices communicate?*
- *What patterns did you see/hear?*

Communicate-

		5. Students evaluate and communicate information to discuss <u>structures</u> of devices that use light and sound to communicate information over a distance using light. <i>Teaching suggestions: Ask the students if they could redesign the traffic signal how would they communicate how someone should stop, go, or slow down using only light.</i>		
Elaborate/ Evaluate Time: 60 minutes Can be broken up over smaller chunk of time	Problem: Design a structure that uses light or sound to solve a communication problem defined by you. <i>The problem will be defined as a class, but will be along these lines.</i>	Gather- 1. Students define problems to plan a <u>structure</u> of their design to send a message. <i>Teaching suggestions: Have students come up with a problem they see where students are not getting information across a distance. For example, they want to send a message to a friend who lives across the street, or the teacher needs to call students to attention from anywhere in the classroom.</i> <i>Set the criteria for their solutions:</i> • <i>it must use light or sound to communicate</i> • <i>recipients must understand the message</i> • <i>the solution must work across the determined distance</i> <i>Review the constraints for their solutions:</i> • <i>Show students available materials to use. These may be a variety of materials: flashlights, paper cups, string, balloons, boxes, sticks, paper</i> Reason- 2. Design a <u>structure</u> that will use light or sound to communicate a message over a distance. <i>Give students a couple of minutes to brainstorm ideas on what they could design to send this information. They can work on ideas on their own for a few minutes then share ideas. Make sure students are following the criteria and constraints of the problem.</i>	There are many ways sound or light can be used to send messages to other people.	I can test my idea to communicate with sounds or light.

Questions to help students design a solution:

- *What message are you trying to convey?*
- *How will you send your message?*
- *How will this design send the message over the distance?*
- *What materials will be useful?*
- *How will others know what the message means?*

3. **Develop a model** of their solution's structure that uses light or sound to communicate a message over a distance.

Students should draw a picture of the device. They should include the materials that the device will use. They should also show how the device will send a message over a distance. In addition, models should explain how recipients will know what a message means (for example, green light means go, red light means stop). Encourage students to add labels to their models.

Materials: Timer

Flashlights, paper cups, String, Balloon, Boxes, Sticks, Paper, Sticks, Drums, etc

Questions to help students develop their models:

- *How will the device work?*
- *How will it use light/sound to communicate?*
- *How do the materials used help to send the message?*
- *How will others know what the messages mean?*

4. Students **develop an argument** for how the structure of their device is a solution to their defined problem.

Students will share their design with others. Ask students to explain how their design works and how it solves the problem. Students should also provide feedback to one another for improvement.

		<i>Questions to ask students:</i> • <i>Why do you think sound/light is the best way to send this message over a distance?</i> • <i>How does the structure of this device communicate the message?</i> • <i>Do you agree or disagree with the design of this device?</i> • <i>What suggestions would you offer to improve this device?</i> <i>Allow students make improvements to their design.</i> Communicate- 5. Students communicate information to explain the <u>structure</u> of sounds to communicate over a distance. <i>Teaching suggestions: Students can present their device to the class or explain to you through an interview. They should be able to explain the following:</i> • <i>What problem the device solves & the message it is sending.</i> • <i>How sound/light sends the message.</i> • <i>How recipients know what the message means.</i> <i>This explanation will be used as the summative assessment for the storyline.</i>		
Summative Assessment		Students communicate their argument for their <u>structure</u> and how it uses light or sound to communicate over a distance as a solution to the defined problem. Use the design solutions from the previous episode. <i>(Teaching suggestions: Students explain the structure of the device and how their device is able to communicate the message they want to send. Students explain how light/sound communicates the message across distance.)</i>		

Formative Assessment		1.3.4 USBE Formative Assessment		
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