Lesson 4.4
End-of-Unit Assessment
Students’ Explanations

In this final lesson of the unit, students send and receive messages for the purpose of learning about how digital devices use binary code to transmit information. Using the Communication Plans they created in the previous lesson, students send binary codes to group members across the classroom. Students who receive those codes decode them using the Code Communicator Tool. Students compare their decoded images with the original images that were sent to them, to assess their accuracy. Then, students reflect on the efficiency of using binary code for communicating messages across distances. Finally, students engage in a writing task that serves as the End-of-Unit Assessment. The End-of-Unit Assessment is designed to reveal students’ understanding of unit-specific science concepts, the crosscutting concept of Patterns, and the practice of constructing explanations. For this independent writing task, students draw upon their knowledge of how sound waves and digital devices are used for communication. This lesson gives students more experience with using binary code to communicate, enables them to demonstrate their knowledge of sound and patterns in digital communication, and offers them the opportunity to reflect on the unit.

Anchor Phenomenon: Human communication
Investigative Phenomenon: Maria was surprised by music from a computer.

Students learn:

- Humans use patterns to communicate information and use technology to communicate those patterns across long distances.
Students are introduced to the second part of the Code Challenge. Pairs send and receive encoded messages across the classroom.

Instructional Guide

1. Introduce the second part of the Code Challenge.

Today you will complete the second part of the Code Challenge: sending and decoding images, using binary code—similar to the way digital devices do.

2. Have students review their Communication Plans. Have students turn to page 94, Communication Plan, in their notebooks and look over the Communication Plans they recorded in the previous lesson to remind themselves of what they planned to do.

Your challenge for today is to send your message across the room, using binary code and the method you decided on in your Communication Plan. One pair of students in each group will send their message first, and the other pair will receive and decode it. Then, you will switch roles.

3. Project notebook. Have students turn to page 96, Code Challenge Part 2: Sending and Decoding Images, in their notebooks. Review the directions with students.

- Senders and receivers stand on opposite sides of the room.
- Senders: Partner A reads the binary code from page 92 to Partner B. Partner B sends the code across the room.
- Receivers: Partner A watches for the code from the senders. Partner B enters the code into the Code Communicator Tool.
- Be sure to keep the image you received on your screen to show the rest of your group later.
- Senders and receivers switch roles.
4. Project the Code Communicator Tool and demonstrate what receivers will do. Go to the Code Communicator Tool and show students how to record codes in the Decode mode, using the Live Code option.

- Press DECODE.
- Under Black and White Image Large, press LIVE CODE.
- Make sure the Show Colors toggle is turned off.
- Have a student read you the first seven digits of the binary code for her pair’s image. As the student reads the code aloud, press 0 or 1 for each square in the first row of the grid, starting with the top-left square.
- Turn on the Show Colors toggle to reveal the decoded image.

5. Distribute digital devices. Distribute one digital device to each pair of students.

6. Arrange groups so pairs are standing across the room from one another. Make sure each pair has a digital device and their notebooks. Indicate, or have students quickly select, which pair in their group will start as the senders and which pair will start as the receivers.

7. Have students send and receive messages. Have students begin sending and receiving the binary codes for their images. As students are working, remind them to keep the images they received on their screens so they can compare them with the original images later.

8. Signal for pairs to switch roles. Make sure there is time for both pairs in each group to send and receive messages.

9. Conclude the activity. Make sure pairs have finished sending messages and then have them sit with their group members.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection
What have you learned about how digital devices send messages across long distances? What questions do you still have? This prompt (on page 95 in the Investigation Notebook) asks students to think about what they have learned over the past few lessons and to consider what else they would like to know about digital devices and communication.

Instructional Suggestion

Classroom Management: Find a Large Space for the Code Challenge
If your classroom is small, you may want to find a larger space, such as a playground or multipurpose room, for students to complete the Code Challenge. This will allow students to spread out so that it will be more difficult to see and hear one another as they send their codes.
Instructional Suggestion

Providing More Support: Review Communication Plans
You may want to have students spend more time reviewing their Communication Plans (on page 94 in the Investigation Notebook) before they begin sending and receiving messages so that they are prepared and remember what they planned to do. You can use the opportunity to check in with students who might need more support figuring out a method for sending their messages and offer suggestions if needed.

Possible Responses

Code Communicator Tool: Decode mode

What students should do and notice:
In the Decode mode of the Code Communicator Tool, students use the Live Code option to receive and decode images that their group members made and encoded in the previous lesson. Because students are receiving encoded images that other students made, their decoded images will vary. The accuracy of the decoded images will also vary depending on the accuracy of the code transmission and reception. This experience supports students’ understanding of how binary code can be useful for communicating information. It also shows students the importance of accuracy when using codes to communicate information.
Code Challenge
Part 2: Sending and Decoding Images

1. Senders and receivers stand on opposite sides of the room.
2. Senders: Partner A reads the binary code from page 92 to Partner B. Partner B sends the code across the room.
3. Receivers: Partner A watches for the code from the senders. Partner B enters the code into the Code Communicator Tool.
4. Be sure to keep the image you received on your screen to show the rest of your group later.
5. Senders and receivers switch roles.
Completing the Code Challenge

Students are introduced to the second part of the Code Challenge. Pairs send and receive encoded messages across the classroom.

Instructional Guide

1. Introduce the second part of the Code Challenge.

- Hoy terminarán la segunda parte del Reto de códigos: enviar y decodificar imágenes, usando el código binario, de manera similar a como lo hacen los aparatos digitales.

2. Have students review their Communication Plans. Have students turn to page 94, Communication Plan, in their notebooks and look over the Communication Plans they recorded in the previous lesson to remind themselves of what they planned to do.

- Su reto para hoy es enviar su mensaje a través del salón, usando el código binario y el método que acordaron en su Plan de comunicación. Una pareja de estudiantes en cada grupo enviará su mensaje primero, y la otra pareja lo recibirá y decodificará. Luego, intercambiarán roles.

3. Project notebook. Have students turn to page 96, Code Challenge Part 2: Sending and Decoding Images, in their notebooks. Review the directions with students.

- Senders and receivers stand on opposite sides of the room.
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8. Signal for pairs to switch roles. Make sure there is time for both pairs in each group to send and receive messages.

9. Conclude the activity. Make sure pairs have finished sending messages and then have them sit with their group members.

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Desafío de los códigos
parte 2: enviar y descodificar imágenes

1. Los emisores y los receptores se paran en lados opuestos del salón.
2. Emisores: el/la compañero/a A lee el código binario de la página 92 al/la la compañero/a B.
3. Receptores: el/la compañero/a A espera el código de los emisores. El/La compañero/a B introduce el código en la herramienta “Code Communicator” (comunicadora de códigos).
4. Asegúrate de mantener la imagen que recibiste en tu pantalla para mostrarla al resto de tu grupo más tarde.
5. Los emisores y los receptores intercambian posiciones.