Lesson 4.2
Patterns in Codes
Lesson Overview

In this lesson, students deepen their understanding of patterns in human communication by focusing on codes. Students discuss the various codes they read about in *Patterns in Communication*, and they think of codes they have observed or used in everyday life. Then, the teacher sends an image to students, using binary code. Students compare the experience of re-creating the teacher’s image with the activity they did in the previous lesson and reflect on how using binary code makes communication easier. Finally, students explore the Code Communicator Tool—an app they will use throughout the rest of the chapter to encode and decode information. The purpose of this lesson is to help students see how humans use codes, particularly binary code, to communicate information efficiently.

Anchor Phenomenon: Human communication

Students learn:

- A code is a pattern of symbols.
- Binary code can be used to transmit information easily because it only has two symbols.
- Digital devices use binary code.
Exploring the Code Communicator Tool

Model how to use the Code Communicator Tool. Students explore the features of the app.

Instructional Guide

1. Introduce the activity.

You will now get to explore an app called the Code Communicator Tool. This tool is a model of how digital devices use binary code. As you explore it, think about what you know about how digital devices use binary code.

2. Project the Code Communicator Tool. Go to the Student Apps Page. Show students how to open the Code Communicator Tool.

The app allows you to do two things: encode an image into binary code and decode an image that is sent in binary code.

To encode means to turn information (such as an image, words, or a sound) into code. To decode means to turn code into information that we can understand.

3. Show students how to use the Code Communicator Tool. Explain that students will first choose to either encode or decode. With the app projected, show students how to encode a black and white image, as follows:

- Press ENCODE.
- Under Black and White Image Small, press NEW.
- Make a simple image by selecting the black square at the bottom of the screen and then filling in some squares in the grid.
- Save the image by pressing SAVE CODE.
- Go back to the main menu by pressing HOME, and then press DECODE.
Point out that there are other options students can explore in the tool, including encoding color images, text, and sound. Let students know that they will work with black and white images for the investigations they will do in class, but they can explore the other options if they wish.

4. Distribute digital devices and have students begin exploring the Code Communicator Tool. Distribute one digital device to each pair of students. Circulate to assist students, as needed. After a few minutes, prompt students to switch “drivers” so that both partners can explore the app.

5. Ask students to explain the features they noticed in the Code Communicator Tool. Regain students’ attention and ask them to talk about the different features they noticed. Ask them to think about how this app could help them send and receive information across distances.

6. Ask students how the Code Communicator Tool is similar to the digital devices they use daily. Encourage students to consider if any devices they use can send and receive images, sounds, or text. Remind students that digital devices communicate using binary code.

7. Collect all digital devices and conclude the lesson. Ask students to make sure that their digital devices are turned off.

Teacher Support

Background

Technology Note: Sizing the Code Communicator Tool in Browser Windows
On some devices, the default browser window size may cut off portions of the Code Communicator Tool. Make sure that students enlarge their browser window so that the app is fully visible.

Instructional Suggestion

Providing More Experience: Using Binary Code to Encode and Decode Images
The optional activity on pages 88–89 (Encoding an Image and Decoding an Image) in the Investigation Notebook gives students additional practice with using binary code to communicate information. It is also an opportunity to reflect on how using binary code can be a more efficient way to communicate in certain situations.
Have each student make an image on page 88, Encoding an Image, in the notebook. Assign partners and remind students not to show their images to their partners. Have partners take turns using the Code Communicator Tool to encode their images into binary code and record the code at the bottom of page 88. (Remind the first partner to clear his image before passing the digital device to his partner.) When both partners have recorded their binary codes in their notebooks, have them take turns reading their code to their partner, who will decode the image on page 89, Decoding an Image.

You may suggest that students number the rows of the grid from top to bottom so as to better guide their partners in recording the binary code. After partners have taken turns decoding each other’s images, invite them to reflect on how this activity was different from how they sent their images in the previous lesson. Ask students the following questions: “Was it easier?” “Why was it easier?”

Background

Science Note: Binary Code in the Code Communicator Tool

In digital communications, the basic unit of information is called a bit, which is a single 1 or 0. The Code Communicator Tool uses one bit to encode each pixel in a black and white image, three bits to encode each pixel in a color image, three bits to encode each musical note, and five bits to encode each letter in a text message. Note that the binary code for text is simplified in the Code Communicator Tool. Normally, eight bits are used to encode a character of text; the extra bits allow for communication of capital letters and symbols, which are not included in the Code Communicator Tool. If you want to convert the text messages into standard binary code, simply add “011” (which specifies lowercase letters) directly before the five bits that represent each letter.
Exploring the Code Communicator Tool

Model how to use the Code Communicator Tool. Students explore the features of the app.

Instructional Guide

1. Introduce the activity.

   Ahora van a explorar una aplicación llamada Herramienta comunicadora de códigos. Esta herramienta es un modelo de cómo usan el código binario los aparatos digitales. Mientras la exploran, piensen en lo que saben sobre cómo usan el código binario los aparatos digitales.

2. Project the Code Communicator Tool. Go to the Student Apps Page. Show students how to open the Code Communicator Tool.

   La aplicación les permite hacer dos cosas: codificar una imagen en código binario y decodificar una imagen que es enviada en código binario.

   Codificar significa convertir información (como una imagen, palabras o un sonido) en un código. Decodificar significa convertir el código en información que podemos entender.

3. Show students how to use the Code Communicator Tool. Explain that students will first choose to either encode or decode. With the app projected, show students how to encode a black and white image, as follows:

   - Press ENCODE.
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   - Make a simple image by selecting the black square at the bottom of the screen and then filling in some squares in the grid.
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