Lesson 2: Representing Information

Overview

Using everyday materials, students create devices for sending information to a partner. Each group then uses its device to send an answer to a question. Following this, students modify their devices to answer more complex answers, responding with one of four possible messages, then one of eight possible messages, then one of sixteen possible messages.

Purpose

This lesson introduces the concept of sending bits of information from one place to another. While building and modifying their information sending devices students should eventually recognize that it's easier to invent a system of communication that used a combination of patterns with a simple device, rather than making a new, or increasingly complex device for each new problem. This lays the foundation for understanding how complex information is represented in computers using a combination of bits.

Standards

Full Course Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **DA** - Data & Analysis

Agenda

Lesson Modifications

Warm Up (5 minutes)

Activity (35 minutes)

Information Sending Devices
Challenge #1:
Challenge #2:
Challenge #3:

Wrap Up (5 minutes)

Assessment: Check For Understanding

Objectives

Students will be able to:

- Explain how the same piece of information can be represented in a variety of different ways.
- Use a device to represent different pieces of information
- Use patterns to represent information

Preparation

- Reusable and consumable supplies for the classroom, such as markers, small flashlights, noisemakers, bells, whistles, cups and string, straws, slinkies, blocks, or colored paper.

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the teachers

- **CSP Unit 1 - Digital Information** - Slides

Teaching Guide

Lesson Modifications

 **Attention, teachers!** If you are teaching virtually or in a socially-distanced classroom, please read the full lesson plan below, then click **here** to access the modifications.

Warm Up (5 minutes)

Remarks

> A lot of people think that computer science is the study of computers, like the phone in your pocket or the computer on your desk. As we'll see this year, computer science actually has a lot more to do with information.

Discuss: What is your definition of information?

Have students silently write their own definition, then share with a partner, and finally have some volunteers share with the room.

Discussion Goal: More important than writing a formal definition of information is getting students discussing the term and its diverse forms. If students struggle with defining "information," modify the prompt by asking them to provide examples of information in their world such as texts, books, videos, music, conversations, etc.

Teaching Tip

Reminder: A slide icon indicates there is a corresponding slide in the unit slide deck.

Remarks

> - There are many ways we can think about the word “information,” but one possible definition we’ll explore today is that information is the answer to a question.
> - We're going to investigate what it takes to send that information back and forth to one another.

Activity (35 minutes)

Information Sending Devices

Group: Place students in groups of two.

Distribute: Materials for students to build their binary message devices (straws, scissors, etc.).

Remarks

> Today you are going to build your own device for sending and receiving messages which you will use to answer questions that you write.

Challenge #1:

Journal: Write down a question that has two possible answers.

Do This: Build a device out of classroom supplies to communicate the answer to your question.

- Rules:
  - No projectiles.
  - No language can be used.
    - For example: If my question is "Is your favorite color blue or green?" I can't write the words blue and green on my device.

Do This: After students have completed their devices, choose a few groups to demonstrate their device in action. Students stand on opposite sides of the classroom. One student asks the agreed upon question. The other student uses the device to communicate the answer.

Challenge #2:

Journal: Modify the answer to your question so there are now four possible answers.

Do This: Update your device to communicate one of four possible answers to your question.

Do This: Again, choose groups to demonstrate their updated devices.

Challenge #3:

Journal: Modify the answers to your question so there are now eight possible choices.

Do This: Update your device to communicate one of eight possible answers to your question.

- Consider:
  - Should you modify your device?
  - Can you use it in a different way?
  - Should you make a new device?

Demo: Do a final demonstration of devices before ending the activity.

Teaching Tip

Challenge 1 - Question with 2 Answers: In this activity, avoid the urge to give students a pre-written question or answers without allowing them time to struggle with the challenge. Encourage students to write down in their journal how their device works.

- Example Question: Do you like strawberry or vanilla ice cream?
- Answer: strawberry (move my pencil up and down), vanilla (move my pencil side to side)

Challenge 2 - Question with 4 Answers: Some students may add new ways of answering a question. Others may notice that they can reuse their previous responses, sending those responses in sequences that produce new messages. Avoid the urge to tell them to reuse the device, instead allowing them to explore their own ideas.

Challenge 3 - Question with 8 or More Answers: At this point, students may start to realize that the way their device communicates information is not practical and could not be scaled up if there were for example, a thousand or a million possible answers.

Wrap Up (5 minutes)

Remarks

> Let's wrap up by discussing how you designed your devices and what that means about the questions you can ask and the messages you can send.

Discuss: *Think back to your simple two-option device from Challenge #1. Instead of changing your device and adding more options every time you added more answers, how could you simply modify the way you use your device with only two options?*

Discussion Goal: Focus the discussion on why some groups created devices using unique options for each additional message, while other groups devised plans in which they reused the same device to create new combinations of the original two options.

Ultimately, groups begin to notice that, for example: instead of bending a straw in four different directions, they could simply bend the straw the same two ways multiple times.

- Sample Question: Do you like strawberry, chocolate, vanilla, or peanut butter ice cream?
- Answers: strawberry (bend straw forward once), chocolate (bend straw forward twice), vanilla (bend straw backwards once), peanut butter (bend straw backwards twice)

Assessment: Check For Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.

Question: Recall when you built your information sending device. Why did we decide to send a message as a sequence of two options rather than modifying our devices to represent more options?

For example: Modifications with two options

- bend straw forward once
- bend straw backwards once
- bend straw forwards twice
- bend straw backwards twice

vs.

Four options

- bend straw forward
- bend straw backwards
- bend straw to the left
- bend straw to the right

Check for Understanding