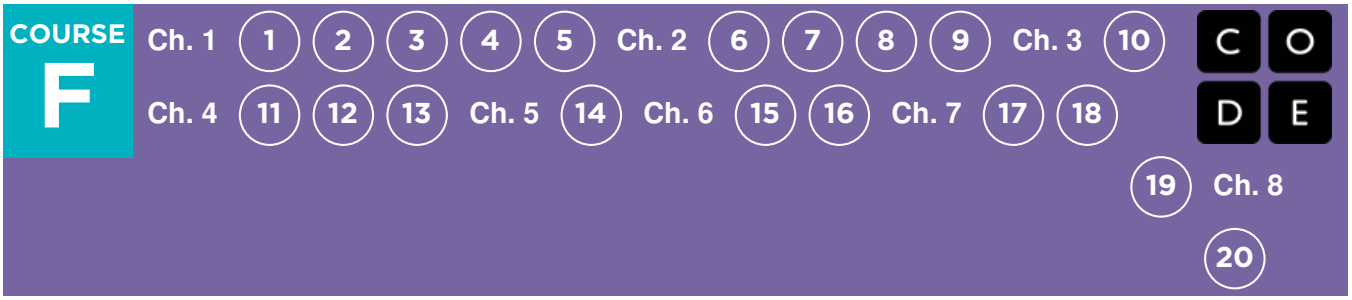


Course F

The last course in CS Fundamentals is tailored to the needs of students in the fifth grade. In these lessons, students will create programs with different kinds of loops, events, functions, and conditionals. They will also investigate different problem-solving techniques and discuss societal impacts of computing and the internet. By the end of the curriculum, students create interactive stories and games that they can share with their friends and family.

Journaling

The lessons in this course include journaling prompts. Journals are also useful as scratch paper for building, debugging, and strategizing. Journals can become a fantastic resource for referencing previous answers when struggling with more complex problems.

Think Spot Journal Student Handout

Debugging

From beginners to professionals, debugging is an essential yet often underrated practice. It is likely that your students will find most of their "coding" time is actually spent fixing bugs! To encourage students to take ownership of this practice, we provide this handy reference they can use while coding. Please consult the "Debugging" section of our CS Fundamentals Curriculum Guide for more information on this, as well as other debugging facilitation strategies for your classroom.

Debugging Guide Student Handout

Chapter 1: Ramp Up

Lesson 1: Functions in Minecraft

Skill Building | Ramp Up

Can you figure out how to use functions for the most efficient code?

Lesson 2: Swimming Fish with Sprite Lab

Skill Building | Ramp Up

Learn how to create and edit sprites.

Lesson 3: Alien Dance Party with Sprite Lab

Skill Building | Ramp Up

Create an interactive project that can be shared with classmates.

Lesson 4: Drawing with Loops

Skill Building | Ramp Up

In this lesson, loops make it easy to make even cooler images with Artist!

Lesson 5: Nested Loops in Maze

Skill Building | Ramp Up

Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you place a loop inside another loop.

Chapter Commentary

Ramp Up

Chapter 2: Variables

Lesson 6: Envelope Variables

Unplugged | Variables

Envelopes and variables have something in common: both can hold valuable things. Here you will learn what variables are and the awesome things they can do.

Lesson 7: Variables with Artist

Skill Building | Variables

Don't forget to bring creativity to class! In these puzzles you will be making fantastic drawings using variables.

Lesson 8: Changing Variables with Bee

Skill Building | Variables

This bee loves variables!

Lesson 9: Changing Variables with Artist

Skill Building | Variables

In this lesson, you'll make drawings using variables that change as the program runs.

Chapter Commentary

Variables

Chapter 3: Data

Lesson 10: Simulating Experiments

Unplugged | Data

Run simulations on the computer and experiment by changing variables.

Chapter Commentary

Data

Chapter 4: For Loops

Lesson 11: For Loop Fun

Unplugged | For Loops

You're going to have loads of fun learning about `for` loops!

Lesson 12: For Loops with Bee

Skill Building | For Loops

Buzz buzz. In these puzzles you will be guiding a bee to nectar and honey using `for` loops!

Lesson 13: For Loops with Artist

Skill Building | For Loops

Get ready to make your next masterpiece. Here you will be using `for` loops to make some jaw-dropping pictures.

Chapter Commentary

For Loops

Chapter 5: Internet

Lesson 14: The Internet

Unplugged | Internet

Ever wondered how information travels across the internet? It's not magic! This lesson will teach you the basics of how the internet works.

Chapter Commentary

Internet

Chapter 6: Sprites

Lesson 15: Behaviors in Sprite Lab

Skill Building | Behaviors

Learn to program your own sprite behaviors!

Lesson 16: Virtual Pet with Sprite Lab

Application | Sprites

In this lesson, students will create an interactive Virtual Pet that looks and behaves how they wish. Students will use Sprite Lab's "Costumes" tool to customize their pet's appearance. They will then use events, behaviors, and other concepts they have learned to give their pet a life of its own!

Chapter Commentary

Sprites

Chapter 7: Digital Citizenship

Lesson 17: The Power of Words

Unplugged | Cyberbullying

Bullying is never okay. This lesson will teach you about what is and isn't okay to say online.

Lesson 18: Crowdsourcing

Unplugged | Social Interactions

This lesson will teach you about crowdsourcing, the process of building a project with a team.

Lesson 19: Digital Sharing

Unplugged | Social Interactions

In this lesson, you'll learn about the challenges and benefits of ownership and copyright.

Chapter Commentary

Digital Citizenship

Chapter 8: End of Course Project

Lesson 20: End of Course Project

End of Course Project

Projects this big take time and plenty of planning. Find your inspiration, develop a plan, and unleash your creativity!

Chapter Commentary

End of Course Project

Lesson 1: Functions in Minecraft

Overview

Students will begin to understand how functions can be helpful in this fun and interactive Minecraft adventure!

Purpose

Students will discover the versatility of programming by practicing functions in different environments. Here, students will recognize reusable patterns and be able to incorporate named blocks to call pre-defined functions.

Agenda

Warm Up (10 min)

- **Introduction**

Bridging Activity - Functions (15 min)

- **Unplugged Activity Using Some Blockly**
- **Preview of Online Puzzles**

Main Activity (30 min)

- **Online Puzzles**

Wrap Up (15 min)

- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Use functions to simplify complex programs.
- Use pre-determined functions to complete commonly repeated tasks.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Function** - A named group of programming instructions. Functions are reusable abstractions that reduce the complexity of writing and maintaining programs.

Teaching Guide

Warm Up (10 min)

Introduction

Help the class understand that functions are simply a chunk of code that has a name. Once defined, you can use that name over and over in your program to tell the computer to run the chunk of code that you assigned to it.

Bridging Activity - Functions (15 min)

This activity will help bring the unplugged concepts from "Functions Unplugged: Songwriting" into the online world that the students are moving into. Choose **one** of the following to do with your class:

Unplugged Activity Using Some Blockly

Pick a song to play that the students enjoy and print out the lyrics. You can use the same song from "Functions Unplugged: Songwriting." Break your class into groups or pairs. Pass out the printed out lyrics (including the repeated chorus) and the basic function blocks from **Unplugged Blocks (Courses C-F) - Manipulatives** to each group or pair of students. See lesson tip for details.

Lesson Tip

Function blocks:

The block to the left is a function declaration, a block that students will name and use to fill in the function. The block to the right is a function call, a block that makes the function code run. Students will need multiple of the function call blocks.

Ask the students to cross out any part of the song that can be made into a function (the chorus is a good example) and put it into the function blocks provided. Students should fill in the function declaration with a function name and the words of the repeated lyrics. Once the function declaration is done, ask the students to fill in the function calls and place them on top of the crossed out lyrics.

Once every group or pair is done, ask the class where they put their functions and why. Did everyone make the same function? How often is the function repeated?

Preview of Online Puzzles

Pull up a puzzle 9 of this lesson. As a class, work through the puzzle without using functions. Once you have gotten the solution, display it on a white board or overhead. Ask the class to point to the repeated code. Ask the class how they would simplify the program. Why can you not just use a loop?

On the white board or overhead, rewrite the program without the repeated code, but leaving one line space. In that/those line space(s), call a function. Off to the side, declare the function like the left example block in the lesson tip. Ask the class what they think the code will do now.

Open up a discussion with the class on why functions could be useful in programming. Invite students to discuss the difference between functions and loops.

Main Activity (30 min)

Online Puzzles

Code Studio levels

Practice 1 2 3 4 5 6 7 8 9 10 11 *(click tabs to see student view)*

Free Play 12 *(click tabs to see student view)*

We recommend providing paper and pencils for students to write (or draw) out ideas. Also, if students are having trouble recognizing patterns, have them work with a partner on the harder puzzles.

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

- What was today's lesson about?
- How do you feel about today's lesson?
- What did your functions do in the programs you wrote today? How did that help you?
- When should you use a function instead of a loop?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 2: Swimming Fish with Sprite Lab

Overview

In this lesson, students will learn about the two concepts at the heart of Sprite Lab: sprites and behaviors. Sprites are characters or objects on the screen that students can move, change, and manipulate. Behaviors are actions that sprites will take continuously until they are stopped.

Purpose

This lesson is designed to introduce students to the core vocabulary of Sprite Lab, and allow them to apply concepts they learned in other environments to this tool. By creating a fish tank, students will begin to form an understanding of the programming model of this tool, and explore ways they can use it to express themselves.

Agenda

Warm Up (10 min)
- **Introduction**

Main Activity (20 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Define “sprite” as a character or object on the screen that can be moved and changed.
- Create new sprites and assign them costumes and behaviors.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Behavior** - An action that a sprite performs continuously until it’s told to stop.
- **Sprite** - A graphic character on the screen with properties that describe its location, movement, and look.

Introduced Code

- set background color
- make new sprite
- set sprite property

Teaching Guide

Warm Up (10 min)

Introduction

Today students will learn how to work with sprites in Sprite Lab.

Display: Pull up a previous puzzle from Code.org, ideally one containing a "main character" like Scrat from Ice Age or one of the Angry Birds.

Discuss: Let the students know that this character on the screen is a "sprite." It is a graphic that is controlled by a program. In this lesson, students will have the opportunity to choose their own sprites to control.

Display: Begin by showing Puzzle 1 from today's Online Puzzles to your students.

Think/Pair: Ask them to predict what will happen when the code is run, and to discuss with their neighbors. Run the code, and discuss the outcome.

Before heading into the Main Activity, introduce or review today's lesson vocabulary.

Main Activity (20 min)

Online Puzzles

Goal: Today, students will be programming their own Fish Tank. They'll begin by learning how to put some sprites on the screen, then they will make them move. Finally, they'll customize their fish tank to add whatever creatures and objects they want.

Transition: Move students to their machines. Encourage students to follow the instructions for each puzzle. Help them realize that this is a creative activity, intended to help them learn Sprite Lab. It is not an assessment activity of any sort.

Teaching Tip

Encourage students with questions/challenges to start by asking their partner. Unanswered questions can be escalated to a nearby group, who might already know the solution. Have students describe the problem that they're seeing:

- What is it supposed to do?
- What does it do?
- What does that tell you?

Code Studio levels

Introducing Sprite Lab

1 *(click tabs to see student view)*

Prediction

2 *(click tabs to see student view)*

Mini-Project: Swimming Fish

3 4 5 *(click tabs to see student view)*

How to Make a Sprite

6 *(click tabs to see student view)*

Mini-Project: Swimming Fish (continued)

7 8

(click tabs to see student view)

Free Play

9 *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- How did it feel to make a scene that was more creative?
- Was it difficult to finish a lesson where there was no clear "right" and "wrong"?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 3: Alien Dance Party with Sprite Lab

Overview

This lesson features Sprite Lab, a platform where students can create their own interactive animations and games. In addition to behaviors, today students will incorporate user input as events to create an "alien dance party".

Purpose

Students will use events to make characters move around the screen, make noises, and change backgrounds based on user input. This lesson offers a great introduction to events in programming and even gives students a chance to show creativity! At the end of the puzzle sequence, students will be presented with the opportunity to share their projects.

Agenda

Warm Up (5 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (10 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Identify actions that correlate to input events.
- Create an interactive animation using sprites, behaviors, and events.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Event** - An action that causes something to happen.

Introduced Code

- set background
- random location
- location picker
- change color
- remove color
- sprite clicked
- sprite touches sprite

Teaching Guide

Warm Up (5 min)

Introduction

Today students will visit **events** in programming.

Demo: Ask the students to raise their hands in the air.

What you did was declare an event. When you say "raise your hands in the air" the students responded by raising their hands. In coding, you would declare this by saying something like "when I say 'raise your hands,' you raise your hands".

You can also think of cities as declaring events. There are laws that say "when there is a green light, cars move through the intersection".

Discuss: Ask the students why they think this is an event.

Today, students will play in Sprite Lab, but the events they will be working on will be more like the video games they are used to playing. Events will take the form of actions, such as clicking the screen or two characters running into each other.

Display: Begin by showing Puzzle 1 to your students.

Think/Pair: Ask them to predict what will happen when the code is run, and to discuss with their neighbors. Run the code, and discuss the outcome.

Main Activity (30 min)

Online Puzzles

Goal: Today, students will be creating their own alien dance party! They'll begin by reviewing how to put sprites on the screen, then they will assign them behaviors and learn to change those behaviors when an event is initiated.

Transition: Move students to their machines. Encourage students to follow the instructions for each puzzle. Help them realize that this is a creative activity, intended to help them learn Sprite Lab. It is not an assessment activity of any sort.

Teaching Tip

Encourage students with questions/challenges to start by asking their partner. Unanswered questions can be escalated to a nearby group, who might already know the solution. Have students describe the problem that they're seeing:

- What is it supposed to do?
- What does it do?
- What does that tell you?

Code Studio levels

Prediction

1 *(click tabs to see student view)*

Video

2 *(click tabs to see student view)*

Mini-Project: Alien Dance Moves

3 4 5 6

(click tabs to see student view)

Mini-Project: Alien Dance Party

7 8 9 *(click tabs to see student view)*

Wrap Up (10 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- How did it feel to have control over what your characters were able to do?
- Did you change the program in any way to make it feel more like your own?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▸ **AP** - Algorithms & Programming

Lesson 4: Drawing with Loops

Overview

Watch student faces light up as they make their own gorgeous designs using a small number of blocks and digital stickers! This lesson builds on the understanding of loops from previous lessons and gives students a chance to be truly creative. This activity is fantastic for producing artifacts for portfolios or parent/teacher conferences.

Purpose

This series highlights the power of loops with creative and personal designs.

Offered as a project-backed sequence, this progression will allow students to build on top of their own work and create amazing artifacts.

Agenda

Warm Up (15 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Identify the benefits of using a loop structure instead of manual repetition.
- Differentiate between commands that need to be repeated in loops and commands that should be used on their own.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Loop** - The action of doing something over and over again.
- **Repeat** - Do something again

Teaching Guide

Warm Up (15 min)

Introduction

Students should have had plenty of introduction to loops at this point. Based on what you think your class could benefit from, we recommend:

- Creating a new stack design with loops just like in "My Loopy Robotic Friends"
- Reviewing how to use Artist by playing through a puzzle from "Programming in Artist"
- Previewing a puzzle from this lesson

All of these options will either review loops or the artist, which will help prepare your class for fun with the online puzzles!

Main Activity (30 min)

Online Puzzles

Some students may discover where to add `repeat` loops by writing out the program without loops then circling sections of repetitions. If the students in your class seem like they could benefit from this, have them keep paper and pencils beside them at their machines. Students might also enjoy drawing some of the shapes and figures on paper before they program it online. (When drawing stamps, it can be easier to symbolize those with simple shapes like circles and squares.)

Code Studio levels

Artist Intro with JR Hildebrande 1 *(click tabs to see student view)*

Practice 2 3 *(click tabs to see student view)*

Loops with the Artist 4 *(click tabs to see student view)*

Practice 5 6 *(click tabs to see student view)*

Challenge 7 8 *(click tabs to see student view)*

Practice 9 10 *(click tabs to see student view)*

Challenge 11 *(click tabs to see student view)*

Levels Extra Extra *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- What was the coolest shape or figure you programmed today? Draw it out!
- What is another shape or figure you would like to program? Can you come up with the code to create it?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▸ **AP** - Algorithms & Programming

Lesson 5: Nested Loops in Maze

Overview

In this online activity, students will have the opportunity to push their understanding of loops to a whole new level. Playing with the Bee and Plants vs Zombies, students will learn how to program a loop to be inside of another loop. They will also be encouraged to figure out how little changes in either loop will affect their program when they click Run .

Purpose

In this introduction to **nested loops**, students will go outside of their comfort zone to create more efficient solutions to puzzles.

In earlier puzzles, loops pushed students to recognize repetition. Here, students will learn to recognize patterns **within** repeated patterns to develop these **nested loops**. This stage starts off by encouraging students try to solve a puzzle where the code is irritating and complex to write out the long way. After a video introduces **nested loops**, students are shown an example and asked to predict what will happen when a loop is put inside of another loop. This progression leads into plenty of practice for students to solidify and build on their understanding of looping in programming.

Agenda

Warm Up (10 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Break complex tasks into smaller repeatable sections.
- Recognize large repeated patterns as made from smaller repeated patterns.
- Identify the benefits of using a loop structure instead of manual repetition.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Loop** - The action of doing something over and over again.
- **Repeat** - Do something again

Teaching Guide

Warm Up (10 min)

Introduction

Briefly review with the class what loops are and why we use them.

- What do loops do?
  - Loops repeat a set of commands. (see vocabulary on command if students don't recognize it)
- How do we use loops?
  - We use loops to create a pattern made of repeated actions.

Tell the class that they will now be doing something super cool: using loops inside loops. Ask the class to predict what kinds of things we would be using a loop inside of a loop for.

"If a loop repeats a pattern, then looping a loop would repeat a pattern of patterns!"

Students don't need to understand this right away, so feel free to move on to the online puzzles even if students still seem a little confused.

Main Activity (30 min)

Online Puzzles

We highly recommend **Pair Programming - Student Video** in this lesson. This may not be an easy topic for the majority of your students. Working with a partner and discussing potential solutions to the puzzles might ease the students' minds.

Also, have paper and pencils nearby for students to write out their plan before coding. Some puzzles have a limit on the number of certain blocks you can use, so if students like to write out the long answer to find the repeats, paper can be useful.

Code Studio levels

Practice 1 2 *(click tabs to see student view)*

Nested Loops with the Bee 3 *(click tabs to see student view)*

Prediction 4 *(click tabs to see student view)*

Practice 5 6 7 8 9 *(click tabs to see student view)*

Challenge 10 *(click tabs to see student view)*

Practice 11 12 *(click tabs to see student view)*

Prediction 13 *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel about today's lesson?
- What is a nested loop?
- Can you draw a puzzle that would use a nested loop? Try coding the solution to your own puzzle.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▸ **AP** - Algorithms & Programming

Lesson 6: Envelope Variables

Overview

Variables are used as placeholders for values such as numbers or words. Variables allow for a lot of freedom in programming. Instead of having to type out a phrase many times or remember an obscure number, computer scientists can use variables to reference them. This lesson helps to explain what variables are and how we can use them in many different ways. The idea of variables isn't an easy concept to grasp, so we recommend allowing plenty of time for discussion at the end of the lesson.

Purpose

Variables are very helpful in programming. Students will be introduced to this topic using envelopes to represent variables that have been given names. The value of the variable will be written on a card inside of an envelope. This lesson helps students understand how names can be a placeholder for values in the physical world, so that programming with variables will seem less confusing in the virtual world.

Agenda

Warm Up (10 min)

- **Vocabulary Introduction**

Main Activity (20 min)

- **Envelope Variables - Worksheet**

Wrap Up (10 min)

- **Flash Chat: What did we learn?**
- **Journaling**

Assessment (10 min)

- **Envelope Variables - Assessment**

Extended Learning

View on Code Studio

Objectives

Students will be able to:

- Identify variables and determine their values.
- Define and call variables in the context of real-life activities.
- Create situations which require the use of variables.

Preparation

- [ ] Obtain 6 or more blank envelopes for warm up plus some for the main activity.
- [ ] Print one worksheet per student.
- [ ] Print one assessment for each student.
- [ ] Provide students with envelopes, paper, pens & pencils.
- [ ] Make sure every student has a journal.

Links

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

For the Teachers

- **Variables in Envelopes** - Unplugged Video (**download**)
- **Envelope Variables** - Worksheet Answer Key **Make a Copy**
- **Envelope Variables** - Assessment Answer Key **Make a Copy**

For the Students

- **Envelope Variables** - Worksheet **Make a Copy**
- **Envelope Variables** - Assessment **Make a Copy**

Vocabulary

- **Variable** - A placeholder for a piece of information that can change.

Teaching Guide

Warm Up (10 min)

Vocabulary

This lesson has one important word:

- **Variable** - Say it with me: Vayr-ee-ah-buhl

A placeholder for a piece of information that can change.

Introduction

Call four volunteers to the front of the room and line them up. Let the students know that you are going to write a poem for each of them.

On the board (or under your document camera) write the sentence for your first student (suppose it's Bill):

"My student Bill, standing proud
is a fine example for the crowd"

Encourage the students to clap at your abilities and thank Bill for volunteering. Allow Bill to sit down (or go to the back of the line) as you erase the board, then call the next volunteer (we'll say that she's called Annie).

"My student Annie, standing proud
is a fine example for the crowd"

Again, accepting applause, erase the board and invite the next volunteer.

"My student Jenny, standing proud
is a fine example for the crowd"

As you call the final volunteer, inquire as to whether everyone in the class would like a poem written about each of them. Maybe the everyone in the whole school? Goodness, that's going to take a while! Pose the question to your students:

"How could I do this more quickly?"

Your students will likely pick up on the fact that only one word is changing, and that word is simply a person's name. Help them see the location by circling Jenny's name on the board and writing "firstName" next to it.

"It would take a long time to write a poem for everyone in the school if I couldn't start until I knew who I was writing it about, wouldn't it?"

- How long do you think it would take to make a video game if they couldn't start until they knew your username?
- How expensive would video games be if they had to be created separately for each person?
- How do you think we can get around that?

By this time, it's quite likely that your class will come up with the idea of having a placeholder. With that, they're most of the way into understanding where this lesson goes.

- What would we call that placeholder?
  - We need to call it something that makes sense. We wouldn't want to call it "age" if it was a placeholder for their name, right?

Now, let's add some more volunteers. Give them each a piece of paper to write their name on, and have them tuck it inside individual envelopes labeled firstName.

This time, put the poem on the board with a blank space labeled "firstName" where the student's name will go.

- Have the first student in line (likely the last student from the previous example) pull their name from the envelope and that's what you'll write in the space.
- When you erase the board, only erase the portion with the last student's name in it.

- Call the next student to show their variable.
- Repeat as many times as is entertaining

Now it's time for the main activity.

Main Activity (20 min)

Envelope Variables - Worksheet

Once the students understand how the envelopes relate to the sentences, pass out the activity worksheet and let them prepare some variables of their own.

Directions:

- Divide students into groups of 2-4.
- Have students design (draw) a robot.
- After 10-15 minutes, request that the students fill their envelopes with important details about their robot such as its name, height, and purpose.
- Collect each group's envelopes, then bring them to the front of the room to share.
- Write on the board, "My robot's name is robotName, it is numUnitsTall tall, and it's purpose is purpose."
- Use the envelopes to fill the appropriate variable in the sentence, then ask each group to stand when they hear the sentence that describes their creation.

Wrap Up (10 min)

Flash Chat: What did we learn?

- What did we learn today?
- Can you think of anywhere that you have seen variables before?
- There is at least one variable at the top of most homework hand outs? Can you think of what it could be?
- Why do you think that professionals do not put spaces in variable names?
  - What would happen if there was a variable "eye" a variable "color" and a variable "eye color"?
- Variables can be used to store numbers, too.
  - Suppose I have envelopes labeled num1 and num2, then I write num1+num2?
  - What happens if the "num1" envelope contains the number 4 and "num2" contains the number 5?

Journaling

Having students write about what they learned, why it’s useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What is a variable?
- Why do you think variables are important in programming?

Assessment (10 min)

Envelope Variables - Assessment

Allow students enough time to finish this assessment. If you are willing to spare more time, go over the answers as a class.

Extended Learning

Use these activities to enhance student learning. They can be used as outside of class activities or other enrichment.

What's in the box?

- Draw boxes on a piece of paper with simple mathematical operators between them.
  - For instance [] + [] = []
- Have similar size squares with numbers between 1 & 20.
- Ask one student to come create a true equation, using the numbers provided.
- Once the student has finished (and the class verifies the equation) exchange one of the numbers with another one, then remove a second number entirely.
  - Tell the students that there is a hidden number in the empty box that makes that equation true again.
  - What number is in the box?
- Play this game over and over again until you can remove the number from any location and the students can figure out what it is supposed to be.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 7: Variables with Artist

Overview

In this lesson, students will explore the creation of repetitive designs using variables in the Artist environment. Students will learn how variables can be used to make code easier to write and easier to read, even when the values don't change at runtime.

Purpose

This stage teaches the most basic use for variables, as a constant that reoccurs frequently in a program.

Agenda

Warm Up (15 min)

- **Introduction**

Bridging Activity - Variables (15 min)

- **Unplugged Activity Using Variables as Constant**
- **Preview of Online Puzzles as a Class**

Main Activity (30 min)

- **Online Puzzles**

Wrap Up (15 min)

- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Assign values to existing variables.
- Utilize variables in place of repetitive values inside of a program.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Links

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

For the Students

- **Variables** - Student Video (**download**)
- **Unplugged Blocks (Courses C-F)** - Manipulatives **Make a Copy**

Vocabulary

- **Constant** - A variable used throughout a program that never changes value
- **Variable** - A placeholder for a piece of information that can change.

Teaching Guide

Warm Up (15 min)

Introduction

This is the first online lesson dealing with variables, so it might be a worthwhile exercise to review the "Envelope Variables" unplugged activity from last time, as well as the vocabulary that was introduced in that lesson.

Discussion:

- What is a variable? (A placeholder for a piece of information that can change.)
- When can a variable be helpful? (When you don't know what information is going to be used in a certain place until runtime, or when you have lots of places that one piece of information will be used, but that information might change someday.)

Ask the class when they could see a variable being helpful in programming. When would they NOT want to use a variable?

If the class seems interested, continue the discussion. Otherwise, move on to one of the bridging activities.

Bridging Activity - Variables (15 min)

This activity will help bring the unplugged concepts from "Envelope Variables" into the online world that the students are moving into.

Unplugged Activity Using Variables as Constant

Discuss: Remember our robot article? It used each variable only once...but what if I wanted to mention the robot's name several times?

Display: Write a paragraph on the board that refers back to the name of a specific robot several times. Ask the students what happens when you need to make the article about a different robot.

Think/Pair: Ask students to work together to see if they can come up with an idea to make changing the article for each robot easier.

Share: Work with students until you eventually get to the place where you have defined a variable called **robotName** somewhere before the paragraph, then set **robotName** equal to the robot that you are writing the article about. Replace all specific naming instances for the previous robot with the variable **robotName**.

Preview of Online Puzzles as a Class

Demo: Display a puzzle for the class. We recommend the 6th puzzle. Go over the code with the students to make sure they understand what's happening before they help you convert the code to use variables. Can they think of something that might happen that would make them really glad that they used variables instead of hardcoded numbers?

Transition: Now it's time for your students to move to their own machines and get started!

Main Activity (30 min)

Online Puzzles

Notice that this stage first covers the idea of a variable as a constant (a variable that you use in many places, but it does not change.) This might be something that students find helpful as they're creating their own projects.

Watch out for puzzle #6. It is the first time that students will be expected to set a variable on their own. This can be tricky if they don't have a true grasp on the concept. If they're having trouble, send them back to the prediction level (#5) and have

them explain to their partners why the answer ended up what it was. Once both partners are convinced, let them continue back to puzzle #6.

Code Studio levels

Practice 1 2 *(click tabs to see student view)*

Artist: Variables 3 *(click tabs to see student view)*

Prediction 4 *(click tabs to see student view)*

Practice 5 6 7 8 9 *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- What is a variable? Why is it helpful in programming?
- How well do you think you understand variables? (Answer on a scale from 1-5 or with an emoticon.) If you're having troubles, can you put into words what you don't understand?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 8: Changing Variables with Bee

Overview

This lesson will help illustrate how variables can make programs more powerful by allowing values to change while the code is running.

Purpose

You don't always know what a value is going to be before you begin your program. Sometimes, values change while your code is running. This lesson will illustrate how code with changing values can be helpful.

Agenda

Warm Up (15 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Identify areas where they can use variables to modify quantities during runtime.
- Examine code to find places where variables can be substituted for specific values.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

- **Variable** - A placeholder for a piece of information that can change.

Teaching Guide

Warm Up (15 min)

Introduction

This series is a little different than what students have done in the past. Now, instead of simply assigning a value to a variable and running your code, you'll need to help students see how a variable can be modified during program runtime.

Display Show students the play area from one of the later puzzles.

There are several things to unpack here, so you might need to give your students a chance to look at it critically before you expect them to do anything with it.

Think/Pair: Suppose all of the flowers/honeycomb in this picture had the same amount of nectar/honey. How would you solve this puzzle?

Share: Let students share their ideas until you decide on one that the entire class is good with.

Discuss: Now, imagine that we didn't want to have to write a separate chunk of code for each set of flowers and honeycomb. How could we use a variable to have our loop do this for us?

(Eventually, you'll want to get to the place where you initialize a variable to the original value, then change it each time through the loop so that it's ready for the next time.)

Main Activity (30 min)

Online Puzzles

Code Studio levels

Practice 1 | 2 | 3 | 4 | 5 *(click tabs to see student view)*

Challenge 6 *(click tabs to see student view)*

Practice 7 *(click tabs to see student view)*

This set of puzzles takes some serious computational thinking skills. If you find that students are getting stuck, help them break down the puzzles into the individual pieces:

- What would it look like if the flowers/honeycomb all had the same amount of nectar/honey?
- What would it look like without the functions?
- Now how can you use a variable to get the quantities the way you want them?
- Now can you build it back up to use a function?

Hint: Puzzle 7 becomes much easier if students utilize the while path ahead loop instead of a variable.

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- What are some ways you have used variables so far?
- What else do you think you can do with variables?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 9: Changing Variables with Artist

Overview

In this lesson, students will explore the creation of repetitive designs using variables in the Artist environment. Students will learn how variables can be used to make code easier to write and easier to read. After guided puzzles, students will end in a freeplay level to show what they have learned and create their own designs.

Purpose

Variables are essentially placeholders for values that might be unknown at the time that you run your program or for values that can change during the execution of a program. These are vital to creating dynamic code because they allow your program to change and grow based on any number of potential modifications. This stage reinforces the use of variables, using the most basic capabilities of setting and using them.

Agenda

Warm Up (5 min)
- **Introduction**

Main Activity (20 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Assign values to existing variables.
- Utilize variables in place of repetitive values inside of a program.
- Use variables to change values inside of a loop.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Links

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

For the Students

- **Variables** - Student Video (**download**)
- **Unplugged Blocks (Courses C-F)** - Manipulatives **Make a Copy**

Vocabulary

- **Variable** - A placeholder for a piece of information that can change.

Teaching Guide

Warm Up (5 min)

Introduction

It might be helpful to remind students of "Variables that Change in Bee," since variables will be used in a similar way here.

- How can we change the value of a variable inside of a loop?
- Do we have to change the value of a variable only by one each time?

Main Activity (20 min)

Online Puzzles

The latter half of this series is made up of freeplay puzzles. Students will have the opportunity to play with variables, shape, and color to create something unique.

Code Studio levels

Practice 1 | 2 | 3 | 4 *(click tabs to see student view)*

Free Play 5 *(click tabs to see student view)*

Levels Extra | Extra *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- Have you tried mixing multiple variables into one program? What might that look like? When would it be helpful?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 10: Simulating Experiments

Overview

By running a simple simulation in Sprite Lab, students will experience how computing can be used to collect data that identify trends or patterns. After running the simulation multiple times, students will have an opportunity to make a prediction about how changing a variable in the simulation might impact the outcome, and then test that hypothesis.

Purpose

Sciences in many disciplines use Computer Science to run models and simulations to run experiments, collect data, and analyze that data for insights. Though the simulation introduced in this lesson is quite simplistic, it can be used as a jumping off point for students to consider how more sophisticated computational models could be used to test hypotheses.

Agenda

Warm Up (5 min)
- **Why Simulate an Experiment**

Activity (35 min)
- **Simulating Experiments**

Wrap Up (5 min)
- **Reflection**

View on Code Studio

Objectives

Students will be able to:

- Use a computer simulation to collect data about a model
- Create double line graph to compare data about two different sources
- Make and test a prediction by modifying simulation variables

Preparation

- [ ] Determine whether students will run simulations on their own computer, or if you will be running them as a whole class
- [ ] If necessary, prepare to project the two simulations in this lesson.

Links

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

For the Students

- **Running Simulations** - Worksheet
  Make a Copy

Vocabulary

- **Models and Simulations** - a program which replicates or mimics key features of a real world event in order to investigate its behavior without the cost, time, or danger of running an experiment in real life.

Teaching Guide

Warm Up (5 min)

Why Simulate an Experiment

Prompt: If you were a scientist, when might you want to simulate an experiment on a computer instead of in real life? Encourage students to consider experiments that might be dangerous or difficult to reproduce in real life.

Say: Today we're going to run a simulation to gather data about an experiment, just like scientists do.

Activity (35 min)

Simulating Experiments

Distribute: Pass out the **Running Simulations - Worksheet** along with pencils and coloring instruments of some kind. Direct students to Code Studio or project the level on the board.

Running Simulations

> **Step 1 Gather Data**: The first bubble is a simple simulation of an elephant and a hippo collecting apples. Students will run the simulation at least 5 times, recording the number of apples collected by each animal and the total time it took to run the simulation.
>
> **Step 2 Line Graph**: Using the data collected in the previous step, students will plot a double line graph. Encourage students to share their graphs with neighbors and discuss the following questions:
>
> - Are the graphs the same or different? Why do you think that is?
> - Do you see any patterns?
> - What do you think you'd see if you ran this simulation 5 more times?
>
> **Step 3 Modify and Predict**: In the second bubble students will be able to modify some of the variables that control this simulation. Each student will choose a variable to modify, predict how that change will impact the simulation. Potential variables to modify include:
>
> - Number of elephants
> - Number of hippos
> - Number of apples
> - Speed of elephants
> - Speed of hippos
>
> **Step 4 Collecting More Data**: With the modifications students decided on in the last step, they'll run the simulation five more times and collect the data.
>
> **Step 5 Visualize Your Data** : This step is purposefully left open to allow students to explore any visual representation of their data that they'd like. The goal of this visual should be to prove or disprove their prediction.

Share: After finishing, students can share their results with a neighbor. When the whole class is ready, bring everyone together.

Wrap Up (5 min)

Reflection

Discuss: Ask students to discuss how their modification and prediction came out, first with a neighbor and then as a whole class. Encourage students to consider **why** they made the modifications they did and how that change connected to their predictions.

Journal: What is one interesting thing that you might simulate using a computer? What kinds of variables would you want to control in that experiment?

Discussion

This simulation used in this lesson is purposefully broad and kind of silly. Through this discussion, students should start to connect the predictions and variable changes with actual scientific hypotheses. From there you can encourage students to think about computational modeling or more authentic scenarios or experiments.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **DA** - Data & Analysis

Lesson 11: For Loop Fun

Overview

We know that loops allow us to do things over and over again, but now we're going to learn how to use loops that have extra structures built right in. These new structures will allow students to create code that is more powerful and dynamic.

Purpose

At this point, students have become masters of loops. Today, they will learn about another loop commonly used in programming. The for loop repeats commands a certain number of times, but also keeps track of the values it is iterating over. For example, a for loop that begins at 4, ends with 8, and has a step value of 1 will repeat 4 times, but the values 4, 5, 6, and 7 will also be captured for use elsewhere. Using this structure with variables can create some pretty fantastic programs. Today, students will simply be learning the basics of a for loop before diving into programming with them next time!

Agenda

Warm Up (20 min)

- **Vocabulary**
- **For One and All**

Main Activity (20 min)

- **For Loop Fun - Worksheet**

Wrap Up (15 min)

- **Flash Chat: What did we learn?**
- **Journaling**

Assessment (5 min)

- **For Loop Fun - Assessment**

Extended Learning

View on Code Studio

Objectives

Students will be able to:

- Determine starting value, stopping value, and stepping value for a `for` loop.
- Illustrate the counter values hit each time through a for loop during runtime.

Preparation

- [ ] Watch the **For Loop Fun - Lesson in Action Video**.
- [ ] Print one **For Loop Fun - Worksheet** per group.
- [ ] Print one **For Loop Fun - Assessment** for each student.
- [ ] Make sure every student has a**Think Spot Journal - Reflection Journal**.

Links

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

For the Teachers

- **For Loop Fun** - Unplugged Video (**download**)
- **For Loop Fun - Assessment Key** - Teacher Key **Make a Copy**
- **For Loop Fun** - Lesson in Action Video
- **For Loop Fun** - Worksheet Answer Key **Make a Copy**

For the Students

- **For Loop Fun** - Worksheet **Make a Copy**
- **For Loop Fun** - Assessment **Make a Copy**

Vocabulary

- **For Loop** - Loops that have a predetermined beginning, end, and increment (step interval).

Teaching Guide

Warm Up (20 min)

Vocabulary

This lesson has one new and important word:

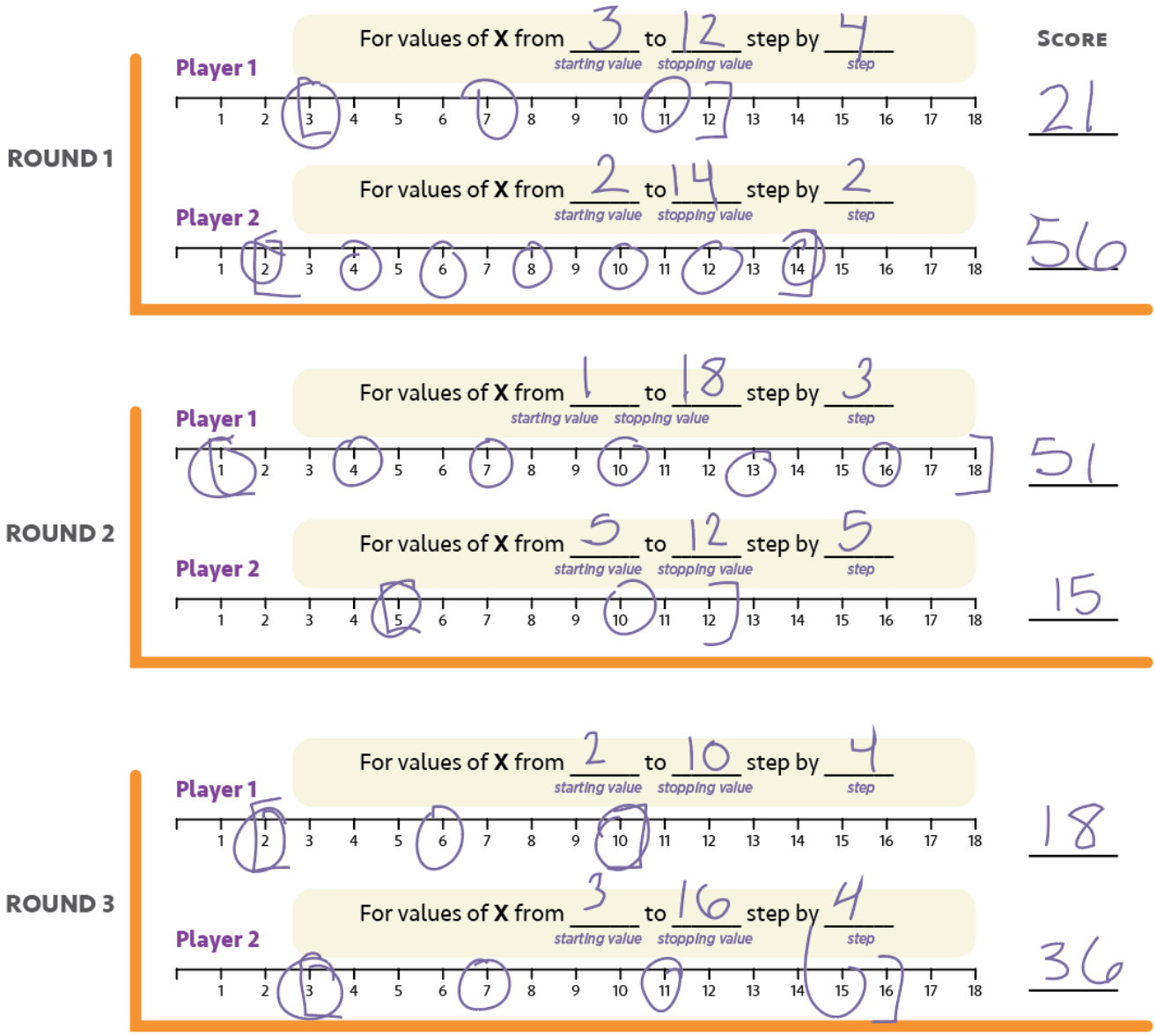
- **For Loop** - Say it with me: For-Loop

Loops that have a predetermined start, stop, and step value.

For One and All

- Point out that there are certain loops that happen very frequently, for example, loops where you need to keep track of how many times you have been through
  - Sometimes, you don't want to start with one
  - Sometimes, you don't want to count by ones
  - "for" loops give you a powerful way to keep a counter that starts when you want, ends when you want, and increases by whatever size step that you want

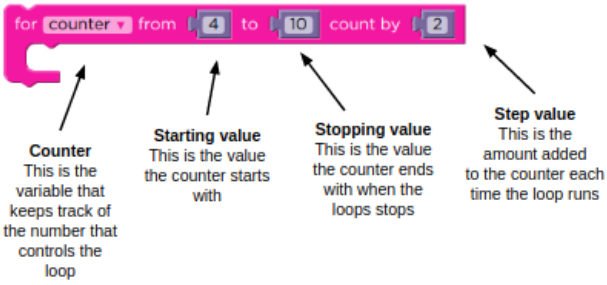
Here, you can jump right into a sample of the game (example in English)



Main Activity (20 min)

For Loop Fun - Worksheet

Sometimes we want to repeat things a certain number of times, but we want to keep track of values as we do. This is where a "for" loop comes in handy. When you use a "for" loop, you know right from the start what your beginning value is, what your ending value is, and how much the value changes each time through the loop.



"for" Loop block (in English)

Directions:

It may be difficult for young students to understand this written in pseudocode, but it may be helpful to have you explain out loud (and perhaps with a diagram) what they will be using as the content of a "for" loop.

- Divide students into pairs
- To start the round, each student rolls three times:
  - One die to determine the starting value of X
  - Three dice to determine the stopping value for X
  - One die to determine the stepping value of X each time through
- Use one of the provided number lines to trace the "for" loop that they've made
  - Start at the starting value of X
  - Count down the number line, circling the numbers at the rolled interval
  - Stop when you get to the predetermined stopping value
- Add all of the circled values to your score, then let the other player take a turn
- Best 2 out of 3 wins

Lesson Tip

When you play this game, it's as if you're running through a loop like this

```
for (x=startValue; x <= stopValue; x = x + step){
circle currentXvalue;
add currentXvalue to roundScore;
}
```

Lesson Tip

If any of the values rolled are outside the bounds of the game (like rolling a start value of 6 but then rolling 2, 1, 2 for the end value), have the student re-roll everything.

Wrap Up (15 min)

Flash Chat: What did we learn?

- What would your interval need to be if you wanted to count from 4 to 13 by threes?
- What kinds of things do you think you could do with a for loop?
- Can you reproduce a normal loop using a for loop?
- What would you need to do?

Lesson Tip

Flash Chat questions are intended to spark big-picture thinking about how the lesson relates to the greater world and the students' greater future. Use your knowledge of your classroom to decide if you want to discuss these as a class, in groups, or with an elbow-partner.

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What is a "for" loop?
- Why would you use a "for" loop instead of a "repeat" loop or a "while" loop?

Assessment (5 min)

For Loop Fun - Assessment

Hand out the assessment worksheet and allow students to complete the activity independently after the instructions have been well explained. This should feel familiar, thanks to the previous activities.

Extended Learning

Use these activities to enhance student learning. They can be used as outside of class activities or other enrichment.

Run it Backward

- Try this activity again, but this time have the start number be selected using three dice, and the stop number with only one. Make sure to have a negative increment!

Hop Scotch

- Using chalk, draw a hop scotch diagram outside on the blacktop
  - Number the squares from bottom to top
  - Have students give each other a start square, stop square, and how many at a time they need to jump
  - When the jumper is done, have them write down the loop they just performed
  - Start adding additional activities to be done at each square, this will add complexity to the written portion, as well

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 12: For Loops with Bee

Overview

Featuring Bee, this lesson focuses on `for` loops and using an incrementing variable to solve more complicated puzzles. Students will begin by reviewing loops from previous lessons, then they'll walk through an introduction to `for` loops so they can more effectively solve complicated problems.

Purpose

Today's concept, `for` loops, are a very important topic in computer science. Not only are they widely used, the process of learning `for` loops enhances the learning of other important concepts (such as variables and parameters.) Students will have plenty of practice critically thinking through problems by determining the starting, ending, and stepping values for each `for` loop. This concept uses plenty of math as well, so feel free to pair it with a math lesson for an even deeper learning experience.

Agenda

Warm Up (15 min)
- **Introduction**

Bridging Activity - For Loops (15 min)
- **Unplugged Activity Using Paper Blocks**
- **Previewing Online Puzzles as a Class**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Determine starting value, stopping value, and stepping value for a `for` loop.
- Recognize when to use a `for` loop and when to use other loops such as `repeat` and `while` loops.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Links

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

For the Students

- **Unplugged Blocks (Courses C-F)** - Manipulatives **Make a Copy**

Vocabulary

- **For Loop** - Loops that have a predetermined beginning, end, and increment (step interval).

Teaching Guide

Warm Up (15 min)

Introduction

Remind students of the work they did in "For Loop Fun". Open a discussion about what they learned, why they think it might be useful, and if they had any fun. Here are some discussion starters.

- What did you learn in "For Loop Fun"?
- What are the three main components of a `for` loop?
  - starting value, step interval, ending value
- Why do you think a `for` loop might be helpful in programming?
  - Many students might not know an answer to this. Let them hypothesize, but don't dwell on this question for too long.
- Did you have fun learning about `for` loops? Why or why not?
- Are you excited to use `for` loops in online puzzles?

Bridging Activity - For Loops (15 min)

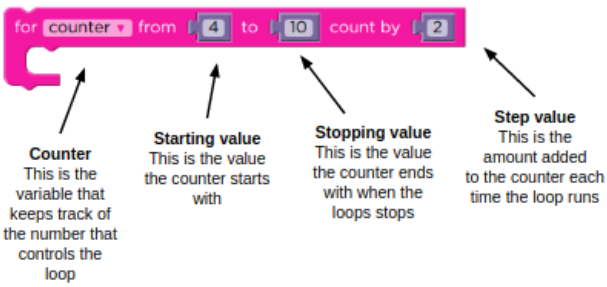
This activity will help bring the unplugged concepts from "For Loop Fun" into the online world that the students are moving into. Choose **one** of the following to do with your class:

Unplugged Activity Using Paper Blocks

Split up the students of your class into pairs. Ideally have the pairs be the same from when your class did "For Loop Fun". Print out a `for` loop from **Unplugged Blocks (Courses C-F) - Manipulatives** for each pair of students. Pass out one die to each pair. Have the partners take turns rolling the die to obtain the following values:

- One roll for the starting value
- Four rolls for the ending value
- One roll for the step value

Have each pair fill in the `for` loop with the appropriate values in the correct spot.



Using a basic number line, like the one used in "For Loop Fun", have the students mark the beginning, ending, and middle values that this `for` loop will touch. When everyone is done, see who got the most points by totaling the starting, middle, and ending numbers of each pair.

Previewing Online Puzzles as a Class

Display a puzzle from the lesson. We recommend puzzle #4 because it displays a potential solution and asks the user to evaluate it.

Using a number line similar to the ones used in "For Loop Fun", mark the start and ending values of the given `for` loop (if you aren't using puzzle #4, you will need to come up with a potential solution first). With the class's help, circle the values

between the start and end that the `for` loop will touch. If you are working on puzzle #4, ask the class what they think the answer is to the question, given what they found with the number line.

Main Activity (30 min)

Online Puzzles

Some students may have a hard time differentiating between `repeat` loops and `for` loops. We recommend having scratch paper out for students to make guesses on values like the start, stop, and step. Implementing pair programming amongst the class might also be helpful for your students.

Code Studio levels

Practice 1 2 *(click tabs to see student view)*

For Loops and Repeat Blocks 3 *(click tabs to see student view)*

Prediction 4 *(click tabs to see student view)*

Practice 5 6 7 8 9 10 *(click tabs to see student view)*

Challenge 11 *(click tabs to see student view)*

Practice 12 *(click tabs to see student view)*

Levels Extra Extra *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- How is a `for` loop different from a `repeat` loop?
- Why do you think `for` loops could be useful?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming

Lesson 13: For Loops with Artist

Overview

In this lesson, students continue to practice for loops, but this time with Artist. Students will complete puzzles combining the ideas of variables, loops, and for loops to create complex designs. At the end, they will have a chance to create their own art in a freeplay level.

Purpose

Creativity and critical thinking come together beautifully in this lesson. Students will continue their practice with for loops and variables while they create jaw-dropping images. This lesson inspires a creative mind while teaching core concepts to computer science.

Agenda

Warm Up (15 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Use `for` loops to change loop several times with different values.
- Recognize when to use a `for` loop and when to use other loops such as `repeat` and `while` loops.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Vocabulary

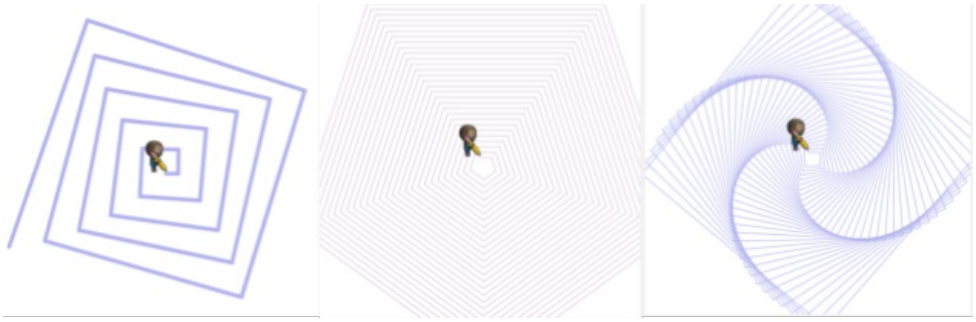
- **For Loop** - Loops that have a predetermined beginning, end, and increment (step interval).

Teaching Guide

Warm Up (15 min)

Introduction

On a board displayed to the entire class, draw (or display via projector) one of the final projects from the **Course F Online Puzzles - 2018 - Website** associated with this lesson. We recommend one of the following:



Ask the class how a computer might draw the drawing you displayed.

After a few predictions have been said, reply with `for` loops of course!

Tell the students they will soon be learning how to create these fine drawings using `for` loops and variables.

Main Activity (30 min)

Online Puzzles

Code Studio levels

Intro to For Loops 1 *(click tabs to see student view)*

Free Play 2 *(click tabs to see student view)*

Practice 3 4 5 6 7 8 9 *(click tabs to see student view)*

Free Play 10 *(click tabs to see student view)*

Prediction 11 *(click tabs to see student view)*

Free Play 12 *(click tabs to see student view)*

Levels Extra Extra *(click tabs to see student view)*

These puzzles are super fun, but it may be helpful for students to have protractors and scratch paper to see these designs made in the physical form. If that isn't an option in your class, try to get the students to trace on the computer screen with their fingers.

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- Draw one of the designs you made today. What was the code needed to create it?
- What are some designs you would like to create? How do you think for loops or variables could help create those?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 14: The Internet

Overview

Even though many people use the internet daily, not very many know how it works. In this lesson, students will pretend to flow through the internet, all the while learning about connections, URLs, IP Addresses, and the DNS.

Purpose

If you have been doing every lesson in this course, then each student in your classroom has used the internet...but how many know how it works? Learning more about the internet will help students develop a better understanding of its endless possibilities.

Agenda

Warm Up (20 min)

- **Vocabulary**
- **Getting the Message**

Main Activity (20 min)

- **The Internet**

Wrap Up (15 min)

- **Flash Chat: What did we learn?**
- **Journaling**

Assessment (5 min)

- **Internet - Assessment**

View on Code Studio

Objectives

Students will be able to:

- Learn about the complexity of sending messages over the internet.
- Translate URLs into IP Addresses.

Preparation

- [ ] Watch the **Internet - Teacher Video**.
- [ ] Print enough **IP Address Cards and Delivery Type Cards - Manipulatives** for each group.
- [ ] Print one **Internet - Assessment** for each student.
- [ ] Access to the internet (such as **get-site-ip.com**).
- [ ] Make sure every student has a **Think Spot Journal - Reflection Journal**.

Links

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

For the Teachers

- **The Internet** - Unplugged Video (**download**)
- **IP Address Cards and Delivery Type Cards** - Manipulatives **Make a Copy**
- **Internet** - Assessment **Make a Copy**
- **Internet** - Assessment Answer Key **Make a Copy**

Vocabulary

- **DNS** - short for Domain Name System, this system translates domain names (like example.com) to IP addresses (like 93.184.216.34)

- **DSL/Cable** - A method of sending information using telephone or television cables.
- **Fiber Optic Cable** - A connection that uses light to transmit information
- **Internet** - A group of computers and servers that are connected to each other.
- **IP Address** - A number assigned to any item that is connected to the Internet.
- **Packets** - Small chunks of information that have been carefully formed from larger chunks of information.
- **Servers** - Computers that exist only to provide things to others.
- **URL** - An easy-to-remember address for calling a web page (like www.code.org).
- **Wi-Fi** - A wireless method of sending information using radio waves.

Teaching Guide

Warm Up (20 min)

Vocabulary

This lesson has several new and important words:

- **IP Address** - Say it with me: I-P Add-ress

A number assigned to any item that is connected to the Internet

- **DNS (Domain Name Service)** - Say it with me: D-N-S

The service that translates URLs to IP addresses

- **URL (Universal Resource Locator)** - Say it with me: U-R-L

An easy-to-remember address for calling a web page (like www.code.org)

- **Internet** - Say it with me: In-ter-net

A group of computers and servers that are connected to each other

- **Servers** - Say it with me: Ser-vers

Computers that exist only to provide things to others

- **Fiber Optic Cable** - Say it with me: Fye-ber Op-tic Cay-bl

A connection that uses light to transmit information

- **Wi-Fi** - Say it with me: Wye-Fye

A wireless method of sending information using radio waves

- **DSL/Cable** - Say it with me: D-S-L / Cay-bl

A method of sending information using telephone or television cables

- **Packets** - Say it with me: Pack-ets

Small chunks of information that have been carefully formed from larger chunks of information

> Lesson Tip
>
> A quick preview is all you need here. These words will all be explained as part of the lesson, so it would be far less confusing to do a brief intro to the words as a "see if you can spot these during the day" type of heads-up.

Getting the Message

- It's quite likely that your students are aware of what the internet is, but they may not really understand what the internet does.
  - Ask "What is the internet?"
  - Is the internet a public place or a private place?
  - (Truthfully, many people think it can be both, but it should be viewed as a public space no matter what settings you think you've mastered.)
  - How does information get from place to place?
- Let's say that I want to look at the webpage for Code.org. What do you suppose the process would be like for me to send a message to request that page?
  - What do I do as a user?
  - What do you think happens inside the internet?

> Lesson Tip
>
> There are some great YouTube videos on this subject that can make this lesson a little easier to understand. You can show them to the class in advance, or just watch them yourself. **Here is one of the videos in the Code.org video series on "How the Internet Works"**. (We recommend watching from 1:44 - 5:13, if possible.) The rest of the playlist is available **here**.

Sending a message over the internet is a lot like sending a message through the mail...if every letter we sent required thousands of envelopes!

Every message we send through the internet gets chopped up and each piece is wrapped in its own version of an envelope. We call those "packets." Packets are specially formed chunks of information that are able to easily flow through any of the internet's channels.

Sometimes, a few of those packets will get lost, because the internet is a crazy place. In that case, the packets need to be resent, and the whole message has to get put on hold until they arrive.

Where do you think those packets are headed?

- Even if you're sending messages to another person, they first have to go to at least one "server."
  - A server is a special computer that is supposed to be always on and ready to send and receive information.
  - Every website has a server.
  - Even email goes through servers.

Servers don't have names like you and I do. They're actually addressed using numbers. These numbers are called IP addresses, and they look a little strange.

- For example: One of Code.org's IP addresses used to be 54.243.71.82
  - (Please be sure to check this out in advance. Most IP addresses change from time to time and they are then reused for other sites.)

There are many ways to reach the internet from your house, school, or place of business.

- You can connect directly using a cable (that might be DSL, Cable, or Fiber Optic)
- Or you can connect using radio waves over the air through Wi-Fi

Direct connections are most reliable, but they can be inconvenient.

- Can you figure out why?
  - (You have to be attached to a cable!)

Wi-Fi connections are super convenient, but the aren't always reliable.

- Can you figure out why not?
  - (Radio waves bounce all over the place and can get lost.)

So, if you're used to sending information to URLs (like **www.code.org**) and the servers actually have IP addresses for names (like 54.243.71.82) how does the Internet change from one to the other? That's what the DNS is for. The DNS (Domain Name Server) has tables that allow the system to go back and forth between URLs and IP addresses. If the Domain Name Servers ever stopped working, it would shut down the internet as we know it!

With that said, let's try to understand what the DNS does by making a little DNS table ourselves.

Lesson Tip

If you're thinking that this is a lot of text and it would be extremely boring to try to lecture this to a class full of elementary school kids, you're absolutely right! If you're unable to show a YouTube video in class to help explain it all, I highly recommend drawing pictures to explain each idea above, or choosing students as volunteers to act out what you describe while you're explaining. They're not expected to get every detail and definition at this point, only to gain exposure.

Pull out a piece of paper and draw a grid similar to that in the internet activity:

Sample of DNS Table:

#	URL	IP Address
1	code.org	54.243.71.82
2		
3		

#	URL	IP Address
4		
5		

First, we need to fill in this table.

- Survey the class for their favorite websites and write the URLs in the left column
- Use a site like **get-site-ip.com** to find the IP addresses for those sites and write them in the corresponding rows of the right column.

Now let's take this DNS Table and pretend to send messages through the internet!

Main Activity (20 min)

The Internet

Directions:

- Create your own DNS table, similar to what is shown above.
- Have the class help you fill in the blank spots in the table. Pick your favorite URLs and find their IP addresses using a site like **www.get-site-ip.com**.
- Divide into groups of 3 to 5.
- Assign each group an IP address from the newly created table, and assign each person in the group a position:
  - The Message Writer
  - The Internet
  - The Server (carries the IP address)
  - The Return Internet (optional)
  - The Message Receiver (optional)
- Each group will draw an **IP Address Cards and Delivery Type Cards - Manipulatives** to find out where their message is going and what their method of message delivery (Wi-Fi, Cable/DSL, or Fiber Optic Cable) will be.
- The Message Writer will craft a note to send to the server.
- The Internet will rip the message up into 4 small pieces called packets, then deliver each packet one at a time to the Server with the IP address that was drawn from the IP Address Card stack.
- The Server will make sure that the message arrives in order, then will send each packet off one at a time with the Return Internet (can be the same person or different person than the original Internet).
- The Return Internet will deliver each piece back to the Message Receiver (can be the same person or different person than the Message Writer) and put it back together.
- The Message Receiver will wait for all of the pieces to arrive, then read the message to be sure it arrived correctly!

Rules:

- The Internet must rip the message into exactly four packets.
- If the Internet drops a packet, they have to pick it up and go back to the start to deliver it again.
- The server has to wait for all of the message pieces to arrive before it can begin to send the message along.

Info:

- Wi-Fi: Convenient, but spotty. Wi-Fi doesn't require cables, but since the signal bounces all over the place, packets can get lost pretty easily.
  - Simulation: Internet must carry each packet on their shoulder (no hands).
- Cable/DSL: Fairly good at delivering messages, but you must be connected to a wire.
  - Simulation: Internet must carry each packet on the back of one hand and must keep the other hand touching a wall, desk, chair or the floor at all times.

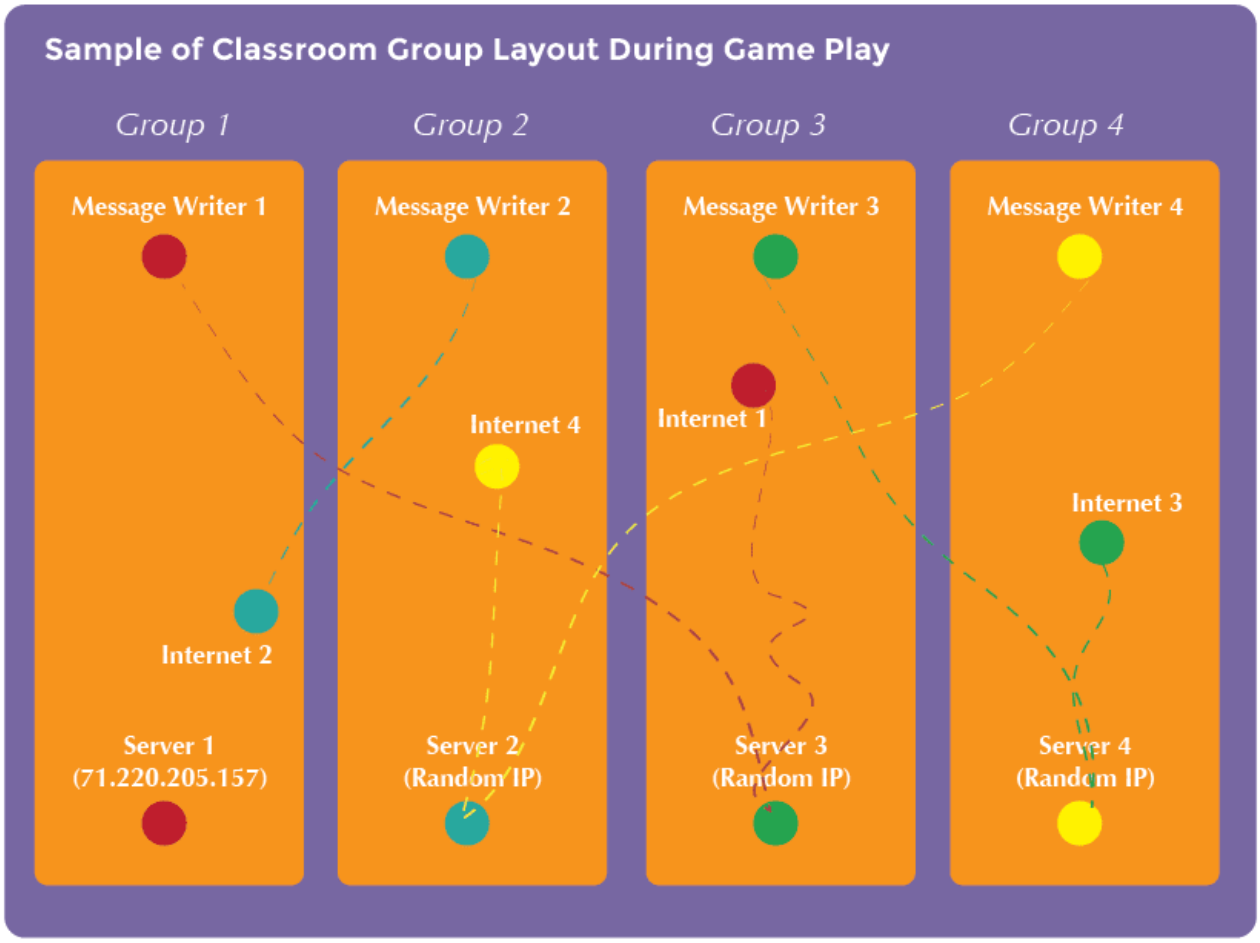
- Fiber Optic Cable: The best at delivering messages, but you must be connected to a wire.
  - Simulation: Internet can carry packets in hand, but must keep the other hand touching a wall, desk, chair or the floor at all times.

To play this game, you can have your groups cluster anywhere, but for the first time it can be less confusing to have groups play in a line.

Lesson Tip

If it feels like there are too many rules to explain outright, feel free to post them on the board and just explain the game as you go. You can play multiple rounds until the class really understands.

- Line up the "Servers" on one end of the room (holding their IP addresses). The Return Internet players can be over there as well (if you have that many people in each group).
- Have the everyone else line up across from their server at the other side of the room.
- The Message Senders will likely be sending their messages to a server other than their own, so the Internet players will likely cross over from group to group. It may look something like the diagram below (in English):



Wrap Up (15 min)

Flash Chat: What did we learn?

- What kind of connection would you rather have (Wi-Fi, DSL/Cable, or Fiber Optic)? Why?
- Why might it take your message a long time to get somewhere?

Lesson Tip

Flash Chat questions are intended to spark big-picture thinking about how the lesson relates to the greater world and the students' greater future. Use your knowledge of your classroom to decide if you want to discuss these as a class, in groups, or with an elbow partner.

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What's something you learned about the internet today?
- Why is learning about the internet important?

Assessment (5 min)

Internet - Assessment

Hand out the assessment worksheet and allow students to complete the activity independently after the instructions have been well explained. This should feel familiar, thanks to the previous activities.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **NI** - Networks & the Internet

Lesson 15: Behaviors in Sprite Lab

Overview

Here, students will use Sprite Lab to create their own customized behaviors.

Purpose

Students will use events to make characters move around the screen, change size, and change colors based on user input. This lesson offers a great introduction to events in programming and even gives a chance to show creativity!

Agenda

Warm Up (15 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Identify actions that correlate to input events.
- Create an animated, interactive game using sequence and events.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Introduced Code

- move in direction
- turn
- change sprite property

Teaching Guide

Warm Up (15 min)

Introduction

Today students will revisit **sprite behaviors**, this time learning how to edit behaviors directly and even make new ones.

Review: Ask students questions about the Swimming Fish and Alien Dance Party lessons.

- What are some of the behaviors we can assign to our sprites?
- What do you imagine the code **inside** a behavior might look like?

Display: Begin by showing Puzzle 1 to your students.

Think/Pair: Ask them to predict what will happen when the code is run, and to discuss with their neighbors. Be sure to open the behavior editor by clicking "edit" on the mystery behavior block. Run the code, and discuss the outcome.

Discuss Ask students questions about how they might change this behavior's code to create a different effect.

- What would happen if you change the -1 to another number? -5? Positive 1? 0?
- What other properties might we be able to change about a sprite besides its size?

Main Activity (30 min)

Goal: Today, students will be editing and creating their own behaviors! They'll begin by making small changes to some familiar but new behaviors and gradually move towards writing their own behaviors from scratch.

Online Puzzles

Transition: Move students to their machines. Encourage students to follow the instructions for each puzzle. Help them realize that this is a creative activity, intended to help them learn Sprite Lab. It is not an assessment activity of any sort.

Reminder: If puzzles are sharable, remind the students to only share their work with their close friends or family. For more information watch or show the class **Pause and Think Online - Video**.

Teaching Tip

Encourage students with questions/challenges to start by asking their partner. Unanswered questions can be escalated to a nearby group, who might already know the solution. Have students describe the problem that they're seeing:

- What is it supposed to do?
- What does it do?
- What does that tell you?

Code Studio levels

Prediction 1 *(click tabs to see student view)*

Practice 2 3 4 5 6 *(click tabs to see student view)*

Free Play 7 *(click tabs to see student view)*

Levels Extra Extra *(click tabs to see student view)*

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What other options would you like to be able to have your pet do?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▶ **AP** - Algorithms & Programming

Lesson 16: Virtual Pet with Sprite Lab

Overview

In this lesson, students will create an interactive Virtual Pet that looks and behaves how they wish. Students will use Sprite Lab's "Costumes" tool to customize their pet's appearance. They will then use events, behaviors, and other concepts they have learned to give their pet a life of its own!

Purpose

This lesson allows students to apply programming concepts from prior lessons in a more creative context. For example, students will use a variable to store their pet's "happiness" as an integer, which should help them understand how variables can be used in other applications. Last, completing this lesson should prepare students to engage with the open-ended final project.

Agenda

Warm Up (15 min)
- **Introduction**

Main Activity (30 min)
- **Online Puzzles**

Wrap Up (15 min)
- **Journaling**

View on Code Studio

Objectives

Students will be able to:

- Create an interactive virtual pet using events, behaviors, variables, and custom art.
- Program solutions to problems that arise when designing a virtual pet, like feeding it or monitoring its energy.

Preparation

- [ ] Play through the puzzles to find any potential problem areas for your class.
- [ ] Make sure every student has a journal.

Introduced Code

- print
- jump to
- key pressed

Teaching Guide

Warm Up (15 min)

Introduction

Revisit **events** and **behaviors** in programming. Additionally, introduce the Sprite Lab "Costumes" tool that allows students to draw their own costumes.

Review: Ask students questions about events and behaviors. Show them the Alien Dance Party mini-project (from the **Events with Sprite Lab** lesson) as an example.

- Do you remember what an event is?
- Can you name any of the events that you used to make the aliens dance? What do they do?
  - sprite clicked event
  - sprite touches sprite event
  - key pressed event
- Do you remember what a behavior is?
- Can you remember some of the behaviors you used to make the aliens dance? What do they do?
  - patrolling
  - jittering
  - spinning right/left

Display: Begin by showing Puzzle 1 of today's lesson to your students.

Think/Pair: Ask students to predict what will happen when the code is run, and to discuss with their neighbors. Run the code, and discuss the outcome.

Display: Show Puzzle 2. Briefly demonstrate how to do the following:

- Navigate between the **Code** and **Costumes** tabs.
- Draw a costume.
- Choose a costume from the costume library.
- Change the virtual pet's sprite's costume to a custom one.

Main Activity (30 min)

Goal: Today, students will be creating their own virtual pet! They will begin by drawing or selecting a new costume for a sprite. Then they will create events that cause actions and behaviors upon interaction.

Online Puzzles

Transition: Move students to their machines. Encourage students to follow the instructions for each puzzle. Help them realize that this is a creative activity, intended to help them learn Sprite Lab. It is not an assessment activity of any sort.

Reminder: If puzzles are sharable, remind the students to only share their work with their close friends or family. For more information watch or show the class **Pause and Think Online - Video**.

Teaching Tip

Encourage students with questions/challenges to start by asking their partner. Unanswered questions can be escalated to a nearby group, who might already know the solution. Have students describe the problem that they're seeing:

- What is it supposed to do?
- What does it do?
- What does that tell you?

Code Studio levels

Free Play

1 *(click tabs to see student view)*

Mini-Project: Virtual Pet

2 3 4 5 6 7 8

(click tabs to see student view)

Wrap Up (15 min)

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What other options would you like to be able to have your pet do?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▸ **AP** - Algorithms & Programming

Lesson 17: The Power of Words

Overview

Students consider that while they are enjoying their favorite websites they may encounter messages from other kids that can make them feel angry, hurt, sad, or fearful. They explore ways to handle cyberbullying and how to respond in the face of upsetting language online.

Students discuss all the ways they use technology for communication and explore the similarities and differences between in-person and online communication. Students then brainstorm ways to respond to cyberbullying.

For more information, please visit: **The Power of Words - Common Sense Education Website**

Purpose

This lesson will provide students with the tools that they need to handle cyberbullying if they are ever in the situation of having someone negatively responds to their online postings.

Students may not ever have the misfortune of experiencing cyberbullying, but they should understand what it is so that they can spot it online. Students will learn how to identify cyberbullying and what steps they should take to make it stop. This may become helpful in later puzzles when students have the opportunity to share their work.

Agenda

Warm Up (5 min)

- **Introduction**

Main Activity (35 min)

- **What's the Problem?**
- **Crossing the Line**
- **Talk and Take Action**

Wrap Up (15 min)

- **Flash Chat: What did we learn today?**
- **Journaling**

Assessment (10 min)

View on Code Studio

Objectives

Students will be able to:

- Empathize with those who have received mean and hurtful messages.
- Judge what it means to cross the line from harmless to harmful communication online.
- Generate solutions for dealing with cyberbullying.

Preparation

- [ ] Print one copy each of Talk and Take Action, Words Can Hurt, and the lesson assessment for each student.
- [ ] Obtain colored pencils and a string the length of the classroom.

Links

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

For the Teachers

- **The Power of Words** - Assessment Answer Key **Make a Copy**

For the Students

- **The Power of Words** - Assessment **Make a Copy**
- **Words Can Hurt** - Worksheet **Make a Copy**
- **Talk and Take Action** - Worksheet **Make a Copy**
- **The Power of Words** - Lesson Video

Vocabulary

- **Cyberbully** - Using technology tools to deliberately upset someone else.

Teaching Guide

Warm Up (5 min)

Introduction

Draw a series of expressive faces on the board. View **Feeling Faces - Emotion Images** for examples.

Invite the students to suggest emotions that match each face's expression. With every suggestion, write the emotion next to the feeling face. Answers will vary.

Tell students that not everyone will react to a particular situation in the same way, but just because a reaction is different from our own, doesn't mean we should discount others' feelings.

Explain to students they are going to watch a video about how words, whether typed or spoken, can impact how someone else feels.

Show students **The Power of Words - Lesson Video** .

Ask:

- Who has heard of the saying, "Sticks and stones may break my bones, but words will never hurt me"?
- What did Guts mean in his text that sometimes words can hurt?
  - Words are powerful. Sometimes it is hard to ignore what someone is saying when it's a mean name. Names **can** make you feel sad or hurt.

Remind students to keep Leg's question in the back of their mind during this lesson **How do you treat others online?**

Main Activity (35 min)

common sense education®

What's the Problem?

Organize students into groups of four and have each group pick a person to record their ideas.

Distribute the **Words Can Hurt Student Handout** . Have the groups of students read the scenario about Rani and Aruna receiving mean messages through a children's game website.

Have each group answer the questions, then have them share their responses with the class. Look for responses that show empahty for Rani and Aruna and acknowledge that the messages sent to them were mean and hurtful. Ask the students to read the 'Use Common Sense!' section on the **Words Can Hurt Student Handout** .

Invite students to share their own stories.

Ask:

- Have you seen mean messages sent to you or others online? Tell us about it, but do not use real names.

Divide students into pairs.

Invite one partner to write the phrase "You're weird" on a piece of paper, then hand it to their partner. Tell them that they just received this text.

Ask:

- What are the reasons the person might have texted "You're weird"?
  - They're continuing an inside joke; the first person did something silly at an earlier time; a group of kids is teasing the kid; the person who sent the text really does think the person is weird but is afraid to say it to his or her face.
- How did the partner feel about being called weird?
  - Possibly like the other person was kidding around, but maybe that the person was teasing or being hurtful.

Tell one person from each pair to say to the other person, "You're weird," with a smile on their face.

Ask:

- Why might you feel differently if you could see the person?
  - People give non-verbal cues through facial expressions and body language.

Crossing the Line

Place the piece of string across the length of the classroom. Ask students to stand on one side of the line. Then ask them to imagine that they are online and somebody has sent them a message, which you will read to them. Tell the students to stay where they are if they think the message is okay; to cross over the line if they think the message is not okay; or to stand on the line if they think the message is in between.

Read:

- You are my friend.
- You are an idiot.
- I'm having a party and you're not invited.
- I like your new haircut.
- You are ugly.
- Thanks for the advice. Next time, will you tell me in person rather than through text?
- Did you finish your homework?
- Why is it taking you so long to finish it?
- You are such a freak.

Review with the students that kids like to go online and use cell phones to email, chat, watch videos, send messages, play games, and do homework. But sometimes the language can get mean or scary. Messages that make people feel bad cross the line. Sometimes that meanness is unintentional, but when people use tools such as the internet and cell phones to deliberately upset someone else over and over, that's cyberbullying.

Talk and Take Action

Have students return to their seats.

Discuss how easy is it to feel angry or upset when somebody sends you a mean or scary message online.

Define:

- **Cyberbullying**: Using technology tools such as the internet and cell phones to deliberately upset someone else.

Explain that cyberbullies deliberately try to make you feel that way, just like real-life bullies.

Discuss:

- Cooling down can be a good first step when you receive a mean message online. Taking a deep breath, counting backwards from 10, or pausing to think about what you will do next can give you time to think of the BEST way to handle the situation.
- Finding help or telling a trusted adult or friend can be a good way to take action. You shouldn't deal with the cyberbullying situation alone. The person you tell should be someone who wants to hear what you have to say and will help you work on a solution. Adults can be especially good because they often have the power to influence the situation or they can give you advice about what to do.
- Ignoring the person who is cyberbullying you can be very effective. Those who bully often like attention.
- Whatever you do, remember to keep a copy of your communication with the individual who is cyberbullying you. If you delete the communication, there is no proof of how the bully treated you if you need to show a trusted adult.

Distribute the **Talk and Take Action Student Handout** to each student. Encourage them to depict a cyberbullying scenario and possible solution. They can use pencils and paper to make the comics.

Wrap Up (15 min)

Flash Chat: What did we learn today?

You can use these questions to assess your students' understanding of the lesson objectives. You may want to ask students to reflect in writing on these questions in their journal.

Ask:

- Why is it a bad idea to send mean or scary messages online?
  - Because they can make the person who gets the message upset, angry, or scared.
- Why might there be more misunderstandings between people when they send online messages as opposed to a face-to-face discussion?
  - Online messages can be more confusing or scarier than face-to-face messages because there are no face-to-face cues to help you understand people's intentions.
- What can kids do when they get cyberbullying messages?
  1. Stay calm and take a deep breath
  2. Tell a friend or trusted adult who can help develop a plan to handle the situation
  3. Ignore the bully
  4. Keep a copy of the communication with the bully.

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What is cyberbullying?
- Who are some people you can go to if you are ever bullied online or in person?

Assessment (10 min)

Print out the assessment and distribute it to the class. Give students enough time to complete the assessment, but make sure there is enough time to go over answers.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **NI** - Networks & the Internet

Lesson 18: Crowdsourcing

Overview

In computer science, we face some big, daunting problems. Challenges such as finding large prime numbers or sequencing DNA are almost impossible to do as an individual. Adding the power of others makes these tasks manageable. This lesson will show your students how helpful teamwork can be in the industry of computer science.

Purpose

It's very rare that one computer scientist works completely alone on a project. Even when that does happen, there is always benefit in numbers. Today, students will learn what it means to crowdsource a project. This activity builds teamwork and creates an efficient environment for students to solve problems.

Agenda

Warm Up (20 min)

- **Vocabulary Introduction**

Main Activity (20 min)

- **Crowdsourcing - Slides**

Wrap Up (15 min)

- **Flash Chat: What did we learn?**
- **Journaling**

Extended Learning

View on Code Studio

Objectives

Students will be able to:

- Identify a large task that needs to be done.
- Rearrange a large task into several smaller tasks.
- Build a complete solution from several smaller solutions.

Preparation

- [ ] Obtain a jar of lots of something (pennies, buttons, slips of paper, etc) and a deck of cards.
- [ ] Make sure every student has a journal.

Links

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

For the Teachers

- **Crowdsourcing** - Unplugged Video (**download**)
- **Crowdsourcing** - Slides

Vocabulary

- **Crowdsourcing** - Getting help from a large group of people to finish something faster.

Teaching Guide

Warm Up (20 min)

Vocabulary

This lesson has one new and important word:

Crowdsourcing - Say it with me: Crowd-sore-sing

Getting help from a large group of people to finish something faster.

Introduction

- Show your students your jar full of something.
  - "Look at this jar. I have a lot of buttons in here, and I need to tell the principal how many there are before the end of class."
  - "Can you think of a way I could get these counted quickly?"

Lesson Tip

Jars of buttons and pennies work nicely, but if you find yourself with little time to prepare, you can cut slips of paper and put them in a ziplock bag or even a pencil box.

- Your students may guide you toward seeking help, but if they don't, you can suggest it, too.
  - Pour all of the buttons (or pennies, etc.) into a pile on the floor.
  - Invite all of the students to come up and grab a small number (ten is good, but you can do more if your students can handle it).
  - Once they've counted out their ten, have them report to you, drop their buttons back in the jar, and go again until the pile is gone.
- Comment on how fast the task went.
  - Have the class reflect on how long it might have taken or how hard it may have felt to do alone.

Main Activity (20 min)

Crowdsourcing - Slides

Sometimes you have a big job that needs to get done, but it feels like it will take forever. Crowdsourcing is a way of using teamwork to make the job go much faster! In this game, we'll use crowdsourcing to sort decks of playing cards.

Directions:

1. Divide into groups of 4, 5, or 6.
2. Grab your deck of playing cards and dump it into a bag, bucket, or even a loose pocket that you can make with the bottom of your shirt.
3. Shake the cards until they're all mixed up.
4. Dump the cards out onto a table or desk where the whole group can see them.
5. Decide how to break up the task of sorting the deck so that every person has something to do and no one is doing too much.
6. Time yourself sorting the cards. Can you figure out a way to do it faster?
7. Repeat the game over and over until you think you have found the fastest way of crowdsourcing the card sorting activity.

Wrap Up (15 min)

Flash Chat: What did we learn?

- Have you ever tried to sort a pile of cards by yourself?
- Do you think it was easier or harder to have help?
- What other things do you have to do in life that could be easier with help?

Journaling

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How do you feel about today's lesson?
- What are the benefits of crowdsourcing?
- What kind of things do you want to make with computer science? How do you see crowdsourcing being beneficial in those projects?

Lesson Tip

It can be challenging for students to figure out how to break apart large tasks at first. Students might find it helpful to have some ideas handed to them after working for a while. One great division for sorting cards is as follows:

- One person picks up the cards and determines the suit of each one.
- One person manages Hearts.
- One person manages Diamonds.
- One person manages Clubs.
- One person manages Spades.
- (If there's another, they can put all sorted suits back together again.)

Lesson Tip

Flash Chat questions are intended to spark big-picture thinking about how the lesson relates to the greater world and the students' greater future. Use your knowledge of your classroom to decide if you want to discuss these as a class, in groups, or with an elbow partner.

Extended Learning

Use these activities to enhance student learning. They can be used as outside of class activities or other enrichment.

Reverse Crowdsourcing

Often we think of crowdsourcing as pulling things apart to make them more simple. You can also make big, beautiful things with the same technique.

Have your students each grab three cards and build one segment of a **card house**. Each student can go one after another to build a grand card tower.

Try with two, or even three students adding their chunk at a time.

- Does crowdsourcing always make a task easier?

Crowdsourcing in the Round

- You can crowdsource all at the same time or you can do it one person at a time. Try having the whole class sort the same deck of cards, one student at a time.
  - Shuffle the cards and place them in a pile in the center of the room.
  - Have each student approach the pile and choose four cards.
    - Have four piles for the students to sort their cards into
      - Spades
      - Clubs
      - Hearts
      - Diamonds
    - Once all cards have been put in their four piles, have the following four students sort the individual piles.
    - The last person will put all four piles together.
- This version may not save a lot of time, but it still divides the work and lets each individual have more free time!

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **IC** - Impacts of Computing

Lesson 19: Digital Sharing

Overview

Loaned to Computer Science Fundamentals by the team over at Copyright and Creativity, this lesson exists to help students understand the challenges and benefits of respecting ownership and copyright, particularly in digital environments. Students should be encouraged to respect artists' rights as an important part of being an ethical digital citizen.

Purpose

Students will soon be creating projects to share and most of these projects will contain either code or imagery that students did not create themselves. This lesson is here to show students the proper way to handle the use of content that is not their own.

Agenda

Warm-Up (Optional) (15 min)

- **Write a Character Sketch**

Ethical Sharing (30 min)

- **To Share or Not to Share?**
- **Okay to Share**
- **Not Okay to Share**

Wrap-Up (10 min)

- **Journaling / Flash Chat**

Extended Learning

View on Code Studio

Objectives

Students will be able to:

- Interpret ethical sharing of copyrighted material vs. sharing that is not ethical.
- Understand their own rights regarding materials that they have created

Preparation

- [ ] Locate the copyright sharing video at **Digital Sharing Ethics (Video) - Video**
- [ ] Download and review the complete **Digital Sharing Lesson Plan** from Copyright and Creativity
- [ ] As the teacher, create a piece of art for the lesson (picture, song, slideshow, etc.)
- [ ] You will need a tablet or smart phone to replicate the sharing of that item

Links

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

For the Teachers

- **Digital Sharing Lesson Plan**

For the Students

- **Digital Sharing Ethics (Video)** - Video

Vocabulary

- **Copyright** - the exclusive legal right to print, publish, perform, film, or record literary, artistic, or musical material, and to authorize others to do the same

Teaching Guide

Warm-Up (Optional) (15 min)

The following writing exercises are designed to create context, help students engage with the topic, and prepare them for the lesson discussion.

Watch: Have students watch the one-minute **Digital Sharing Ethics (Video) - Video**. **You may need to play it two or three times.**

Write a Character Sketch

Ask students to write a character sketch about one or both of the characters in the video. Be as creative as you can. There are no wrong answers. Give these characters a life of their own, whatever you want it to be.

Prompt with questions:

- Who is your character?
- What is his/her name?
- Who are his/her friends?
- How long have they known each other?
- Who are the people in his/her family? What are they like?
- What's his/her backstory?
- Where does he/she live?
- Where did he/she used to live?
- What exciting thing might have happened to them back in kindergarten, first grade, etc.?
- What is he/she looking forward to?
- What is he/she afraid of?

NOTE: These exercises may also be done orally as a class discussion before the copyright lesson. Write the story or character sketch on the board as students contribute ideas.

Ethical Sharing (30 min)

Activity: Have all of your students stand up. Begin reading the list of ways to create content below. Instruct students to sit down as soon as they can answer "Yes" to one of the prompts.

- Have you ever made a video (on a camera, phone, iPad, or computer) and sent it to a family member or posted it online?
- Have you taken a photo and sent to a family member or posted it online?
- Have you created a piece of art to share with your family and friends?
- Have you made up a song to make your friends laugh? Or a sad song to make them cry?
- Have you written a poem for your mom or dad on their birthday?

Keep asking similar questions until the entire class is seated.

Discuss:

- How did it feel to produce something creative?
- How did you feel when you were able to share your creation with others?
- How do you feel when you view or listen to other people's creations?

Encourage all responses.

Help students feel the joy of creating something. Creating can be a lot of hard work, but it is one of the most rewarding things we do. Sharing what we create is fun, and it can encourage more creativity and art. As we get older, we have more and more opportunities to share our work and explore media and art that other people have created. We want to make sure we are always fair when using others' art and creative work.

Say: Remember, copyright protects all kinds of creative work so that artists/creators can get paid for their effort. This includes, original writing (stories), art, photographs, audio, images, music, song lyrics, even the doodle you drew on your napkin at lunch. It doesn't matter if it was created by a famous artist or by you. When you make an original work, you get to decide who can:

- make copies
- distribute copies
- display or perform the work in public
- make spin-offs; we call these derivatives (for example, like a book being made into a movie)

These rights are given to artists and creators to encourage them to make even more creative work.

Think: Have students think back to the art creation prompt where they first sat down. Inform them that they created an original work with legal protection. Congratulations!

Pair:

- How might you know if something is copyrighted?
- **[The circle © indicates copyright, but copyright protection exists even without the symbol. Creators have ownership over their work, unless they sell it to someone else.]**
- Where have you seen the copyright symbol?
- [At the front of books, in movies, on images, posters, etc.]

Share: Encourage students to share their answers with the class.

Demonstrate: Show students how to draw a copyright symbol and write the year next to it. When you make something creative like this, it's automatically protected by copyright, even without the copyright symbol.

Discuss:

- How does it feel when you share your things with someone else?
- What does it feel like when someone takes your things and shares them without your permission?

The same principles of respect and fairness apply when we share our work or someone else's work online.

To Share or Not to Share?

Demonstrate: Pull out the instructor's creative work: picture, song, story, video, recipe.

Watch: Have students watch the one-minute **Digital Sharing Ethics (Video) - Video** . **You may need to play it two or three times.**

As we watch the video, decide if the music is OK to share or not.

Discuss: What did you think of that? How do you think you would feel if you wrote a song and people shared it without asking for your permission? When we share digital files by:

- sending pictures or songs through email
- copying songs from our MP3 player to our friend's computer
- copying a movie from a DVD to all our friends' computers

That's not just sharing, it's making new copies!

Discuss: If you were one of these characters in the video, what could you do to share fairly? What about other sharing situations? What other ethical considerations are there?

(Some acceptable responses:) - Send your friend a link to the artist's YouTube channel where she can listen to the song. - Help your friend buy the song from an online store that you can trust because it's used by a large online community, like iTunes or Amazon.

Ask yourself: Who owns this? Do I have permission to share? Do I have a right to make a copy? Am I being fair to everyone involved?]

Wrap-Up (10 min)

Remember, copyright is a protection given to writers and artists for a limited time to let them receive payment for their work. It's intended to foster more creativity. As we share and use, we need to respect each other's work and the laws of copyright. Just because we own a copy of something does not mean we have the right to make more copies to give or sell to other people. Copyright gives us some protection over how our art will be used and shared by others.

Journaling / Flash Chat

Having students write about what they learned, why it's useful, and how they feel about it can help solidify any knowledge they obtained today and build a review sheet for them to look to in the future.

Journal Prompts:

- What was today's lesson about?
- How did you feel during today's lesson?
- Give an example of a way that you have seen other creators share or remix someone's work. Do you believe that was fair? Why or why not?

Extended Learning

Please be sure to visit **Copyright & Creativity** to find more lessons on digital sharing and creative rights.

Discussion

Okay to Share

- I made this. That means I own it. I think I'm going to share it. I'm going to take out my phone (iPad, camera, etc.) to get a picture. I think I want to share it on my blog where I might make some money advertising on[Use the site of your choice.] Is this fair?
  - [Yes, this is OK to share because I made it — I own the copyright.]
- What about a song I wrote? Can I share that? . . . Who gets to decide?
  - ["That's right, I do."]
- What will happen when I share it?
  - [Take responses: "It's fun, . . . I'll get a bunch of 'likes' . . . People will want to use it for mashups."]
- Let's say you draw a picture to sell at a school art show. The money from the art sale will go to buy new library books. Is this a good share . . . is it ethical?
  - [Yes.]
  - Why is this share OK?
    - [Take responses: "It's yours!", "You made it. You own it. You can choose to share it."]

Discussion

Not Okay to Share

- Have you ever transferred songs to your friend's MP3 player? Is that OK?
  - [If it's a song you hear on the radio, it's most likely protected by copyright and NOT OK to share, copy, and give away.]
- What if your friend invites you to his house to watch a movie that just came out on DVD? This is one of your favorite movies. You want it on your phone, so you can watch it whenever you want. So, you take out your phone and record the movie. Is this a fair way to get a copy of the movie?
  - [No. This is not OK to share/copy. Why? Because you don't own the right to make a copy and give it away.]
  - How else could you get an authorized (legal) copy of the movie for your phone?
    - [iTunes or Amazon sell movies legally.]

Teaching Tip

Demonstrate the following by handing a book to a student:

Sharing a digital file is different from face-to-face sharing. If I hand you my book to share it with you, you have the book and I don't—that's sharing. If I hand you my iPod, so you can listen to my music, that is sharing. If I share a digital file with you—like a song or a movie or computer game—we both end up with the file. In that case, we made a copy. If I copy my songs for you to put on your iPod, that is not sharing—it's copying. Making copies of copyrighted work hurts the artist/creators. In addition, P2P sharing and torrent sites can put your computer at risk for bad stuff: malware, ads, and worse.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming

Lesson 20: End of Course Project

Overview

The next five lessons provide an opportunity for students to put their coding skills to use in a capstone project. This project will help individuals gain experience with coding and produce an exemplar to share with peers and loved ones. This is intended to be a multi-lesson or multi-week project where students spend time brainstorming, learning about the design process, building, and then presenting their final work.

In the "Explore" stage, students will play around with pre-built Artist and Sprite Lab programs for inspiration. Next, students will learn about the design process and how to implement it in their own projects. They will then be given the space to create their own project in Artist, Sprite Lab, or any other interface that you are comfortable providing. (This is likely the longest stage of the project.) Students will then revise their code after testing and peer review. Finally, students will be able to present their finished work to their classmates.

Purpose

Students may be ready to jump straight into building their projects, but this lesson will help shape their ideas into plans. This structure will keep the dreamers grounded and illuminate a path for those feeling left in the dark. Provide students with ample time to build and revise their projects. The trial and error inevitably involved in this lesson will teach problem solving and persistence.

Agenda

Day 1 - Explore Project Ideas (45 min)

Example Projects

Day 2 - The Design Process (45 min)

Define and Prepare

Day 3 - Build Your Project (45 min)

Try

Day 4 (Recommended for 5th Grade) - Revise Your Project (45 min)

Reflect and Try Again

Day 5 & 6 - Present Your Project (45 min each)

Presentations

Extension Activity

View on Code Studio

Objectives

Students will be able to:

- Learn to plan in advance for an ongoing assignment.
- Be able to explain how system limitations can affect project design.
- Describe how compromise can help keep a project on track and inspire creativity.
- Draft and implement plans to resolve any issues in their code.
- Articulate the design process and how it helped shape the finished culminating project.

Preparation

- [ ] Spend time making your own project with both the Artist and Sprite Lab. Familiarize yourself with the capabilities and limitations of each tool.
- [ ] Modify the rubric to fit your class goals and print out a copy for each student.
- [ ] Modify the project design worksheet to fit your class and print one packet for each student.

Links

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

For the Teachers

- **Design Process** - Teacher Prep Guide **Make a Copy**
- **Final Project Design** - Worksheet **Make a Copy**
- **CS Fundamentals Final Project** - Rubric

Vocabulary

- **Define** - Figure out the details of the problems that you are trying to solve
- **Prepare** - Research, plan, and acquire materials for the activity you are about to do
- **Reflect** - Carefully think back on something with the intention of improving the outcome in the future
- **Try** - Attempt to do something

Teaching Guide

Day 1 - Explore Project Ideas (45 min)

Example Projects

Goal: This part of the process is an exploration. Students will sit down with a stage full of example projects to remix and learn. Not only will this give students an idea of what is possible, it will also help them see the limitations of the tool.

Give students a day to play with and remix the projects found on Code Studio. Have them use their journals (or notebook paper) to keep track of thoughts and ideas as they go.

This activity should be done in the same pairs/groups that will be working on projects together over the next several lessons.

Make sure your class understands that they will be spending the next several weeks working with projects of their own, so they should pay close attention to how these programs were written, as well as the concepts that they use.

Day 2 - The Design Process (45 min)

Define and Prepare

Goal: Students will come up with a project and plan their strategy for programming that project in a single day. Students should have a project sketch and a description by the time the day is done.

Preparing Students for the Process:

The most important responsibility you have in kicking off this segment is to help your class understand the scope of this project. Students should be clear about the various expectations over the coming weeks so that they can prepare for their review and presentations appropriately.

To help your class manage this multi-stage undertaking, they should be given both the **Final Project Design - Worksheet** and the **CS Fundamentals Final Project - Rubric** on the first day of planning. Students will then be able to follow the rubric each step of the way to predict what their project grade will be in the end.

The Final Project Design Worksheet will provide a place for students to capture relevant thoughts and processes as they go, so they are more prepared for their reviews and presentations in the end.

As the teacher, you should download a copy of the documents and decide which elements are important to you. Be sure to edit or remove anything that you do not intend to draw student focus.

Define and Prepare:

Now that the class has their Final Project Design Worksheet in hand, they should start filling out the questions under **Day 1**.

Students will likely need to refer back to their notes from playing with the example projects, especially if they don't have access to online Artist or Play Lab project levels while they plan.

Lesson Tip:

Save 5 minutes or so at the end of the day to have students trade Final Project Design Worksheets to look at each other's work. This will help make sure that nothing is omitted or overlooked.

Students should focus on defining and planning their project during Day 1, and not cross over into building until their ideas have been written up and/or drawn out.

If students get stuck, help them work through ideas by asking questions and recalling examples, rather than offering solutions.

Day 3 - Build Your Project (45 min)

Try

Code Studio levels

Example Projects 1 *(click tabs to see student view)*

Sprite Lab Project 2 *(click tabs to see student view)*

Artist Project 3 *(click tabs to see student view)*

Goal: Students will use this day to build an initial version of their project.

Equipped with their Final Project Design Worksheet, students should head to the computers to start bringing their projects to life.

This process will come complete with plenty of trial and error. Projects are likely to become truncated versions of the original scope (if not morphed altogether). Remind students that this kind of compromise is common in software design, but they need to be sure to document the reasons for the changes in their product.

Don't let the class forget to fill out their Final Project Design Worksheets as they go. It might be helpful to suggest that pairs/groups take a worksheet break to begin discussing these questions about halfway through their lab time. Alternatively, the navigator can keep their eyes open for pertinent answers while the driver codes.

Be sure that each team member has their own Final Project Design Worksheet, as there are questions about each student's own individual thoughts and behaviors that need to get captured along the way.

Day 4 (Recommended for 5th Grade) - Revise Your Project (45 min)

Reflect and Try Again

Goal: Students will work with another group to give and receive feedback in an effort to make each other's projects stronger.

Reflect:

For reflections, have each group pair up with another group to try each other's projects. After about 10 minutes, have the groups discuss the questions in the Final Project Design Worksheet.

Encourage students to ask the questions on the FPDW and write down feedback provided by their reviewing teams so that they can refer back to it later. This portion should take approximately 15 more minutes.

Try Again:

With their new reflections in hand, students can head back to their machines to make a handful of edits. With just 10 minutes left, they will likely have to select only the most important feedback to incorporate.

Lesson Tip:

Teachers should avoid assigning the final bit of project work as homework unless they are certain that students both live within a close proximity to one another **and** have internet access at home.

Day 5 & 6 - Present Your Project (45 min each)

Presentations

Goal: Students will create and present their projects in an approved manner (written, oral, or using multimedia).

Create:

Ideally, you will have class time available to give students to work on their presentations. This will allow them to incorporate rich multimedia components, like **Google Slides**. For other presentation ideas, visit **72 Creative Ways for Your Students to Show What They Know - Website**.

Lesson Tip:

If you are looking for a section of this series to assign as homework, this is it! Projects do not have to be presented in electronic form, so this is a great offline option.

Encourage students to include all of the information from Section J of the Final Project Design Worksheet into their presentation, as well as two or more questions from Section K.

Present

Students should showcase their apps first, then they can discuss the questions that they covered in their presentations.

It can be very helpful to have students sign up for a specific order in which to give their presentations, so that they are able to enjoy the demonstrations of their classmates without worrying about whether they will be called on next.

Extension Activity

If your students are already comfortable with coding concepts, try having them create their projects in another platform, like **Scratch** or **Alice**.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming