Course D

Course D was created for students who read at roughly a third grade level. Angles and mathematical concepts are introduced with helpful videos and hints.

The course begins with a review of the concepts found in Courses A, B, and C. This review helps introduce or refresh basic ideas such as repeat loops and events. Students will develop their understanding of algorithms, nested loops, while loops, conditionals, and events. Lessons on digital citizenship are also included. This course is crafted to build a strong foundation of basic concepts before opening up to a wide range of new and exciting topics.

Chapter 1: Sequencing

Lesson 1: Graph Paper Programming

Unplugged | Sequencing

In this lesson, you will program your classmate to draw pictures!

Lesson 2: Introduction to Online Puzzles

Skill Building | Sequencing

This lesson will give you practice in the skills you will need for this course.

Lesson 3: Relay Programming

Unplugged | Sequencing

Remember at the beginning of the course when you made drawings with code? In this lesson, you will be working with a team to do something very similar!

Lesson 4: Debugging with Laurel

Skill Building | Sequencing

Have you ever run into problems while coding? In this lesson, you will learn about the secrets of debugging. Debugging is the process of finding and fixing problems in your code.

Chapter Commentary

Sequencing

Chapter 2: Events
Lesson 5: Events in Bounce
Skill Building | Events
Ever wish you could play video games in school? In this lesson, you will get to make your own!

Lesson 6: Build a Star Wars Game
Skill Building | Events
Feel the force as you build your own Star Wars game in this lesson.

Chapter Commentary
Events

Chapter 3: Loops

Lesson 7: Loops in Ice Age
Skill Building | Loops
In this lesson you'll use the repeat block to help Scrat reach the acorn as efficiently as possible.

Lesson 8: Drawing Shapes with Loops
Skill Building | Loops
In this lesson, loops make it easy to make cool images with the Artist!

Lesson 9: Nested Loops in Maze
Skill Building | Loops
Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you create a nested loop.

Chapter Commentary
Loops

Chapter 4: Conditionals

Lesson 10: Conditionals with Cards
Unplugged | Conditionals
It's time to play a game where you earn points only under certain conditions!
Lesson 11: If/Else with Bee
Skill Building | Conditionals
Now that you understand conditionals, it's time to program Bee to use them when collecting honey and nectar.

Lesson 12: While Loops in Farmer
Skill Building | Conditionals
Loops are so useful in coding. This lesson will teach you about a new kind of loop: while loops!

Lesson 13: Until Loops in Maze
Skill Building | Conditionals
You can do some amazing things when you use `until` loops!

Lesson 14: Harvesting with Conditionals
Skill Building | Conditionals
It's not always clear when to use each conditional. This lesson will help you get practice deciding what to do.

Chapter Commentary
Conditionals

Chapter 5: Binary

Lesson 15: Binary Images
Unplugged | Binary
Learn how computers store pictures using a language with only two options.

Lesson 16: Binary Images with Artist
Skill Building | Binary
In this lesson, you will learn how to make images using only 0s and 1s.

Chapter Commentary
Binary

Chapter 6: Digital Citizenship
Lesson 17: Digital Citizenship

Unplugged | Online Safety

Some information is not safe to share online. This lesson will help you learn the difference between safe and private information.

Chapter Commentary

Digital Citizenship

Chapter 7: End of Course Project

Lesson 18: Dance Party

End of Course Project

Time to celebrate! In this lesson, you will program your own interactive dance party.

Chapter Commentary

End of Course Project
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Lesson 1: Graph Paper Programming

Overview

By "programming" one another to draw pictures, students get an opportunity to experience some of the core concepts of programming in a fun and accessible way. The class will start by having students use symbols to instruct each other to color squares on graph paper in an effort to reproduce an existing picture. If there's time, the lesson can conclude with images that the students create themselves.

Purpose

The goal of this activity is to build critical thinking skills and excitement for the course, while introducing some of the fundamental programming concepts that will be used throughout the course. By introducing basic concepts like sequencing and algorithms to the class in an unplugged activity, students who are intimidated by computers can still build a foundation of understanding on these topics. In this lesson, students will learn how to develop an algorithm and encode it into a program.

Agenda

Warm Up (10 min)
  - Introduction to Graph Paper Programming
Main Activity (30 min)
  - Practice Together
  - The Students' Turn
Wrap Up (15 min)
  - Journaling / Flash Chat
Optional Assessment (10 min)
  - Graph Paper Programming - Assessment
Extended Learning

Objectives

Students will be able to:
- Reframe a sequence of steps as an encoded program
- Explain constraints of translating problems from human language to machine language

Preparation

- Watch the Graph Paper Programming - Teacher Video.
- Watch the Graph Paper Programming - Lesson in Action Video.
- Print out one Graph Paper Programming - Worksheet for each group.
- Print one Graph Paper Programming - Assessment for each student.
- Supply each group with several drawing grids, paper, and pens/pencils.
- 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 Teacher
- Graph Paper Programming - Lesson in Action Video
- Graph Paper Programming - Worksheet Answer Key
- Graph Paper Programming - Assessment Answer Key

For the Students
- Graph Paper Programming - Activity Worksheet
- Graph Paper Programming - Unplugged
Video (download)
- Graph Paper Programming - Assessment
- Think Spot Journal - Reflection Journal

Vocabulary

- **Algorithm** - A list of steps to finish a task.
- **Program** - An algorithm that has been coded into something that can be run by a machine.
Teaching Guide

Warm Up (10 min)

Introduction to Graph Paper Programming

In this activity, students will encode instructions to guide each other toward making drawings without letting the rest of their group see the original image. This warm-up frames the activity for the class.

Display: Watch one of the videos below to give students context for the types of things that robots can do:

- Asimo by Honda (3:58)
- Egg drawing robot (3:15)
- Dancing Lego Robot (1:35)

Discuss: How do you suppose that robots know how to do the things that they do? Do they have brains that work the same way that ours do?

Work this into a discussion on how people have to program robots to do specific things, using specific commands.

Main Activity (30 min)

Practice Together

In this activity, students will act as both programmers and robots, coloring in squares according to programs that they have written for one another.

Distribute: Students will use 4x4 grids (or sheets of graph paper with 4x4 boxes sectioned off). They will also need the image worksheet.

Display: Project these commands, or write them on the board. They won't persist long, but they will help students make the transition from Algorithm to Program.

Move one square right
Move one square left
Move one square up
Move one square down
Fill in square with color

Say: Today, we all get to program robots...and they're already here in the room! It's you! We're going to write programs using symbols with special meanings to help each other recreate a picture. First, we'll practice together as if I am the robot and you are the programmers, then we can break up into groups so that everyone can get a turn.

Display: Display both the image that you are going to have the students walk you through, and a blank grid that you will fill-in with your ARM. Make sure that the instructions, grid, and image remain visible at the same time.
Remarks

Here is an image. Pretend that I am the robot with an Automatic Realization Machine (ARM). These are the only instructions that I understand.

Starting at the upper left-hand corner, guide my ARM out loud with your words.

Model: The class might give you instructions like these below. As you hear an instruction that you intend to follow, make sure to repeat it out loud so that the students can keep track of what you are doing.

```
Move One Square Right
Fill In Square with Color
Move One Square Right
Move One Square Down
Fill In Square with Color
```

Continue with the activity until you have completed your sample square.

Capture: Write each of the commands down so that students can see all of the steps that went into the one image.

```
Move One Square Right
Fill In Square with Color
Move One Square Right
Move One Square Down
Fill In Square with Color
```

Say: You just gave me a list of steps to finish a task. In programming, they call that an algorithm. Algorithms are great, because they are easy for you to understand as the programmer. BUT, what happens when we want to write down the algorithm for a drawing like this?

Display: Show the students a more complicated image, like the one below.

```
Move One Square Right
Fill In Square with Color
Move One Square Right
Move One Square Down
Fill In Square with Color
```

Next, begin writing down some of the instructions that it would take to replicate that image. Hopefully, students will see that writing everything out longhand would quickly become a bit of a nightmare.
Goal

The goal for this discussion is to get at the idea that students can use symbols to stand for entire phrases. Once they understand that, share with them that making the switch from listing steps in detail to encoding them is called "programming."

Teaching Tip

Notice that we have written our program from left to right like you would read a book in English. Some students prefer this method. Others like to start each line of the grid on a new line of paper. The way they write their program doesn't matter as much as whether the other people in their groups can follow along!

Discussion:

How could we use these symbols to make our instructions easier?

Draw out ideas that relate to transitioning from the verbal instructions to the symbols. Once the students get to that place, point out that this text:

- “Move one square right, Move one square right, Fill-in square with color”

would now correspond to the program:

![Symbol example]

Discussion:

The goal for this discussion is to get at the idea that students can use symbols to stand for entire phrases. Once they understand that, share with them that making the switch from listing steps in detail to encoding them is called "programming."

Model:

Now, have the class help you draw the larger image using only symbols. Do not worry about unnecessary steps for now. If their final program works to create the image, consider it a win.

The classroom may be buzzing with suggestions by this point. If the class gets the gist of the exercise, this is a good place to discuss alternate ways of filling out the same grid. If there is still confusion, save that piece for another day and work with another example.

See a sample solution below:
The Students’ Turn

**Group:** Divide students into pairs or small groups.

- Have each pair/group choose an image from the worksheet.
- Discuss the algorithm to draw chosen image with partner(s).
- Convert algorithm into a program using symbols.
- Trade programs with another pair/group and draw one another's image.
- Choose another image and go again!

Wrap Up (15 min)

**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?
Draw another image that you could code. Can you write the program that goes with this drawing?
What other types of robots could we program if we changed what the arrows meant?

Optional Assessment (10 min)

Graph Paper Programming - 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.

Better and Better

- Have your class try making up their own images.
- Can they figure out how to program the images that they create?

Class Challenge

- As the teacher, draw an image on a 5x5 grid.
- Can the class code that up along with you?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)
- AP - Algorithms & Programming

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Lesson 2: Introduction to Online Puzzles

Skill Building | Sequencing

Overview

In this set of puzzles, students will begin with an introduction (or review depending on the experience of your class) of Code.org’s online workspace. There will be videos pointing out the basic functionality of the workspace including the Run, Reset, and Step buttons. Also discussed in these videos: dragging Blockly blocks, deleting Blockly blocks, and connecting Blockly blocks. Next, students will practice their sequencing and debugging skills in maze. From there, students will see new types of puzzles like Collector, Artist, and Harvester when they learn the very basics of loops.

Purpose

We recognize that every classroom has a spectrum of understanding for every subject. Some students in your class may be computer wizards, while others haven't had much experience at all. In order to create an equal playing (and learning) field, we have developed this "Ramp Up Stage" for Course D. This can be used as either an introduction or a review of how to use Code.org and basic computer science concepts. This stage covers all prerequisites needed to start Course D.

Agenda

Warm Up (10 min)
  Introduction
  Vocabulary
Bridging Activities - Programming (10 min)
  Unplugged Activity Using Paper Blocks
  Preview of Online Puzzles as a Class
Main Activity (30 min)
  Online Puzzles
Wrap Up (10 min)
  Journaling

View on Code Studio

Objectives

Students will be able to:
- Order movement commands as sequential steps in a program.
- Modify an existing program to solve errors.
- Break down a long sequence of instructions into the largest repeatable sequence.

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 Blockly Blocks (Grades 2 - 5) - Manipulatives (download)
- Think Spot Journal - Reflection Journal

Vocabulary

- Bug - Part of a program that does not work correctly.
- Debugging - Finding and fixing problems in an algorithm or program.
- Loop - The action of doing something over and over again.
- Program - An algorithm that has been coded into something that can be run by a machine.
- Programming - The art of creating a program.

Vocabulary

- Bug - Part of a program that does not work correctly.
- Debugging - Finding and fixing problems in an algorithm or program.
- Loop - The action of doing something over and over again.
- Program - An algorithm that has been coded into something that can be run by a machine.
- Programming - The art of creating a program.
Teaching Guide

Warm Up (10 min)

Introduction
Students will either be learning a lot of new concepts or reviewing a lot of basic concepts. Based on your class’s experience, you can cover the following vocabulary or move on to a bridging activity. We recommend using the following words in sentences if the definitions aren’t explicitly covered.

Vocabulary
This lesson has four new and important vocabulary words:

- **Program** - Say it with me: Pro - Gram An algorithm that has been coded into something that can be run by a machine.
- **Programming** - Say it with me: Pro - Gramm - ing The art of creating a program.
- **Bug** - Say it with me: Bug An error in a program that prevents the program from running as expected.
- **Debugging** - Say it with me: De - Bugg - ing Finding and fixing errors in programs.
- **Loop** - Say it with me: Loo-p The action of doing something over and over again

Bridging Activities - Programming (10 min)

This activity will help bring the unplugged concepts from “Graph Paper Programming” 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
Similar to “Graph Paper Programming”, have the students in your class pair up. Pass out multiple fill 1 and move ___ blocks from the Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives to each pair. Have each pair of students draw a design on a four by four graph from Graph Paper Programming - Worksheet. Next, have the students work together to write the program needed to draw this design using the paper Blockly blocks. The students will need to write up, down, right, or left on the move ___ block. Make sure the students know that the program goes from top to bottom and the blocks need to touch!

Preview of Online Puzzles as a Class
Pull up a puzzle from Course D Online Puzzles 2018 - Website. We recommend puzzle 6 for this activity. Break up the students into groups of three or four. Have them “program” Red, the angry bird, to get to the pig using arrows from "Graph Paper Programming."

The class will not need to use the last arrow.

Once all the groups have an answer, discuss the path as a class.

Main Activity (30 min)
Online Puzzles

Teachers play a vital role in computer science education and supporting a collaborative and vibrant classroom environment. During online activities, the role of the teacher is primarily one of encouragement and support. Online lessons are meant to be student-centered, so teachers should avoid stepping in when students get stuck. Some ideas on how to do this are:

- Utilize **Pair Programming - Student Video** whenever possible during the activity.
- 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?
- Remind frustrated students that frustration is a step on the path to learning, and that persistence will pay off.
- If a student is still stuck after all of this, ask leading questions to get the student to spot an error on their own.

**Teacher Tip:**

Show the students the right way to help classmates:
- Don’t sit in the classmate’s chair
- Don’t use the classmate’s keyboard
- Don’t touch the classmate’s mouse
- Make sure the classmate can describe the solution to you out loud before you walk away

**Code Studio levels**

Maze Intro: Programming with Blocks

Practice 2 3 4 5 6 7

Challenge 8

Practice 9 10

**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 did you feel about today’s lesson?
- List some of the bugs you found in your programs today.
- What was your favorite puzzle to complete? Draw your favorite character completing a puzzle.

**Standards Alignment**

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming
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Lesson 3: Relay Programming

Unplugged | Sequencing

Overview

This activity will begin with a short lesson on debugging and persistence, then will quickly move to a race against the clock as students break into teams and work together to write a program one instruction at a time.

Purpose

Teamwork is very important in computer science. Teams write and debug code with each other, instead of working as individuals. In this lesson, students will learn to work together while being as efficient as possible.

This activity also provides a sense of urgency that will teach students to balance their time carefully and avoid mistakes without falling too far behind. This experience can be stressful (which is expected!) Make sure you provide students with the tools to deal with potential frustration.

Agenda

Warm Up (15 min)
  Where did I go wrong?
Main Activity (20 min)
  Relay Programming
Wrap Up (15 min)
  Journaling
Extended Learning

Objectives

Students will be able to:
- Define ideas using code and symbols.
- Verify work done by teammates.
- Identify signs of frustration

Preparation

- Watch the Relay Programming - Teacher Video.
- Locate a wide open space for this activity, such as the gym or outdoor field.
- Print out one Relay Programming Activity Packet - Activity Packet for each group.
- Supply each group with plenty of paper and pens/pencils.
- Print one Relay Programming - 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 Teacher
- Relay Programming - Teacher Debugging - Image
- Relay Programming - Unplugged Video (download)
- Relay Programming - Teacher Video

For the Students
- Relay Programming Debugging Packet
- Relay Programming Activity Packet - Activity Packet
- Think Spot Journal - Reflection Journal
Vocabulary

- **Algorithm** - A list of steps to finish a task.
- **Bug** - Part of a program that does not work correctly.
- **Debugging** - Finding and fixing problems in an algorithm or program.
- **Frustrated** - Feeling annoyed or angry because something is not the way you want it.
- **Persistence** - Trying again and again, even when something is very hard.
- **Program** - An algorithm that has been coded into something that can be run by a machine.
Teaching Guide

Warm Up (15 min)

Recall that in "Graph Paper Programming" we guided our teammate's Automatic Realization Machine (ARM) using arrows. This warm up will bring back these ideas, which will be needed in the main activity.

Where did I go wrong?

**Goal:** In this lesson, we want to help students learn to identify and fix bugs in their own programs. The easiest way to do that is to first present students with a program that contains bugs that are not their fault. Once they've helped you fix "your" program, share with them how frustrating it can be to make mistakes, and help them see that those feelings are completely normal and they shouldn't feel embarrassed by them.

**Display:** Show your students the provided Relay Programming - Teacher Debugging - Image.

![Image](start here)

**Discuss:** Get the attention of the class and let them know that you are stuck! You have this challenge, and you thought you had solved it, but it doesn't seem to be working. Your program has a bug, can they help you fix it?

Take a moment to walk them through the rules: - Start at the star - Follow the instructions step-by-step - End when all of the right squares are filled in

**Optional:** Follow along by filling in a blank grid. Express frustration when the picture doesn't turn out the way that you wanted it to.

**Think:** Can you figure out why my program doesn't work?

**Pair:** Let students work together to see if they can figure out what the program is supposed to say.

**Share:** Ask students if anyone was able to figure out a way to solve the problem. When you get a correct answer, let the students know that they are great at "debugging"!

**Discuss:** Ask the students if they could tell how you were feeling when you couldn't figure out the answer. They might suggest that you were "mad" or "sad". Instead of telling them "no", describe that you were feeling a little bit mad, a little bit sad, and a little bit confused. When you put all of those emotions together, it makes a feeling called "frustration". When you are "frustrated" you might think you are mad, sad, or confused -- and you might be tempted to give up -- but frustration is a natural feeling and it's a big hint that you are about to learn something! Instead of quitting, practice persistence. Keep trying over and over again. After a few times, you will start to understand how to debug your problems!

**Distribute:** To make sure that students understand the idea of finding and fixing errors (debugging) pass out the Relay Programming Debugging Packet and have students complete the task in pairs.

**Optional:** If you want to move the activity along more quickly, feel free to complete these as a class, instead.

**Transition:** Now it's time to play the game!

Main Activity (20 min)
Clarifications
Here are some clarifications that need to be shared from time to time:

- Only one person from each group can be at the image at one time.
- It is okay to discuss algorithms with the rest of the group in line, even up to the point of planning who is going to write what when they get to the image.
- When a student debugs a program by crossing out an incorrect instruction (or a grouping of incorrect instructions) this counts as their entire turn. The next player will need to figure out how to correct the removed item.

Content Corner
For more on persistence and frustration, try reading Stevie and the Big Project to your students. It will help them spot moments of frustration. It will also help give them the tools to deal with it.

If you do not read the book, take a moment to cover tips on frustration and persistence as a class:

Tips to Help With Frustration
- Count to 10
- Take deep breaths
- Journal about them
- Talk to a partner about them
- Ask for help

Tips for Being Persistent
- Keep track of what you have already tried
- Describe what is happening
- Describe what is supposed to happen
- What does that tell you?
- Make a change and try again

Relay Programming
With Graph Paper Programming in mind, it’s time to split up into teams and prepare to run the activity as a relay!

Set-Up: Prepare the Relay Programming Activity Packet - Activity Packet by printing out one copy for each team of 4-5 students. Cut or fold each page along the center dotted line.

Go over the rules of the game with your class:
- Divide students into groups of 3-5.
- Have each group queue up relay-style.
- Place an identical image at the other side of the room/gym/field from each team.
- Have the first student in line dash over to the image, review it, and write down the first symbol in the program to reproduce that image.
- The first student then runs back and tags the next person in line, then goes to the back of the queue.
- The next person in line dashes to the image, reviews the program that has already been written, then either debugs the program by crossing out an incorrect symbol, or adds a new one. That student then dashes back to tag the next person, and the process continues until one group has finished their program.

First group to finish with a program that matches the image is the winner! Play through this several times, with images of increasing difficulty.

Go through the game as many times as you can before time runs out or your students begin feeling exhausted.

Transition: Once the game is over, circle everyone up to share lessons learned.

Discuss: What did we learn today?
- What if each person on a team were allowed to do five arrows at a time?
  - How important would it be to debug our own work and the work of the programmer before us?
  - How about with 10 arrows?
  - 10,000? Would it be more or less important?
- Do you think a program is better or worse when more than one person has worked on it?
- Do you think people make more or fewer mistakes when they’re in a hurry?
- If you find a mistake, do you have to throw out the entire program and start over?

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 did teamwork play a role in the success of writing today's program?
Did you start to get frustrated at any point? What did you do about it?

Extended Learning

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

Pass the paper
- If you don’t have the time or room for a relay, you can have students pass the paper around their desk grouping, each writing one arrow before they move the paper along.

Fill It, Move It
- As the teacher, draw an image with as many filled squares as children in each group.
- Have the students write as many arrows in the program as it takes to get to a filled-in square (including actually filling that square in) before passing to the next person.

Debugging Together
- Draw an image on the board. Have each student create a program for the image. Ask students to trade with their elbow partner and debug each other’s code.
- Circle the first incorrect step, then pass it back.
- Give the students another chance to review and debug their own work.
- Ask for a volunteer to share their program.

Ask the class:
- How many students had the same program?
- Anyone have something different?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)
- AP - Algorithms & Programming

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Lesson 4: Debugging with Laurel

Skill Building | Sequencing

Overview

In this online activity, students will practice debugging in the "collector" environment. Students will get to practice reading and editing code to fix puzzles with simple algorithms, loops and nested loops.

Purpose

The purpose of this lesson is to teach students that failure is normal when learning a new skill. Students will be given pre-written programs that do NOT work. They will be asked to fix these programs. This process, called "debugging", teaches students essential problem solving and critical thinking skills. These skills transfer over as students proceed to harder and harder programming projects.

Agenda

- Warm Up (15 min)
  - Introduction
- Bridging Activities - Debugging (15 min)
  - Unplugged Activity with Paper Blocks
  - 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:

- Read and comprehend given code.
- Identify a bug and the problems it causes in a program.
- Describe and implement a plan to debug 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

- Relay Programming Activity Packet - Activity Packet
- Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives (download)
- Think Spot Journal - Reflection Journal

Vocabulary

- Bug - Part of a program that does not work correctly.
- Debugging - Finding and fixing problems in an algorithm or program.
Teaching Guide

Warm Up (15 min)

Introduction
One of the most important parts of learning to program is learning to debug. Ask the class if they have ever learned a new skill and faced failure.

For example:

- Learning to ride a bike and falling down
- Learning to bake and burning the food
- Learning to play a sport and not winning a game

Facing failure is very common when learning new things. Have students discuss past failures and how they overcame them.

In programming, computer scientists often run into "bugs" in their code.

- **Bug**: Part of a program that does not work correctly.

A bug can really mess up the program, so it's important to learn to "debug" your code.

- **Debug**: Finding and fixing problems in your algorithm or program.

Continue the conversation if you think your class needs more of an introduction, but leave time for one of the bridging activities.

Bridging Activities - Debugging (15 min)

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

Unplugged Activity with Paper Blocks

Break your class up into teams of 3-5 and go to a large space. This space could be in a gym or outside. Queue up these teams like in "Relay Programming". Pick a semi-difficult design from Relay Programming Activity Packet - Activity Packet. Display this design at the end of a long distance between each team. Along with the display, provide each team with enough paper blocks from Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives. Each team will need plenty of fill 1 and move ___ blocks. The move ___ blocks can either be filled in ahead of time, or filled in during the game.

Either way, make sure these blocks are properly defined when the game is playing out.

Once all the teams are lined up, display or read out the following rules:

- The first student in line gets to run over to the image, review it, and place the first code block in the program to reproduce that image.
- The first student then runs back and tags the next person in line, then goes to the back of the queue.
- The next person in line dashes to the image, reviews the image, reviews the program that has already been written, then either debugs the program by taking out an incorrect code block, or adds a new block in. That student then dashes back to tag the next person, and the process continues until one group has finished their program.

Make sure the students are only using the fill 1 or move ___ blocks, and only placing one down per turn. The first team to correctly write out the code for their image wins.

Preview of Online Puzzles as a Class

Group the students into teams of 3. Choose a puzzle from the Course D Online Puzzles 2018 - Website associated with this lesson. We recommend the fifth puzzle. Have the students in each team sit at a computer with the puzzle
displayed. Each team only gets one computer and only one student can be looking at the screen. Display or read the following rules:

- Only one student in each team can look at the screen.
- This person can only delete or add one block at a time. Once that person has added or removed a block, they can tap the shoulder of the next person.
- The next person can proceed to play out their turn.
- No turns can be skipped or repeated, everyone must play an equal amount.

The first team to finish the puzzle correctly wins!

**Main Activity (30 min)**

**Online Puzzles**

It might be helpful for students to sit with their teams from the bridging activities. Every student should work on these puzzles individually or in pairs, but having a closely knit group to ask and answer questions with can help develop confidence and understanding with the subject matter.

**CodeAtStudio levels**

De-bugging with the Step Button  
Practice  
Challenge  
Practice

**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 bug? How do you know there is a bug in your program?
- What does it mean to debug code? How do you debug a program?

**Standards Alignment**

CSTA K-12 Computer Science Standards (2017)
  - AP - Algorithms & Programming
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Lesson 5: Events in Bounce

Skill Building | Events

Overview

In this online activity, students will learn what events are, and how computers use them in programs like video games. Students will work through puzzles making the program react to events (like arrow buttons being pressed.) At the end of the puzzle, students will have the opportunity to customize their game with different speeds and sounds.

Purpose

Events are very common in computer programs, especially in video games.

In this lesson, students will develop their understanding of events by making a sports-based game. Students will learn to make their paddle move according to arrow keys, and make noises when objects collide. At the very end, they will get to customize their game to make it more unique!

Agenda

- Warm Up (10 min)
  - Introduction
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (10 min)
  - Assessment
  - Journaling
- Extended Learning

View on Code Studio

Objectives

Students will be able to:
- Identify actions that correlate to input events.
- Create an interactive game using sequence and event-handlers.
- Share a creative artifact with other students.

Preparation

- Make sure every student has a journal.
- Play through the puzzles to find any potential problem areas for your class.
- Read the “Events in Bounce - How Do They Happen?” slide deck (to be presented to students at end of class).

Links

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

For the Teacher

- Events in Bounce - How Do They Happen? - Slide Deck

For the Students

- Think Spot Journal - Reflection Journal

Vocabulary

- Event - An action that causes something to happen.
Teaching Guide

Warm Up (10 min)

Introduction
Ask the students to come sit down near you. Now tell them to all stand up!

Tell the students what you just did was declare an event and an action. When you say to sit down, it is an event. The action responding to this event is the class sitting down. This is the same when you ask the class to stand up. Events and actions are easily identifiable in our lives.

Some other events and actions include:
- Feeling hungry and eating food
- Stubbing your toe and yelling "Ouch!"
- Getting the basketball in the basket and scoring a point for your team!

Ask the class to come up with a couple of more events. Tell them that they will be making a game where the program will have actions associated to events that they code!

Main Activity (30 min)

Online Puzzles

Code Studio levels

Practice

Free Play

At the end of the set of puzzles, students will have the opportunity to make their game unique. Have the students try new ways to make the game more challenging. For example, try playing with many balls at once, or each time the ball bounces off a wall, launch more balls.

Wrap Up (10 min)

Assessment

Present the "Events in Bounce - How Do They Happen?" slide deck to students. Allow them to record the correct order of events on the second slide in their journals first. Call on a few students to share their answers before revealing the third slide. Discuss the correct sequence with the class.

Correct Order: D, B, A, C

Teaching Tip

Although introduced in this lesson, the slide deck "Events in Bounce - How Do They Happen?" can be applied more generally to express the relationship between hardware and software. Particularly, the final slide simplifies the input-to-output sequence and can be made into a poster for your classroom.

Teaching Tip

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.
**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 did you do to make your game super cool?
- What kind of game do you want to code in the future?

**Extended Learning**

**Take Me Out to the Ball Game**

Take the students outside to play some sort of ball game. Keep track of events and actions. For example, not dribbling in basketball results in a traveling foul and the other team gets the ball. In soccer, kicking the ball out of bounds results in the other team kicking the ball in. Getting the ball to the goal results in a point! Make up more events if your students are into it. Have the all of the students yell “Yippee” when the captain of one team scores a point. Have everyone fall to the ground and roll around if a student makes two goals in a row!

**Standards Alignment**

CSTA K-12 Computer Science Standards (2017)

- **AP** - Algorithms & Programming
- **CS** - Computing Systems

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Lesson 6: Build a Star Wars Game

Skill Building | Events

Overview
In this lesson, students will practice using events to build a game that they can share online. Featuring R2-D2 and other Star Wars characters, students will be guided through events, then given space to create their own game.

Purpose
CS Fundamentals is not simply about teaching computer science, it is about making computer science fun and exciting. In this series, students will learn about events using popular characters from Star Wars. These puzzles blur the lines between "learning" and "fun". Also, students will learn to recognize regular programming practices in games so that when they play games at home, they can see common computer science principles being used.

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

Preparation
- Play through the puzzles and find any potential problem areas.
- 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
  - Think Spot Journal - Reflection Journal

Vocabulary
- Event - An action that causes something to happen.
### Warm Up (15 min)

**Introduction**

In a class discussion, ask the students what their favorite video game is (you might need to remind the students to only use games that are classroom appropriate). Ask the students what their favorite part of the game is.

Most of the time, students will respond with some kind of event. When you recognize a student response that describes an event, ask the student to describe it further.

Once the student is done describing their fun, take a minute to relate it back to the definition of an event.

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

Ask the students to try and relate some of their favorite parts of video games and how they can be described as events. Have them pair share and discuss the differences between their events and their partner's.

### Main Activity (30 min)

**Online Puzzles**

- **Code Studio levels**

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

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

Students will likely be very excited to make their own Star Wars game at the end of this set of puzzles. If there's time, ask them to plan out what they want the game to do. The planning and preparation will help the students better recognize the key concepts this lesson is trying to teach. Encourage the students to share and remix each other's games at the end of this lesson.

### 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?
- Give an example of an event you used in your program today?
- Why is it important not to share private information online? How do you know if information is private?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming

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Lesson 7: Loops in Ice Age

Skill Building | Loops

Overview

As a quick update (or introduction) to using loops, this stage will have students using the repeat block to get Scrat to the acorn more efficiently.

Purpose

In this lesson, students will be learning more about loops and how to implement them in Blockly code. Using loops is an important skill in programming because manually repeating commands is tedious and inefficient. With these Code.org puzzles, students will learn to add instructions to existing loops, gather repeated code into loops, and recognize patterns that need to be repeated.

Agenda

- Warm Up - The Unplugged Foundation (10 min)
  - Repeat After Me
- Online Foundation: Preview Loops in Ice Age
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (5 - 10 min)
  - Journaling
- Extended Learning

View on Code Studio

Objectives

Students will be able to:
- Construct a program using structures that repeat areas of code
- Improve existing code by finding areas of repetition and moving them into looping structures

Preparation

(Optional) Pick a couple of puzzles to do as a group with your class.
Make sure each student has a journal.

Links

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

For the Students
- Feeling Faces - Emotion Images

Make a Copy

Think Spot Journal - Reflection Journal

Vocabulary

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

Warm Up - The Unplugged Foundation (10 min)

Repeat After Me

Model: Ask for a volunteer and have them stand.

- Instruct your volunteer to walk around the table (or their chair, or a friend).
- When they finish, instruct them to do it again, using the exact same words you did before.
- When they finish, instruct again.
- Then again.

Prompt: Would it have been easier for me to just ask you to go around the table four times?

Think: What if I wanted you to do it ten times? How would you reword my instructions so that they were more efficient and I didn't have to repeat myself so much? Feel free to write your instructions down on a piece of scrap paper.

Share: Ask a few students to share their instructions with the class, pointing out how each approach has simplified the overall approach to giving instructions.

Say: Today we're going to work on finding ways to make giving lots of instructions easier, especially when those instructions repeat themselves a lot.

Online Foundation: Preview Loops in Ice Age

To finish the connection, preview an online puzzle (or two) as a class.

Model: Reveal an entire online puzzle from the progression to come. We recommend Puzzle 5. Point out the “Play Area” with Scrat and the acorn, as well as the “Work Space” with the Blockly code. Explain that this Blockly code is now the language that the class will be using to help Scrat get to the acorn. Do students see any similarities to the exercise that they just did? What are the big differences?

Work with your class to drag code into the workspace in such a way that Scrat (eventually) gets to the acorn.

Transition: Students should now be ready to transition to computers to complete online puzzles on their own.

Main Activity (30 min)

Online Puzzles

As students work through the puzzles, see if they can figure out how many blocks they use with a loop vs. without a loop.

Code Studio levels

Practice

Using the Repeat Block

Challenge
**Wrap Up (5 - 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?
- Draw one of the Feeling Faces - Emotion Images that shows how you felt about today’s lesson in the corner of your journal page.
- Draw your own maze with Scrat trying to get to an Acorn. Will loops help you solve it?
- Draw yourself using a loop to do an everyday activity, like brushing your teeth.

**Extended Learning**

**So Moving**
- Give the students pictures of actions or dance moves that they can do.
  - Have students arrange moves and add loops to choreograph their own dance.
- Share the dances with the rest of the class.

**Connect It Back**
- Find some YouTube videos of popular dances that repeat themselves.
- Can your class find the loops?
- Try the same thing with songs!

**Standards Alignment**

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Lesson 8: Drawing Shapes with Loops

Skill Building | Loops

Overview
This lesson builds on the understanding of loops from previous lessons and gives students a chance to be truly creative. This activity doubles as a debugging exercise for extra problem-solving practice.

Purpose
This series highlights the power of loops with an array of puzzles meant to get students thinking about why repeat loops are superior to longhand.

Agenda
- Warm Up (15 min)
  - Introduction
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (15 min)
  - Journaling

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.

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

For the Students
- **Think Spot Journal** - Reflection 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 an introduction to loops at this point. Based on what you think your class could benefit from, we recommend:

- Creating a new dance with loops just like in "Getting Loopy"
- Reviewing a puzzle from the last lesson
- Previewing a puzzle from this lesson

Any of these should help prepare your class for fun with the online puzzles!

Main Activity (30 min)

Online Puzzles

Code Studio levels

**Artist Intro with JR Hildebrand**

Practice

Loops with the Artist

Practice

Challenge

Practice

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 as they program online.

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 could program using loops? Can you come up with the code to create it?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

▶ AP - Algorithms & Programming

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Lesson 9: Nested Loops in Maze

Skill Building | Loops

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.

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.

Links

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

For the Students

- Think Spot Journal - Reflection Journal

Vocabulary

- Command - An instruction for the computer. Many commands put together make up algorithms and computer programs.
- 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

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Lesson 10: Conditionals with Cards

Unplugged | Conditionals

Overview

This lesson demonstrates how conditionals can be used to tailor a program to specific information. We don’t always have all of the information we need when writing a program. Sometimes you will want to do something different in one situation than in another, even if you don’t know what situation will be true when your code runs. That is where conditionals come in. Conditionals allow a computer to make a decision, based on the information that is true any time your code is run.

Purpose

One of the best parts of teaching conditionals is that students already understand the concept from their everyday lives.

This lesson merges computer science into the real world by building off of their ability to tell if a condition is true or false. Students will learn to use if statements to declare when a certain command should be run, as well as if / else statements to declare when a command should be run and what do run otherwise. Students may not recognize the word conditionals, but most students will understand the idea of using “if” to make sure that some action only occurs when it is supposed to.

Agenda

- Warm Up (20 min)
  - Vocabulary
  - Introduction
- Main Activity (20 min)
  - Conditionals with Cards Sample Program - Teacher Prep Guide
- Wrap Up (15 min)
  - Flash Chat: What did we learn?
  - Journaling
- Assessment (5 min)
  - Conditionals with Cards - Assessment
- Extended Learning

View on Code Studio

Objectives

Students will be able to:
- Define circumstances when certain parts of a program should run and when they shouldn’t.
- Determine whether a conditional is met based on criteria.
- Traverse a program and predict the outcome, given a set of input.

Preparation

- Watch the Conditionals with Cards - Teacher Video.
- Watch the Conditionals with Cards - Lesson in Action Video.
- Gather decks of cards or something similar.
- One Conditionals with Cards Sample Program - Teacher Prep Guide for the class to look at.
- Print one Conditionals with Cards - Assessment for each student.
- Make sure every student has aThink Spot Journal - Reflection Journal.

Links

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

For the Teacher

- Conditionals with Cards - Unplugged Video (download)
- Conditionals with Cards - Teacher Video
- Conditionals with Cards - Lesson in Action Video
- Conditionals with Cards Sample Program - Teacher Prep Guide
- Conditionals with Cards - Assessment Video
Conditionals with Cards - Assessment
Answer Key

For the Students
• Conditionals with Cards - Assessment
• Think Spot Journal - Reflection Journal

Vocabulary
• Conditionals - Statements that only run under certain conditions.
Vocabulary
This lesson has one new and important word:

**Conditionals** - Say it with me: Con-di-shun-ul-s

Statements that only run under certain conditions.

**Introduction**
- We can start this lesson off right away
  - Let the class know that if they can be completely quiet for thirty seconds, you will do something like:
    - Sing an opera song
    - Give five more minutes of recess
    - Do a handstand
  - Start counting right away.
  - If the students succeed, point out that they succeeded, so they get the reward.
  - Otherwise, point out that they were not completely quiet for a full thirty seconds, so they do not get the reward.
- Ask the class "What was the condition of the reward?"
  - The condition was IF you were quiet for 30 seconds
    - If you were, the condition would be true, and you would get the reward.
    - If you weren't, the condition would be false, so the reward woud not apply.
  - Can we come up with another conditional?
    - If you can guess my age correctly, the class can give you applause.
    - If I know an answer, I can raise my hand.
    - What examples can you come up with?
- Sometimes, we want to have an extra condition, in case the "IF" statement is not true.
  - This extra condition is called an "ELSE" statement
  - When the "IF" condition isn't met, we can look at the "ELSE" for what to do
    - Example: IF I draw a king from this deck of cards, everybody claps. Or ELSE, everyone says "Awwwwwe."
    - Let's try it. (Draw a card and see if your class reacts appropriately.)
  - Ask the class to analyze what just happened.
    - What was the IF?
    - What was the ELSE?
    - Which condition was met?
- Believe it or not, we have even one more option.
  - What if I wanted you to clap if I draw a 7, or else if I draw something less than seven you say "YAY," or else you say "Awwwwee"?
    - This is why we have the terms If, Else-If, and Else.
    - If is the first condition
    - Else-If gets looked at only if the "If" isn't true.
    - Else gets looked at only if nothing before it is true.

Now let's play a game.

**Main Activity (20 min)**

**Conditionals with Cards Sample Program - Teacher Prep Guide**
Directions:

- Create a few programs with your class that depend on things like a card's suit, color, or value to award or subtract points.
  You can write the program as an algorithm, pseudocode, or actual code.

Here is a sample algorithm:

```plaintext
if (CARD is RED)
    Award YOUR team 1 point
else
    Award OTHER team 1 point
```

Here is a sample of the same program in pseudocode:

```plaintext
If (card.color == RED){
    points.yours = points.yours + 1;
}
Else {
    points.other = points.other + 1;
}
```

- Decide how you want to split your class into teams.
- Each team should have a pile of cards (at least as many cards as team members) nearby.
- Put one of your “Programs” up on the board for all to see.
- Have the teams take turns drawing cards and following the program to see how many points they score in each round.
- Play several times with several different programs to help the students really understand conditionals.

Once the class has had some practice, you can encourage students to nest conditionals inside one another. Make sure they understand that if the card is red, YOUR team is awarded 1 point, and then nothing else happens, since the condition was met:

```plaintext
if (CARD is RED)
    Award YOUR team 1 point
else
    if (CARD is higher than 9)
        Award OTHER team 1 point
    else
        Award YOUR team the same number of points on the card
```

Here is the same program in pseudocode:

```plaintext
If (card.color == RED){
    points.yours = points.yours + 1;
}
else {
    if (card.value > 9){
        points.other = points.other + 1;
    }
    else {
        points.yours = points.yours + card.value;
    }
}
```

Wrap Up (15 min)

Flash Chat: What did we learn?

- If you were going to code this up in Blocky, what would you need to add around your conditionals to let the code run more than one time? (A loop)
• What other things do you do during the day under certain conditions?
• If you are supposed to do something when the value of a card is more than 5, and you draw a 5, do you meet that condition?
• Notice that conditions are either “True” or “False.” There is no assessment of a condition that evaluates to “Banana.”
• When you need to meet several combinations of conditions, we can use something called “nested conditionals.”
  ◦ What do you think that means?
  ◦ Can you give an example of where we saw that during the game?
• What part of that game did you like the best?

**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 conditional? How did you use a conditional today?
• What are some of the conditionals you used today? Can you come up with some more that you would use with a deck of cards?

**Assessment (5 min)**

**Conditionals with Cards - 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. Here’s a [Conditionals with Cards - Assessment Video](#) to watch as a guide.

**Extended Learning**

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

**True/False Tag**

• Line students up as if to play Red Light / Green Light.
• Select one person to stand in front as the Caller.
• The Caller chooses a condition and asks everyone who meets that condition to take a step forward.
  ◦ If you have a red belt, step forward.
  ◦ If you are wearing sandals, take a step forward.
• Try switching it up by saying things like "If you are not blonde, step forward."

**Nesting**

• Break students up into pairs or small groups.
• Have them write if statements for playing cards on strips of paper, such as:
  ◦ the suit is clubs
  ◦ the color is red
• Have students create similar strips for outcomes.
  ◦ Add one point
  ◦ Subtract one point
Once that's done, have students choose three of each type of strip and three playing cards, paying attention to the order selected.

Using three pieces of paper, have students write three different programs using only the sets of strips that they selected, in any order.

- Encourage students to put some if statements inside other if statements.

Now, students should run through all three programs using the cards that they drew, in the same order for each program.

- Did any two programs return the same answer?
- Did any return something different?

## Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming

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Lesson 11: If/Else with Bee

Skill Building | Conditionals

Overview

Up until this point students have been writing code that executes exactly the same way each time it is run - reliable, but not very flexible. In this lesson, your class will begin to code with conditionals, allowing them to write code that functions differently depending on the specific conditions the program encounters.

Purpose

After being introduced to conditionals in “Conditionals with Cards,” students will now practice using them in their programs. The if / else blocks will allow for a more flexible program. The bee will only collect nectar if there is a flower or make honey if there is a honeycomb. Students will also practice and recognize a connection between if / else blocks and while loops in this set of puzzles.

Agenda

Warm Up (10 min)
  Introduction
Bridging Activity - Conditionals (15 min)
  Unplugged Activity Using Paper Blocks
  Preview of Online Puzzles
Main Activity (30 min)
  Online Puzzles
Wrap Up (15 min)
  Journaling
Extended Learning

Objectives

Students will be able to:
- Translate spoken language conditional statements into a program.
- Solve puzzles using a combination of looped sequences and conditionals.

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 Blockly Blocks (Grades 2 - 5) - Manipulatives (download)
- Think Spot Journal - Reflection Journal

Vocabulary

- Conditionals - Statements that only run under certain conditions.
Teaching Guide

Warm Up (10 min)

Introduction

Review the "Conditionals with Cards" activity with your students.

- What is a conditional statement?
- When is a conditional useful?
- What are some of the conditions you used in the last activity?

Now we're going to use conditionals with the Code.org bee to help him deal with some mysterious clouds. We don't know if his flowers have nectar or not, so we'll need to use conditionals to make sure that we collect nectar if it's there, but that we don't try to collect nectar from a flower that doesn't have any.

Bridging Activity - Conditionals (15 min)

This activity will help bring the unplugged concepts from "Conditionals With Cards" 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

Print and cut out 2-3 if / else and blank action blocks from Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives and pull out a deck of cards. Ask the class to come up with a couple of conditionals to use with the deck of cards like they did in "Conditionals with Cards." When the conditionals have been decided on as a class, fill in the blank part of the if block with the various card values that the kids came up with. Examples include "King of Hearts", "Even Numbered", or "Diamonds". Fill in the action blocks with the actions the students came up with. Make sure the students know the action blocks need to be directly under the if or else block. Below is an example.

![Conditionals with Cards Paper Blocks](image)

Now shuffle the deck of cards and play "Conditionals with Cards" again. Flip through the deck card-by-card, reacting to cards if a conditional has been made for it.

Preview of Online Puzzles

Pull up a puzzle from Course D, we recommend puzzle 9.

- Ask the class what the bee should do when it gets to the cloud.
  - The bee should use a conditional to check for a flower or a honeycomb.
- Use the if at flower / else block. Ask the class what the bee should do if there's a flower. If there's not a flower, there will be a honeycomb. What should the bee do then?
  - The bee should get nectar if there is a flower and make honey if there is a honeycomb.

Fill in the rest of the code and press Run. Discuss with the class why this worked.

Main Activity (30 min)
Online Puzzles
These puzzles might sprout some questions, so have the students work in pairs or implement the “Ask three before you ask me” rule (have the students ask three other peers for help before they go to the teacher.) This will spark discussions that will develop each student's understanding.

Code Studio levels

Conditionals: If Statements (click tabs to see student view)

Prediction (click tabs to see student view)

Practice (click tabs to see student view)

Conditionals: If and If/Else Statements (click tabs to see student view)

Practice (click tabs to see student view)

Prediction (click tabs to see student view)

Challenge (click tabs to see student view)

Practice (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 today’s lesson make you feel?
- What conditionals did you use in your code today?
- What are some other conditionals a bee might use? Examples include:
  - if there is a tree in front of me, buzz out of the way
  - if my wing is hurt, rest on the ground
  - if I see another bee, say "Hello!"

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

**True/False Tag**
- Line students up as if to play *Red Light / Green Light*.
- Select one person to stand in front as the Caller.
- The Caller chooses a condition and asks everyone who meets that condition to take a step forward.
  - If you have a red belt, step forward.
  - If you are wearing sandals, take a step forward.
- Try switching it up by saying things like "If you are not blonde, step forward."

**Nesting**
- Break students up into pairs or small groups.
- Have them write if statements for playing cards on strips of paper, such as:
  - If the suit is clubs
  - If the color is red
- Have students create similar strips for outcomes.
  - Add one point
  - Subtract one point
- Once that’s done, have students choose three of each type of strip and three playing cards, paying attention to the order selected.
- Using three pieces of paper, have students write three different programs using only the sets of strips that they selected, in any order.
  - Encourage students to put some if statements inside other if statements.
- Now, students should run through all three programs using the cards that they drew, in the same order for each program.
  - Did any two programs return the same answer?
  - Did any return something different?

**Standards Alignment**

*CSTA K-12 Computer Science Standards (2017)*

- **AP - Algorithms & Programming**

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Lesson 12: While Loops in Farmer

Skill Building | Conditionals

Overview

By the time students reach this lesson, they should already have plenty of practice using repeat loops, so now it's time to mix things up.

While loops are loops that continue to repeat commands while a condition is met. While loops are used when the programmer doesn't know the exact number of times commands need to be repeated, but does know what condition needs to be true in order for the loop to continue repeating. For example, students will be working to fill holes and dig dirt in Farmer. They will not know the size of the holes or the height of the mountains of dirt, but the students will know they need to keep filling the holes and digging the dirt as long as the ground is not flat.

Purpose

As your students continue to deepen their knowledge of loops, they will come across problems where a command needs to be repeated, but it is unknown how many times it needs to be repeated. This is where while loops come in. In today's lesson, students will develop a beginner's understanding of condition-based loops and also expand their knowledge of loops in general.

Agenda

- Warm Up (10 min)
  - Introduction
- Bridging Activity (15 min)
  - Unplugged Activity Using Paper Blocks
  - Preview of Online Puzzles
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (15 min)
  - Journaling

Objectives

Students will be able to:
- Distinguish between loops that repeat a fixed number of times and loops that repeat as long as a condition is true.
- Use a while loop to create programs that can solve problems with unknown values.

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 Teacher

- Conditionals with Cards Sample Program - Teacher Prep Guide

For the Students

- Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives (download)
- Think Spot Journal - Reflection Journal

Vocabulary

- Condition - A statement that a program checks to see if it is true or false. If true, an action is taken. Otherwise, the action is ignored.
- Loop - The action of doing something over and over again.
- Repeat - Do something again
- While Loop - A loop that continues to repeat while a condition is true.
Teaching Guide

Warm Up (10 min)

Introduction

Use "while" in a sentence in front of the students. Ask the students what the word "while" means. If you were to say "while there is a hole, fill it with dirt" what would they do? How long would they do that?

When you use a word like "while", you are relying on a condition to tell the computer how long the loop should run. A condition is a statement that is tested and found to be true or false. In the case above, the condition is if there is a hole. It's only possible for there to be a hole or for there not to be a hole, thus the statement is only ever true or false.

Tell the students they will be learning about a new kind of loop. Previously, students only used loops to repeat a command a certain number of times. Here, they won't always know how many times to repeat the command, however, they will know when to stop or when to keep going. While loops allow the programmer to repeat a command as long as a condition is still true. In the previous example, the condition is the existence of a hole.

If there's time, have the students discuss other times using a while loop would be useful. Examples include:

- Running toward a ball while it is in front of you.
- Filling a glass while it has space for more liquid.
- Walk forward while there is a path ahead.

Bridging Activity (15 min)

This activity will help bring the unplugged concepts from "Conditionals With Cards" into the online world that the students are moving into. It will also help bridge the concept of conditionals to a new type of loop- while loops. Choose one of the following to do with your class:

Unplugged Activity Using Paper Blocks

Print and cut out 2-3 while / do blocks and blank action blocks from Unplugged Blockly Blocks (Grades 2 - 5) - Manipulatives and pull out a deck of cards. Ask the class to come up with a couple of conditionals to use with the deck of cards like they did in "Conditionals with Cards." This time, instead of using the conditional in an if / else statement, they will be using it in a while loop.

When the conditionals have been decided on as a class, fill in the blank part of the while block with the various card groups that the kids came up with. Examples include "Even Numbered", "Red card", or "Diamonds". Fill in the action blocks with the actions the students came up with. Make sure the students know the action blocks need to be directly inside the while block. Line the blocks up sequentially so students can see how it runs as a program.

Below is an example.

![Example Image]

Now shuffle the deck of cards and play "Conditionals with Cards" again. Flip through the deck card-by-card, reacting to cards if a conditional has been made for it. To maintain authenticity for this while loop experience, make sure you hold up the selected card for a good long while to give students time to react over several beats. Feel free to jump back to previous
cards to get the point across that once you have left a while loop, you continue moving forward and do not return to the previous loop just because the conditions match again.

**Preview of Online Puzzles**

Pull up a puzzle from [CSF Express Course - Website](#), we recommend Puzzle 6.

- Ask the class what the farmer should do when she gets to the pile of dirt.
  - The farmer should use a conditional in a while loop to check if there is a pile.
- Use the while there is a pile / do block. Ask the class what the farmer should do if there is no pile. When should the farmer stop?
  - The farmer should remove 1 if there is a pile. The while loop will continue until there is no pile, so then your code is finished!

Fill in the rest of the code and press Run. Discuss with the class why this worked.

**Main Activity (30 min)**

**Online Puzzles**

While loops are not always a difficult concept for students to understand, but if you think your class might struggle with these puzzles, we recommend [Pair Programming - Student Video](#). This will allow students to bounce ideas of each other before implementing the code. Pair programming works to increase confidence and understanding with topics like while loops.

**Code Studio levels**

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

While Loops with the Farmer 4 (click tabs to see student view)

Prediction 5 (click tabs to see student view)

Practice 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)

Levels 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 is the difference between a while loop and a normal repeat loop?
- Give an example of a puzzle where you would use a while loop, but not use a repeat loop. Can you give an example of a puzzle where you would use a repeat loop, but not a while loop?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming

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Lesson 13: Until Loops in Maze

Skill Building | Conditionals

Overview
In this lesson, students will learn about until loops. Students will build programs that have the main character repeat actions until they reach their desired stopping point.

Purpose
This set of puzzles will work to solidify and build on the knowledge of loops by adding the until conditional. By pairing these concepts together, students will be able to explore the potential for creating complex and innovative programs.

Agenda
- Warm Up (10 min)
  - Introduction
  - Preview of Online Puzzles
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (15 min)
  - Journaling

Objectives
Students will be able to:
- Build programs with the understanding of multiple strategies to implement conditionals.
- Translate spoken language conditional statements and loops into 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
- Think Spot Journal - Reflection Journal

Vocabulary
- Condition - A statement that a program checks to see if it is true or false. If true, an action is taken. Otherwise, the action is ignored.
- Conditionals - Statements that only run under certain conditions.
- Loop - The action of doing something over and over again.
- Repeat - Do something again
- Until - A command that tells you to do something only up to the point that something becomes true.
Teaching Guide

Warm Up (10 min)

Introduction

In this lesson, students will be creating loops that only run until a condition is true. Help the students understand how this works by leading them in group activities and having them do an action until some condition is true. For example: Have students touch their nose until you tell them to stop.

Preview of Online Puzzles

Pull up a puzzle from Course D Online Puzzles 2018 - Website, we recommend Puzzle 4.

- Ask the class what the bird should repeat to get to the pig.
  - The bird should repeat move forward, turn right, move forward, and then turn left.
- Ask the class what they can use to repeat this code.
  - The bird should repeat this pattern until it reaches the pig.

Fill in the rest of the code using the repeat until loop and press Run. Discuss with the class why this worked.

Main Activity (30 min)

Online Puzzles

Code Studio levels

Practice | ❯ 1 (click tabs to see student view)

Repeat Until Statements | ❯ 2 (click tabs to see student view)

Prediction | ❯ 3 (click tabs to see student view)

Practice | ❯ 4 ❯ 5 ❯ 6 ❯ 7 ❯ 8 (click tabs to see student view)

Challenge | ❯ 9 (click tabs to see student view)

Practice | ❯ 10 (click tabs to see student view)

Prediction | ❯ 11 (click tabs to see student view)

Bringing together concepts is not easy, but this set of lessons is meant to help students see the endless possibilities of coding when using conditions. If students struggle at all with understanding the similarities or differences between while loops and until loops, have them try to think of how they would use similar statements in their real lives.

Wrap Up (15 min)
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's the difference between an until loop and a while loop?

Standards Alignment

CSTA K-12 Computer Science Standards (2017)
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Lesson 14: Harvesting with Conditionals

Skill Building | Conditionals

Overview

Students will practice while loops, until loops, and if / else statements. All of these blocks use conditionals. By practicing all three, students will learn to write complex and flexible code.

Purpose

Practicing the use of conditionals in different scenarios helps to develop a student's understanding of what conditionals can do. In the previous lesson, students only used conditionals to move around a maze. In this lesson, students will use conditionals to help the farmer know when to harvest crops. New patterns will emerge and students will use creativity and logical thinking to determine the conditions where code should be run and repeated.

Agenda

- Warm Up (5 min)
  - Introduction
- Main Activity (30 min)
  - Online Puzzles
- Wrap Up (15 min)
  - Journaling

Objectives

Students will be able to:

- Nest conditionals to analyze multiple value conditions using if, else if, else logic.
- Pair a loop and conditional statement together.

Preparation

- Play through online 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

- Think Spot Journal - Reflection Journal

Vocabulary

- **Condition** - A statement that a program checks to see if it is true or false. If true, an action is taken. Otherwise, the action is ignored.
- **Conditionals** - Statements that only run under certain conditions.
- **Loop** - The action of doing something over and over again.
- **Repeat** - Do something again
- **While Loop** - A loop that continues to repeat while a condition is true.
Teaching Guide

Warm Up (5 min)

Introduction

Students shouldn't need as much of an introduction to concepts today because they have had practice with them in the previous lesson. Instead, you can share the story of the harvester.

The harvester is trying to pick crops like pumpkins, lettuce, and corn. However, the farmer has forgotten where she planted these crops, so she needs to check each plant before harvesting.

Main Activity (30 min)

Online Puzzles

Students will continue to work with if / else statements, while loops, and until loops. These puzzles are a bit more challenging, though, so encourage students to stick with them until they can describe what needs to happen for each program.

Code Studio levels

The Harvester

Practice

Challenge

Practice

Prediction

Levels

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 can you see conditionals being useful in programs?
- What if people only spoke in if/else statements? What would be some advantages and disadvantages of this?
Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming

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Lesson 15: Binary Images

Unplugged | Binary

Overview

Though many people think of binary as strictly zeros and ones, students will be introduced to the idea that information can be represented in a variety of binary options. This lesson takes that concept one step further as it illustrates how a computer can store even more complex information (such as images and colors) in binary, as well.

Purpose

In this lesson students will learn how information is represented in a way such that a computer can interpret and store it. When learning binary, students will have the opportunity to write code and share it with peers to view as images. This can then be related back to how computers read a program, translate it to binary, use the information in some way, then reply back in a way humans can understand. For example, when we type a sentence into a document then press "save", a computer translates the sentence into binary, stores the information, then posts a message indicating the document has been stored.

Agenda

Warm Up (10 min)
- Vocabulary
- Introduction to Binary
Main Activity (20 min)
- Binary Images - Worksheet
Wrap Up (10 min)
- Flash Chat: What did we learn?
- Journaling
Assessment (10 min)
- Binary Image - Assessment
Extended Learning
Vocabulary

- **Binary** - A way of representing information using only two options.
- **Binary Alphabet** - The two options used in your binary code.
Teaching Guide

Warm Up (10 min)

Vocabulary
This lesson has two new terms:

- **Binary** - Say it with me: Bi-nare-ee
  A way of representing information using only two options.
- **Binary Alphabet** - Say it with me: Bi-nare-ee Al-fa-bet
  The two options used in your binary code.

Introduction to Binary
What if we had a picture like this, where there's only two color options for each square, black or white.

![Binary Image]

How might we encode this so that someone else could recreate the picture without seeing it?

- Some students might think back to the Graph Paper Programming lesson. While there could be a lot of similarities, let them know that this is different enough that they should not use that lesson to guide this one.
- "That's a great suggestion! Now I'm going to break you up into pairs. Work with your teammate to decide on a binary alphabet."

Decide whether you want your pairs to share their encodings with the other groups ahead of time, and tell them if they will be creating a key, or keeping their methods secret.
- "Now, let's encode some images, just like a computer would!"

Main Activity (20 min)

Binary Images - Worksheet
Now it's the students' turn!

**Activity Directions:**
1. Divide students into pairs.
2. Have them choose an image with their partner.
3. Encourage them to figure out what their binary alphabet is going to be.
4. Have them encode their image using their new binary alphabet.
5. Instruct students to trade encodings with another team and see if they can figure out which picture the other worked on.
6. Choose a Level
   - Easy: Let the other team know what your encoding method was
   - Tough: Have the other team guess your encoding method.

Wrap Up (10 min)
Flash Chat: What did we learn?

- What did we learn today?
- What kind of binary alphabet did you create?
- Can you think of how you could encode an image using only your fingers?
- Do you think you could create a binary alphabet out of sounds?

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 binary alphabet?
- What kind of information can you share using binary?

Assessment (10 min)

Binary Image - Assessment

Pass out this assessment for students to do individually. Try to save time at the end to go over answers.

Extended Learning

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

Storing Color Images

- If your class really gets the idea behind storing binary images, they may want to know how to do color images.
  - First, you'll need to discuss how color works using binary (as in Binary Baubles - Thinkersmith Lesson, page 21).
  - Then, introduce some images that use combinations of those colors
- Encourage your students to come up with ways to code these color images.

Hexadecimal

- Take the idea of color one step further to introduce hexadecimal color codes.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

- AP - Algorithms & Programming

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Lesson 16: Binary Images with Artist

Skill Building | Binary

Overview

This series of online lessons will have students learning to make images using on and off.

Purpose

This will help reinforce the fact that computers can do a multitude of things with 0s and 1s.

Agenda

- Warm Up (15)
- Main Activity (30)
  - Online Puzzles
- Wrap Up (15)
- Journaling

View on Code Studio

Objectives

Students will be able to:
- Create pictures using unique combinations of on and off
- Identify repeated sequences and break long codes up into smaller chunks that can be looped
- Utilize loops and binary code to recreate provided images

Preparation

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

Vocabulary

- Binary - A way of representing information using only two options.
Teaching Guide

Warm Up (15)

To begin, it can be helpful to review the previous lesson, specifically different ways of using binary to indicate how to create an image on a grid. This stage will translate the unplugged activity into a simple, independent online lesson.

Main Activity (30)

Online Puzzles

 Code Studio levels

Practice

(click tabs to see student view)

Prediction

(click tabs to see student view)

Free Play

(click tabs to see student view)

Levels

Extra Extra

(click tabs to see student view)

Not all of these images are intuitive. Encourage students to click "Run" to see what happens, even if their code isn't "finished" yet.

Wrap Up (15)

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?
• Did you like drawing on the 8x8 grid or the 16x16 grid better? Why?
• Computers also store sounds using binary. Use your imagination to write down a possible way for that to work.

Standards Alignment

CSTA K-12 Computer Science Standards (2017)

► AP - Algorithms & Programming
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Lesson 17: Digital Citizenship

Unplugged | Online Safety

Overview

In collaboration with Common Sense Education, this lesson helps students learn to think critically about the user information that some websites request or require. Students learn the difference between private information and personal information, distinguishing what is safe and unsafe to share online.

Students will also explore what it means to be responsible and respectful to their offline and online communities as a step toward learning how to be good digital citizens.

Purpose

As students spend more time on computers, they should be aware that the internet is not always a safe space. In this lesson, students are taught what information is safe to share and what information should remain private. Students will create "superheros" and learn what it means to be a Digital Citizen on the internet.

Agenda

- Warm Up (15 min)
  - Vocabulary
  - Personal vs. Private Online
- Main Activity (35 - 40 min)
  - Cubeecraft Superhero Templates - Manipulatives
- Wrap Up (15 min)
  - Flash Chat: What did we learn?
  - Journaling
- Assessment (5 min)
  - Digital Citizenship - Assessment
- Extended Learning

Objectives

Students will be able to:

- Compare and contrast their responsibilities to their online and offline communities.
- Understand what type of information can put them at risk for identity theft and other scams.
- Reflect on the characteristics that make someone an upstanding citizen.
- Devise resolutions to digital dilemmas.

Preparation

- Watch the Digital Citizenship - Teacher Video.
- Print out a good selection of male and female Cubeecraft Superhero Templates - Manipulatives sheets for the whole class.
- Print one Digital Citizenship - Assessment for each student.
- Review CSF Digital Citizenship - Resource List for more online safety content.

Links

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

For the Teacher

- Digital Citizenship - Assessment Answer Key
- Common Sense Education - Website
- CSF Digital Citizenship - Resource List

For the Students

- Cubeecraft Superhero Templates - Manipulatives
- Digital Citizenship - Assessment
- Think Spot Journal - Reflection Journal
Vocabulary

- **Digital Citizen** - Someone who acts safely, responsibly, and respectfully online.
Teaching Guide

Warm Up (15 min)

Vocabulary
This lesson has one new and important phrase:

**Digital Citizen** - Say it with me: Dih-jih-tal Sit-i-zen

Someone who acts safely, responsibly, and respectfully online

Personal vs. Private Online

- Ask "What types of information do you think are okay to share publicly online or on a profile that others will see?"
- What are some examples of websites where you must register in order to participate?
  - Write the names of the websites on the board.
- What information is required and why do you think it is required?
  - Information may be required to help distinguish one person from another.
  - The website may keep a record of who uses it.
- Explain that it’s important to know that sharing some kinds of user information can put you and your family’s privacy at risk.
- Point out that you do not have to fill out fields on websites if they are not required.
  - Required fields are usually marked by an asterisk (*) or are highlighted in red.
- Elementary school students should never register for sites that require private information without the approval and guidance of a parent or guardian.
- Here is an example of public versus private information:

<table>
<thead>
<tr>
<th>SAFE - Personal Information</th>
<th>UNSAFE - Private Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your favorite food</td>
<td>Mother’s maiden name</td>
</tr>
<tr>
<td>Your opinion (though it should be done respectfully)</td>
<td>Social Security number</td>
</tr>
<tr>
<td>First name (with permission)</td>
<td>Your date of birth</td>
</tr>
<tr>
<td></td>
<td>Parents’ credit card information</td>
</tr>
<tr>
<td></td>
<td>Phone number</td>
</tr>
</tbody>
</table>

- Explain that some people will actively try to get you to share this kind of information so that they can use it to take over your identity. Once a thief has taken someone’s identity, he or she can use that person’s name to get a driver’s license or buy things, even if the person whose identity they stole isn’t old enough to do these things!
- It’s often not until much later that people realize that their identity has been stolen. Identity thieves may also apply for credit cards in other people’s names and run up big bills that they don’t pay off. Let students know that identity thieves often target children and teens because they have a clean credit history and their parents are unlikely to be aware that someone is taking on their child’s identity.

Now, let’s see what we can do to keep ourselves safe.

Main Activity (35 - 40 min)
Cubeecraft Superhero Templates - Manipulatives

- Spiderman says "With great power comes great responsibility." This is also true when working or playing on the Internet.
- The things we read, see, and hear online can lead people to have all sorts of feelings (e.g., happy, hurt, excited, angry, curious).
  - What we do and say online can be powerful.
- The Internet allows us to learn about anything, talk to people at any time (no matter where they are in the world), and share our knowledge and creative projects with other people.
  - This also means that negative comments can spread very quickly to friends of all ages.
- CREATE a three-column chart with the terms “Safe,” “Responsible,” and “Respectful” written at the top of each column. Invite students to shout out words or phrases that describe how people can act safely, responsibly, and respectfully online, and then write them in the appropriate column.

<table>
<thead>
<tr>
<th>Safe</th>
<th>Responsible</th>
<th>respectful</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now, let's really make sure we understand how to be a Super Digital Citizen!

Directions:
- Have each student grab a small selection of papercraft sheets and encourage them to blend the pieces to make their very own superhero.
- Allow plenty of time for students to cut, glue, and color.
- Give students a 5 minute warning to wrap up.
- Separate students into groups of 2-4 and tell them to use their superheroes and leftover supplies to stage a scene in which one superhero sees an act of poor digital citizenship. Then have the superhero fix the problem ... and save the day!
- Go around the room, having each student explain their scene to the class.

Wrap Up (15 min)

Flash Chat: What did we learn?
- What is a good way to act responsibly online?
- What kinds of personal information could you share about yourself without showing your identity?
- What kinds of superpowers or qualities did your digital superheroes have in common?
- What does Spider-Man's motto “With great power comes great responsibility” mean to you, as someone who uses the internet?

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 Digital Citizen?
- What do you need to do to be a Digital Citizen?

**Assessment (5 min)**

**Digital Citizenship - 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.

**Common Sense Education**

- Visit Common Sense Education - Website to learn more about how you can keep your students safe in this digital age.

**Standards Alignment**

**CSTA K-12 Computer Science Standards (2017)**

- **NI** - Networks & the Internet

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Lesson 18: Dance Party

End of Course Project

Overview

In this lesson, students will program their own interactive dance party. This activity requires sound as the tool was built to respond to music.

Purpose

This lesson introduces the core CS concepts of coding and event programming (using blocks).

Agenda

- Getting Started (5 minutes)
  - Setting the Stage
- Activity (30-45 minutes)
  - Code Your Own Dance Party
  - Level by Level Support
- Wrap Up (5 minutes)
  - Debrief
  - Assessment (2 minutes)

View on Code Studio

Objectives

Students will be able to:

- Develop programs that respond to timed events
- Develop programs that respond to user input
- Create dance animations with code

Preparation

- Play through the puzzles to find any potential problem areas for your class.
- Make sure every student has a journal.
- Consider the need for headphones. This activity relies on sound.

Links

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

For the Teacher

- Spotify Playlist (all ages)

For the Students

- Dance Party Project Guide - Worksheet
  
Vocabulary

- code - (v) to write code, or to write instructions for a computer.
- Event - An action that causes something to happen.
- Program - An algorithm that has been coded into something that can be run by a machine.
Teaching Guide

Getting Started (5 minutes)

Setting the Stage
Welcome students to class and very briefly introduce the day’s activity.

Remarks
Today we’re going to do something really creative. What’s your favorite way to be creative?
Encourage students to share the ways they express creativity, such as with art, dance, music, writing.

Explain that today we’re going to be creative with our code. Just like choosing which type of colors of paint to use, or what kinds of words you write with can be express creativity, choosing what code you write and how people interact with it can be an opportunity to express your creativity too!

Get up and dance: Announce to the class that today we’re going to see how we can combine coding with dancing in a creative way. Ask your kids to floss, dab, or do a creative dance move of their own for 10 seconds to get them in the mood. You can play a song from this Spotify Playlist (all ages) to help kick things off. Capture your class's moves on video.

Activity (30-45 minutes)

Code Your Own Dance Party
Music Filtering
This tutorial features songs from popular artists. To get a preview of the song list in this tutorial, check out this Spotify Playlist. We are using radio-safe versions of all songs and for students under 13, we limit the music to this filtered list Spotify Playlist (all ages). If you would like to use the filtered list with older students, you can share this link with your classroom.

Code Studio levels

Practice (click tabs to see student view)

Free Play (click tabs to see student view)
Level by Level Support

Level 1
- Drag the red *make a new* block from the toolbox on the left to the workspace on the right. Connect it inside the *setup* block.
- You have now written your first program. Make sure to press Run to see what happens. You should hear music and see a character start to move in the display area.

Level 2
- The green blocks are event blocks. These blocks start a new sequence of code and do not need to be connected inside the *setup* block.
- Connecting the purple block under the green event block should make the character perform a dance move after the number of measures you indicate.

Level 3
- Make sure to bring out a second green event block. You should have a *after 4 measures* block and a *after 6 measures* block in your workspace. Both should have purple block connected underneath.

Level 4
- Drag out the *set background effect* block.
- This block can be connected inside *setup*, under an event block, or in both places!

Level 5
- With the right code, you should see the dancer cycle through a different move every 2 measures.
- Make sure there is a purple *do forever* block connected inside the *every 2 measures* block.
- Make sure the *do forever* block is set to either (Next), (Previous), or (Random). Otherwise, the dancer will just perform the set move repeatedly.

Level 6
- Be careful to avoid putting the red *make a new* block inside the *every 2 measures* block. This will cause your program to create multiple identical dancers at the same location.

Level 7
- Many students will be familiar with the idea that you can make something seem to be further away by drawing it a smaller scale. In this level, you’ll create this effect by making the two dancers on the ends smaller.
- It is important to make sure that the teal *set* block is placed somewhere in the program *after* the dancer has been created. To solve this puzzle, place a *set backup_dancer2 size to 50* block somewhere under the *make a new robot called backup_dancer2* block.

Level 8
- As with the previous level, make sure to only use the *set tint to (color)* block after you have the made the dancer in your program. For example, placing it as the first step in the *setup* area of your program will have no effect.

Level 9
- Computer science allows to process input information into interesting types of output. In this level, students can explore how a dancer’s properties can be updated automatically based on the actual sound of the music.

Level 10-11
- These levels are about making the dance interactive. Try out the new *when pressed* event to make the dancers respond to key presses.
- You can use the arrow keys on your computer keyboard or click the orange buttons under the display area.
- Note that the code students write in these levels is not checked for correctness. This means they will always pass the level, even if they do not change the program. Encourage students to determine for themselves
whether the code is doing what they expect before moving on.

Level 12

- The top six blocks in this tool box look familiar but all work in a different way. Instead of creating or controlling one dancer, they work with groups of dancers.
- Like the previous levels, code is not checked for correctness here. Students should feel free to experiment with groups in ways that are interesting to them.

Level 13

- This last level is very open-ended. The tutorial itself is designed to give students ample time to keep working on their own dance.
- **Encourage Sharing:** If students have cell phones with a data plan they can quickly text a link to their projects to their own phone or a friend's. If your school policy allows it, encourage them to do so here.
- **Encourage Creativity:** Creativity is important throughout this lesson, but this is true here more than anywhere else!

**Wrap Up (5 minutes)**

**Debrief**

- Pose a prompt that has multiple answers such as “What is something you enjoyed about today's activity?” or “What is the connection between creativity and computer science?”

**Assessment (2 minutes)**

Ask students to add their “Whip Around” sticky notes or note cards to your "Computer Science" mind map on their way out the door. Try to populate the board with lots of great ideas about what CS is and why it matters.

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