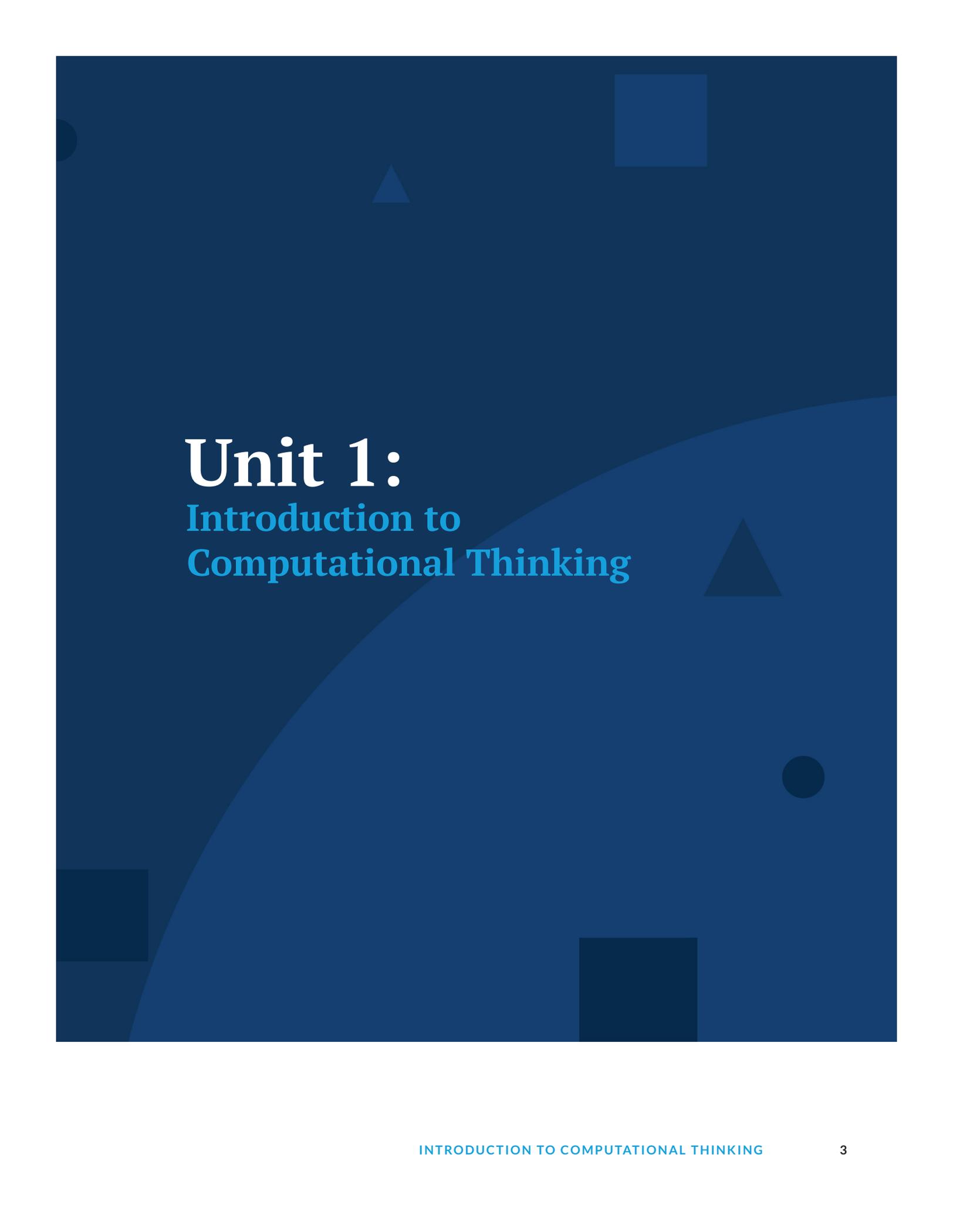


Introducing Computational Thinking into the Classroom:

Student Learning Modules



Unit 1:

Introduction to Computational Thinking



Unit 1: Introduction to Computational Thinking

In this unit, we introduce computational thinking through fun and collaborative student activities, which can be facilitated with or without technology. Through these activities, students learn computational thinking strategies, such as sequencing, decomposition, and abstraction. The activities then lead into an introduction to visual programming and an opportunity to design and create a Choose Your Own Adventure project.

Big Ideas

- Design can be responsive to identified needs.
- Complex tasks require the acquisition of additional skills.
- Complex tasks may require multiple tools and technologies.

Unit Outline

Activity	Estimated Time (hr.)
Ping-Pong Rescue	1
Pizza Recipes	1
Scavenger Hunt	1
Introduction to Visual Programming using Twine	1
Choose Your Own Adventure	6
Total Estimated Time (hr.)	10



Activity 1: Ping-Pong Rescue

The ability to sequence instructions into simple algorithms is fundamental to computational thinking. In this activity, students work in teams of 2 to 4 to create a simple algorithm that guides one of their team members, who is blindfolded, to rescue a ping-pong ball. At the same time, students develop their core competencies in communication and critical thinking, as well as their curricular competency in ideating, which involves generating potential ideas or adding to others' ideas, screening ideas against criteria or constraints, and choosing an idea to pursue.

Core Competencies

Communication

- Connect and engage with others (to share and develop ideas)
- Collaborate to plan, carry out, and review constructions and activities
- Explain/recount and reflect on experiences and accomplishments

Critical Thinking

- Analyze and critique

Curricular Competencies

Ideating

- Generate potential ideas and add to others' ideas

Content

Computational Thinking

- Simple algorithms that reflect computational thinking

Activity Overview

Estimated Time 1 hr.

Materials for each group of 2 to 4 students:

- Ping-Pong Ball
- Blindfold
- Paper and Pencil
- Cup (Optional)
- Printed Analog Clock Face (Optional)

Materials for each student:

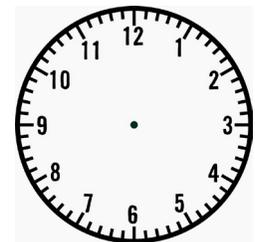
- Self-Assessment Student Sheet (Optional)
- Pencil (Optional)

Preparation:

- Arrange the classroom such that students can move freely. Create “obstacles” using desks or chairs to represent areas that students cannot enter.
- Optionally, arrange for the activity to be completed in the gym or outdoors using cones, jump ropes, or hoops as obstacles.
- Print out 1 Printed Analog Clock Face per group. (Optional)
- Print out 1 [Self-Assessment Student Sheet per student](#). (Optional)

Note to the teacher:

A printable analog clock face can be found from the following website:
http://www.sawyoo.com/postpic/2010/11/blank-clock-face_105120.jpg



Analog Clock Face

Warm-up: Estimating Algorithmic Complexity (10 minutes)

Ask students to think about an everyday task, such as making a peanut butter and jelly sandwich, or tying their shoes. Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- How many steps do you think it will take to accomplish the task?
- What are the steps to complete the task?
- What obstacles might you encounter during the task?

Activity: Algorithmic Construction (30 minutes)

Arrange students into groups of 2 to 4. Ask each group to determine the role(s) for each person:

The **Robot** is blindfolded and follows the instructions given by the Walker and Turner. The **Walker** calls out how many steps and the size of the steps the Robot should take. The **Turner** calls out which direction and how far the Robot should turn. The **Recorder** writes down each instruction given to the Robot.

In a group of 4, each person has one role. In a group of 3, one person can be the Turner and the Recorder. In a group of 2, one person is the Robot, while the other person is the Walker, the Turner, and the Recorder.

Getting Started:

1. Have each group decide on a start and end position. The positions may be close together or far apart. Groups may add obstacles, but safety should be first concern.
2. Ask each group to place the ping-pong ball between the start and end positions.
3. Give each group a minute to write down their estimate for how many instructions the Robot will need to retrieve the ping-pong ball and bring it to the end position.
4. Have the Robot stand at the start position and apply the blindfold.
5. Have the Walker and Turner stand at the end position.

General Rules:

- The Walker and Turner take turns giving instructions to the Robot to retrieve and deliver the ping-pong ball to the end position.
- The Robot must respond to each instruction with “OK” if the instruction is valid, or “No” if the instruction is invalid. A list of valid instructions is provided below.
- The Recorder must write down each instruction only after the Robot says “OK”.
- Once the Robot successfully brings the ping-pong ball to the end position, the Recorder must write down the total number of instructions.

Instructions:

Instructions	Who can give the instruction	How to record the instruction
Number of steps in whole numbers and size of the steps, large or small. Examples: <ul style="list-style-type: none"> • “3 large steps” • “2 small steps” 	Walker	<#> <SIZE> Examples: <ul style="list-style-type: none"> • 3L (3 large steps) • 2S (2 small steps)
Direction to turn, left or right, and size of turn, large or small. Examples: <ul style="list-style-type: none"> • “left large turn” • “right small turn” 	Turner	<DIRECTION><SIZE> Examples: <ul style="list-style-type: none"> • LL (left large turn) • RS (right small turn)
Undo To reverse the last instruction.	Walker or Turner	UNDO
Pick up To pick up the ball.	Walker	PICK UP

Reflections: Refactoring Algorithms (20 minutes)

Identify the series of instructions that each group recorded as an algorithm. Explain that an algorithm is a solution to a problem. It is broken down into individual steps and can be repeated.

Ask each group to analyze their algorithm and to look for sequences of instructions that can be combined. For example, 2L followed by 1L can be combined into 3L. The goal is to have the least number of instructions but still produce the same result. This is called refactoring.

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups using the following prompts:

- How did your estimate compare to the actual number of instructions in your algorithm?
- Did refactoring your algorithm help reduce the number of instructions? Why or why not?
- What was easy or difficult about making the initial estimate?
- What was easy or difficult about being the Walker or the Turner?
- What was easy or difficult about being the Robot?
- What was easy or difficult about being the Recorder?
- How would you combine existing instructions to make new instructions? Examples:
 - A “knight” move in chess would be 2L + RL + 1L
 - “Turn around” would be LL + LL

Assessment

Criteria	Approaching	Meeting	Exceeding
Student shared ideas during the warm-up.			
Student worked together with his or her team to generate their algorithm.			
Student contributed to the refactoring process either by coming up with ideas, building on others' ideas, or giving constructive feedback.			
Student shared his or her reflections either individually or in a group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	When thinking about an everyday task, I expressed my ideas and/or supported other students by actively listening to their ideas.
Communication: Collaborate to plan, carry out, and review constructions and activities	During the activity, I took on an active role in my group and helped my group build our algorithm to retrieve the ping-pong ball.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about what was easy or challenging about my role and the roles of other members in my group.
Critical Thinking: Analyze and critique	During the refactoring process, I helped my group by analyzing our algorithm and looking for sequences of instructions that could be combined.

Extensions

Allow the word “double” to be used as a modifier

For example, 5DL would mean 5 double large steps where each step is twice the size of a regular large step, or LDS would mean a double small left turn, which would be half the size of a regular small left turn. This is analogous to clothing sizes, in which XXL is bigger than XL, but XXS is smaller than XS.

Include a cup at the end position

The Walker or Turner now need to tell the Robot to “put down” in order to place the ping-pong ball in the cup.

Include a printed analog clock face

Instead of using the instructions RS and LL, the Turner uses the clock face to direct the turns using instructions such as 11 o'clock or 4 o'clock, which would cause the Robot to turn left or right by the indicated increment and be recorded as 11:00 or 4:00, respectively.

Include the “If-Then” instruction

The If-Then instruction must be agreed upon before the Robot begins. An example would be, “If you reach an obstacle, then LL and 1L.”

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
<p>When thinking about an everyday task, I expressed my ideas and/or supported other students by actively listening to their ideas.</p>	
<p>During the activity, I took on an active role in my group and helped my group build our algorithm to retrieve the ping-pong ball.</p>	
<p>At the end of the activity, I thought about what was easy or challenging about my role and the roles of other members in my group.</p>	
<p>During the refactoring process, I helped my group by analyzing our algorithm and looking for sequences of instructions that could be combined.</p>	



Activity 2: Pizza Recipes

In the previous activity, Ping-Pong Rescue, students were introduced to algorithms, which we defined as sequences of instructions. To rescue their ping-pong balls, they constructed algorithms that were generally linear, that is, they followed a strict series of steps.

However, not all algorithms follow a single path. Some algorithms have “branches”, or in other words, more than one possible path. The path that’s taken depends on the logic of the algorithm.

In this activity, students first engage in a playful, interactive quiz in which they start to see how logic can be used to design algorithms with multiple paths. Afterwards, they’ll demonstrate their understanding by using logic to construct their favourite pizza recipes.

Core Competencies

Communication

- Connect and engage with others (to share and develop ideas)
- Explain/recount and reflect on experiences and accomplishments

Curricular Competencies

Ideating

- Generate potential ideas and add to others’ ideas
- Screen ideas against criteria and constraints

Content

Computational Thinking

- Simple algorithms that reflect computational thinking

Activity Overview

Estimated Time 1 hr.

Materials for the teacher:

- Computer or Laptop
- Projector and Screen
- Internet Access (Optional)
- Mobile Device (Optional)
- Speakers (Optional)

Materials for each student:

- Pizza Recipes Student Sheet
- Pencil
- Computer, Laptop, or Mobile Device (Optional)
- Internet Access (Optional)
- Logic Operators Student Sheet (Optional)
- Self-Assessment Student Sheet (Optional)

Preparation:

- Set up the equipment, including the computer or laptop, projector, and screen, to facilitate the quiz.
- If devices and Internet are available to all students, run through the warm-up and test the Kahoot! quiz using a mobile device. Ensure that all 10 questions can be answered.
- If devices and Internet are not available to all students, ensure that you have [the Kahoot! quiz in PDF format](#), which is provided in the warm-up section.
- Print out 1 [Pizza Recipes Student Sheet](#) per student.
- Print out 1 [Logic Operators Student Sheet](#) per student. (Optional)
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)

Note to the teacher: Kahoot! is an online platform that allows users to create and share learning games made up of multiple choice questions. The games are intended to be played in a group setting in which each person chooses his or her answer on a computer, laptop, or mobile device. For more information, please visit the Kahoot! website: <https://getkahoot.com/>.

Warm-up: Logic Kahoot! Pizza Edition (10 minutes)

Facilitate a game of Logic Kahoot! Pizza Edition with your class using one of the following options:



Kahoot.it Screenshot

Option 1: Students have devices.

1. Using the projector, show the following page:
<https://play.kahoot.it/#/k/34839be1-8dbb-4961-bcbc-a2aadfa4565d>
2. Once the page has loaded, click PLAY.
3. On the next page, click START NOW.
4. On the following page, choose Classic.
5. Once the Game PIN is displayed on the screen, ask students to use their devices to do the following:
 - a. Go to kahoot.it.
 - b. Enter the Game PIN.
 - c. Enter a name.
6. Once everyone has entered their name, click Start to begin the game.

Option 2: Students do not have devices.

Using the projector, display the PDF copy of the Kahoot! quiz. Students may vote for their answers by raising their hands.

During the quiz, ask students to reflect after each question using the following prompts:

- Why did you choose your answer?
- What was easy or difficult about the question?

Kahoot! - Logic Kahoot! Pizza x

https://play.kahoot.it/#/k/34839be1-8dbb-4961-bcbc-a2adfa4565d

Kahoot!

Quiz



Logic Kahoot! Pizza Edition

A #kahoot quiz to introduce logic operators used in #coding and #computer #science.

Created by: wendyhoy Language: English Audience: School

Plays 13 Players 22 Shares 0 Favorites 1

1. Which answer is TRUE?
2. Which answer is TRUE?
3. Which answer is TRUE?
4. Which answer is TRUE?
5. Which answer is TRUE?
6. Which answer is TRUE?

[PLAY](#)

Like 0 Tweet Pin it

You don't need an account to play! Sign in to save results or sign up to make quizzes.

Which answer is TRUE?



Skip

10



0
Answers



Cheese



NOT Cheese

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers

▲ Cheese



◆ NOT Cheese

Which answer is TRUE?



Skip

10



0
Answers

▲ Cheese

◆ NOT Cheese

Which answer is TRUE?



Full Screen

Next

0
Answers

Time up!



Cheese



NOT Cheese



Which answer is TRUE?



Full Screen

Skip

10



0
Answers



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms

Which answer is TRUE?



Full Screen

Skip

10



0
Answers



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms

Which answer is TRUE?



Full Screen

Skip

0
Answers

10



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms

Which answer is TRUE?



Full Screen

Next

0
Answers

Time up!



Pepperoni OR Mushrooms



Pepperoni AND Mushrooms



Which answer is TRUE?



Full Screen

Skip

10



0
Answers



Ham AND Pineapple



Ham AND NOT Pineapple

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers

▲ Ham AND Pineapple

◆ Ham AND NOT Pineapple ✓

Which answer is TRUE?



Full Screen

Skip

0
Answers

10



Ham AND Pineapple



Ham AND NOT Pineapple

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers



Ham AND Pineapple



Ham AND NOT Pineapple

Which answer is TRUE?



Full Screen

Skip

20



0
Answers



Pepperoni AND Broccoli AND
Mushrooms AND Olives



Pepperoni AND Green Peppers AND
Mushrooms AND Olives

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers



Pepperoni AND Broccoli AND
Mushrooms AND Olives



Pepperoni AND Green Peppers
AND Mushrooms AND Olives



Which answer is TRUE?



Full Screen

Skip

20



0
Answers

▲ (Pepperoni AND Mushrooms) OR
(Ham AND Cheese)

◆ (Pepperoni OR Mushrooms) AND
(Ham OR Cheese)

Which answer is TRUE?



Full Screen

Next

0
Answers

Time up!



(Pepperoni AND Mushrooms) OR
(Ham AND Cheese)



(Pepperoni OR Mushrooms)
AND (Ham OR Cheese)



Which answer is TRUE?



Full Screen

Skip

20



0
Answers



(Sweet AND Salty) OR (Hot AND Cold)



(Sweet OR Salty) AND (Hot OR Cold)

Which answer is TRUE?



Full Screen

Next

Time up!



0
Answers



(Sweet AND Salty) OR (Hot AND Cold)



(Sweet OR Salty) AND (Hot OR Cold)



Activity: Build Your Favourite Pizzas

(40 minutes)

Ensure that each student has a pencil and the Pizza Recipes Student Sheet.

Review the Pizza Recipes Student Sheet as a class. Explain that on the sheet, there are 6 steps to building a pizza. Their first task is to help fill in as many blanks as possible by coming up with more options and toppings that they can add to each step. Give students 10 to 15 minutes to brainstorm individually or in small groups and write down their ideas.

Next, review the examples on the sheet. Explain that they need to use the words AND, OR, and NOT to build their pizzas. Allow students to build their top 3 favourite pizzas.

Reflections: Logic Operators

(10 minutes)

Identify the words AND, OR, and NOT as logic operators. Explain that even though we all followed the same set of steps or algorithm to build a pizza, that is, we started with the crust, then added the sauce, meat, vegetables, cheese, and finally, the dipping sauce, we were able to use logic operators to change the outcome. Everyone ended up with different pizzas.

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups using the following prompts:

- Describe your process for building your pizzas.
- When did you use the NOT operator?
- When did you use the OR operator?
- When did you use the AND operator?
- What was easy or difficult about building your pizzas?
- In what other situations do you use logic operators?
- How might a computer program use logic operators?

Assessment

Criteria	Approaching	Meeting	Exceeding
Student participated in the Kahoot! game by trying to answer one or more questions.			
Student added at least one option or topping to each step in the pizza menu.			
Student incorporated all three logic operators, AND, OR, and NOT in his or her pizza recipes.			
Student shared his or her reflections either individually or in a group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	During the quiz, I actively participated by answering one or more questions, and/or I supported other students when they shared their answers.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about how I used the logic operators to build my favourite pizza recipes, and how logic operators might be used in other situations.

Extensions

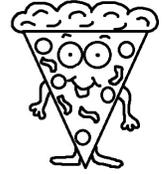
Include the XOR operator

The XOR operator is short for exclusive OR, which means one or the other, but not both. For example, ham XOR pineapple would mean ham OR pineapple, but NOT (ham AND pineapple).

Replace the words AND, OR, NOT, XOR with symbols

Provide each student with a copy of the Logic Operators Student Sheet. Rather than using the words AND, OR, NOT, and XOR, replace them with their symbols as outlined in the sheet.

Pizza Recipes Student Sheet

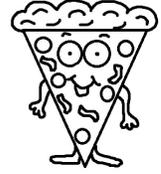


In this activity, you'll help design the pizza menu and use it to build your favourite pizza recipes.

To help design the pizza menu, fill in as many blanks as you can with more options. What other crusts, sauces, and toppings can you add?

<p>Step 1: Choose your crust.</p> <ul style="list-style-type: none"><input type="checkbox"/> Regular Crust<input type="checkbox"/> Thin Crust<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____	<p>Step 2: Choose your sauce.</p> <ul style="list-style-type: none"><input type="checkbox"/> Tomato Sauce<input type="checkbox"/> BBQ Sauce<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____
<p>Step 3: Choose your meat.</p> <ul style="list-style-type: none"><input type="checkbox"/> Pepperoni<input type="checkbox"/> Ham<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____	<p>Step 4: Choose your vegetables.</p> <ul style="list-style-type: none"><input type="checkbox"/> Mushrooms<input type="checkbox"/> Pineapple<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____
<p>Step 5: Choose your cheese.</p> <ul style="list-style-type: none"><input type="checkbox"/> Mozzarella<input type="checkbox"/> Cheddar<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____	<p>Step 6: Choose your dipping sauce.</p> <ul style="list-style-type: none"><input type="checkbox"/> Tomato Dip<input type="checkbox"/> Ranch Dip<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____<input type="checkbox"/> _____

Pizza Recipes Student Sheet



Next, using the words **AND**, **OR**, and **NOT**, build your favourite pizzas.

Example 1:

Here's an example of a basic pepperoni pizza:

Regular Crust **AND** Tomato Sauce **AND** Pepperoni **AND** Mozzarella **AND** Tomato Dip

Example 2:

If there's a topping that you really don't want on your pizza, like mushrooms, then you can use the word **NOT**:

Regular Crust **AND** Tomato Sauce **AND** Pepperoni **AND NOT** Mushrooms **AND** Mozzarella
AND Tomato Dip

Example 3:

If there's an option where you don't mind having either one thing or the other, for example, maybe you don't mind having regular crust or thin crust, then you can use the word **OR**:

(Regular Crust **OR** Thin Crust) **AND** Tomato Sauce **AND** Pepperoni **AND NOT** Mushrooms
AND Mozzarella **AND** Tomato Dip

Use the pizza menu to build your top 3 favourite pizzas.

Make sure that you include **AND**, **OR**, and **NOT** in your pizza recipes.

Pizza Recipe 1:

Pizza Recipe 2:

Pizza Recipe 3:

Logic Operators Student Sheet

Instead of using the words AND, OR, NOT, and XOR, replace them with their symbols as outlined below.

Logic Operator	Symbol
AND	&&
OR	
NOT	!
XOR	^

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
<p>During the quiz, I actively participated by answering one or more questions, and/or I supported other students when they shared their answers.</p>	
<p>At the end of the activity, I thought about how I used the logic operators to build my favourite pizza recipes, and how logic operators might be used in other situations.</p>	



Activity 3: Scavenger Hunt

Students continue to construct their knowledge of algorithms. We saw in the previous activity that we can use logic operators AND, OR, and NOT to change the outcome of an algorithm, specifically, what toppings end up on a pizza. In this activity, we continue to build on the idea that algorithms can have multiple paths by having students help design and participate in a scavenger hunt.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)• Collaborate to plan, carry out, and review constructions and activities• Explain/recount and reflect on experiences and accomplishments
Critical Thinking
<ul style="list-style-type: none">• Analyze and critique
Curricular Competencies
Ideating
<ul style="list-style-type: none">• Generate potential ideas and add to others' ideas• Screen ideas against criteria and constraints
Testing
<ul style="list-style-type: none">• Test the first version of the product or the prototype
Content
Computational Thinking
<ul style="list-style-type: none">• Simple algorithms that reflect computational thinking

Activity Overview

Estimated Time 1 hr.

Materials for each group of 2 to 3 students:

- Scavenger Hunt Student Sheet
- Paper and Pencil
- Mobile Device (Optional)
- Internet Access (Optional)

Materials for each student:

- Self-Assessment Student Sheet (Optional)
- Pencil (Optional)

Preparation:

- Review the Scavenger Hunt Student Sheet to ensure that students will be able to find the items either in the classroom or on school grounds. Modify the items as needed.
- If students will be using mobile devices, ensure that they are available for the activity.
- Print out 1 [Scavenger Hunt Student Sheet](#) for each group.
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)

Warm-up: Cause and Effect (10 minutes)

Ask students to think of a situation where a set of conditions causes them to do something. For example, a dark and cloudy morning causes them to put on their rain jackets and bring their umbrellas to school. Or maybe the fire alarm goes off at school, which causes everyone to stop what they're doing and safely go outside. Or maybe it's soccer season, and it's 3:00 PM on a Wednesday, which means that they need to get ready and go to soccer practice. Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- Brainstorm situations where a set of conditions causes you to do something.
- For each situation, what is the set of conditions?
- What does each set of conditions cause you to do?

Activity: Scavenger Hunt (40 minutes)

Arrange students into groups of 2 to 3. Ensure that each group has a pencil, paper, the Scavenger Hunt Student Sheet, and optionally, a mobile device.

Review the Scavenger Hunt Student Sheet as a class. Explain that on the sheet, there's not only a list of items that they need to find, but also a list of conditions that when they occur, will trigger them to do one or more actions. Notice that the first 3 conditions already have their actions defined. Facilitate a brief brainstorming session, about 10 minutes, to come up with the remaining actions. Students may brainstorm as a class or in their groups.

Once all the actions are defined, students start the scavenger hunt. When they return from their scavenger hunt, they may share their pictures and photos with other students.

Reflections: Types of Algorithms (10 minutes)

Explain that the list of conditions and actions in the scavenger hunt is an algorithm. It has instructions that tell us what to do, but also when to do it. Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups using the following prompts:

- How is this algorithm different from the algorithm for your pizza or ping-pong rescue?
- What was easy or difficult about the scavenger hunt?
- What other conditions could you add to the scavenger hunt?

Assessment

Criteria	Approaching	Meeting	Exceeding
Student shared one or more situations where a set of conditions causes him or her to do something.			
Student helped plan the scavenger hunt by generating ideas and/or adding to other students' ideas for the remaining actions.			
Student collaborated with his or her group to carry out their scavenger hunt.			
Student shared his or her reflections either individually or in a group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	When brainstorming situations where a set of conditions causes us to do something, I expressed my ideas and/or supported other students by listening to their ideas.
Communication: Collaborate to plan, carry out, and review constructions and activities	During the scavenger hunt, I was an active team member by helping to find one or more items and/or completing one or more actions.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about the scavenger hunt as an algorithm, and how it is different from other algorithms we've learned.
Critical Thinking: Analyze and critique	When other students shared their pictures and photos, I gave constructive feedback.

Extensions

Include logic operators in the conditions

For example, students can create conditions such as “You found item 5 OR item 6”, or “You found item 2 AND item 3 AND item 7”.

Scavenger Hunt Student Sheet

Adapted from Creative Photography Game:

<http://www.scavenger-hunt-guru.com/photography-game.html>

In this activity, you'll go on a scavenger hunt with your group to find all the items listed below:

#	Item	Found
1	Five different red items	
2	Book spines	
3	Instrument (One or more)	
4	Flower (One or more)	
5	The horizon line	
6	Sand, dirt, or stone	
7	Crayons	
8	Food	

Scavenger Hunt Student Sheet

As you find each item, see which condition has occurred, and do the corresponding action. Keep in mind that more than one condition can occur at once.

Before you start hunting, come up with the remaining actions. For example, what will you do when you find item 3, or item 4? Once you fill out all the actions, you're ready for your scavenger hunt. Happy hunting!

Condition	Action
You found an item.	<ul style="list-style-type: none">• Check off the item in the list.• Make a sketch of the item, or if you have a mobile device, take a photo.
You found item 1.	<ul style="list-style-type: none">• Arrange the items in an interesting way.• Make another sketch, or if you have a mobile device, take another photo.
You found item 2.	<ul style="list-style-type: none">• Read the title of each book. If you have a mobile device, record it.
You found item 3.	
You found item 4.	
You found item 5.	
You found item 6.	
You found item 7.	
You found item 8.	
You found all the items.	Nice job! Return to your desk and share your pictures or photos with others.

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
<p>When brainstorming situations where a set of conditions causes us to do something, I expressed my ideas and/or supported other students by listening to their ideas.</p>	
<p>During the scavenger hunt, I was an active team member by helping to find one or more items and/or completing one or more actions.</p>	
<p>At the end of the activity, I thought about the scavenger hunt as an algorithm, and how it is different from other algorithms we've learned.</p>	
<p>When other students shared their pictures and photos, I gave constructive feedback.</p>	



Activity 4: Introduction to Visual Programming using Twine

In the last 3 activities, we saw how algorithms can be linear, that is, they can follow a strict sequence of instructions, or they can be nonlinear by incorporating logic operators or conditions that create different outcomes or multiple paths.

With that foundation, students begin to explore how to design algorithms using a visual programming language called Twine. Twine is a tool for creating interactive, nonlinear stories. You can download the software onto a computer or laptop, or use it online on a computer, laptop, or tablet. For more information, please visit the Twine website at <http://twinery.org/> and the Twine 2 Guide at <http://twinery.org/wiki/twine2:guide>.

Note to the teacher: If using the downloadable version of Twine, ensure to plan ahead so that Twine can be downloaded and installed on each computer or laptop before starting this activity. If using the online version of Twine, students do not need to create accounts. Twine projects are saved automatically to the computer. If students use Twine over multiple sessions, they must use the same computer with the same browser, such as Google Chrome, as well as not clear any browsing data to avoid losing work. Twine recommends that users archive their projects to save an extra copy to their computers. For more information, please see the Twine 2 Guide: http://twinery.org/wiki/twine2:where_your_stories_are_saved.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)• Explain/recount and reflect on experiences and accomplishments
Curricular Competencies
Ideating
<ul style="list-style-type: none">• Generate potential ideas and add to others' ideas
Content
Computational Thinking
<ul style="list-style-type: none">• Simple algorithms that reflect computational thinking• Visual representations of problems and data• Visual programming

Activity Overview

Estimated Time 1 hr.

Materials for the teacher:

- Computer, Laptop or Tablet
- Projector and Screen
- Internet Access
- Speakers (Optional)

Materials for each student:

- Computer, Laptop, or Tablet
- Internet Access (Optional)
- Self-Assessment Student Sheet (Optional)
- Pencil (Optional)

Preparation:

- Set up the equipment, including the computer or laptop, projector, and screen, to show the Introduction to Twine video, and for demonstrations.
- Ensure that students will have devices for the activity.
- If using the online version of Twine, visit the Twine website, <http://twinery.org/>, click/tap on “Use it online”, and ensure that the website loads.
- If using the downloadable version of Twine, ensure that Twine is downloaded and installed on each device, and open the program to make sure that it runs.
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)



Twinery.org Website link

Warm-up: Introduction to Twine (15 minutes)

Introduce Twine as a tool for creating interactive, nonlinear stories, meaning that a person reading one of these stories can follow links, like on a web page, to choose different paths in the story. So one person reading the story can have a completely different experience from someone else reading the same story. Using the projector, show an introductory video, such as An Introduction to Twine 2.0:

https://youtu.be/5yCZaQLb_Kw.

Activity: Create Your First Story (30 minutes)

Using the projector, help students open the Twine editor by demonstrating one of the following options:

Option 1: Students are online.	Option 2: Students are offline.
Navigate to the Twine website at http://twinery.org/ .	Open the Twine program on their computers or laptops.
Click/Tap on "Use it online".	Click "Skip" to go to the "Stories" page.
Click/Tap "Skip" to go to the "Stories" page.	Click "+Story" to create a new story.
Click/Tap "+Story" to create a new story.	Enter a name for the story.
Enter a name for the story.	Click "+Add".
Click/Tap "+Add".	



Twinery.org Website link

Allow students to explore fearlessly. Encourage students to work together, ask each other questions, and share what they discover.

Optionally, students who have online access may follow the Twine 2 Guide to create their first story: http://twinery.org/wiki/twine2:how_to_create_your_first_story

Reflections: Share Your Discoveries (15 minutes)

Ask for a few volunteers to share with the class one thing that they discovered.

Afterwards, ask students to reflect individually using the following prompts:

- What did you figure out?
- What would you like to know more about?
- What would you like to create?

Assessment

Criteria	Approaching	Meeting	Exceeding
Student connected and engaged with others to explore the Twine interface by sharing discoveries and asking questions.			
Student created a Twine project with at least one passage with multiple branches.			
Student shared his or her discoveries and/or what he or she would like to learn or create next either individually or in the group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	I worked with other students to learn about Twine by sharing my discoveries and/or asking questions.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about what I had discovered, and what I would like to learn or create next.

Extensions

Offer several challenges

Provide challenges while students are exploring. Examples:

- Can you figure out how to **bold**, *italicize*, and underline text?
- Can you figure out how to change the story format?
- Can you figure out how to add an image, movie, or sound?
- Can you figure out how to archive or save your stories to a file?

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
I worked with other students to learn about Twine by sharing my discoveries and/or asking questions.	
At the end of the activity, I thought about what I had discovered, and what I would like to learn or create next.	



Project: Choose Your Own Adventure

Students combine all their knowledge about algorithms from the previous activities to design and develop their own interactive Choose Your Own Adventure stories, which they will share with each other or with students from another class, such as their “buddy class”. Through this project, students experience all stages of the making process, from understanding context to making and sharing.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)• Explain/recount and reflect on experiences and accomplishments
Creative Thinking
<ul style="list-style-type: none">• Novelty and value• Generating ideas• Developing ideas
Critical Thinking
<ul style="list-style-type: none">• Analyze and critique• Develop and design
Personal Awareness and Responsibility
<ul style="list-style-type: none">• Self-determination
Content
Computational Thinking
<ul style="list-style-type: none">• Simple algorithms that reflect computational thinking• Visual representations of problems and data• Visual programming

Curricular Competencies

Understanding context

- Empathize with potential users to find issues and uncover needs and potential design opportunities

Defining

- Identify key features or potential users and their requirements

Ideating

- Generate potential ideas and add to others' ideas
- Screen ideas against criteria and constraints
- Choose an idea to pursue

Prototyping

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed

Testing

- Test the first version of the product or the prototype
- Gather peer and/or user and/or expert feedback and inspiration
- Make changes, troubleshoot, and test again

Making

- Identify and use appropriate tools, technologies, and materials for production
- Use materials in ways that minimize waste

Sharing

- Demonstrate their product and describe their process, using appropriate terminology and providing reasons for their selected solution and modifications
- Reflect on their design thinking and processes, and evaluate their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain an efficient cooperative work space
- Identify new design issues

Project Overview

The Choose Your Own Adventure project is a chance for students to design and create for an audience. Their audience may be each other or perhaps their “buddy class” in the school. Before the start of the project, select the audience that would be most appropriate for your class.

This project is also an opportunity to integrate learning from other subjects. A Choose Your Own Adventure story is ultimately an interactive, nonlinear story. Students can use this medium to demonstrate their knowledge and understanding from other learning areas. In addition to choosing an audience, select either an open-ended or specific theme for your students to anchor their stories.

The resulting project may be completed with or without technology. If students have access to computers, laptops, or tablets as well as Internet, we recommend that students implement their stories using Twine from the previous activity. Alternatively, projects may also be unplugged and take on more traditional forms, such as a book, or even a live performance in which the audience can participate. Determine what resources are available for your students and the possible forms that their projects could take.

Finally, consider the assessment criteria for this project. Feel free to review and customize the assessment criteria provided at the end of the project.

The estimated time for this project from start to finish is 6 hours, and involves every stage of the making process. The table below outlines the overall project.

Project Stage	Estimated Time (hr.)
Understanding Context, Defining, and Ideating	1
Ideating, Prototyping, and Testing	1
Making	3
Sharing	1
Total Estimated Time (hr.)	6

Stage 1:

Understanding Context, Defining, and Ideating

In this first stage, students are introduced to the Choose Your Own Adventure project, and begin to brainstorm ideas for their stories.

Stage Overview
Estimated Time: 1hr.
Materials for the teacher:
<ul style="list-style-type: none">• Choose Your Own Adventure storybook (Optional)
Materials for each student:
<ul style="list-style-type: none">• Computer, Laptop, or Tablet (Optional)• Internet Access (Optional)
Preparation:
<ul style="list-style-type: none">• Choose the audience for your students' stories.• Choose either a specific or open-ended theme for your students' stories.• Choose the possible forms your students' stories could take.• Determine any additional project criteria.• If students will be using computers, laptops, or mobile devices, ensure that they are available for the activity.

Warm-up: What is Choose Your Own Adventure? (10 minutes)

Introduce the concept of Choose Your Own Adventure to your class. Explain that traditionally, Choose Your Own Adventure is a storybook in which the reader can make choices that determine the main character's actions and the plot's outcome, but essentially, it's an algorithm that has multiple paths. Optionally, share an example of a Choose Your Own Adventure storybook with the class.

Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- What are some of your favourite Choose Your Own Adventure experiences? Your experiences could come from books or different types of games.
- In each of your experiences, what choices could you make, and how did your choices affect the outcome?

Process: Understanding Context, Defining, and Ideating (40 minutes)

Introduce the project to your class and describe the audience, theme, resources available, and possible forms that their projects could take. Review the assessment criteria for the project.

After reviewing the assessment criteria, give students time to brainstorm. Ensure that students record their ideas and any key or unique features they are considering for their projects. Optionally, allow students to explore online if they have access to devices and Internet.

Reflections: Creative Thinking (10 minutes)

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups about the creative thinking process using the following prompts:

- How do you come up with new ideas?
- When do you come up with your best ideas?
- When you get stuck, how do you get unstuck?

Stage 2:

Ideating, Prototyping, and Testing

In this stage, students must choose an idea that's appropriate for the intended audience, theme, and available resources, produce a quick prototype of their project, and gather feedback.

Stage Overview
Estimated Time: 1hr.
Materials for the teacher:
<ul style="list-style-type: none">• Example of a tree diagram for a Choose Your Own Adventure story (Optional)
Materials for each student:
<ul style="list-style-type: none">• Project Planning Student Sheet• Project Feedback Student Sheet• Pencil
Preparation:
<ul style="list-style-type: none">• Print out 1 Project Planning Student Sheet per student• Print out 1 Project Feedback Student Sheet per student

Warm-up: What is a prototype? (10 minutes)

Explain to students that at this stage, they need to choose an idea to prototype and test. Describe a prototype as a simplified version of a project. To prototype an idea means to find a way to present the idea so that other people can give feedback. For a Choose Your Own Adventure story, a prototype can be as simple as a tree diagram that illustrates the different paths in the story.

Demonstrate how to quickly sketch a tree diagram for a Choose Your Own Adventure story. Optionally, show an existing example of a tree diagram for a story.

Process: Ideating, Prototyping, and Testing (40 minutes)

Ensure that each student has a pencil, the Project Planning Student Sheet, and the Project Feedback Student Sheet.

Review the Project Planning Student Sheet with the class. Stress that they need to choose an idea to prototype, and describe the idea and any special features of the idea on the sheet. They also need to sketch a tree diagram of the story, so that someone can clearly see the possible paths in the story.

Next, review the Project Feedback Student Sheet. Explain that once they've sketched a tree diagram of their stories, they need to collect feedback from at least 3 different people. The person giving feedback must write down the following:

- Name
- One thing that works really well that the person should keep
- One thing that works well but could be done differently
- One thing that could be improved

Allow enough time for students to complete both student sheets.

Reflections: Giving and Receiving Feedback (10 minutes)

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups about giving and receiving feedback using the following prompts:

- What are some examples of constructive feedback?
- Did you receive feedback that you might incorporate into your project?
Why or why not?

Project Planning Student Sheet

Answer the questions below to start planning your project. You may describe your ideas in writing, draw sketches, or refer to other materials.

What is the main idea for your Choose Your Own Adventure story?

Who are the main characters in your story and what do they look like?

What are some unique or key features of your story?

Sketch a tree diagram for your story.

Project Feedback Student Sheet

Name	What is one thing that works really well that the person should keep?	What is one thing that works well that could be done differently?	What is one thing that could be improved?

Stage 3: Making

In this stage, students implement their ideas using available resources.

Stage Overview
Estimated Time: 3hr.
Materials for each student:
<ul style="list-style-type: none">• Equipment and materials required to complete the project (depending on the chosen form)
Preparation:
<ul style="list-style-type: none">• Ensure that students have access to all necessary equipment and materials.

At this stage, students are developing their projects using either online tools or traditional materials. Ensure that students have all the required equipment and supplies during this phase. We recommend giving students at least 2 to 3 sessions to complete their projects.

Stage 4: Sharing

In this final stage, students present their projects to the intended audience, reflect on their own design and development process, as well as receive feedback from the audience.

Stage Overview
Estimated Time: 1hr.
Materials for the teacher:
<ul style="list-style-type: none">• Computer, Laptop or Tablet (Optional)• Projector and Screen (Optional)• Internet Access (Optional)• Speakers (Optional)
Materials for each student:
<ul style="list-style-type: none">• Completed Choose Your Own Adventure Project• Self-Assessment Student Sheet (Optional)• Pencil (Optional)
Preparation:
<ul style="list-style-type: none">• If the intended audience is outside of the classroom, arrange for the students and their audience members to meet.• If projects are stored on devices, set up the equipment, including the computer, laptop, or tablet, projector, and screen.• If students require their computers, laptops, or mobile devices, ensure that they are available.• Print out 1 Self-Assessment Student Sheet per student. (Optional)

Warm-up: Preparing for Presentations (10 minutes)

Review what each person will present about his or her project. For example, each student may present the following:

- Describe the main idea, characters, and key features of the story
- Demonstrate one path that the story can take
- Share one challenging aspect of making the project
- Explain why he or she chose this idea
- Describe what he or she could do differently next time

Process: Sharing and Reflecting (50 minutes)

Students present their projects to their intended audience and reflect on their design process. After each presentation, allow the audience to provide some constructive feedback. Once all the presentations are completed, congratulate students on a job well done!

Assessment

Criteria	Approaching	Meeting	Exceeding
Student recorded ideas and key features from his or her brainstorming.			
Student chose an idea to pursue that was appropriate for the intended audience, theme, and availability of resources.			
Student generated a prototype that could be tested and used to gather feedback.			
Student gave and gathered constructive feedback to and from peers, and was receptive to feedback.			
Student used appropriate tools and materials to construct his or her story.			
Student presented his or her project to the intended audience.			
Student reflected on his or her making process, and considered opportunities for improvement.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this project, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	At the beginning of the project, I shared my favourite Choose Your Own Adventure experiences and/or listened to other students share their experiences.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the project, I thought about my design process: how I chose my idea, the challenges I overcame, and what I could do differently next time.

Core Competency: Facet	"I" Statement
Creative Thinking: Novelty and value	When brainstorming ideas for my story, I came up with ideas that were interesting to me and/or my audience.
Creative Thinking: Generating ideas	When coming up with ideas for my story, I thought about when I come up with my best ideas and what I could do if I got stuck.
Creative Thinking: Developing ideas	I chose my idea based on my interests and the criteria that we discussed in class.
Critical Thinking: Analyze and critique	I thoughtfully reviewed another student's project plan, and gave constructive feedback.
Critical Thinking: Develop and design	I reviewed my feedback from other students, considered each suggestion, and adapted my project based on ideas that I agreed with.
Personal Awareness and Responsibility: Self-determination	I was happy to complete and/or share my project with other students.

Extensions

Try other visual or text-based programming tools

In addition to Twine, students learning Scratch can build their Choose Your Own Adventure stories by switching between various backdrops. Students learning Python or JavaScript can also implement their Choose Your Own Adventure story as a text-based game.

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this project. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
At the beginning of the project, I shared my favourite Choose Your Own Adventure experiences and/or listened to other students share their experiences.share their experiences.	
At the end of the project, I thought about my design process: how I chose my idea, the challenges I overcame, and what I could do differently next time.	
When brainstorming ideas for my story, I came up with ideas that were interesting to me and/or my audience.	
When coming up with ideas for my story, I thought about when I come up with my best ideas and what I could do if I got stuck.	
I chose my idea based on my interests and the criteria that we discussed in class.	
I thoughtfully reviewed another student's project plan, and gave constructive feedback.	
I reviewed my feedback from other students, considered each suggestion, and adapted my project based on ideas that I agreed with.	
I was happy to complete and/or share my project with other students.	

Resources

Code.org

Code.org provides fun, interactive, self-directed tutorials that introduce computational thinking and coding for all ages. The tutorials are educational, rewarding, and many can be completed in less than an hour as a part of their Hour of Code initiative. For more information, visit the Code.org website: <https://code.org/>.

Codecademy

Learn the rudiments of JavaScript programming in about an hour. Then synthesize these with the choose your own adventure step-by-step project at Codecademy's School Curriculum platform: <https://www.codecademy.com/schools/curriculum/resources#3>.

Scratch

Scratch is a creative computing platform that allows students build interactive animations, stories, and games, and share their creations with the Scratch community. Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab. It is provided free of charge. For more information, visit the Scratch website: <https://scratch.mit.edu/>.

Trinket

Designed with teachers in mind, Trinket is a free platform that facilitates the transition from visual block-based programming to text-based programming in Python. Rudimentary computational thinking concepts are explored through turtle graphics. Trinket also supports learning the basics of HTML. Code can be embedded and run on any web page similar to YouTube videos. For more information, visit the Trinket website: <https://www.trinket.io>.

Twine

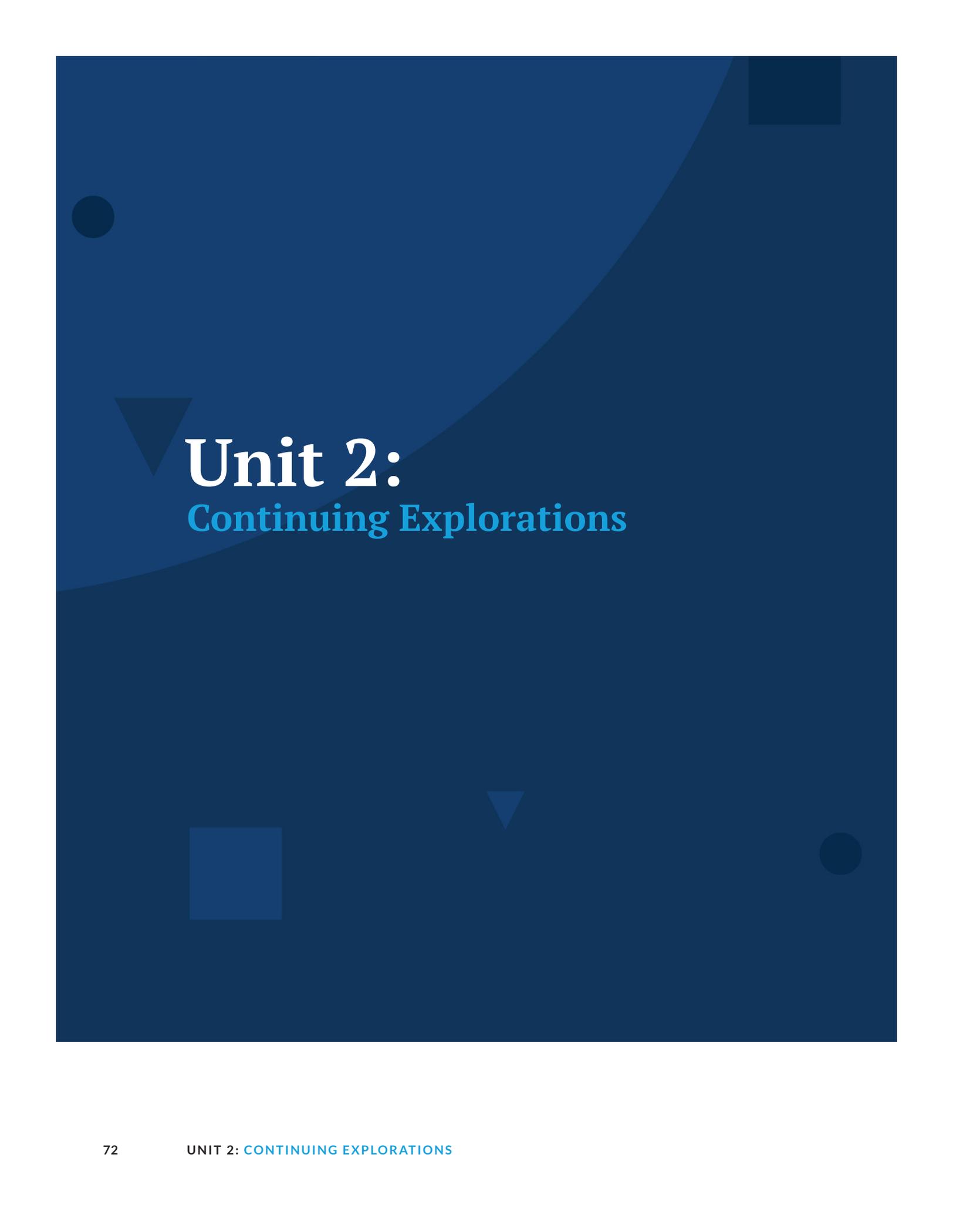
Built specifically for creating choose your own adventure type experiences, Twine is an excellent resource that is easy to learn. There is a downloadable version that is based in JavaScript and easy to use. Twine also offers a web-based version that requires no installation. In addition to being open-sourced, it is supported by a large and faithful community who have created many examples and tutorials to help you use this toolkit. For more information, visit the Twine website: <https://twinery.org/>.

Resources

Tynker

Tynker is a computing platform designed for students to learn about the basics of computational thinking and coding. There are self-directed and self-paced online courses available, as well as project-based exercises that give students the opportunity to explore coding. For more information, visit the Tynker website:

<https://www.tynker.com/>.

The cover page features a dark blue background with a lighter blue curved shape in the top-left corner. Several geometric shapes are scattered across the page: a circle in the top-left, a square in the top-right, a triangle in the middle-left, a square in the bottom-left, a triangle in the bottom-center, and a circle in the bottom-right. The title is centered in the middle-left area.

Unit 2:

Continuing Explorations



Unit 2: Continuing Explorations

Students build on the knowledge, skills, and understanding that they developed in the previous unit to continue their learning in computational thinking. In this unit, students transition from visual programming to text-based programming, in particular, they begin to experiment with web development languages, such as HTML. As students strengthen their foundation and expand their skillset, they also begin to apply computational thinking in more real-world contexts. The unit ends with a Collaborative Design Project, in which students choose an idea from their community to develop while considering the needs of others and the social impact of their project.

Big Ideas

- Social, ethical, and sustainability considerations impact design.
- Complex tasks require the acquisition of additional skills.
- Complex tasks may require multiple tools and technologies.

Unit Outline

Activity	Estimated Time (hr.)
User Stories	1
Real-World Modelling with Wireframes	1
Introduction to HTML	1
Introduction to CSS	1
Collaborative Design Project	6
Total Estimated Time (hr.)	10



Activity 1: User Stories

Students learn how to identify features and components of complex systems by constructing user stories. Building user stories helps students understand how to define and abstract modular and atomic components of a problem. It also encourages students to explore how the features of an invention would directly benefit the user.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)• Explain/recount and reflect on experiences and accomplishments
Curricular Competencies
Understanding context
<ul style="list-style-type: none">• Empathize with potential users to find issues and uncover needs and potential design opportunities
Defining
<ul style="list-style-type: none">• Identify key features or potential users and their requirements
Ideating
<ul style="list-style-type: none">• Generate potential ideas and add to others' ideas
Content
Computational Thinking
<ul style="list-style-type: none">• Debugging algorithms and programs by breaking problems down into a series of sub-problems

Activity Overview

Estimated Time 1 hr.

Materials for each student:

- Pencil
- User Stories Student Sheet
- Self-Assessment Student Sheet (Optional)

Preparation:

- Print out 1 [User Stories Student Sheet](#) per student.
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)

Warm-up: Features versus Benefits (10 minutes)

Students differentiate between features and benefits of a product. Features describe the actual function of the product whereas benefits impact the user's life in a positive way. Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- What do you think is the difference between a feature and a benefit of a product?
- What do you think is the most important piece of technology in your lifetime?
- What are five benefits of that technology?
- What are five features of that technology?
- What are the features and benefits of a smart phone?

Activity: Constructing User Stories (40 minutes)

Ensure that each student has a pencil and the User Stories Student Sheet. Review the User Stories Student Sheet with the class. In particular, review each of the user story formats.

Explain that user stories describe features not behaviours. Users expect the features to give them some kind of benefit. Present students with a product from the following list, and have them design the specifications. The product can also be something else that supports learning in another curricular area.

- Basic calculator
- Bunsen burner
- Coffee maker
- Pencil sharpener
- Printing press
- Radar
- Single-gear bicycle

Ask students to write a full list of user stories on the provided sheet that describe the features of the chosen product. Features include reasons why the user would use the product or something that the user expects from the product. The following principles should be encouraged:

Principle	Description
Value	Has the student described a set of features that give the user a measurable or tangible benefit?
Completeness	Has the student described all of the features of the product? Has the student considered describing the size of the product as a benefit?
Context	Are the features relevant within the modern context, or do they reflect the time period when the product was originally invented?

Reflections: Innovation (10 minutes)

Give students an opportunity to share their user stories. Facilitate a class discussion, or ask students to reflect individually or in small groups using the following prompts:

- If you could design your product from scratch, what would you change to make it better?
- How would the users of the product benefit from your innovations?

Assessment

Criteria	Approaching	Meeting	Exceeding
Student shared one or more ideas about features and benefits during the warm-up.			
Student completed a minimum of 5 user stories that define the basic set of features for the product.			
Student demonstrated an understanding of the connection between features and benefits by consistently using at least one of the templates provided.			
Student reflected on how he or she could improve the product either individually or in a group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	At the beginning of the activity, I actively participated in the discussion by sharing my thoughts on features and benefits and/or listening to other students’ ideas.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about how the product could be improved and how my improvements might benefit others.

Extensions

Explore different materials

Encourage students to think about the different types of materials from which the product could be manufactured.

Build a cost-benefit user story

Encourage students to explore a cost-benefit user story, which emphasizes that the product should be affordable (or not) depending on the benefit that it provides.

Consider a different historical context

Challenge students to take the features and benefits of the product and craft them to fit in a different historical context. For example, how would a coffee maker be different in the year 1275 versus 2075?

User Stories Student Sheet

A user story can have one of two forms:

Positive Benefit 1	Positive Benefit 2
As a <role>, I want to <task> because <benefit>.	As a <role>, I should be able to <task> because <benefit>.
Example: As a mathematician, I want to calculate the square root of a number because doing it manually is time-consuming.	Example: As a student, I should be able to group operations with parentheses because some of my assignments are complex.

User stories can also be expressed in the negative to restrict the features of the product:

Negative Outcome 1	Negative Outcome 2
As a <role>, I don't want to <task> because <negative outcome>.	As a <role>, I shouldn't be able to <task> because <negative outcome>.
Example: As a user of the calculator, I don't want to use too many keys to enter my equations because that doesn't save me any time.	Example: As a user of the calculator, I shouldn't be able to divide by zero because that is a mathematically incorrect operation.

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
At the beginning of the activity, I actively participated in the discussion by sharing my thoughts on features and benefits and/or listening to other students' ideas.	
At the end of the activity, I thought about how the product could be improved and how my improvements might benefit others.	



Activity 2: Real-World Modelling with Wireframes

In the previous activity, students constructed user stories to describe the benefits and features of a product. Understanding why someone might want a product and what someone can do with a product is an important part of the design process.

Often, the next step in the design process is to model how someone might use the product. For example, if the product is a mobile app, what will someone see on the home screen after they open the app? On what areas can the person tap? What screen will show up next?

People who design mobile apps and other interfaces, such as websites, often create **wireframes** to model the screens that they want to build. A wireframe is a sketch of one screen that shows where all the different elements, such as the headings, images, and buttons, will live.

In this activity, students model an existing website or mobile app by creating wireframes. Building wireframes for an existing website or mobile app allows students to focus on the technique, and helps reinforce the idea that websites and apps can be broken down into smaller components, first into separate screens and then into individual elements on the screen.

Core Competencies

Communication

- Connect and engage with others (to share and develop ideas)
- Explain/recount and reflect on experiences and accomplishments

Curricular Competencies

Prototyping

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed

Content

Computational Thinking

- Debugging algorithms and programs by breaking problems down into a series of sub-problems

Activity Overview

Estimated Time 1 hr.

Materials for the teacher:

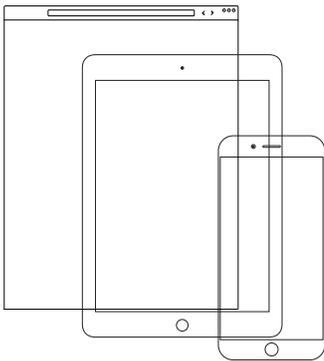
- Computer, Laptop, or Mobile Device
- Internet Access
- Projector and Screen

Materials for each student:

- Pencil
- 2 Browser Templates, 2 Tablet Templates, or 1 Phone Template depending on the type of device you or your students will be using
- Computer, Laptop, or Mobile Device (Optional)
- Internet Access (Optional)
- Self-Assessment Student Sheet (Optional)

Preparation:

- Choose one or more websites or mobile apps for students to wireframe.
- Set up the equipment, including the computer or laptop, projector, and screen to display examples.
- If students will be using computers, laptops, or mobile devices, ensure that they are available for the activity.
- Print out the wireframe templates as outlined below depending on the type of device you or your students will be using.
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)



Note to the teacher:

If using computers or laptops, print 2 copies of the browser template (with or without the grid) per student, which can be found at:

<http://sneakpeekit.com/download/sneakpeekit-browser/>

If using tablets, print 2 copies of the tablet template (with or without the grid) per student, which can be downloaded at:

<http://sneakpeekit.com/download/sneakpeekit-tablet/>

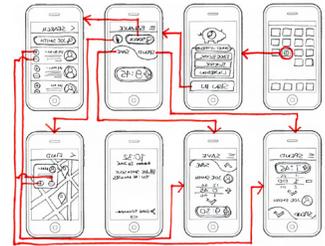
If using phones, print 1 copy of the phone template (with or without the grid) per student, which can be downloaded at:

<http://sneakpeekit.com/download/sneakpeekit-4-up-mobiles/>

Warm-up: What is a wireframe? (10 minutes)

Using the projector, show students the following wireframe examples:

- Time Bank Wireframe:
<https://www.flickr.com/photos/interactivemark/15033569833/>
- OnlyJames Wireframe Sketch:
<https://www.flickr.com/photos/jamesmowery/4155129641/>
- Prototyping a webshop:
<https://www.flickr.com/photos/painz/4702327527/>



Time Bank Wireframe

Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- Based on the wireframes, what is the purpose of each website or app?
- How would the actual websites or apps be different from their wireframes?
- What details are missing from the wireframes that would be on the websites or apps?

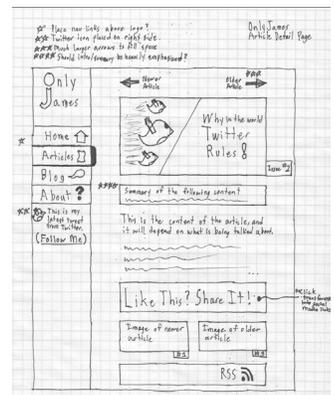
Activity: Build Your Wireframes (40 minutes)

Provide students with their own devices if available. Ensure that each student has a pencil and the appropriate wireframe templates as previously outlined.

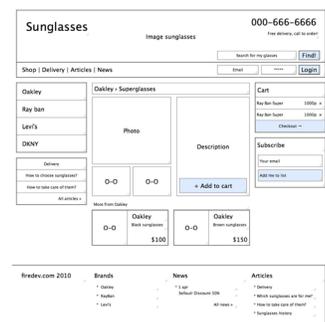
Explain to students that their objective is to produce wireframes for an existing website or app. Use the projector to show the website or app that you've chosen. Optionally, provide students with a selection of websites or apps that they can view on their devices, and allow students to choose the website or app they'd like to wireframe.

For students with the browser and tablet templates, they must wireframe 2 screens: the website's homepage or home screen of the app, plus an additional screen that they can navigate to from the homepage or home screen.

For students with the phone template, they must wireframe 4 screens: the website's homepage or home screen of the app, plus 3 additional screens that they can navigate to from the homepage or home screen.



Only James Wireframe Sketch



Prototyping a webshop

Reflections: Value of Wireframes (10 minutes)

Give students an opportunity to share their wireframes. Facilitate a class discussion, or ask students to reflect individually or in small groups using the following prompts:

- Why would it be helpful to draw wireframes before building the actual website or app?
- Who would you show these wireframes to if you were designing this website or app?
- Based on your wireframes, what improvements would you suggest?

Assessment

Criteria	Approaching	Meeting	Exceeding
Student shared one or more ideas about wireframes during the warm-up.			
Student produced a set of wireframes that reflected the overall layout and included key elements of the website or app.			
Student reflected on his or her wireframes either individually or in a group discussion.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	At the beginning of the activity, I actively participated in the discussion about wireframes by sharing one or more ideas and/or listening to other students’ ideas.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the activity, I thought about how wireframes might be helpful in my design process and/or if I was designing the wireframe or app, what improvements I would make based on my wireframes.

Extensions

Experiment with InVision

Have students create digital copies of their wireframes. One option is to scan or take pictures of their wireframes. With Invision, students can upload their wireframes, and make them interactive. Visit the Invision website for more information: <https://www.invisionapp.com/>

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
<p>At the beginning of the activity, I actively participated in the discussion about wireframes by sharing one or more ideas and/or listening to other students' ideas.</p>	
<p>At the end of the activity, I thought about how wireframes might be helpful in my design process and/or if I was designing the wireframe or app, what improvements I would make based on my wireframes.</p>	



Activity 3: Introduction to HTML

This activity introduces students to HTML (Hyper Text Markup Language), which is the *de facto* language of the world wide web. Students begin by writing a blog entry to describe their day in order to establish the base content. Afterwards, they add HTML markup to identify the different pieces of content. Through this activity, students learn what markup is, and how it can be used to describe the layout and hierarchy of information in a logical way.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)
Critical Thinking
<ul style="list-style-type: none">• Analyze and critique
Curricular Competencies
Ideating
<ul style="list-style-type: none">• Generate potential ideas and add to others' ideas
Testing
<ul style="list-style-type: none">• Test the first version of the product or the prototype• Make changes, troubleshoot, and test again
Content
Computational Thinking
<ul style="list-style-type: none">• Software programs as specific and sequential instructions with algorithms that can be reliably repeated by others• Debugging algorithms and programs by breaking problems down into a series of sub-problems
Information and Communications Technology
<ul style="list-style-type: none">• Text-based coding

Activity Overview

Estimated Time 1 hr.

Materials for each student:

- HTML Sample Student Sheet
- HTML Syntax Student Sheet
- Paper and Pencil
- Computer or Laptop (Optional)
- Self-Assessment Student Sheet (Optional)

Preparation:

- Print out 1 [HTML Sample Student Sheet](#) per student.
- Print out 1 [HTML Syntax Student Sheet](#) per student.
- If students will be using computers or laptops, ensure they are available for the activity.
- Print out 1 [Self-Assessment Student Sheet](#) per student. (Optional)

Warm-up: Brainstorming content (10 minutes)

Ask students to imagine that they're writing a blog post to describe their day. Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- If you had to give a title to your day, what would it be?
- What can you write about that describes the activities you've done today?
- List three or more people with whom you have communicated today.
- What is one quote you have heard today that you would want to remember?
Was it something funny or meaningful that you would want to record?

Part 1: Writing content (20 minutes)

Based on the warm-up discussion, ask students to write a blog post that describes what they did today. Students with access to computers or laptops may type their blog post using a text editor. The blog post should contain the following elements:

- Title
- Two paragraphs
- One list with three or more elements
- One or more quotations

Ideally, this is an opportunity for students to describe their day and reflect on major events, people, and influences.

Part 2: Adding markup (20 minutes)

In this following activity, students add proper HTML markup to represent the various types of elements in their blog post. Ensure that each student has the HTML Sample Student Sheet and the HTML Syntax Student Sheet.

Review both sheets with the class. Students should use the HTML Sample Student Sheet as a template and the HTML Syntax Student Sheet to explore the purpose of various tags.

For example, the entire blog post should first be surrounded by the `<body>` tag. Then each paragraph within the `<body>` should be surrounded by the `<p>` tag.

The list of people with whom they have interacted should be presented in the `` tag with each person being enclosed by the `` tag as illustrated below:

```
<ul>
  <li>John Doe</li>
  <li>Jane Doe</li>
  <li>John Smith</li>
</ul>
```

Lastly, the title of the blog post should be surrounded by the `<h1>` tag, which is still contained within the `<body>`. Students will need to add the `<head>` tag above the `<body>`, and include the title of their blog post again, but this time surrounded by the `<title>` tag. This way, both the overall page and the displayed content in the browser will have the title.

Reflections: Testing markup (10 minutes)

Have each student review their own blog post or exchange their blog post with another student. Facilitate a review session using the following prompts:

- Is every title, paragraph, list, and list item marked up with the proper tag?
- Is the entire blog post contained inside the `<body>` tag?
- Is there a `<head>` tag above the `<body>`?
- Is everything, including the `<head>` and `<body>` enclosed within the `<html>` tag?

Optionally, if students typed their blog posts in a text editor, have them save their blog posts as HTML files, that is, with the `.html` extension. Students can then open the HTML files in a web browser. If the browser displays the content of the blog posts without any tags and the content is nicely formatted, for example, the title is in a larger font, the paragraphs are separated, and the list items have bullet points, then the markup has been added correctly.

After the initial review, ask students to make any necessary changes to their blog posts, and to continue the review process until no more changes are needed.

Assessment

Criteria	Approaching	Meeting	Exceeding
Student participated in the brainstorming session by sharing one or more ideas for the blog.			
Student completed his or her blog post, which contained a title, two paragraphs, a list with three or more items, and one or more quotes.			
Student added proper HTML markup to his or her blog post. The result resembles the template provided in the HTML Sample Student Sheet.			
Student reviewed his or her own blog post, or reviewed another student's blog post, made the necessary changes or provided constructive feedback.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following "I" statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	"I" Statement
Communication: Connect and engage with others (to share and develop ideas)	I actively participated in the brainstorming session by sharing one or more ideas for the blog and/or supporting other students by listening to their ideas.
Critical Thinking: Analyze and critique	I reviewed and analyzed either my own markup or another student's markup, and made the necessary changes or offered constructive feedback.

Extensions

Incorporate creative writing

Rather than writing a blog post to describe their day, students may use this activity as a creative writing opportunity or any other writing opportunity which could be part of another learning area.

Explore more tags

Encourage students to explore other formatting tags, such as `` and `` tags listed in the HTML Syntax Student Sheet. Students are also welcome to visit the w3schools.com website to discover even more tags:

<http://www.w3schools.com/>

Validate the HTML markup

Students can copy and paste their HTML markup or upload their HTML files into the following website to validate their markup: <https://validator.w3.org/>

HTML Sample Student Sheet

```
<!doctype html>
<html>
  <head>
    <title>Title of My Website</title>
  </head>
  <body>
    <h1>Title of My Website</h1>
    <p>First paragraph.</p>
    <p>Second paragraph.</p>
    <ul>
      <li>List Item</li>
      <li>List Item</li>
      <li>List Item</li>
    </ul>
  </body>
</html>
```

HTML Syntax Student Sheet

Tag	Description
<code><!doctype html></code>	Only occurs at the top of a web page and tells the browser to evaluate all of the HTML on the page using HTML5 rules. HTML5 is the fifth version of HTML and represents the newest and best practices for building web content.
<code><html>...</html></code>	Creates an HTML document that the browser interprets and displays according to the tags in the <code><body></code> .
<code><head>...</head></code>	Contains instructions to the browser about how to render the page. This is not content which shows in the main browser window, instead it is meta-content which helps the browser.
<code><title>...</title></code>	Defines the title of a page. This is what shows in the top of the browser when the page loads, and also what is shown when the browser bookmarks the page.
<code><body>...</body></code>	This is the main content which is shown in the browser. All of the content here is shown to the user.
<code><h#>...</h#></code>	Where # is a number from 1 to 6, these represent headings of various sizes. An <code><h1></code> tag is the largest and boldest, whereas an <code><h6></code> is the smallest and least important. New sections of pages should have a header of appropriate level at the top of it. Example: <code><h1>Title of the Page</h1></code>
<code>...</code>	Creates bold text.
<code>...</code>	For this tag, "em" means "emphasis" and text wrapped in this tag is italicized.
<code><p>...</p></code>	This tag is for paragraphs. They will be automatically spaced out from each other.
<code>...</code>	Creates an unordered list using bullet points by default.
<code>...</code>	Generates a list item within a list tag (<code></code> or <code></code>).
<code><section>...</section></code>	Section tags draw an invisible box around elements that you want to group together. They should be related content.

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
I actively participated in the brainstorming session by sharing one or more ideas for the blog and/or supporting other students by listening to their ideas.	
I reviewed and analyzed either my own markup or another student's markup, and made the necessary changes or offered constructive feedback.	



Activity 4: Introduction to CSS

In the previous activity, students used HTML to markup or identify the different pieces of content, such as headings, paragraphs, and lists in their blog entries. It also helped to describe the layout and hierarchy of their content. For example, every paragraph was marked up with the `<p>` tag, and all paragraphs in the blog post were contained inside the `<body>` tag.

While HTML allows us to specify the content of a web page, it doesn't give us many options to change how the content is displayed in our browsers. CSS (Cascading Style Sheets) is another language of the web that works together with HTML. It allows us to create a set of rules to describe what the content should look like.

In this activity, students are introduced to CSS. They develop an understanding of the relationship between HTML markup and CSS declarations, and how to use CSS to change the appearance of basic HTML content.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)
Critical Thinking
<ul style="list-style-type: none">• Analyze and critique
Curricular Competencies
Ideating
<ul style="list-style-type: none">• Generate potential ideas and add to others' ideas
Testing
<ul style="list-style-type: none">• Test the first version of the product or the prototype• Make changes, troubleshoot, and test again

Content

Computational Thinking

- Software programs as specific and sequential instructions with algorithms that can be reliably repeated by others
- Debugging algorithms and programs by breaking problems down into a series of sub-problems

Information and Communications Technology

- Text-based coding

Activity Overview

Estimated Time 1 hr.

Prerequisites:

- Students must have completed Activity 3: Introduction to HTML.

Materials for each student:

- Paper and Pencil
- CSS Property-Value Pair Student Sheet
- HTML Blog Post with HTML Markup from Activity 3: Introduction to HTML
- Computer or Laptop (Optional)
- Internet Access (Optional)
- Self-Assessment Student Sheet (Optional)

Preparation:

- Print out 1 [CSS Property-Value Pair Student Sheet](#) per student.
- If students will be using computers or laptops, ensure they are available for the activity.
- Print out 1 [Self-Assessment Student Sheet per student](#). (Optional)

Warm-up: Understanding property-value pairs (10 minutes)

Explain to students that while HTML allows us to specify the content and structure of a web page, CSS allows us to customize its appearance. Every web browser has a built-in set of definitions, or a default appearance, for all HTML elements. For example, all headings and paragraphs have a default font size. The colour of all headings and paragraphs is also initially set to black.

Font size and colour are just two examples of properties in CSS, but there are many more. Using CSS declarations, we can change the value of specific properties, which gives us, as content creators, the opportunity to personalize the appearance of our content. For instance, using CSS, we can change the colour of all paragraphs to blue instead.

Ensure that each student has a copy of the CSS Property-Value Pair Student Sheet. Review the sheet as a class. Facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- What is unique about the way these rules are written?
- How would you write a CSS declaration that makes the text of `<h1>` elements green?

Activity: Writing CSS (40 minutes)

Make sure that each student has their blog post complete with HTML markup from the previous activity, and ask them to think about what they'd like to change about its appearance. Now that they know some of the main CSS properties that web designers use to change their web pages, they can use these properties to customize the appearance of their blog posts.

Before students begin, ask students to add the `<style>` tag inside the `<head>` element of their blog posts. The `<head>` should now look like the following:

```
<head>
  <title>My Post</title>
  <style>

  </style>
</head>
```

Students can write their CSS declarations within the `<style>...</style>` tag. Optionally, students who typed their blog posts on computers or laptops using a text editor may continue to type their CSS declarations using the text editor.

Reflections: Testing CSS (10 minutes)

Similar to the last activity, have each student review their own blog post or exchange their blog post with another student. Facilitate a review session using the following prompts:

- Is there a `<style>` tag inside the `<head>` tag?
- Are all the CSS declarations contained inside the `<style>` tag?
- Are there CSS declarations for `<h1>`, `<p>`, and `` or `` elements?
- For each CSS declaration, are all the rules contained within curly braces?
- Is there a semicolon at the end of every rule?

Optionally, if students typed their blog posts in a text editor and saved them as HTML files, that is, with the `.html` extension, they can test their HTML files in a web browser. If the browser displays the content of the blog posts according to the specified CSS declarations, then the CSS was added correctly.

After the initial review, ask students to make any necessary changes to their blog posts, and to continue the review process until no more changes are needed. Students saving their blog posts as HTML files will need to reload their pages in the browser to see any new changes. Remind students to pay careful attention to syntax; semicolons matter!

Assessment

Criteria	Approaching	Meeting	Exceeding
Student participated in the warm-up by making observations of how CSS is written and/or sharing one or more ideas on how to write the CSS declaration.			
Student added at least 3 CSS declarations to his or her blog post, for example, one declaration for each of the following elements: <code><h1></code> , <code><p></code> , and <code></code> or <code></code> .			
Student included at least 5 different CSS properties from the CSS Property-Value Pair Student Sheet, such: border, color, font-size, padding, and text-align.			
Student reviewed his or her own blog post, or reviewed another student's blog post, and made the necessary changes or provided constructive feedback.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following "I" statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this activity, and can be printed out for each student.

Core Competency: Facet	"I" Statement
Communication: Connect and engage with others (to share and develop ideas)	At the beginning of the activity, I shared one or more observations on how CSS is written and/or supported other students by listening to their ideas.
Critical Thinking: Analyze and critique	I reviewed and analyzed my own CSS declarations or another student's CSS declarations, and made the necessary changes or offered constructive feedback.

Extensions

Exploring more properties

Given the full list of properties at <https://developer.mozilla.org/en-US/docs/Web/CSS/Reference> and the accompanying student sheet, students who are comfortable with changing properties can customize their content further. This is an excellent opportunity to engage students as mentors for other students, sharing knowledge and insight into how the CSS properties work.

CSS Property-Value Pair Student Sheet

```
div {  
  height: 100px;  
  width: 100px;  
  color: blue;  
}
```

This is a CSS declaration. It is a set of rules, or property-value pairs, that modify the appearance of a particular kind of element on a page, in this case, the <div> element. When writing a declaration, you must do the following:

- Use the curly braces, {}, to group rules together.
- For each rule, place the property to the left of the colon.
- For each rule, place the value to the right of the colon.
- End each rule with a semicolon to tell the browser that you're done setting the rule.

The declaration above has three rules to describe how a <div> element should appear.

- The height of the element should be 100 pixels.
- The width of the element should be 100 pixels.
- The color of the text inside the element should be blue.

These rules change the default behaviour of the element. The browser has built-in rules that dictate how every possible element appears. Because every aspect of the appearance has already been defined, any changes we make override the built-in rules.

This is a huge benefit because it means that we don't have to define every possible aspect every time we want to add a new element to our page. Here's another example:

```
p {  
  margin: 5px;  
  border: 2px solid black;  
  text-align: center;  
  font-size: 14px;  
}
```

This declaration modifies four properties of all paragraphs on a page. There are over a hundred possible properties that can be changed, giving us infinite control over how elements appear. Here are the ten most commonly used properties for you to try.

Property	Description
background-color	<p>Changes the background color of the element. You can specify colors the same way as in color below.</p> <p>Example: background-color: black;</p>
border	<p>Creates a border around the element. This rule has three properties:</p> <ol style="list-style-type: none">1. Width: Express this as a number of pixels, such as 1px or 4px.2. Style: solid is the most common border, but other possibilities include: none, dotted, dashed, double, groove, ridge, inset, and outset.3. Color: This follows the same rules as color below. <p>Example: border: 5px dashed red;</p>
color	<p>Changes the color of the text inside the element. There are multiple ways to designate the color of an element. Many common words, such as blue, white, and orange will work. Here's a complete list of all available named colors: http://www.colors.commutercreative.com/grid/</p> <p>Example: color: orange;</p>
font-size	<p>Sets the size of the text inside the element using pixels.</p> <p>Example: font-size: 14px;</p>
height	<p>Sets the height of the element. This can be expressed as a percentage or in pixels. If you use a percentage, you're telling the browser that you want this element to take up some percentage of the height of the element it's in. Tip: Even if it's the first element on the page, it's still inside the <body> element!</p> <p>Example: height: 500px;</p>
margin	<p>Sets the space between the element and all surrounding elements, like the margin on a piece of notebook paper.</p> <p>Example: margin: 20px;</p>

Property	Description
padding	Sets the space between the content and its border. It adds extra whitespace inside of the element. Example: padding: 15px;
text-align	Aligns the text inside of the element. Possible values include left, center, and right. Example: text-align: center;
text-decoration	Sets all of the text in an element to be underline, overline, or line-through. Example: text-decoration: underline;
width	Same as height, just horizontal instead of vertical. Example: width: 100%;

For a full list of CSS properties, visit the following website:

<https://developer.mozilla.org/en-US/docs/Web/CSS/Reference>

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this activity. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
At the beginning of the activity, I shared one or more observations on how CSS is written and/or supported other students by listening to their ideas.	
I reviewed and analyzed my own CSS declarations or another student's CSS declarations, and made the necessary changes or offered constructive feedback.	



Project: Collaborative Design Project

The Collaborative Design Project is an opportunity for students to participate in a larger community beyond the classroom. Students are provided with app ideas developed by other students in British Columbia. These ideas include apps for managing anger, raising awareness of animal exploitation, and dealing with bullies. Students are encouraged to choose an app idea that interests them, and help build and further develop the idea by generating user stories, and building prototypes.

The app ideas are from other students in British Columbia who participated in workshops provided by IdeaDriven Education. To view all app ideas or to learn more about the organization, visit the IdeaDriven Education website at <http://www.ideadriven.org/app-ideas>.

Core Competencies
Communication
<ul style="list-style-type: none">• Connect and engage with others (to share and develop ideas)• Explain/recount and reflect on experiences and accomplishments
Creative Thinking
<ul style="list-style-type: none">• Novelty and value• Generating ideas• Developing ideas
Critical Thinking
<ul style="list-style-type: none">• Analyze and critique• Develop and design
Personal Awareness and Responsibility
<ul style="list-style-type: none">• Self-determination

Content

Computational Thinking

- Software programs as specific and sequential instructions with algorithms that can be reliably repeated by others
- Debugging algorithms and programs by breaking problems down into a series of sub-problems

Information and Communications Technology

- Text-based coding (Optional)

Curricular Competencies

Understanding context

- Empathize with potential users to find issues and uncover needs and potential design opportunities

Defining

- Choose a design opportunity
- Identify key features or potential users and their requirements
- Identify criteria for success and any constraints

Ideating

- Generate potential ideas and add to others' ideas
- Screen ideas against criteria and constraints
- Evaluate personal, social, and environmental impacts and ethical considerations
- Choose an idea to pursue

Prototyping

- Explore and test a variety of materials for effective use
- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- Record iterations of prototyping

Testing

- Test the first version of the product or the prototype
- Gather peer and/or user and/or expert feedback and inspiration
- Make changes, troubleshoot, and test again

Making

- Identify and use appropriate tools, technologies, and materials for production

Sharing

- Demonstrate their product and describe their process, using appropriate terminology and providing reasons for their selected solution and modifications
- Evaluate their product against their criteria and explain how it contributes to the individual, family, community, and/or environment
- Reflect on their design thinking and processes, and evaluate their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain an efficient cooperative work space
- Identify new design issues

Project Overview

Students are presented with a variety of app ideas from other students in British Columbia. Their goal for this project is to choose an idea that interests them, and to help bring the app to life by adding their own ideas, building on existing ideas, and using their experience with designing, prototyping, and wireframing from previous activities.

More specifically, students will further develop the idea by generating user stories, making an initial prototype using wireframes, testing, revising, and then creating a set of higher fidelity wireframes to present to the class.

The estimated time for this project from start to finish is 6 hours, and involves every stage of the making process. The table below provides an outline of the overall project.

Activity	Estimated Time (hr.)
Understanding Context, Defining, and Ideating	1
Ideating, Prototyping, and Testing	1
Making	3
Sharing	1
Total Estimated Time (hr.)	6

Stage 1:

Understanding Context, Defining, and Ideating

In this first stage, students are introduced to the Collaborative Design Project. They begin to explore the various app ideas available, and select a few ideas that interest them.

Stage Overview
Estimated Time: 1hr.
Materials for the teacher:
<ul style="list-style-type: none">• Computer, Laptop or Tablet• Projector and Screen• Internet Access
Materials for each student:
<ul style="list-style-type: none">• App Ideas Student Sheet• Pencil• Computer, Laptop, or Tablet (Optional)• Internet Access (Optional)
Preparation:
<ul style="list-style-type: none">• Set up the equipment, including the computer or laptop, projector, and screen, in order to present the app ideas.• If students have access to computers, laptops, or mobile devices, ensure that they are available for the activity.• Print out 1 App Ideas Student Sheet per student.

Warm-up: App Ideas (10 minutes)

Using the projector, present the app ideas from the IdeaDriven Education website to the class: <http://www.ideadriven.org/app-ideas>

Select 2 or 3 ideas to explore. For each idea, facilitate a class discussion or ask students to discuss in small groups using the following prompts:

- Do you like this idea? Why or why not?
- In what ways could you build on the idea?
- In what ways could you change or improve the idea?

Process: Understanding Context, Defining, and Ideating (40 minutes)

Ensure each student has a pencil and an App Ideas Student Sheet.

Introduce the project to the class. Review the expectations or assessment criteria for the project. Their objectives for the project include the following:

- Choosing an idea
- Creating a prototype using wireframes
- Gathering feedback
- Revising
- Building detailed wireframes, called high-fidelity wireframes
- Presenting their projects

After reviewing the assessment criteria, give students time to explore. Ensure that students record their top 3 choices, what they like or dislike about the idea, and what ideas of their own that they would add on the App Idea Student Sheet.

Reflections: Creative Thinking (10 minutes)

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups using the following prompts:

- Which app ideas did you like the most?
- What did the apps that you chose all have in common?
- Which idea inspired you the most?
- Which idea do you feel you could build on the most?

App Ideas Student Sheet

App ideas	What do you like most about the idea?	What do you like the least about the idea?	What would you add, change, or improve?

Stage 2:

Ideating, Prototyping, and Testing

In this stage, students must choose an idea that they would like to pursue, produce a prototype in the form of wireframes, and gather feedback.

Stage Overview
Estimated Time: 1hr.
Materials for each student:
<ul style="list-style-type: none">• Project Planning Student Sheet• Project Feedback Student Sheet• 1 to 2 Phone Templates• Pencil
Preparation:
<ul style="list-style-type: none">• Print out 1 Project Planning Student Sheet per student.• Print out 1 Project Feedback Student Sheet per student.• Print out 1 to 2 Phone Templates per student. Link provided below.

Note to the teacher: The phone template (with and without the grid) can be downloaded at <http://sneakpeekit.com/download/sneakpeekit-4-up-mobiles/>.

Warm-up: What is a low-fidelity wireframe?

(10 minutes)

Explain to students that at this stage, they need to choose an idea to prototype and test. Recall that a prototype is a simplified version of a project. To prototype an idea means to find a way to present the idea so that other people can give feedback.

In this project, explain that they will create their first prototype by drawing low-fidelity wireframes. These wireframes are meant to be low detail and drawn quickly, but they still have enough information so that others can see what the app is about.

Process: Ideating, Prototyping, and Testing

(40 minutes)

Ensure that each student has a pencil, the Project Planning Student Sheet, 1 to 2 copies of the Phone Template, and the Project Feedback Student Sheet.

Review the Project Planning Student Sheet and the Phone Template with the class. Stress that they need to choose an app idea to prototype, describe the purpose of the app, provide at least 3 user stories that support the purpose, and sketch a set of wireframes that corresponds to one of the user stories.

Next, review the Project Feedback Student Sheet. Explain that once they've sketched their wireframes, they need to collect feedback from at least 3 different people.

The person giving feedback must write down the following:

- Name
- One thing that works really well that the person should keep
- One thing that works well but could be done differently
- One thing that could be improved

Allow enough time for students to complete all sheets.

Reflections: Giving and Receiving Feedback

(10 minutes)

Facilitate a class discussion, or alternatively, ask students to reflect individually or in small groups about giving and receiving feedback using the following prompts:

- What are some examples of constructive feedback?
- Did you receive feedback that you might incorporate into your project?
Why or why not?

Project Planning Student Sheet

What is the purpose of your app?

Describe at least three user stories for your app.

User Story 1:

User Story 2:

User Story 3:

Project Feedback Student Sheet

Name	What is one thing that works really well that the person should keep?	What is one thing that works well that could be done differently?	What is one thing that could be improved?

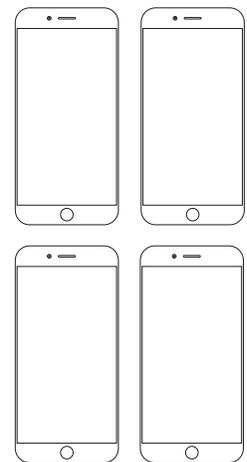
Stage 3: Making

In this stage, students consider the feedback that they gathered during the previous stage, make revisions to their design, and generate high-fidelity wireframes.

Stage Overview
Estimated Time: 3 hr.
Materials for each student:
<ul style="list-style-type: none">• 1 to 2 Phone Templates• Pencil• Colour Pencils or Markers
Preparation:
<ul style="list-style-type: none">• Print out 1 to 2 Phone Templates per student. Link provided below.

Note to the teacher: The phone template (with and without the grid) can be downloaded at <http://sneakpeekit.com/download/sneakpeekit-4-up-mobiles/>.

Explain to students that at this stage, they will review the feedback that they gathered, make revisions to their design, and create high-fidelity wireframes that have more detail than the first set of wireframes. High-fidelity wireframes are higher quality, and may include actual text, images, and colour. Ensure that students have all the required supplies during this phase. We recommend giving students at least 2 to 3 sessions to complete their projects.



Phone Template

Stage 4: Sharing

In this final stage, students present their projects to the class, receive feedback, and reflect on their design and development process.

Stage Overview
Estimated Time: 1 hr.
Materials for each student:
<ul style="list-style-type: none">• Completed Collaborative Design Project• Self-Assessment Student Sheet (Optional)• Pencil (Optional)
Preparation:
<ul style="list-style-type: none">• Prepare a list of presenters. (Optional)• Print out 1 Self-Assessment Student Sheet per student. (Optional)

Warm-up: Preparing for Presentations (10 minutes)

Review what each person will present about his or her project. For example, each student may present the following:

- Describe the purpose, benefits, and features of the app
- Demonstrate how someone might use the app
- Share one challenging aspect of creating this project
- Explain why he or she chose this idea
- Describe what he or she could do differently next time

Process: Sharing and Reflecting (50 minutes)

Students present their projects, gather final feedback from the class, and reflect on their design process. After the presentations, congratulate students on a job well done!

Assessment

Criteria	Approaching	Meeting	Exceeding
Student recorded possible ideas and their opinions from their explorations.			
Student chose an idea to pursue and produced 3 unique user stories.			
Student generated a prototype that could be tested and used to gather feedback.			
Student gave and gathered constructive feedback to and from peers, and was receptive to feedback.			
Student used appropriate tools and materials to construct his or her high fidelity wireframes.			
Student presented his or her project.			
Student reflected on his or her making process, and considered opportunities for improvement.			

Optionally, have each student self-assess how they demonstrated or exercised certain core competencies and facets by asking them to give examples or provide evidence of one or more of the following “I” statements. Examples or evidence can take the form of a sketch, narrative, self-reflection, photo, or video. A sample Self-Assessment Student Sheet can be found at the end of this project, and can be printed out for each student.

Core Competency: Facet	“I” Statement
Communication: Connect and engage with others (to share and develop ideas)	At the beginning of the project, I shared what I liked and/or didn't like about the app ideas, and listened to other students share their opinions.
Communication: Explain/recount and reflect on experiences and accomplishments	At the end of the project, I thought about my design process: how I chose my idea, the challenges I overcame, and what I could do differently next time.
Creative Thinking: Novelty and value	When exploring the different app ideas, I came up with new ideas that I could add and/or ways that I could change the original ideas.

Core Competency: Facet	"I" Statement
Creative Thinking: Generating ideas	When exploring the different app ideas, I thought about which ideas inspired me the most and why.
Creative Thinking: Developing ideas	I chose my app idea based on my interests and the criteria that we discussed in class.
Critical Thinking: Analyze and critique	I thoughtfully reviewed another student's project plan, and gave constructive feedback.
Critical Thinking: Develop and design	I reviewed my feedback from other students, considered each suggestion, and adapted my project based on ideas that I agreed with.
Personal Awareness and Responsibility: Self-determination	I was happy to complete and/or share my project with other students.

Extensions

Partner with a "buddy class"

Instead of using the app ideas from the IdeaDriven Education website, partner with a "buddy class" and have your students' buddies suggest the app ideas. Your students' buddies can also be involved in the testing and sharing stages, and offer constructive feedback.

Create interactive high-fidelity wireframes using InVision

Students can scan or take pictures of their high-fidelity wireframes. Then with Invision, students' can upload their wireframes, and make them interactive. Visit the Invision website for more information: <https://www.invisionapp.com/>

Implement the wireframes using HTML/CSS

Students can create their wireframes using HTML/CSS.

Self-Assessment Student Sheet

Give an example or provide evidence of how you demonstrated or accomplished each of the following statements during this project. Examples and evidence can include sketches, written descriptions, and references to photos or videos.

Statement	Example or Evidence
At the beginning of the project, I shared what I liked and/or didn't like about the app ideas, and listened to other students share their opinions.	
At the end of the project, I thought about my design process: how I chose my idea, the challenges I overcame, and what I could do differently next time.	
When exploring the different app ideas, I came up with new ideas that I could add and/or ways that I could change the original ideas.	
When exploring the different app ideas, I thought about which ideas inspired me the most and why.	
I chose my app idea based on my interests and the criteria that we discussed in class.	
I thoughtfully reviewed another student's project plan, and gave constructive feedback.	
I reviewed my feedback from other students, considered each suggestion, and adapted my project based on ideas that I agreed with.	
I was happy to complete and/or share my project with other students.	



Introducing Computational Thinking into the Classroom:
Student Learning Modules