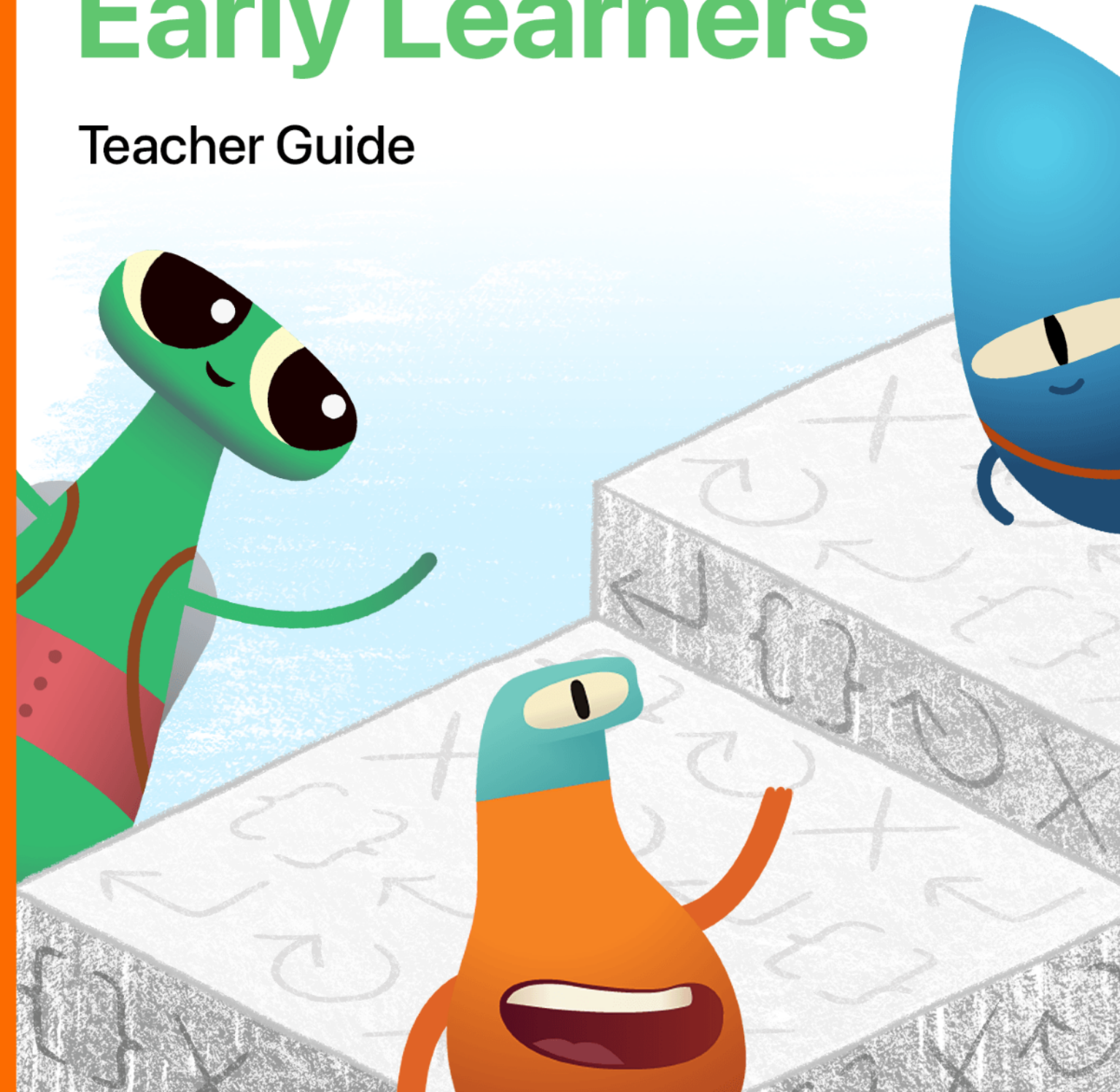


# Everyone Can Code Early Learners

Teacher Guide



## Table of Contents

### Introduction

### Commands

- Lesson 1: Daily Routines
- Lesson 2: Story Order
- Lesson 3: Dance Moves

### Functions

- Lesson 1: Paper Gem
- Lesson 2: Songfest
- Lesson 3: My Calming Function

### Loops

- Lesson 1: Repeating Petals
- Lesson 2: Obstacle Course
- Lesson 3: Drumming Patterns

### Variables

- Lesson 1: Sink or Float
- Lesson 2: Word Game
- Lesson 3: All About Me

### App Design

### Facilitator Resources



*Everyone Can Code Early Learners* is designed to help educators and families introduce coding in early years education when learners are first developing computational thinking skills. Through these lessons, learners aged 5–8 will explore, discover and play to develop a foundation in core coding concepts.





## Instructional Design

This guide is divided into four modules and culminates in an app design project. Every module contains three lessons, each of which focuses on one concept related to coding. Within each lesson, you'll find three activities: Explore, Discover and Play. The activities can be split into multiple sessions or days of learning.

### Day 1: Discussion and hands-on learning

#### Explore

Introduce and discuss the coding concept

#### Discover

Build familiarity with the concept through creative activities

~25  
minutes

#### Play

- Code along with Byte in the Swift Playgrounds app
- Practise coding in companion worksheets and Keynote activities
- Bring Byte's world into the real world with unplugged floor puzzle coding games

~25  
minutes

### Day 2: Connecting learning to code

## Scope and Sequence

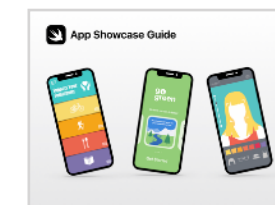
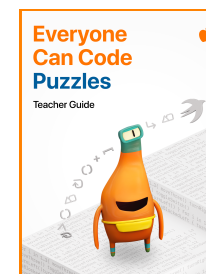
The four modules in this guide are designed to be used when teaching students in Years 1–4. They can be done in any order. We encourage you to use the App Design module at any time, or even multiple times a year, as learners develop their understanding of code and apps.

### Example:

Year	Module	Culminating project	Approximate total time
Pre-school	<a href="#">Commands</a>	<a href="#">App Design</a>	4 hours
Year 2	<a href="#">Functions</a>	<a href="#">App Design</a>	4 hours
Year 3	<a href="#">Loops</a>	<a href="#">App Design</a>	4 hours
Year 4	<a href="#">Variables</a>	<a href="#">App Design</a>	4 hours

### Continue Learning

For teaching pupils in Years 4–9, the Everyone Can Code Puzzles, along with the App Design Journal and the App Showcase Guide, offer more than 45 hours of learning.





## Learner Portfolios (Optional)

Throughout these modules, collect mementos from the activities to create portfolios with your learners.










Module	Lesson	Suggested mementos
<b>Commands</b>	Daily Routines	<ul style="list-style-type: none"> <li>• Issuing Commands worksheet</li> <li>• Adding a New Command worksheet</li> </ul>
	Story Order	<ul style="list-style-type: none"> <li>• Story Order plot point picture</li> <li>• Story Order group picture</li> </ul>
	Dance Moves	<ul style="list-style-type: none"> <li>• Dance Moves cards</li> <li>• Dance Moves video (optional)</li> </ul>
<b>Functions</b>	Paper Gem	<ul style="list-style-type: none"> <li>• Paper Gem shape</li> <li>• Composing a New Behaviour worksheet</li> <li>• Creating a New Function worksheet</li> </ul>
	Songfest	<ul style="list-style-type: none"> <li>• Songfest concert video or written function</li> </ul>
	My Calming Function	<ul style="list-style-type: none"> <li>• My Calming Function drawing or video</li> <li>• Collect, Toggle, Repeat worksheet</li> </ul>
<b>Loops</b>	Repeating Petals	<ul style="list-style-type: none"> <li>• Repeating Petals</li> <li>• Using Loops worksheet</li> <li>• Looping All the Sides worksheet</li> </ul>
	Obstacle Course	<ul style="list-style-type: none"> <li>• Video or pictures of the obstacle course (optional)</li> </ul>
	Drumming Patterns	<ul style="list-style-type: none"> <li>• To the Edge and Back worksheet</li> <li>• Video or pictures of the drumming (optional)</li> </ul>
<b>Variables</b>	Sink or Float	<ul style="list-style-type: none"> <li>• Sink or Float</li> <li>• Keeping Track worksheet</li> </ul>
	Word Game	<ul style="list-style-type: none"> <li>• Word games</li> </ul>
	All About Me	<ul style="list-style-type: none"> <li>• All About Me</li> <li>• All About You</li> </ul>
<b>App Design</b>		<ul style="list-style-type: none"> <li>• What's an App?</li> <li>• My App Design</li> <li>• App Design prototype</li> </ul>

## Getting Started with Swift Playgrounds on iPad or Mac



Before diving into the lessons, make sure you've downloaded [Swift Playgrounds](#), [Pages](#) and [Keynote](#). Visit [Teaching Code with Swift Playgrounds](#) in the Apple Education Community to explore teaching and learning resources.

The modules in this guide use different combinations of playgrounds. Here's what you'll need for each module:

Module	Playgrounds	How to Download in Swift Playgrounds
Commands	 Learn to Code 1  Blu's Adventure	Blu's Adventure can be found in the Books section of the More Playgrounds screen.
Functions	 Learn to Code 1	
Loops	 Learn to Code 1	
Variables	 Learn to Code 2  Rock, Paper, Scissors  Code Machine	Rock, Paper, Scissors and Code Machine can be found in the Books section of the More Playgrounds screen.
App Design		

Visit [Apple Support](#) to get help with Swift Playgrounds.



## Facilitator Tips

To get the most out of lessons with your learners, try some of these tips.

### Explore and Discover Activities:

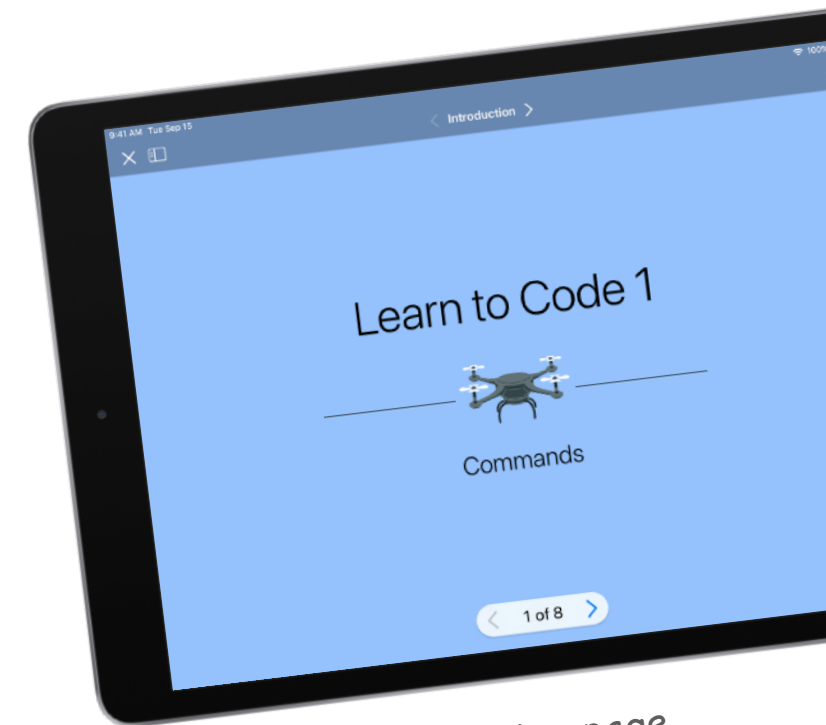
- Simplify any syntax or special casing when writing or demonstrating code – for example:
  - `var names = ["Rose", "Sam", "Joy"]` --> `var names = Rose, Sam, Joy`
  - `var ages = [7, 8, 7, 8, 7]` --> `var ages = 7, 8, 7, 8, 7`
  - `var myFavoriteColor = ■` --> `var my favorite color = ■`

### Play Activities:

- To make the Swift Playgrounds app even more simple for young learners, follow the instructions in the lesson plans. These include:
  - Read the introductions as a group
  - Give learners pared-down directions for the accompanying worksheets so they can come up with their own solutions
  - Use one facilitator iPad or Mac to solve the puzzles in the app
- `let` and `var`: The `let` keyword isn't covered in this guide. To avoid confusion in Swift Playgrounds, please change any `let` keywords to `var` before showing the pages to learners. In the playgrounds that we recommend, the two keywords are interchangeable.
  - `let` = variable doesn't change
  - `var` = variable does change

### Extensions:

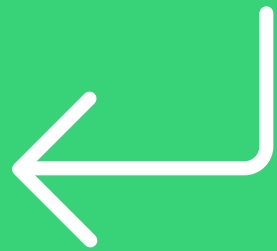
- Expand the floor Play activities to include numeracy, literacy, sight words, spelling and more. Try the floor Play activity in the Functions module for inspiration.
- Personalise the floor Play activities by getting learners to make up their own cards for commands, such as `spin()` or `jump()`.



Introduction page



Playground page



# Commands



## Overview

### Lesson 1: Daily Routines

- Explore: Discussion relating baking to commands
- Discover: Daily Routines activity
- Play: Issuing Commands and Adding a New Command

### Lesson 2: Story Order

- Explore: Discussion relating the order of story plot points to commands
- Discover: Story Order activity
- Play: Floor puzzle game

### Lesson 3: Dance Moves

- Explore: Discussion relating dance moves to commands
- Discover: Dance Moves activity
- Play: Blu's Adventure Preview

## Learners Will Be Able To:

- Use everyday examples to describe step-by-step instructions
- Put instructions in order so they make sense
- Test and debug instructions and code

## Vocabulary

- **Sequence:** The order in which things happen
- **Step:** One action in a larger process
- **Modify:** To change
- **Command:** Code that tells an application to perform a specific action
- **Bug:** An error in code
- **Debug:** To find and fix errors in code

## Standards

1A-AP-08, 1A-AP-10, 1A-AP-12, 1A-AP-14, 1B-AP-16 >



## Explore

**Objective:** Introduce the concept of commands by relating it to making brownies.

**Discussion:**

- When making brownies, would they follow a recipe?
- Would they follow the recipe's steps in order?

**Key point:** Each step or instruction in a recipe is like a command in code. Get learners to come up with commands of their own.

## Discover

**Objective:** Model the process of a daily routine by identifying step-by-step instructions.

**Materials:** Washing Your Hands cards

**Directions:**

1. Shuffle the Washing Your Hands deck of cards and place them on a table or put them up on the board. The cards should be out of order.
2. Ask learners if they think there's a bug in your handwashing sequence.
3. Ask learners to debug – or fix – the instructions by moving one card at a time to its correct location.

**Alternative:**

Get learners to work in pairs or small groups and give each group a set of cards.

**Extension:**

Ask learners to come up with their own set of step-by-step instructions for something they do every day and make pictures of the specific steps.

↓ [Download the Washing Your Hands cards](#)



## Play

**Objective:** Learners will be able to add the commands in the correct order to collect their first gems in Learn to Code 1 in the Swift Playgrounds app.

### Directions:

1. Project the introduction page of the Commands chapter in the Learn to Code 1 playground onto a screen.
2. Introduction:
  - Read through the pages as a class, stopping for questions as needed.
3. Issuing Commands:
  - Review the two commands that learners will need to move Byte to the gem: `moveForward()` and `collectGem()`.
  - Ask learners to experiment with ways to direct Byte from the start arrow to the gem and collect it. They can record the commands on the worksheet or on a separate piece of paper.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Byte!

### Extension:

If learners are ready, move to the next page: Adding a New Command. Here, learners will use a new command: `turnLeft()`.



**Learn to Code 1**

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Learn to Code 1 playground
- Projector or display

### Learner materials:

- Issuing Commands and Adding a New Command worksheets
- Pencils
- Extra paper (optional)

↓ [Download the Learn to Code worksheets](#)





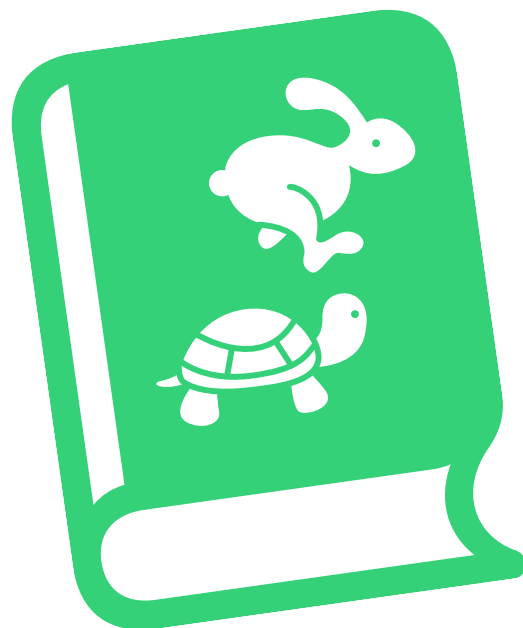
## Explore

**Objective:** Explore how books follow a sequence (beginning, middle and end) in order for stories to make sense.

**Discussion:**

- Ask learners if books follow a sequence.
- What would happen if the beginning, middle and end of a book were in the wrong order?
- Explore several examples.

**Key point:** Make the connection to code, emphasising how important it is to give coding commands in the correct order – just like the plot points of a story.



## Discover

**Objective:** After creating pictures of various plot points from a story, learners will be able to put the pictures in order to accurately re-create the story.

**Facilitator materials:**

- Whiteboard
- Markers

**Learner materials:**

- Paper
- Markers or colouring pencils
- Alternative: iPad devices and a drawing app

**Directions:**

1. Read a story that learners know well. As a class, determine the primary plot points of the story. Ideally, come up with four to six plot points.
2. Create small groups that have the same number of learners as plot points you've determined – for example, if you've come up with four plot points, there should be four learners in each group.
3. Ask each learner in the group to draw one of the plot points.
4. Groups will take it in turns to stand at the front of the room and hold their plot pictures out of order.
5. The audience will re-order the pictures by moving one at a time.
6. Take a photo of each group when learners are in the correct order.

**Extension or Alternative:**

Get each group of learners to work on a different story, determining the plot points as a group before drawing the pictures.

## Play

**Objective:** Learners will be able to guide Byte through a physical grid to reach a gem using directional commands.

**Preparation:** Learners should work in groups of three. Use masking tape to create a four-by-four grid on the floor for each group.

### Directions:

1. Distribute the materials and split learners into groups of three.
2. Read through each role and assign each person in each group a role for the first game.
3. Get learners to play the game, starting with the designer role.
4. Play three times, rotating the role cards each time.

### Roles:

- Designer: Place the gem and the starting arrow on the grid.
- Programmer: With your peers' help, place the command cards on or next to the grid to direct Byte to the gem and collect it.
- Tester: Starting with Byte on the arrow, follow the command cards to move Byte around the grid. If you collect the gem, celebrate! If you don't, work as a team to debug, or fix, the code.

### Alternative:

If learners are working with you individually or learning at home, they can play this game on their own using the downloadable alternative Keynote activity.

### Facilitator materials:

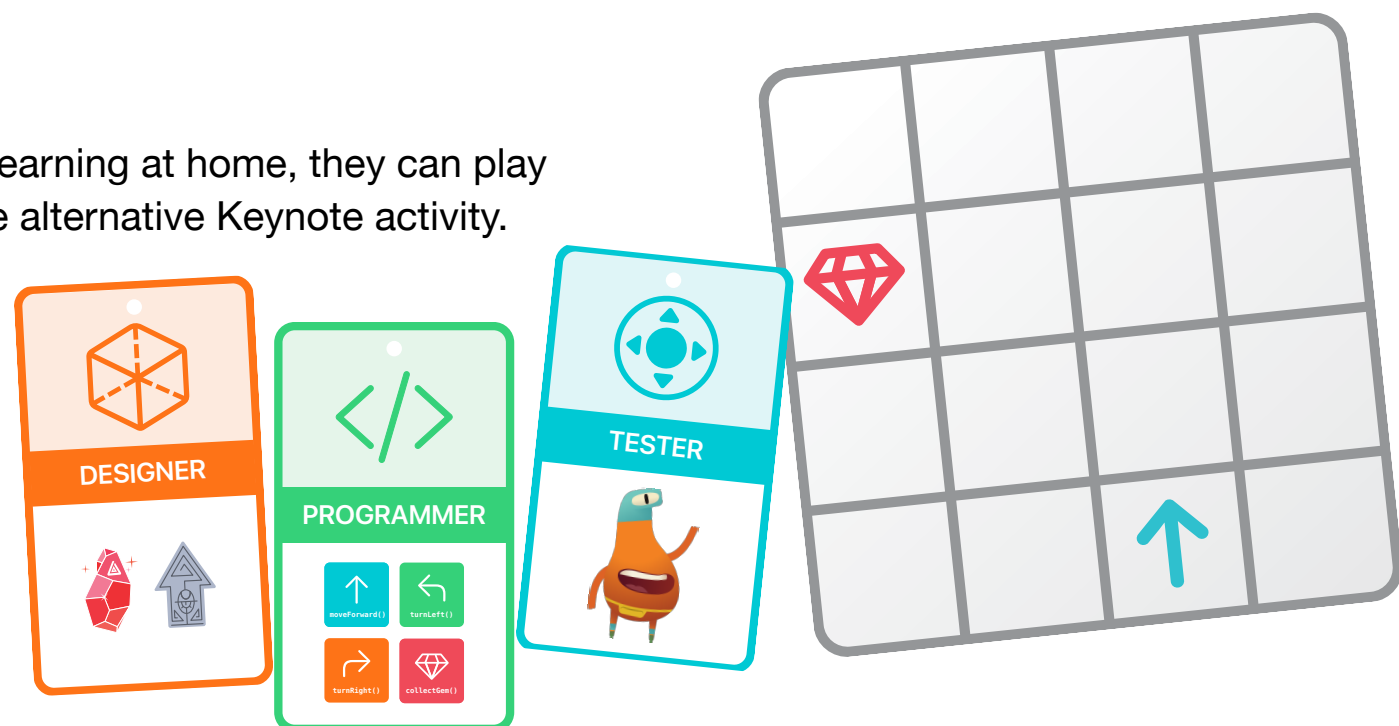
- Masking tape

### Learner materials:

- Role cards
- Command cards:  
`moveForward()`,  
`turnLeft()`, `turnRight()`  
and `collectGem()`
- Gem
- Byte
- Arrow

↓ [Download the materials](#)

↓ [Download the alternative activity](#)





## Explore

**Objective:** Explore the idea that coding can be creative.

**Discussion:**

- Ask learners if they've ever tried to learn a dance routine.
- Did the dance have an order of steps to follow?
- How did they know what to do next?
- Did the different dance moves have names?
- Have learners ever used the same moves at different times in a dance or in different dance routines?

**Key point:** Help learners make the connection that coding is creative and that – just like choreographing a dance – coders can make up new commands and then put them together in different and interesting ways.

## Discover

**Objective:** Create a short dance routine, along with cards to represent the dance moves. Each Dance Moves card is like a command in the Learn to Code playground.

**Learner materials:**

- iPad devices
- Keynote app
- Camera app
- Space to dance

**Directions:**

1. Ask pairs or small groups of learners to create a short dance routine.
2. After learners have established the routine, they'll create cards to represent the different dance moves. Learners should include a drawing and the name of the move on each card, getting as creative and silly as possible.
3. Each group should perform their dance – then you can have a dance party as a whole class!

**Alternative:**

Learners can use the downloadable Dance Moves cards below to create their dance or they can use the cards as examples when making their own cards.

**Extension:**

Learners can create a video of their dance to show to the group.



[Download the Dance Moves cards](#)



## Play

**Objective:** Play with the Preview in Blu's Adventure, including Astrodance.

### Directions:

1. Project the Blu's Adventure playground on a screen.
2. Introduction:
  - Read through the Preview page as a class, stopping for questions if needed.
  - Click or tap Run My Code when suggested. Try out Draw, Kaleido, Play, Hello and Goodbye as you read about each one.
  - Click or tap Clear to clear the universe.
3. Astrodance:
  - Click or tap the Astrodance button multiple times, and/or invite students to come up and tap the button.
4. Code:
  - Scroll down to the first line of code and replace the emoji in the string with anything you want, including words or letters.

```
let emoji = "??❤️?????????????"
```

- Change the number of dancers by typing in a new number.

```
let numberOfDancers = 500
```



**Blu's Adventure**

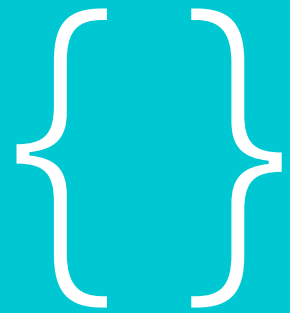
### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Blu's Adventure playground
- Projector or display

### Learner materials:

- iPad devices (optional)





# Functions



## Overview

### Lesson 1: Paper Gem

- Explore: Discussion about step-by-step instructions
- Discover: Paper Gem activity
- Play: Composing a New Behaviour and Creating a New Function

### Lesson 2: Songfest

- Explore: Discussion about how to name a function
- Discover: Songfest activity
- Play: Floor puzzle game

### Lesson 3: My Calming Function

- Explore: Discussion about solving problems in multiple ways
- Discover: My Calming Function activity
- Play: Collect, Toggle, Repeat

## Learners Will Be Able To:

- Deconstruct a large problem or task into smaller steps
- Create a series of steps to solve a problem or complete a task
- Name functions
- Test and debug code

## Vocabulary

- **Function:** A named set of commands that can be run whenever needed
- **Toggle:** To switch on or off

## Explore

**Objective:** Explore the idea of packaging a series of commands and giving it a name.

**Discussion:** Decide on a daily routine to focus on as a class. Get learners to identify the name of their daily routine and the steps it consists of.

**Example:** Bedtime routine

- Step 1: Brush teeth
- Step 2: Go to the toilet
- Step 3: Read
- Step 4: Say goodnight
- Step 5: Turn off the lights

**Key point:** Coming up with a set of instructions and giving it a name is the same concept as creating a function.

**Extension:** Ask learners if the instructions for any of their steps could be more specific. For example, what are the specific steps involving brushing your teeth?

## Discover

**Objective:** Learners will start by following instructions to create a paper gem, then they'll write or draw the instructions for making another shape of their choice.

**Learner materials:**

- Paper
- Scissors
- Pencils
- iPad devices (optional)

**Directions:**

Show learners how to make a paper gem:

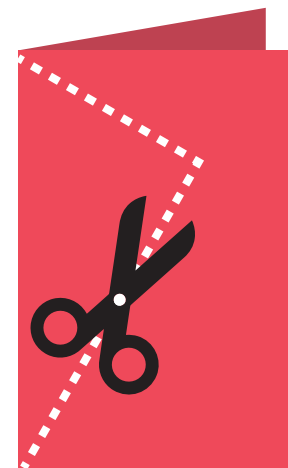
1. Fold a piece of paper in half.
2. Draw a line from the top corner of the folded side to 2.5cm to 5cm above the centre of the paper.
3. Draw another line from where the first line ends to the bottom corner of the folded side.
4. Cut along the lines you drew.
5. Remove the gem from the scrap paper and unfold it.

Ask learners to make their own shapes:

1. Split learners into small groups.
2. Get the groups to decide on a shape to make.
3. Allow time for learners to practise making the shape once or twice.
4. Get learners to write or draw the instructions for making the shape, then give their instructions a name, such as "Make a Circle" or "The Letter T".

**Alternative:**

Create a video showing how to make their shapes.



## Play

**Objective:** Working as a group, learners will be able to break down the steps needed to move Byte to the gem.

### Directions:

1. Project the Learn to Code 1 playground onto a screen. Navigate to the Functions chapter in Learn to Code 1.
2. Introduction:
  - Read through the pages as a class, stopping for questions as needed.
3. Composing a New Behaviour:
  - Review the commands `moveForward()`, `turnLeft()` and `collectGem()` – don't forget that you don't have a `turnRight()` command.
  - Ask learners to experiment with ways to direct Byte from the start arrow to the gem and collect it. They can record the commands on the worksheet or on a separate piece of paper.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Byte!
4. Creating a New Function:
  - Based on what they learnt in the last Playground page, Composing a New Behaviour, ask learners to come up with ideas to create `turnRight()` function.
  - Using their `turnRight()` function, get learners to experiment with ways to direct Byte from the start arrow to the closed switch and toggle it.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Byte – that was a hard puzzle to solve!



**Learn to Code 1**

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Learn to Code 1 playground
- Projector or display

### Learner materials:

- Composing a New Behaviour and Creating a New Function worksheets
- Pencils
- Extra paper (optional)



[Download the Learn to Code worksheets](#)



## Explore

**Objective:** Apply knowledge of commands and functions to songs by giving them descriptive names.

**Discussion:** Get learners to come up with a variety of songs and give each one a descriptive function name.

**Example:** For the song “Twinkle, Twinkle, Little Star”, the function call could be `singTwinkle()`, but `singSong1()` wouldn’t be a good name because the first song could change.

**Key point:** Naming functions with descriptive names is important because it makes code easier for you and others to understand.

## Discover

**Objective:** Learners will create a concert by calling different song commands in a concert function.

### Facilitator materials:

- iPad or Mac
- Projector or display
- Whiteboard
- Markers

### Directions:

1. Help learners to create function names for several songs – for example, `singHappyBirthday()`.
2. As a group, choose the order to sing the songs in.
3. Write a function definition for a concert and fill in the function with the song commands.

### Example:

```
func createConcert() {  
    singHappyBirthday()  
    singTwinkleTwinkle()  
    singMaryHadALittleLamb()  
}  
createConcert()
```

### Alternative:

Learners can sing in small groups, with each group coming up with their own list of songs, song function names and the order to sing the songs in. Each group can then perform their songs and create a video of their concert.

## Play

**Objective:** Learners will solve a simple equation, place a gem on the answer, then guide Byte through the grid using directional commands.

**Preparation:** Learners should work in groups of three. Use masking tape to create a four-by-four grid on the floor for each group. Place the starting arrow inside one square and place one number inside each remaining square.

### Directions:

1. Distribute the materials and split learners into groups of three.
2. Read through each role and assign each person in each group a role for the first game.
3. Get learners to play the game, starting with the designer role.
4. Play three times, rotating the role cards each time.

### Roles:

- Designer: Roll two dice. With the help of your peers, add the two numbers together and place the gem on a grid square that matches the total.
- Programmer: With your peers' help, place the command cards on or next to the grid to direct Byte to the gem and collect it.
- Tester: Starting with Byte on the arrow, follow the command cards to move Byte around the grid. If you collect the gem, celebrate! If you don't, work as a team to fix the code.

### Alternative:

If learners are working with you individually or learning at home, they can play this game on their own using the downloadable alternative Keynote activity.

### Facilitator materials:

- Masking tape
- One set of printed numbers for each grid

### Learner materials:

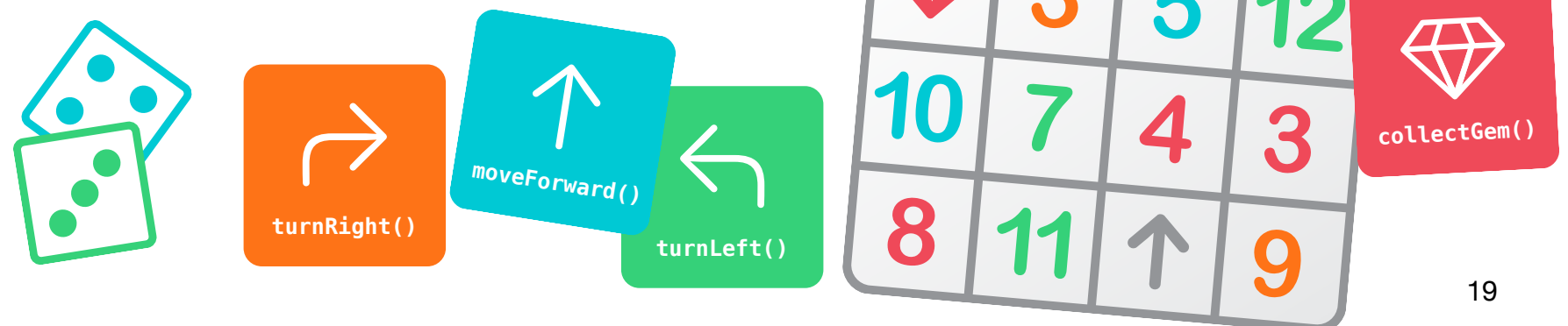
- Role cards
- Command cards: `moveForward()`, `turnLeft()`, `turnRight()` and `collectGem()`
- Gem
- Byte
- Arrow
- Two dice



[Download the materials](#)



[Download the alternative activity](#)

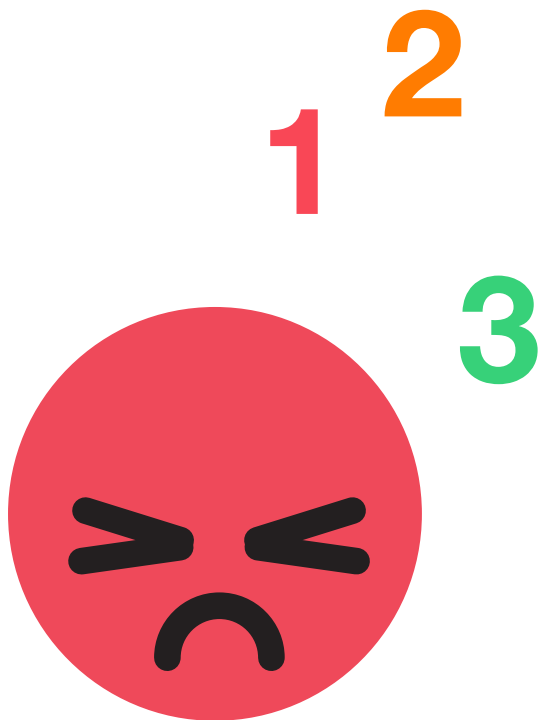


## Explore

**Objective:** Learners will understand that there's usually more than one way to solve a problem.

**Discussion:** Ask learners to think about a problem they've had, then get them to share the ways they solved it. Ask the group if anyone would solve that problem in a different way. Explore several different problems and solutions.

**Key point:** Help learners make the connection to code and understand that there's usually more than one way to solve a programming problem.



## Discover

**Objective:** Learners will write a function for their calming technique and give it a name.

### Learner materials:

- My Calming Function worksheet
- Pencils
- Colouring pens or pencils

### Directions:

Tip: It's best that learners work on this activity individually if possible.

1. Ask learners to brainstorm ways they calm themselves down – either at home or at school – when they're upset. Ask them to break down their calming techniques into steps.
2. Distribute the My Calming Function worksheet and ask learners to draw the steps of their calming technique.
3. Ask learners to give their calming technique a name. They can use camel case – for example, `countToTen()` – or just use a short sentence, such as “Count to ten”.

### Extensions:

Unplugged: Get learners to act out their calming technique in small groups or in front of the class.

With iPad: Learners can create a video of their calming technique to share with the class.



[Download the My Calming Function worksheet](#)



## Play

**Objective:** Learners will be able to write a function composed of several different types of command, then use that function to complete a puzzle.

### Directions:

1. Project the Collect, Toggle, Repeat page in the Learn to Code 1 playground onto a screen, pointing out the empty function that learners will help to complete.
2. Collect, Toggle, Repeat:
  - Review the commands `moveForward()`, `turnLeft()`, `turnRight()`, `collectGem()` and `toggleSwitch()`.
  - Get learners to try to identify the parts of the puzzle that repeat, then use their ideas to complete the function in the app and give it a name.
  - Get learners to invent a symbol for the function and to record the symbol and function name in the commands key on the worksheet.
  - With the additional command, learners can experiment with ways to direct Byte to collect all of the gems and toggle all of the switches. They can record the commands on the worksheet or on a separate piece of paper.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different solutions.
  - Celebrate as a class – that was a hard puzzle to solve!



**Learn to Code 1**

### Facilitator materials:

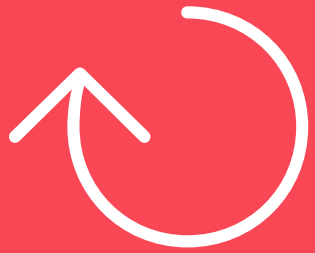
- iPad or Mac
- Swift Playgrounds app
- Learn to Code 1 playground
- Projector or display

### Learner materials:

- Collect, Toggle, Repeat worksheet
- Pencils
- Extra paper (optional)

 [Download the Learn to Code worksheet](#)





# Loops



## Overview

### Lesson 1: Repeating Petals

- Explore: Discussion relating repeating steps in code to real life
- Discover: Repeating Petals activity
- Play: Using Loops and Looping All the Sides

### Lesson 2: Obstacle Course

- Explore: Discussion about stopping points in a loop
- Discover: Obstacle Course activity
- Play: Floor puzzle game

### Lesson 3: Drumming Patterns

- Explore: Discussion about loops in music
- Discover: Drumming Patterns activity
- Play: To the Edge and Back and Dance Loops

## Learners Will Be Able To:

- Identify a loop in code
- Deconstruct a large problem or task into smaller steps
- Create a sequence of commands and repeat that sequence using a loop
- Test and debug instructions and code

## Vocabulary

- **Loop:** A block of code that repeats a certain number of times

## Explore

**Objective:** Connect the idea of loops to real life.

**Discussion:** Explore examples of when learners may repeat a task or step in real life.

**Examples:**

- Walking
- Cycling
- Sewing, knitting or crocheting

**Key point:** Loops repeat a command or a set of commands as many times as you specify.



## Discover

**Objective:** Learners will start to explore the concept of loops by making a unique flower.

**Learner materials:**

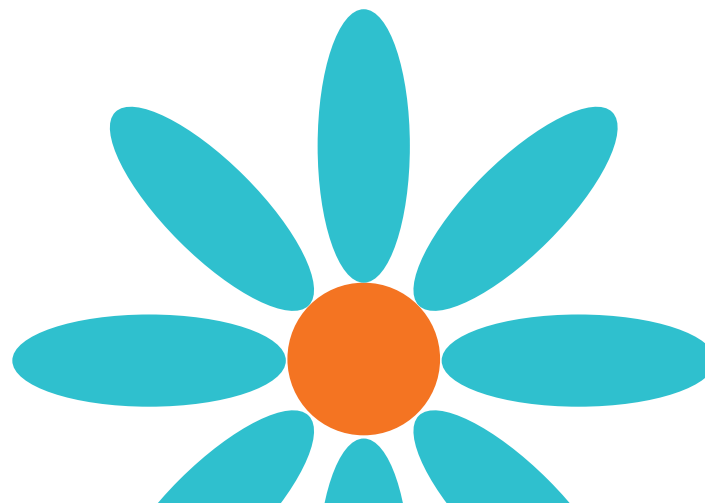
- Repeating Petals worksheet
- Coloured paper
- Pencils
- Scissors
- Glue sticks
- Dice

**Directions:**

1. Learners should draw a single petal – about the length of the palm of their hand – on a piece of coloured paper and cut it out. This will be their petal template for their flower.
2. Each learner will then roll two dice, add the numbers that appear on them together and fill in the missing number in the loop on their Repeating Petals worksheet. This is the number of petals their flower will have.
3. Using their petal template, learners can trace their petal on coloured paper and cut out the correct number of petals for their flower.
4. Using the Repeating Petals worksheet, learners can assemble their flower and glue the parts in place.



[Download the Repeating Petals worksheet](#)



## Play

**Objective:** Learners will be able to write code inside a loop to collect all of the gems.

### Directions:

1. Project the For Loops chapter introduction page in the Learn to Code 1 playground onto a screen.
2. Introduction:
  - Read through the pages as a class, stopping for questions as needed.
3. Using Loops:
  - Show learners how portals work and review the commands `moveForward()`, `turnLeft()`, `turnRight()` and `collectGem()`.
  - Get learners to experiment with ways to direct Byte from the start arrow to the gems to collect them, noticing which commands are repeated. They can record the commands on the worksheet or on a separate piece of paper.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to direct Byte to collect the first gem and walk to the portal.
  - Ask learners how many gems there are. Add that number to the loop. Click or tap Run My Code.
  - Try several different solutions.
  - Celebrate with Byte!
4. Looping All the Sides:
  - Get learners to experiment with ways to collect all of the gems, noticing which commands are repeated.
  - To add a `for` loop, either use the code suggestions at the bottom of the editor or tap `+` at the top of the screen.
  - Gather ideas from the class and write the code in Swift Playgrounds to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Byte!



**Learn to Code 1**

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Learn to Code 1 playground
- Projector or display

### Learner materials:

- Using Loops and Looping
- All the Sides worksheets
- Pencils
- Extra paper (optional)



[Download the Learn to Code worksheets](#)



## Explore

**Objective:** Explore why loops always need a specific end point.

**Discussion:** Ask learners to imagine a Ferris wheel or another fairground ride they're familiar with. What would happen if the operator didn't press the button to stop the ride after five rotations? Ask learners to come up with other examples of what would happen if a loop isn't stopped.

**Key point:** Help learners to understand that if they don't put a stop on a loop, it will repeat infinitely.

## Discover

**Objective:** Learners will discover how loops work by looping through an obstacle course that they design.

### Materials:

- Space to do physical activity
- Obstacle course props
- Dice

### Directions:

1. Create a short obstacle course – either in your classroom or outside.
2. Roll a dice and get learners to repeat the course as many times as the number displayed on the dice.

### Alternative:

Learners come up with a series of moves – for example, touch your toes, jump and kick out one leg. Roll a dice and get learners to repeat the series of moves as many times as the number displayed on the dice.



## Play

**Objective:** Learners will be able to create a puzzle that has a repeating pattern, then solve the puzzle as a group.

**Preparation:** Learners should work in groups of three. Use masking tape to create a four-by-four grid on the floor for each group.

### Directions:

1. Distribute the materials and split learners into groups of three.
2. Read through each role and assign each person in each group a role for the first game.
3. Get learners to play the game, starting with the designer role.
4. Play three times, rotating the role cards each time.

### Roles:

- Designer: With the help of your peers, place three gems in a repeating pattern on the grid. Place the starting arrow on the grid.
- Programmer: With the help of your peers, place the command cards on or next to the grid to direct Byte to the gems and collect them. Use the Loop cards to tell the tester how many times to loop through the commands.
- Tester: Starting with Byte on the arrow, follow the command cards to move Byte around the grid. If you collect all of the gems, celebrate! If you don't, work as a team to fix the code.

### Alternative:

If learners are working with you individually or learning at home, they can play this game on their own using the downloadable alternative Keynote activity.

### Facilitator materials:

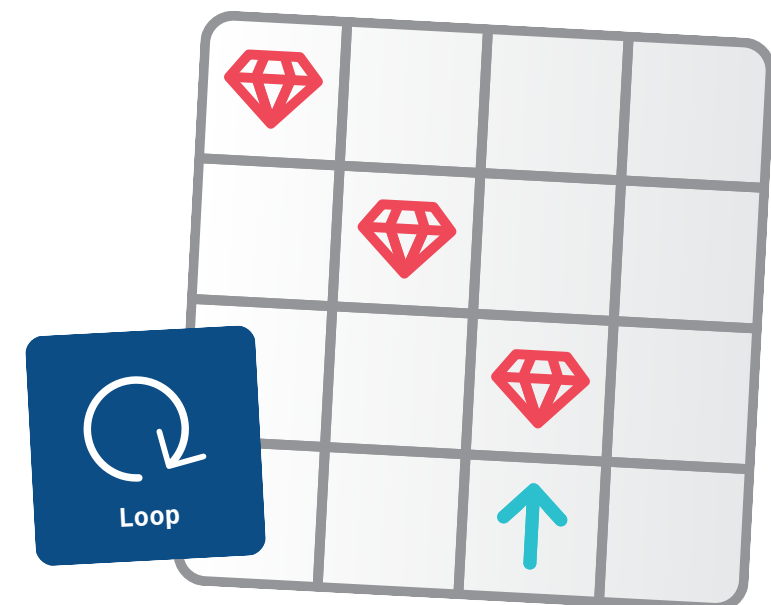
- Masking tape

### Learner materials:

- Role cards
- Command cards:  
moveForward(),  
turnLeft(), turnRight(),  
collectGem() and Loop
- Gems
- Byte
- Arrow

↓ [Download the materials](#)

↓ [Download the alternative activity](#)



## Explore

**Objective:** Explore repeating patterns in music.

**Discussion:** Ask learners to think about the instruments they play or songs they've sung. Ask them if they ever repeat a beat or chorus when playing or singing a song. Can they think of other parts of a song or piece of music that are repeated?

**Key point:** Reinforce the idea that loops consist of two parts:

- The commands
- The number of times to repeat



## Discover

**Objective:** Learners will be able to repeat a drum pattern, making a connection between looping code and a real-life, physical example.

### Materials:

- Something to drum on, such as the floor, their legs or books
- Space to sit in a circle

### Directions:

1. Ask learners to sit in a circle.
2. Instruct learners to repeat the drumbeat that you create as many times as the number of fingers you hold up. For example, if you hold up four fingers, learners should repeat the drumbeat four times and then stop.
3. Go around the circle or split into small groups so that each learner gets a chance to be the lead drummer.

### Extension:

Get learners to make drums.

## Play

**Objective:** Learners will call several different commands inside a loop and determine how many times the loop should be called.

### Directions:

1. Project the Learn to Code 1 playground onto a screen. Navigate to the third page, To the Edge and Back, of the Loops chapter.
2. To the Edge and Back:
  - Review the commands `moveForward()`, `turnLeft()`, `turnRight()`, `collectGem()` and `toggleSwitch()`.
  - Ask learners to experiment with ways to direct Byte from the start arrow to each closed switch and toggle it.
  - To add a for loop, either use the code suggestions at the bottom of the editor or tap + at the top of the screen.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Hopper!



**Learn to Code 1**

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Learn to Code 1 playground
- Projector or display

### Learner materials:

- To the Edge and Back worksheet
- Pencils
- iPad devices (optional)
- Extra paper (optional)



[Download the Learn to Code worksheet](#)





# Variables



## Overview

### Lesson 1: Sink or Float

- Explore: Discussion about updating a variable
- Discover: Sink or Float activity
- Play: Keeping Track and Sample Game

### Lesson 2: Word Game

- Explore: Discussion about the types of answers that can be given to questions
- Discover: Word Game activity
- Play: Floor puzzle game

### Lesson 3: All About Me

- Explore: Discussion about answering questions with lists
- Discover: All About Me activity
- Play: Using a Loop

## Learners Will Be Able To:

- Associate a variable name with a given value
- Change the value assigned to a variable
- Understand the different Swift types you can assign to a variable, including true/false (Booleans), numbers (Ints), words (Strings), colours (colour literals) and images (image literals)
- Test and debug instructions and code

## Vocabulary

- **Variable:** A named container that stores a value and can be changed
- **Data:** Information
- **Boolean:** A type that has a value of either true or false

## Explore

**Objective:** Explore the concept of variables by counting objects and updating the variable number.

**Facilitator materials:**

- Whiteboard
- Marker
- Eraser
- Container
- Five pencils (or five of any of the same object)

**Directions:**

1. Start by writing a variable statement on the whiteboard to keep track of your objects.
  - Example: `var numberOfPencils = 0`
2. Hold up an empty container and tell learners that the container represents your variable, `numberOfPencils`.
3. Add one pencil to the container and ask learners what the variable count is now. When they answer correctly, erase the *0* and write *1*.
4. Continue until you've added all of the pencils and your code reads: `var numberOfPencils = 5`.
5. Then start taking pencils out of the container, updating the variable as you remove them.

**Key point:** Help learners to understand that variables store a bit of information. In this case, the information is a number and the number tells you how many pencils are in the container.

## Discover

**Objective:** Using found objects, learners will conduct experiments to determine if items sink or float, then they'll record the data using images (image literals) and true/false values (Booleans).

**Learner materials:**

- iPad devices
- Keynote app
- Sink or Float worksheet
- Bucket of water
- Several objects to test

**Directions:**

1. Split learners into small groups.
2. Ask them to collect various items to test.
3. For each item, ask learners to:
  - Take a picture of the item and add it to the worksheet.
  - Test the item in the water.
  - Record results on the worksheet by circling either `true` or `false`.



[Download the Sink or Float worksheet](#)

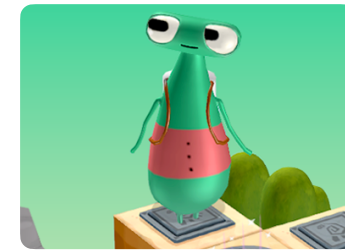
## Play

**Objective:** Learners will be able to create and update variables in two different coding contexts.

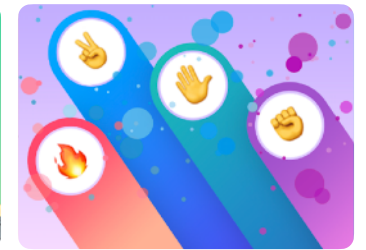
### Directions:

1. Project the Learn to Code 2 playground onto a screen. Navigate to the Variables chapter.
2. Introduction:
  - Read through the pages as a class, stopping for questions as needed.
3. Keeping Track:
  - Get learners to experiment with ways to direct Hopper from the start arrow to the gem and collect it. They can record the commands on the worksheet or on a separate piece of paper.
  - Gather ideas from the class and write the code in the Swift Playgrounds app to complete the puzzle. Click or tap Run My Code.
  - Try several different ideas.
  - Celebrate with Hopper!
4. Leave Learn to Code 2 and move on to the last page of the Rock, Paper, Scissors playground, called Sample Game. (There's no learner worksheet for this playground page.)
5. Sample Game:
  - Click or tap Run My Code to play the game before changing anything.
  - Decide as a group which parts of the game you want to customise. Some fun things you can change include `game.roundsToWin`, `game.challenger.emoji`, `game.addOpponent` and `game.roundPrize`.
  - Play the game several times, changing something different each time.

**Extension:** Many variables are established in the Game.swift file. If learners are curious why some variables don't have `var` in front of them, open the Game.swift file to show them where the game properties were created.



Learn to Code 2



Rock, Paper,  
Scissors

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Learn to Code 2 playground
- Rock, Paper, Scissors playground
- Projector or display

### Learner materials:

- Keeping Track worksheet
- Pencils
- Extra paper (optional)



[Download the Learn to Code worksheet](#)

## Explore

**Objective:** Explore various answer types in the real world and relate them to various Swift types, including yes/no or true/false (Booleans), numbers (Ints), words (Strings), colours (colour literals) and images (image literals).

**Facilitator materials:**

- Whiteboard
- Markers

**Discussion:** Come up with some questions as a class that require different answer types and write them on the board.

**Examples:**

- What colour are your eyes? —> colour
- Do you have a pet? —> yes/no
- Do you have any siblings? —> yes/no
- How old are you? —> number
- What's your name? —> word

**Key point:** Explain that variables also have different types, including numbers, words, colours, pictures and yes/no answers. Depending on how you create a variable, you'll have to maintain the same type, even if you update the variable to something new. For example, `var myAge = 8` can be changed to 9, but it can't be changed to "nine".

## Discover

**Objective:** Learners will be able to complete a word game by filling in the correct answer type.

**Learner materials:**

- Word Game worksheets
- Pencils
- Colouring pencils

**Directions:**

Get learners to work through one or more word games in small groups. Ideally each group should have at least one person able to read or someone to assist with the reading. If all learners are non-readers, do a few games together as a group.

**Extension:** If learners are able to, get them to create a word game for a partner to fill in. Encourage them to use numbers, words, colours, images and yes/no answers for the blanks.



[Download the Word Game worksheets](#)



## Play

**Objective:** Learners will be able to guide Byte to collect several gems, add each gem to a container and update a variable.

**Preparation:** Learners should work in groups of three. Use masking tape to create a four-by-four grid on the floor for each group.

### Directions:

1. Distribute the materials and split learners into groups of three.
2. Read through each role and assign each person in each group a role for the first game.
3. Get learners to play the game, starting with the designer role.
4. Play three times, rotating the role cards each time.

### Roles:

- Designer: Place multiple gems and the starting arrow on the grid.
- Programmer: With the help of your peers, place the command cards on or next to the grid to direct Byte to the gems and collect them.
- Tester: Starting with Byte on the arrow, follow the commands to move Byte around the grid, adding the gems to the container as you collect them. If you collect all of the gems, update the variable `numberOfGems` on the container and celebrate! If you don't collect them all, work as a team to fix the code.

### Alternative:

If learners are working with you individually or learning at home, they can play this game on their own using the downloadable alternative Keynote activity.

### Facilitator materials:

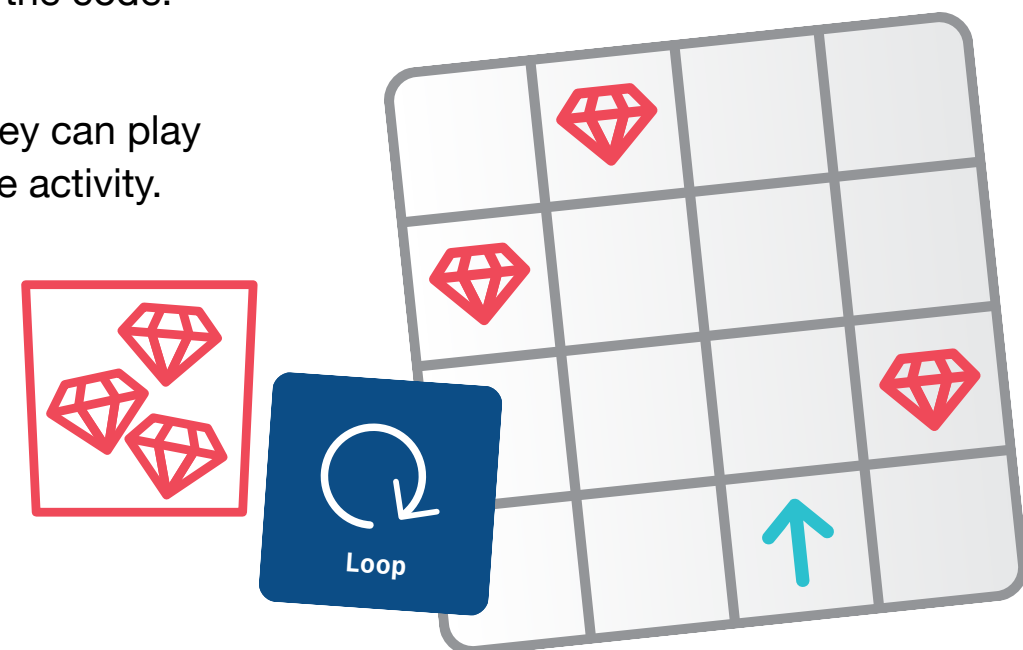
- Masking tape

### Learner materials:

- Role cards
- Command cards:  
`moveForward()`, `turnLeft()`,  
`turnRight()`, `collectGem()`  
and `Loop`
- Gems
- Byte
- Arrow
- Container labelled:  
`var numberOfGems = _____`
- Pen

↓ [Download the materials](#)

↓ [Download the alternative activity](#)



## Explore

**Objective:** Explore how to use lists – or *arrays* – when creating variables.

**Discussion:** What would happen if a worksheet asked learners for their sibling's name and they have more than one sibling? Gather ideas from the class. If they suggest making a list, tell them that's exactly what coders do. When a variable has more than one answer, learners should create a list.

Ask learners to come up with questions that could have multiple answers.

### Examples:

- Friends' names —> Rose, Sam, Joy
- Learners' ages —> 7, 8, 7, 8, 7, 8, 9, 7, 8, 9, 8
- Favourite colours —>  ,  ,  ,  , 
- Favourite animals —>  ,  ,  , 

**Key point:** Lists that learners create in code are just like lists in a sentence.

## Discover

**Objective:** Learners will be able to fill in variables to describe things about themselves and a partner. Learners may have the opportunity to use an array as a variable type.

### Learner materials:

- All About Me and All About You worksheets
- Pencils
- Colouring pencils

### Directions:

1. Ask learners to complete the All About Me worksheet.
  - If learners have more than one sibling or pet, get them to make a list of items separated by commas.
2. Put learners in pairs to complete the All About You worksheet.

**Alternative:** Learners can use their iPad and Keynote to complete the worksheet, taking photos for the picture answers and colouring the colour literals using the formatting options.



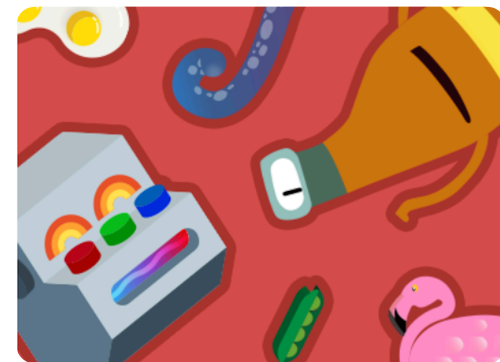
[Download the All About worksheets](#)

## Play

**Objective:** Learners will be able to identify a variable in code and explore ways they can use arrays with loops.

### Directions:

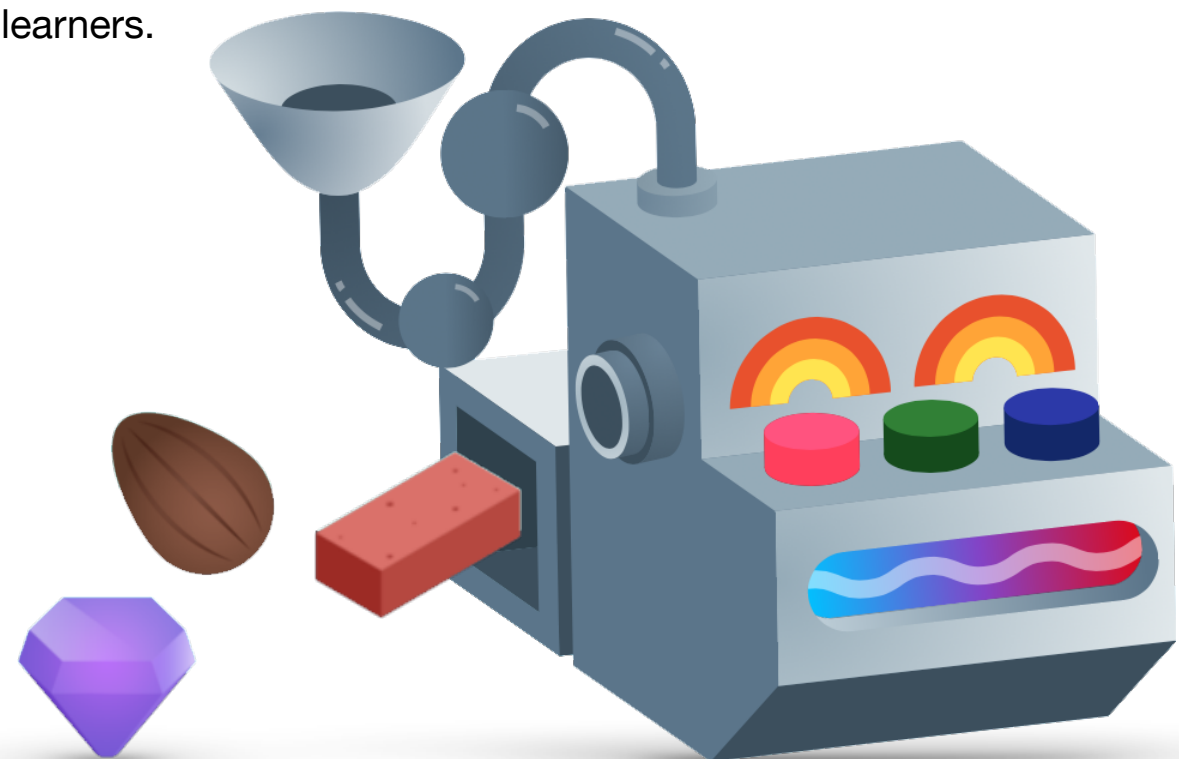
1. Project the Code Machine playground onto a screen.
2. Introduction:
  - Read through the pages as a class, stopping for questions as needed.
  - Optional: Play through the first two pages, Exploring the Machine and Combining with Colours.
3. Using a Loop:
  - On this page, learners will combine their knowledge of loops with variables.
  - See if learners can identify the variable in the code that uses an array.
  - Click or tap Run My Code to see what the machine creates.
  - Move on to the second step in the instructions and update the code to include a second variable, items and a nested loop. Click or tap Run My Code again to see what the machine creates.
  - Note: Try this page yourself before doing the activity with learners.



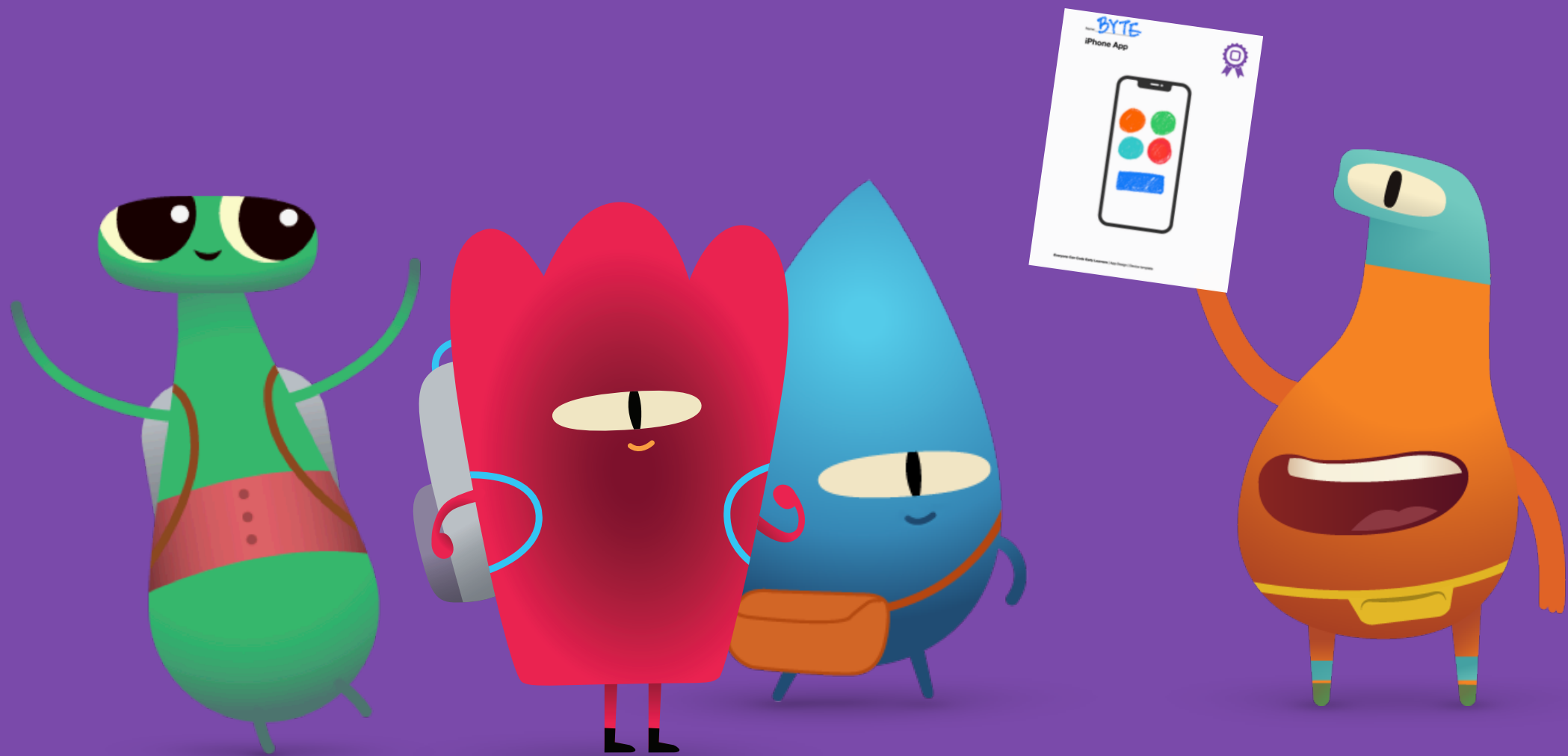
**Code Machine**

### Facilitator materials:

- iPad or Mac
- Swift Playgrounds app
- Code Machine playground
- Projector or display



# App Design





## Explore

**Objective:** Explore familiar apps on various devices.

**Directions:** Start a discussion about the apps that learners use on iPad at home or at school. Then talk about the apps that they – or their parents or guardians – use on devices at home.

**Key point:** Reinforce the idea that apps aren't just on phones but also on watches, tablets, computers and even on TVs.

**Extension:** Go deeper into a few examples of apps, asking learners who the app is designed for, what it does and why they think it was made.

**Example:**

- App: Swift Playgrounds
- Who it's for: People who want to learn about Swift
- What it does: Helps people learn how to code through puzzles and lessons
- Why it was made: To teach people with little or no programming knowledge how to code

## Discover

**Objective:** Prepare learners to design their own apps by analysing a familiar app.

**Learner materials:**

- iPad devices
- What's an App? worksheet
- Pencils
- Colouring pens or pencils

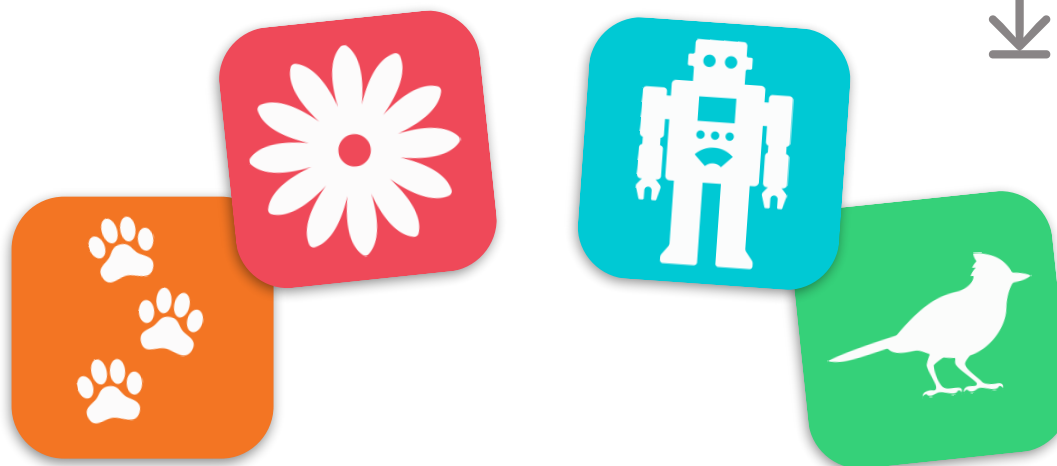
**Directions:**

1. Split learners into small groups or get them to work individually.
2. Ask learners to choose an app that's available on iPad.
3. Instruct them to use the What's an App? worksheet to help with their app exploration.
4. Invite learners to share their findings about the app – either with the whole group or with a partner.

**Facilitator tip:** The younger your learners are, the more help they'll need to complete this worksheet. For age 5 or 6, consider doing two or three apps as a class.



[Download the What's an App? worksheet](#)



## Play

**Objective:** Learners design their own apps.

**Learner materials:**

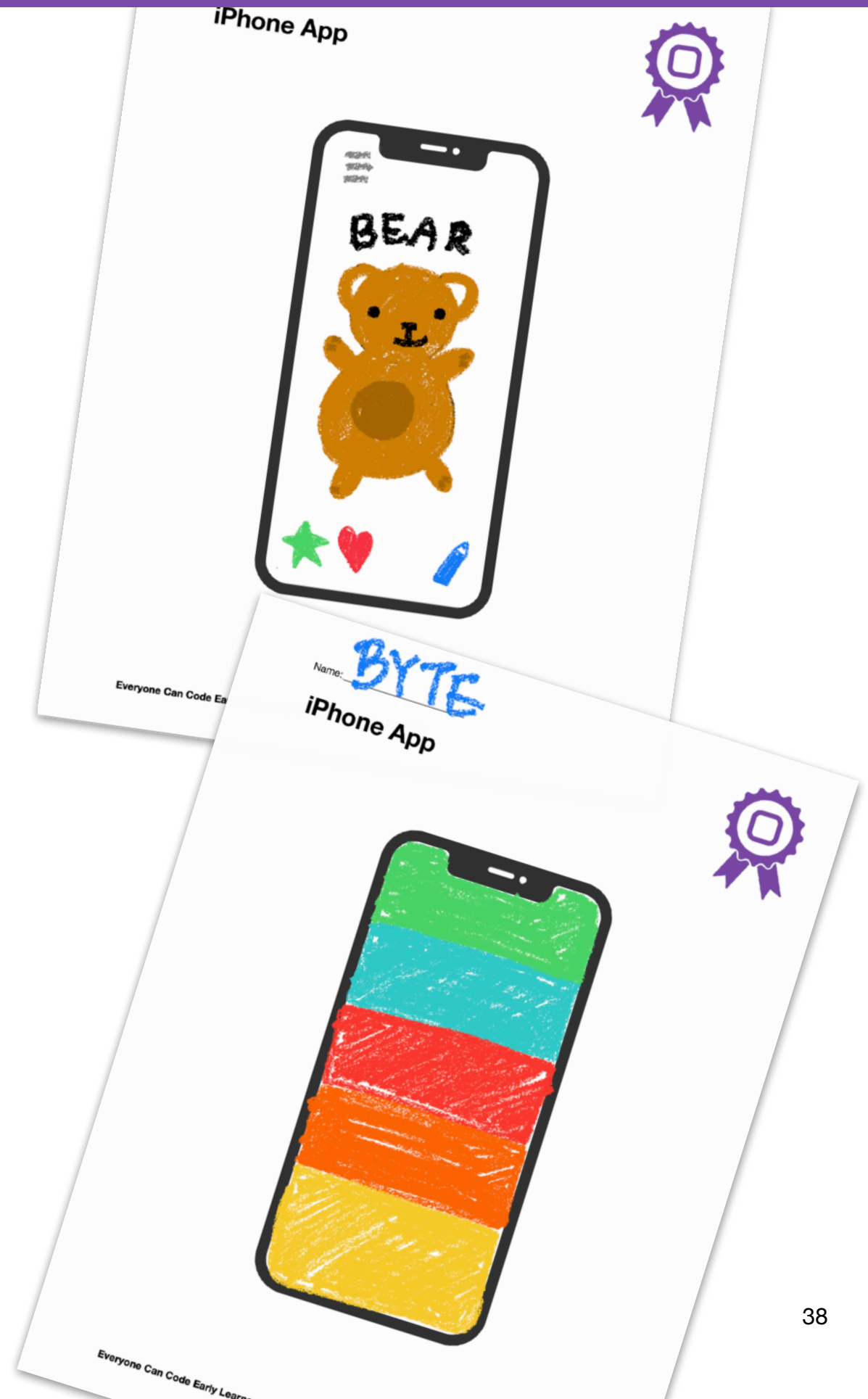
- My App Design worksheet
- Device templates
- Extra paper
- Pencils
- Colouring pens or pencils

**Directions:**

1. Split learners into small groups or get them to work individually.
2. Walk learners through the My App Design worksheet to help them with the initial process of designing an app.
3. Get learners to prototype the pages of their apps using extra paper or the device templates.
4. Instruct learners to create a final version of their app prototypes using the device templates.
5. Invite each learner or group of learners to present their ideas to the whole group.

↓ [Download the My App Design worksheet](#)

↓ [Download the device templates](#)



# Facilitator Resources



## Glossary

- **Boolean:** A type that has a value of either `true` or `false`
- **Bug:** An error in code
- **Command:** Code that tells an application to perform a specific action
- **Data:** Information
- **Debug:** To find and fix errors in code
- **Function:** A named set of commands that can be run whenever needed
- **Loop:** A block of code that repeats a certain number of times
- **Modify:** To change
- **Sequence:** The order in which things happen
- **Step:** One action in a larger process
- **Toggle:** To switch on or off
- **Variable:** A named container that stores a value and can be changed

## CSTA Standards

### 1A-AP

- 1A-AP-08: Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks.
- 1A-AP-09: Model the way programs store and manipulate data by using numbers or other symbols to represent information.
- 1A-AP-10: Develop programs with sequences and simple loops to express ideas or address a problem.
- 1A-AP-11: Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.
- 1A-AP-12: Develop plans that describe a program's sequence of events, goals and expected outcomes.
- 1A-AP-14: Debug (identify and fix) errors in an algorithm or a program that includes sequences and simple loops.

### 1A-CS

- 1A-CS-01: Select and operate appropriate software to perform a variety of tasks, and recognise that users have different needs and preferences for the technology they use.

### 1B-AP

- 1B-AP-09: Create programs that use variables to store and modify data.
- 1B-AP-10: Create programs that include sequences, events, loops and conditionals.
- 1B-AP-16: Take on varying roles, with facilitator guidance, when collaborating with peers during the design, implementation and review stages of program development.

Example Answers

The next three pages provide one possible solution for each Swift Playgrounds puzzle – but the puzzles can be solved in more than one way. Encourage learners to try different ways they can use to direct Byte or other characters.

Celebrate all types of coding and any goals that learners may have. Some learners may want to explore all of the puzzle space in addition to collecting the gems, while others may want to spin as many times as possible on the way to collecting gems. Don't forget – coding should be fun!



Learn To Code 1

Commands  
chapter  
Issuing Commands

```
moveForward()  
moveForward()  
moveForward()  
collectGem()
```

Commands  
chapter  
Adding a New  
Command

```
moveForward()  
moveForward()  
turnLeft()  
moveForward()  
moveForward()  
collectGem()
```

Functions chapter  
Composing a New  
Behaviour

```
moveForward()  
moveForward()  
moveForward()  
turnLeft()  
turnLeft()  
turnLeft()  
moveForward()  
moveForward()  
moveForward()  
collectGem()
```

Functions chapter  
Creating a New  
Function

```
func turnRight() {  
    turnLeft()  
    turnLeft()  
    turnLeft()  
}  
  
moveForward()  
turnLeft()  
moveForward()  
turnRight()  
moveForward()  
turnRight()  
moveForward()  
turnRight()  
moveForward()  
turnLeft()  
moveForward()  
toggleSwitch()
```





## Learn To Code 1

### Functions chapter

Collect, Toggle, Repeat

```
func collectToggle() {
  moveForward()
  collectGem()
  moveForward()
  toggleSwitch()
  moveForward()
}
```

```
collectToggle()
turnLeft()
collectToggle()
moveForward()
turnLeft()
collectToggle()
turnLeft()
collectToggle()
```

### Loops chapter

Using Loops

```
for i in 1 ... 5 {
  moveForward()
  moveForward()
  collectGem()
  moveForward()
}
```

### Loops chapter

Looping All the Sides

```
for i in 1 ... 4 {
  moveForward()
  collectGem()
  moveForward()
  moveForward()
  moveForward()
  turnRight()
}
```

### Loops chapter

To the Edge and Back

```
for i in 1 ... 4 {
  moveForward()
  moveForward()
  toggleSwitch()
  turnLeft()
  turnLeft()
  moveForward()
  moveForward()
  turnLeft()
}
```

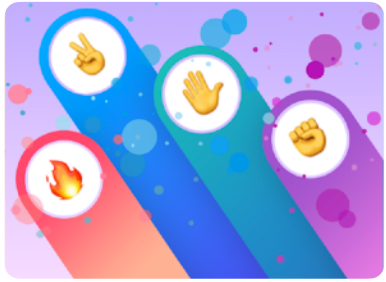


## Learn To Code 2

### Variables chapter

Keeping Track

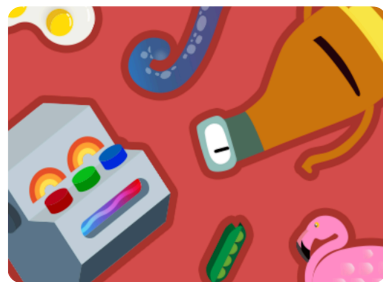
```
var gemCounter = 0
moveForward()
moveForward()
collectGem()
gemCounter += 1
```



## Rock, Paper, Scissors

### Sample Game

There's no example solution for this page because the game is entirely customisable – you can play it any way you want!



## Code Machine

### Using a Loop

```
var colors = [Light.red, Light.green, Light.blue]

var items = [Item.metal, Item.stone,
Item.cloth, Item.dirt, Item.DNA, Item.spring,
Item.wire, Item.egg, Item.tree, Item.gear,
Item.seed, Item.crystal, Item.mushroom,
Item.unidentifiedLifeForm]

for item in items {
  setItemA(item)
  setItemB(.dirt)
  switchLightOn(.green)
  forgeItems()
}
```

