Portfields Primary School Medium Term Plan

Year Group – **5** Subject - **Computing** Strand – **Computer Science** Topic - **Selection in Physical Computing** Term - **Spring 1**

National Curriculum

- Design, write, and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts.
- Use sequence, selection, and repetition in programs; work with variables and various forms of input and output
- Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs.
- Select, use, and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems, and content that accomplish given goals, including collecting, analysing, evaluating, and presenting data and information.

Key Questions

Where have you seen computing parts like these before?
What features can you see on a sparkle?
How can we debug this program?
How are motors used in real-life situations?
What are examples of non-computing-based algorithms?
What do you predict this program will do?
How could selection be used in an automated house?
How can you design a model that uses selection for two output devices?

Technical Questions

What is a microcontroller?
A small device that can be programmed to control components that are connected to it.

What is an LED?
LED stands for light-emitting diode. When connected to a circuit, it emits a coloured glow.

How do the positive and negative parts of the sparkle connect?
The positive pad on the sparkle connects to the positive pad on the crumble controller. The negative pad on the sparkle connects to the negative pad on the crumble controller.

Why are the wire casings different colours?
Different coloured wires are used to connect different parts of the circuit e.g. positive, negative. The wires are all identical internally so the circuit will still work if different coloured wires are used.

How will the output change if we alter the motor %?
Lowering the % will lower the speed the motor rotates.

When are count-controlled loops used?
When you know how many times you want commands repeated.

What is an algorithm?
A precise set of ordered steps that can be followed by a human and implemented on a computer to achieve a task.

When do programmers use conditions?
To trigger actions. They must be able to be answered with a yes or a no.

What is the difference between a 'count-controlled loop' and a 'do…until loop'?
A count-controlled loop uses a number as a condition. In a do…until loop, you can set your own condition.

When is 'if…then…' selection used?
When a programmer wants a set of actions to be carried out if a condition is met.

When using selection, how do you instruct the device to check if the condition has been met?
Use repetition in the form of an infinite loop, otherwise the device will only check once.

Substantive Knowledge

Understand how to control a simple circuit connected to a computer.
Understand how to write a program that includes count-controlled loops.
Understand that a loop can stop when a condition is met and can be used to check whether a condition has been met.
Understand how to use selection coding to produce an intended outcome.

Disciplinary Knowledge

Will be able to connect a Sparkle to a Crumble and then program the Crumble to make the Sparkle flash different colour patterns using infinite loops.
Will be able to apply their understanding of repetition by using count-controlled loops.
Can identify conditions in statements, stating if they are true or false and explain how programs can use an input as a condition.
Will be able to create algorithms that include selection to guide their program writing by using infinite repetition.
Can identify how to use selection before writing an algorithm to meet the requirements of the given task and implement their algorithms as code.
Can identify any bugs, and then return to the code or algorithm to debug it where necessary.

Key Vocabulary

Command
Condition
Device
Direction
Forward
Modify
Negative
Positive
Repetition
Respond
Reverse
Selection

Technical Vocabulary

Coding
Count-controlled loop
Crocodile clip
Crumble controller
Debug
Do…until loop
Input
LED
Microcontroller
Output
Programmed
Sparkle

Real-Life Links

Using computers/laptops

Devices used

Laptops
Crumble kits
Geared motors and wheels

Lesson Breakdown

Lesson 1

Flashback Four		**Learning Objectives**	**Star Knowledge**
Last Lesson N/A	Last Topic What is a system? *A system is a group of items, people, or processes working together toward a goal/purpose.*	Learning Objective LO to control a simple circuit connected to a computer. Success Criteria I can create a simple circuit and connect it to a microcontroller. I can program a microcontroller to make an LED switch on. I can explain what an infinite loop does. Task 1: Tell learners that they will connect a Sparkle to their Crumble and then program it to light up in different colours. A Sparkle is a multi-colour LED (light-emitting diode). Explain how to connect the Sparkle to the Crumble controller: • The positive and negative power pads on the Sparkle need to be connected with the positive and negative power pads on the Crumble controller. These are the + and – pads with the word 'power' written next to them (on one side of the Crumble controller), adjacent to the USB port. • The Sparkle's D pad needs to be connected to the D pad on the Crumble controller. Ensure that learners understand that they need to use the pads on the left-hand side to connect to the Crumble and that the D should be on the bottom of the Sparkle. Give each group a Sparkle, five crocodile leads, and a battery box. Explain to learners that they will connect the Crumble controller to a battery box and a Sparkle using the crocodile clips. Tell them that they will know when they have connected it correctly because the LED will flash white six times. This is because a program has already been downloaded to the Crumble (see the 'Prerequisites' section above). Draw learners' attention to the switch on the battery box, and ensure that it is switched to **on**. Task 2: Explain to learners that they are going to program the Crumble to control the Sparkle. Crumbles are programmed using a block-based programming language similar to Scratch. Dragging blocks from the block palette on the left of the screen to the main programming area allows commands to be snapped together to make a program. Tell learners that they should connect their Crumble to a computer using a USB lead. Once the Crumble is connected, programs written in the Crumble software can be sent to the Crumble by clicking on the green triangular play button. Once the program is transferred, it will run automatically. Explain to learners that they will need to create a program like the one shown on the slide and test that it works on their Crumble. Once learners are happy that it is working properly, they can try to modify and add to the program to produce different light patterns. Show learners that: • Clicking on the red square on the set sparkle(0) to [red] block allows you to change the colour of the Sparkle • Clicking on the time value on a wait 0.5 seconds block allows you to change the duration of the wait command • Adding more blocks to the sequence will make the Crumble light the Sparkle more times Provide learners with the worksheet and explain that it has eight challenges for them. They should modify their program so that it lights the Sparkle in the patterns shown on the worksheet. Explain that the first challenge (top line on the sheet) is to make the Sparkle flash blue three times with a pause of 0.5 seconds between each flash. Highlight that their program needs to: • Turn the Sparkle off as well as on • Be sent to the Crumble each time Task 3: Explain to learners that they are going to return to their program and explore using repetition in a program that instructs an LED to flash forever. Highlight that the block that they need to add can be found in the **Basic** menu. Invite learners to suggest how they will know if their program has been constructed correctly (the Sparkle's LED will flash continuously when the program is downloaded and run on the Crumble controller). Give the learners time to modify their programs.	A crumble kit is a form of microcontroller that can control outputs when it responds to inputs.
Last Year Why do we need to be accurate when creating computer programs? *If we are not accurate when writing computer programmes they will not work correctly.*	Previous Key stage Give an example of a close question and an open question. *For example:* *Close question - Were you born in 2010?* *Open question - What happened when you went to the zoo?*		

Lesson 2

Flashback Four		Learning Objectives	Star Knowledge
Last Lesson What is a crumble kit? *A crumble kit is a microcontroller.*	Last Topic True or false: A digital bus stop sign will need a system to function? *True*	Learning Objective LO to write a program that includes count-controlled loops. Success Criteria I can connect more than one output component to a microcontroller. I can use a count-controlled loop to control outputs. I can design sequences that use count-controlled loops. Task 1: Explain to learners that they are going to connect a geared motor and a Sparkle to their Crumbles. Highlight the three motor commands shown and explain the Crumble can be programmed to make a motor spin forwards and backwards at different speeds. Tell learners that the animation shows that clicking on the word in the centre of the motor command block makes the command change. The command will cycle through forwards, backwards, and stop. Explain to learners that the % value on the right-hand end of the block sets the motor's power. Talk learners through the connection diagram. Highlight that the battery and Sparkle connections are the same as they were in the previous lesson. The motor should be connected to the + and – pads near the number 1 on the Crumble. Tell learners that they should sticky-tack the motor direction disc onto the wheel. When learners use the forwards motor command, the disc should turn in the direction shown (clockwise). If the disc turns the wrong way, learners should switch the red and black motor connections around. Explain to learners that they should create the program on the left side of the slide and run it on their Crumble. Once learners can see their motor is working properly, they can add the Sparkle blocks shown on the right side of the slide and run the program again. Task 2: Tell learners that they need to create an algorithm to make the dancer move and the light flash. Learners can choose how they want to present their algorithm and it should be clear enough for another group to understand. The algorithm should indicate changes, timings, and where a sequence of actions is repeated (loops). After learners have created their algorithm, they should share it with another group to check it's clear and precise. Task 3: Learners should now implement their algorithms as code. They should use the algorithm to guide the creation of their program. When the program is complete, learners should run it to check that it produces their expected outcome. If their program doesn't perform as expected, learners should check their code and fix any problems they find.	A count-controlled loop is a code that tells the microcontroller specifically how many times it needs to complete a command.
Last Year In an algorithm, what does the (x) represent? *The (x) symbol represents any repeats that need to be made.*	Previous Key stage What are the benefits of using a branching database? *Example:* • *Branching databases are clearly organised* • *Branching databases are easy to read* • *Branching databases are clearly presented.*		

Lesson 3

Flashback Four		Learning Objectives	Star Knowledge
Last Lesson What dos a count controlled loop do? *A count controlled loop tells the microcontroller specifically how many times it needs to complete a command.*	Last Topic What are the two ways to complete a web search? *You could use the search box in the search engine itself or type the term into the address bar of the browser.*	Learning Objective LO to explain that a loop can stop when a condition is met. Success Criteria I can explain that a condition is either true or false. I can design a conditional loop. I can program a microcontroller to respond to an input. Task 1: Tell learners that they should write their own conditions for these situations: • What time should I get up in the morning? • What shall I wear today? • What shall I have for breakfast? • How will I get home from school? Task 2: Hand out the 'Do until loops' activity sheet and allow learners time to complete it. Task 3: Provide learners with a Crumble controller, a battery box, crocodile clips, a Sparkle, and a push switch. Ask learners to use the diagram on the slide to connect the switch to the Crumble controller and the battery box, and to connect a Sparkle.	A condition is the rule that tells the microcontroller if the command can be carried out in the count-controlled loop.
Last Year What does repeat mean? *Repeat means 'to do or say something again.'*	Previous Key stage Why is it more beneficial for a branching database to use more groups? *The more groups that are used in a branching database the more organised the information will be.*		

		Task 4: Tell learners that they are going to write a program that uses the switch as a condition to stop a light sequence. Their program can flash the Sparkle up to five colours in sequence. Switch to the Crumble programming software and demonstrate how to construct a program using the do until loop and [A] is [HI] command blocks to create a condition that stops a set of actions when it is true. Ask learners to create a program that uses the push switch as a condition.	
Lesson 4			
Flashback Four		**Learning Objectives**	**Star Knowledge**
Last Lesson What is a condition? *A condition tells the microcontroller if the command can be carried out in the count-controlled loop.*	Last Topic What do web crawlers do? *Crawlers create an index of the World Wide Web. They 'crawl' websites for searchable content and store where it is found in an index.*	Learning Objective LO to explain that a loop can be used to repeatedly check whether a condition has been met. Success Criteria I can explain that a condition being met can start an action. I can identify a condition and an action in my project. I can use selection (an 'if…then…' statement) to direct the flow of a program. Task 1: Ask learners to consider decisions that they routinely make and how these can be represented in a similar structure. Invite learners to share their ideas using the '**if…then…**' structure. Task 2: Remind learners of the input component they used in Lesson 3 to control the flow of actions in their programs. Allow learners to discuss their initial ideas and invite them to share some suggestions. Introduce the 'Design with selection' activity sheet and highlight to learners that the algorithm has been started for them and they should continue it. Task 3: Explain to learners that they are going to use the Crumble programming software to implement their earlier design (algorithm) as a program. Highlight to learners that they need to add 'Do the following continuously:' to the start of their algorithms. Tell learners to implement their algorithms as programs, then to download and run them.	If and then statements, show the cause and effect of the outputs of a microcontroller.
Last Year What do we call a section of code that can be ran multiple times? *A procedure.*	Previous Key stage What are these things examples of: red, big, happy, cold, old? *These are all examples of attributes.*		

<table>
<tr><th colspan="4">Lesson 5</th></tr>
<tr><th colspan="2">Flashback Four</th><th>Learning Objectives</th><th>Star Knowledge</th></tr>
<tr><td>Last Lesson
What do if and then statements show?
If and then statements show the cause and effect of the outputs of a microcontroller.</td><td>Last Topic
How do search engines make money?
Companies pay search engines to have their adverts shown first on web searches.</td><td rowspan="2">Learning Objective
LO to create a program that controls a physical computing project.

Success Criteria
I can write an algorithm that describes what my model will do.
I can use selection to produce an intended outcome.
I can test and debug my project.

Task 1:
Explain that pupils now need to develop an algorithm to show how they will meet the requirements of the task. Identify that the task requires the output devices to be controlled by selection. Remind learners to:
• Use selection
• Ensure conditions are repeatedly checked to see if the condition has been met
• Include waits
• Turn all their outputs off
When learners have written their algorithm, ask them to talk it through with someone else in the class.

Task 2:
Tell learners that they are going to write their own programs to control their model. They should keep referring to their algorithms as they create their code. Advise learners that it’s good practice to test their program as they go along. When they add a few lines to their program, they should run it on the Crumble and check that the code does what they intended. If it doesn’t, they should fix any errors. Point out that doing this makes the task of debugging their program easier.

Task 3:
Tell learners that when their program is complete they should fully test their code. Point out they will also be testing their model at the same time. Learners should review their algorithm and check that their program and model perform as they intended. If they discover any bugs in the code or issues with their model, they should fix them.</td><td rowspan="2">An algorithm is a specific set of instructions that is followed to successfully complete a task.</td></tr>
<tr><td>Last Year
True or false: A count controlled loop will keep running forever?
False – a count controlled loop will only run for what number is programmed into the code.</td><td>Previous Key stage
True or false: the less specific the questions are in a branching database, the easier it is to organise the objects.
False.</td></tr>
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