Year 3 Autumn 1 – Summer 1 **Make a Banana Keyboard** **Design and Technology (Computing & Electronics)**

As Designers we will explore electricity and conductivity. We will link this to science and understand how series circuits are used/made. We will then use this understanding to design a range of products that can be controlled using a MakeyMakey kit. We will begin by recreating 3 identified products, and then we will use our knowledge of useful electrical devices to recreate our own using a MakeyMakey kit. We will also learn about pioneers in the video game industry as part of this unit.

NC Content

- develop the creative, technical and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world
- build and apply a repertoire of knowledge, understanding and skills in order to design and make high-quality prototypes and products for a wide range of users
- critique, evaluate and test their ideas and products and the work of others
- understand and apply the principles of nutrition and learn how to cook.

Materials required for this unit:	**Tools and equipment required for this unit:**	**Vocabulary**
For creating the physical part of products: • Card • Cardboard • Wood??? • Recycled materials (e.g. plastic bottles etc.) • Play dough • Conductive objects	• Makey Makey kits (micro USB cable, crocodile clips, controller) • Laptops/Chromebooks • Scratch website For creating the physical part of products: • Glue • Nails/screws? • Scissors • Junior hack saws	disassemble inventor pioneers efficiency appropriate series accuracy precision effectiveness suitable mechanisms

Episode 1 – Make a banana Keyboard

By the end of this learning sequence, children will know:

- How to create an open and closed series circuit.
- Know which materials are conductors of electricity.
- How a Makey Makey kit works.
- How to design and make a product fit for purpose using a design brief.
- How to evaluate a product against a design brief and make amendments to a product to make it more suitable for purpose.

Research	Design	Make	Evaluate
Procedural skill: Be able to create series circuits. Disassemble products to understand how they work. Control and monitor models using software designed for this purpose. NC links: Pupils should be taught to: Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Understand how key events and individuals in design and technology have helped shape the world. Identify real-world appliances that use electricity (battery/mains operated). Know the requirements of a series circuit.	Procedural skill: Design with purpose by identifying opportunities to design. NC links: Pupils should be taught to: Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design. Understand and use electrical systems in their products. <u>Design Criteria</u> Mrs Pearce would like you to make a simple piano using the Makey Makey kit and every day objects. It	Procedural skill: Be able to create series circuits. Control and monitor models using software designed for this purpose. Make products by working efficiently (such as by carefully selecting materials). Refine work and techniques as work progresses, continually evaluating the product design. NC links: Pupils should be taught to: Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities. Computing NC Links: use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs.	Procedural skill: Control and monitor models using software designed for this purpose. Improve upon existing designs, giving reasons for choices. Refine work and techniques as work progresses, continually evaluating the product design. NC links: Pupils should be taught to: Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. Identify the strengths and areas for development in their product by evaluating this against the design criteria in terms of accessibility and ease. Is it fit for purpose? How can it be improved? Try to play the tune Twinkle Twinkle Little Star (CC GG AA G FF EE DD C). What

Construct a complete and broken circuit. Explore MakeyMakey kit and how it works. Use knowledge of series circuits. https://apps.makeymakey.com/piano Do children recognise how it makes a complete circuit? Grounding themselves to the MakeyMakey forms complete circuit. Explain how this works using key vocab: electricity, battery, earth, wires, closed circuit, conductive. Identify and list conductive materials. What is meant by "conductivity"? Test different objects with the Makey Makey kit to identify potential objects that can be used throughout the project – which ones do/don't work and why?	must be easy to use, be made from cheap, every-day materials, be able to play the notes C,D,E,F,G and A, and be fun for younger children. Create an annotated sketch to communicate design ideas. This should draw upon previous research. This must be annotated with the key elements of the product. Materials and equipment required must also be noted. Children to order the main stages of making the product. Explain how the product will work and how it will be fit for purpose. Indicate how the design features of their products will appeal to intended users.	Refer to their design criteria as they make the banana keyboard. Children to create the keyboard ensuring that all wires are connected to the appropriate components. Encourage children to debug throughout (look for and solve errors).	problems do they come across? How can this be fixed? Consider the views of others, including intended users, to improve their work. Redesign the product taking into account the evaluation. Explain why they have changed the product and how this will improve it (this can be done verbally through Seesaw). Points to consider: You could encourage children to think about the fact that having a banana for each note will be confusing and they could therefore redesign their product to use varying fruits, label the notes on each banana, place the notes in order, organise wires neatly etc. Make amendments to product from evaluation. Re-evaluate product against design criteria. Is it better fit for purpose now? Encourage children to test this by engaging with the target audience. Ask Y1/Y2 children to come and use the keyboard to play twinkle twinkle and get feedback from them.

Episode 2 – Make Musical Water Using Scratch

By the end of this learning sequence, children will know:

- About the conductivity of water.
- How to design, write and debug programs that use selection. (Computing)
- How to incorporate electrical/computing components into a product.
- How to evaluate against a design criteria.

Research	Design	Make	Evaluate
Procedural skill: Create series and parallel circuits. NC links: Pupils should be taught to: understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] Explore the conductivity of water. Can this be used with the MakeyMakey kit? Children to investigate with this. Test with varying liquids and amounts.	Procedural skill: Design with purpose by identifying opportunities to design. Make products by working efficiently (such as by carefully selecting materials). NC links: Pupils should be taught to: Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded	Procedural skill: Be able to create series circuits. Control and monitor models using software designed for this purpose. Make products by working efficiently (such as by carefully selecting materials). Refine work and techniques as work progresses, continually evaluating the product design Create series circuits. NC links: Pupils should be taught to: Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities.	Procedural skill: Improve upon existing designs, giving reasons for choices. Refine work and techniques as work progresses, continually evaluating the product design. NC links: Pupils should be taught to: Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. Evaluate the program and control against the design criteria to determine whether it is fit for purpose. Identify the strengths and areas for development.

	diagrams, prototypes, pattern pieces and computer-aided design. Computing NC Links: Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs. <u>Design Criteria</u> You need to program a musical system that is controlled by water. This part of the unit links to the Year 3 Computer Science objectives. Please see the computing overview to ensure children are meeting these curriculum objectives throughout this episode. Note: Children do NOT need to use repetition in this episode, that will come in the next one. Observe a range of working programs that use music. Decompose the key elements and use logical reasoning to predict what is going to happen. Example of using sounds: (https://projects.raspberrypi.org/en/projects/rock-band)	Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products. Computing NC Links: design, write and debug programs that accomplish specific goals; solve problems by decomposing them into smaller parts. Use sequence in programs; work with 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 Create the program using Scratch, according to their plan. Design, write and debug the program to create a program that plays sounds when the arrow keys are pressed.	Use the feedback from evaluation to suggest improvements and change/adapt the design of the water-controls accordingly. E.G. making it easier to use, changing the aesthetics, dying the water to be different colours etc.

	Recognise that the button presses are an input and that the sound is an output. Explore the controls required for the music to be played (think about which keys can be controlled by the Makey Makey). Use Scratch to program so that when the left, right, up and down arrows are pressed, a different sound is played. Discuss sequencing and then algorithms must execute in a specific order. Generate ideas around how the Makey Makey kit can be programmed to create a musical instrument/series of music. (Note: You can also control WASDFG keys by using the jumper wires - https://www.youtube.com/watch?v=uIxE_5zFjN8&t=113s) Create an annotated sketch and explain how the design will work. Create a list of required materials and equipment. Children must link this knowledge back to conductivity and an understanding of how to make a closed series circuit. Create a plan for the musical program using Scratch. Make a rough note of the algorithms that	Assemble the components required for the water-based controls. Combine the electrical components from the Makey Makey kit and connect these to the laptop to work with the Scratch program.	

	might be used and explain how this will work. It may be useful to create a storyboard to plan out the program.		

Episode 3 – Make a Game Controller Example in this video: https://youtu.be/rfQqh7iCcOU (note how they attached the earth to their wrist for ease – this could be an evaluation point) By the end of this learning sequence, children will know: • How game designers through history have shaped the world of game design. • How different types of game controllers work, and know that buttons work by completing a circuit. • How to create design criteria by gathering information about user needs. • How to design, write and debug programs that use repetition. (Computing) • How to select from and use a range of tools and equipment to perform practical tasks, and how to incorporate electrical/computing components into a product. • How to evaluate against a design criteria and draw upon feedback from the intended user to make amendments.			
Research	Design	Make	Evaluate
Procedural skill: Identify some of the great designers in all of the areas of study (including pioneers in horticultural techniques) to generate ideas for designs. Disassemble products to understand how they work. NC links: Pupils should be taught to:	Procedural skill: Design with purpose by identifying opportunities to design. Make products by working efficiently (such as by carefully selecting materials). Choose suitable techniques to construct products. Strengthen materials using suitable techniques.	Procedural skill: Be able to create series circuits. Control and monitor models using software designed for this purpose. Make products by working efficiently (such as by carefully selecting materials). Refine work and techniques as work progresses, continually evaluating the product design	Procedural skill: Improve upon existing designs, giving reasons for choices. Refine work and techniques as work progresses, continually evaluating the product design. NC links: Pupils should be taught to: Evaluate their ideas and products against their own design criteria and

understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] Investigate and analyse a range of existing products. Understand how key events and individuals in design and technology have helped shape the world. Research into important figures in the gaming industry: • William Higinbotham, 1958, created the first video game – Tennis for Two – which was played on a Brookhaven National Laboratory oscilloscope. • Steve Russell, 1962, designed "SpaceWar!" which was made for computers. • Nolan Bushnell and Ted Dabney created the first arcade game "Computer Space" in 1971. "Pong" was then made by Bushnell in 1972. Bushnell and Dabney went on to be the founders of Atari Computers, which	NC links: Pupils should be taught to: Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design. Computing NC Links: Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs. <u>Design Criteria</u> You need to create a game using Scratch and a controller to play it with. You can decide on the audience for the game and the controller. The controller must be durable and easy to use. This part of the unit links to the Year 3 Computer Science objectives. Please see the computing overview to ensure children are meeting	Choose suitable techniques to construct products. Strengthen materials using suitable techniques. Create series circuits. Cut materials accurately and safely by selecting appropriate tools. Measure and mark out to the nearest millimetre. Select appropriate joining techniques. NC links: Pupils should be taught to: Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities. Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products.	consider the views of others to improve their work. Evaluate the controller against the design criteria to determine whether it is fit for purpose. Identify the strengths and areas for development, considering the views of the intended audience. Use the feedback from evaluation to suggest improvements and change/adapt the design of the controller accordingly. E.G. making it easier to use, changing the aesthetics etc.

re-released Pong in 1975 as a home video game. • 1989 Nintendo introduced the Game Boy system. • 1994 PS1 • 2001 Xbox Research into controllers/gaming systems through time. How have they changed? Why have they needed to change? What has helped them to change? Acknowledge that a game controller is a type of computer input and an algorithm then decides what happens after a button press. Identify different ways in which a controller can be connected to control a game. E.G. buttons, analogue sticks, joy sticks, VR headsets/cameras, voice control, motion control (like Switch controllers). Look at a range of these controllers (if possible play games with them) and use logical reasoning and decomposition to explain how each one works Identify how a controller is made and acknowledge the different components. (For typical	these curriculum objectives throughout this episode. Observe a range of working games that use repetition. Decompose the key elements and use logical reasoning to predict what is going to happen. (https://scratch.mit.edu/studios/5835878/) Use the PRIMM approach when looking at the algorithms (Predict, Run, Investigate, Modify, Make). In the design element, just focus on PRI. Express that algorithms must execute in a specific order. Explore the controls required for the games to be played (think about which keys can be controlled by the Makey Makey). Generate ideas around how the Makey Makey kit can be programmed to create a suitable controller. (Note: You can also control WASDFG keys by using the jumper wires - https://www.youtube.com/watch?v=uIxE_5zFjN8&t=113s) Decide on the audience for the game and controller and use this to influence design criteria. Children to come up with 3 criteria (in addition	Computing NC Links: design, write and debug programs that accomplish specific goals; solve problems by decomposing them into smaller parts. Use sequence and repetition in programs; work with various forms of input. Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs Create the game using Scratch, according to their plan. Design, write and debug the program to create a playable game that uses repetition. Measure, mark out, cut and shape the materials and components required to build the controller with some accuracy. Assemble, join and combine the materials and components to create the controller. Finish the controller so that it is aesthetically pleasing and meets the design criteria. Combine the electrical components from the Makey Makey kit and connect these	

controllers, link this to open/closed circuits and switches) This video is useful for teacher subject knowledge: https://www.youtube.com/watch?v=vQesgAtr2e4	to those above) that link specifically back to the audience/game design. Children to gather information about the needs and wants of the audience. Gather data using a Google Form and use this to inform design ideas. Generate a range of design ideas for the controller using annotated sketches and exploded diagrams. Indicate how the design appeals to the intended audience and explain how the design will work. Create a list of required materials and equipment. Children must link this knowledge back to conductivity and an understanding of how to make a closed series circuit. Explain their choice of materials and components according to functional properties and aesthetic qualities – link back to design criteria. Create a prototype controller using playdough to see how the controller will work with the game. Children to practise using appropriate measuring, cutting, shaping, joining and finishing techniques for the materials they	to the laptop to work with the Scratch game.	

	have selected. Build on understanding of how to strengthen materials from Year 2 to ensure that the controller is durable. Create a plan for the video game using Scratch (this MUST include repetition). Children may choose to modify one of the games above or they can start from scratch. Make a rough note of the algorithms that might be used and explain how this will work. It may be useful to create a storyboard to plan out the game.		

Commented [C1]: Do we need to make this more specific once we know what they're going to make the controllers out of?

Episode 4 – Create a device for a purpose.
Ideas for this episode: https://stemeducationguide.com/makey-makey-games/ There is a list of ideas and how to create them under the video.

https://youtu.be/rfQqh7iCcOU
https://www.youtube.com/watch?v=hztYhF2JAtk
https://makeymakey.com/pages/kit-project-guides
https://www.instructables.com/makeymakey/

By the end of this learning sequence, children will know:

- About real world electrical products that are useful.
- How to create design criteria by gathering information about user needs and using these to generate annotated sketches and exploded diagrams, explaining how products will work.
- How to design, write and debug programs that use repetition. (Computing)
- How to select from and use a range of tools and equipment to perform practical tasks, and how to incorporate electrical/computing components into a product.
- How to evaluate against a design criteria and draw upon feedback from the intended user to make amendments.

Research	Design	Make	Evaluate
Procedural skill: Identify some of the great designers in all of the areas of study (including pioneers in horticultural techniques) to generate ideas for designs. Disassemble products to understand how they work. NC links: Pupils should be taught to: understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors] Investigate and analyse a range of existing products.	Procedural skill: Design with purpose by identifying opportunities to design. Make products by working efficiently (such as by carefully selecting materials). Choose suitable techniques to construct products. Strengthen materials using suitable techniques. NC links: Pupils should be taught to: Use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose,	Procedural skill: Be able to create series circuits. Control and monitor models using software designed for this purpose. Make products by working efficiently (such as by carefully selecting materials). Refine work and techniques as work progresses, continually evaluating the product design Choose suitable techniques to construct products. Strengthen materials using suitable techniques. Create series circuits. Cut materials accurately and safely by selecting appropriate tools. Measure and mark out to the nearest millimetre.	Procedural skill: Improve upon existing designs, giving reasons for choices. Refine work and techniques as work progresses, continually evaluating the product design. NC links: Pupils should be taught to: Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. Evaluate the device against the design criteria to determine whether it is fit for purpose. Identify the strengths and areas for development, considering the views

Understand how key events and individuals in design and technology have helped shape the world. Research into useful electrical devices (e.g. alarm systems, security camera – like the cat photo booth in the video above, exercise dance game, presentation clicker, feedback slider/clicker) and those who invented them. How have these changed the world? Research into different useful MakeyMakey projects that can be completed. Use the PRIMM method (Predict, Run, Investigate, Modify and Make) to support understanding of how it works and how it can be modified.	aimed at particular individuals or groups. Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design. Computing NC Links: Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs. <u>Design Criteria</u> You need to create a useful device using the MakeyMakey kit. You need to develop the design criteria based on your intended audience. This part of the unit links to the Year 3 Computer Science objectives. Please see the computing overview to ensure children are meeting these curriculum objectives throughout this episode. Decide on the audience for the device and use this to influence design criteria. Children to come up with 3 criteria.	Select appropriate joining techniques. NC links: Pupils should be taught to: Select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities. Select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately. Understand and use electrical systems in their products [for example, series circuits incorporating switches, bulbs, buzzers and motors]. Apply their understanding of computing to program, monitor and control their products. Computing NC Links: design, write and debug programs that accomplish specific goals; solve problems by decomposing them into smaller parts. Use sequence and repetition in programs; work with various forms of input.	of the intended audience. Opportunity for the intended audience to use the device at this point to provide feedback. Use the feedback from evaluation to suggest improvements and change/adapt the design of the device accordingly. E.G. making it easier to use, changing the aesthetics etc.

	Children to gather information about the needs and wants of the audience. Gather data using a Google Form and use this to inform design ideas. Generate a range of design ideas for the device using annotated sketches and exploded diagrams. Indicate how the design appeals to the intended audience and explain how the design will work, including the use of inputs and outputs. Create a list of required materials and equipment. Children must link this knowledge back to conductivity and an understanding of how to make a closed series circuit. Explain their choice of materials and components according to functional properties and aesthetic qualities – link back to design criteria. Create a prototype of the device to support the design process and determine how the device will communicate with the programming on the PC. Create a plan for the programming using Scratch (this MUST include repetition, sequencing and wait functions). Children may choose to	Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs Create the program using Scratch, according to their plan. Design, write and debug the program to achieve a specific outcome. This must include sequencing, repetition and wait functions. Measure, mark out, cut and shape the materials and components required to build the device with some accuracy. Assemble, join and combine the materials and components to create the device. Finish the device so that it is aesthetically pleasing and meets the design criteria. Combine the electrical components from the Makey Makey kit and connect these to the laptop to work with the Scratch program.	

	modify existing code or they can start from scratch. Make a rough note of the algorithms that might be used and explain how this will work with their device. It may be useful to create a storyboard to plan out the programming required. Children to practise using appropriate measuring, cutting, shaping, joining and finishing techniques for the materials they have selected. Note: this will be entirely dependent upon the device they choose to create and the design behind it.		

Commented [C2]: Do we need to make this more specific once we know what they're going to make the controllers out of?