Medium Term Plan

Year 5 Computing Overview

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Strands	Computing Systems and Networks	Programming 1	Data Handling	Programming 2	Creating Media	Skills Showcase
Topic	Search Engines	Music	Mars Rover 1	Micro;bit	Stop Animation	Mars Rover 2

Key Stage 2 Pupils should be taught to;

- ✓ 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
- ✓ Understand computer networks including the internet; how they can provide multiple services, such as the world wide web; and the opportunities they offer for communication and collaboration
- ✓ Use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content
- ✓ 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
- ✓ Use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
Computing Systems and Networks 1 - Search Engines ✓ Understand computer networks including the internet; how they can provide multiple services, such as the world wide web; and the opportunities they offer for communication and collaboration ✓ Use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content ✓ 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	▪ To know how search engines work. ▪ To understand that anyone can create a website and therefore we should take steps to check the validity of websites. ▪ To know that web crawlers are computer programs that crawl through the internet. ▪ To understand what copyright is.	▪ Explain what a search engine is, suggesting several search engines to use and explain how to use them to find websites and information. ▪ Suggest that things online aren't always true and recognise what to check for. ▪ Explain why keywords are important and what TASK stands for, using these strategies to search effectively. ▪ Recognise the terms 'copyright' and 'fair use' and combine text		RSE: Online Relationships – online shared data, online friendships and the risks of strangers. English: Spoken Language – consider and evaluate different viewpoints, attending to and building on the contributions of others	Algorithm Appropriate Copyright Correct Credit Data leak Deceive Fair Fake Inappropriate Incorrect Index Information Keywords Network Privacy Rank Real Search engine TASK Web crawler Website

collecting, analysing, evaluating and presenting data and information ✓ Use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.		and images in a poster. ▪ Make parallels between book searching and internet searching, explaining the role of web crawlers and recognising that results are rated to decide rank. ▪ Developing searching skills to help find relevant information on the internet. ▪ Learning how to use search engines effectively to find information, focussing on keyword searches and evaluating search returns. ▪ Learn about different forms			

		of communication that have developed with the use of technology. ▪ Recognising that information on the Internet might not be true or correct and learning ways of checking validity. ▪			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To understand what a search engine is and how to use it • I can explain what a search engine is • I can use a search engine to navigate the web	Children recap search engines and are challenged to find specific websites or information as fast as they can to test their searching skills		**<u>Differentiation:</u>** **Pupils needing extra support:** May need help opening different search engines in different tabs. During the factual searching activity, challenge children to find a useful website and then look for the information on that page. **Pupils working at greater depth:** Should focus on finding the answers with the least number of 'clicks' and	• Website • Search engine • Data leak • Privacy • Network

	• I can suggest keywords for searching		the least amount of typing – searching efficiency. **Key Questions:**	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To be aware that not everything online is true • I recognise that not everything online is true • I understand anyone can create a website • I can suggest ways of checking the validity of a website	Learning that not everything they read online is necessarily true, children learn how to check that information that they find is accurate	**Differentiation:** **Pupils needing extra support:** Should answer the Blue questions on the online differentiated reading activity (e.g. Sir Francis Drake) and may need to see the success criteria during the main activity to refer back to. **Pupils working at greater depth:** Should model good practice for search validity as soon as they click a website. **Key Questions:**	• Real • Fake • Deceive • Information • Correct • Incorrect
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 3	• To search effectively • I understand the	By focusing on key words, children develop their research skills, learning how to quickly find relevant information on a specific topic	**Differentiation:** **Pupils needing extra support:** Should have a reduced number of questions to research.	• Keywords • TASK

	importance of keywords • I can use the acronym TASK • I can use my search skills to answer focused questions		**Pupils working at greater depth:** Should talk through the process as they are working. **<u>Key Questions:</u>** • What is a keyword? • Why are they important? • What does TASK stand for? • How do you know this information is true? • What's the best way to search for facts? • What's the best thing to search for if I want to know about what Tudor roofs are made of?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To create an informative poster • I have a clear poster title • I can type at least five facts	Using the information they found in the previous lesson, pupils create an informative poster, ensuring that they appropriately credit the images and videos that they use	**<u>Differentiation:</u>** **Pupils needing extra support:** Focus on creating their own content, e.g. adding font/shapes. **Pupils working at greater depth:** Explain how they have considered copyright and fair use. **<u>Key Questions:</u>**	• Copyright • Fair • Credit • Appropriate • Inappropriate

	• I can choose appropriate pictures, colours and designs • I can consider fair use • I can credit people for information, images and videos I use		• What do we need to think about when using information found online? • Have you copied your information exactly from the website? • Do you need to credit anyone for the information? • What is copyright? • What is fair use? • How could we use pictures we've seen online? • What information should be included in our poster? • Is it clear what your poster is telling us?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 5	• To understand how search engines work • I understand the role of a web index	Children learn about web indexes, what can affect page rank and the role of web crawlers	**<u>Differentiation:</u>** **Pupils needing extra support:** Regularly draw parallels between search engines and the unplugged activity. **Pupils working at greater depth:** Suggest ways in which these pupils could	• Web crawler • Rank • Algorithm • Index • Search engine

	• I can explain what web crawlers are • I can discuss page rank		improve a website to make it rank higher. **<u>Key Questions:</u>**	

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
<u>Programming 1 - Music</u>	- To know that a soundtrack is music for a film/video and that one way of composing these is on programming software. - To understand that using loops can make the process of writing music simpler and more effective.	- Iterate ideas, testing and changing throughout the lesson. - Explain what the basic commands do: 'play', 'slee'p, '2.times do'. - Explain how their program links to the theme. Include a loop in their work. Correct their own simple mistakes.		Music – appreciate and understand a wide range of music. Play and perform in solo and ensemble contexts. Improvise and compose music for a range of purposes. English: Reading – identifying and discussing themes and convention. Making comparisons within and across books.	Beat Buffer Bugs Coding Commands Debug Decompose Error Format Instructions Live loops Loop Melody Mindmap Music Output Performance Pitch Play Predict

	- To know how to adapt their music while performing.	- Explain their scene in the story. Link musical concepts to their scene. - Include a live loop and explain its function. Use samples effectively to enhance music. - Code a piece of music that combines a variety of structures. Use loops in their programming. Recognise that programming music is a way to apply their skills. - Predicting how software will work based on previous experience. - Writing more complex			Programming Rehearsal Repetition Rhythm Sleep Sonic Pi Soundtrack Spacing Tempo Timbre Tinker Tutorials Typing Typo

		algorithms for a purpose. - Iterating and developing their programming as they work. - Confidently using loops in their programming. - Using a more systematic approach to debugging code, justifying what is wrong and how it can be corrected. - Writing code to create a desired effect. - Using a range of programming commands. - Using repetition within a program.			

		- Amending code within a live scenario. - Using logical thinking to explore software more independently, making predictions based on their previous experience. - Using a software programme (Sonic Pi) to create music. - Identify ways to improve and edit programs, videos, images etc.			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To tinker with a new piece of software • I can predict what I think	Children are introduced to Sonic Pi and given the opportunity to explore its capabilities and learn about debugging		**<u>Differentiation:</u>** **Pupils needing extra support:** Should use the basic command sheet provided to help support spelling and syntax.	• Sonic Pi • Tinker • Predict • Programming • Music • Typing

	something new will do • I can explore something independently • I can explain what I found		**Pupils working at greater depth:** After they have used one loop, discuss what they think would happen if they put another loop between to 'do' and the 'end'. Have the children try this (tinker) and then reflect on what happened. **Key Questions:** • What do you think will happen? • What do you think will happen now the number is different? • What actually happened? • Why is this not good? • What do you think the number next to sleep is? • What is tinkering? • Why do you think it's important to computing? • What is debugging? • Did you get errors when you tried to run your code?	• Spacing • Performance • Coding • Tutorials • Error • Command • Instructions • Debugging • Typo

			• What does it say now? • How can we fix this? • What happens if you miss a number off? • What can we use in programming if we want to repeat a section of our program?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To create a program that plays themed music • I can use Sonic Pi's basic commands • I can include a loop in my program • I can debug simple errors in my code	Using their programming skills, pupils create a piece of music based upon a given theme, including the use of loops. Thanks to the Dubai English Speaking School for our header image!	**<u>Differentiation:</u>** **Pupils needing extra support:** Use the *Sonic Pi basic command* sheet provided to help support spelling and syntax **Pupils working at greater depth:** Can explain how they can use Sonic Pi to change the pitch, tempo, rhythm and timbre of the music. • pitch = higher/lower play notes • tempo = controlling the pauses with sleep	• Program • Music • Sonic Pi • Commands • Loop • Debug • Errors • Code • Mindmap • Pitch • Rhythm • Tempo • Timbre

			• rhythm = using loops appropriately timbre = using the synths **Key Questions:** • What does the word '**coding**' mean to you? • What does the word '**debugging**' mean to you? • Can you remember what you have to include to make Sonic Pi play music? • Can you remember what you have to do to play two notes separately? • What is a '**loop**'? • Can you remember the code to create a loop? • Can you spot the error? • Can you identify what has changed?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary

Lesson 3	• To plan a soundtrack program • I can decompose the story • I can plan my program • I can explain how my program will add to the story	After observing how music can affect the mood of a film scene, pupils compose their own soundtrack to a story, considering the pitch, tempo, timbre and rhythm of their piece	**Differentiation:** **Pupils needing extra support:** Could work within an adult led group where choices are reduced during discussion about the features, eg: Is the scene happy or sad? Do you think the music will be quick or slow? **Pupils working at greater depth:** Amongst their notes, they may begin noting some of the programming commands they're going to use or have identified during the research stage. **Key Questions:** • What's happening in them? • How are the character's feeling? • Why are they important to the rest of the story? • What is a soundtrack? • What happened in this scene? • How are the characters feeling?	• Soundtrack • Program • Decompose • Plan • Music • Pitch • Tempo • Rhythm • Timbre • Command

Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To program a soundtrack • I can work from a plan • I can use a range of programming commands • I can explain how my program enhances the scene	Building on Lesson 3, the children are introduced to live loops to create a repeating beat or rhythm	**Differentiation:** **Pupils needing extra support:** Should continue with the coding commands from last time. No need to add live_loops or samples. **Pupils working at greater depth:** Introduce them to the rrand(a, b) command, which chooses a random number between two parameters. play rrand(60, 70) Will pick a random note to play between 60 and 70. This means every time your code loops around, it will be a different note played. sleep rrand(0.1, 1) You can also use it for sleep duration. **Key Questions:**	• Live loops • Program • Soundtrack • Plan • Programming • Program • Commands • Bugs • Loop • Play • Sleep • Repeat • Beat • Melody • Format
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 5	• To program music for a specific purpose	The topic culminates in a Battle of the Bands which sees pupils playing their music live and adapting their code as they perform.	**Differentiation:** **For pupils needing extra support:** Take the example live loop included here and	• Program • Music • Commands • Code

	• I can combine known commands • I can code music with a purpose • I can use repetition in a program • I can use various forms of output [sound]		change the numbers/synths accordingly. **Pupils working at greater depth:** Should experiment with code and change it whilst it is playing. Should use multiple workspaces or 'Buffers' to test out different sections of code to add. **Key Questions:** • What do you remember about 'live loops'? • How did you we use them in the last lesson? • What can you identify with this code? • Did they all meet the success criteria? • Did they make frequent changes to their code mid-performance?	• Repetition • Output • Live code • Rehearsal • Live loops • Buffer

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
Data Handling - Mars Rover 1	- To know that Mars Rover is a motor vehicle that collects data from space by taking photos and examining samples of rock. - To know what numbers using binary code look like and be able to identify how messages can be sent in this format. - To understand that RAM is	- Identify some of the types of data that the Mars Rover could collect (for example, photos). - Explain how the Mars Rover transmits the data back to Earth and the challenges involved in this. - Read any number in binary, up to eight bits.		Maths – convert between different units of metric measure. Solve problems involving addition, subtraction, multiplication and division. Solve practical problems. Science – describe the movement of the Earth and other planets relative to the sun in the solar system.	8-bit binary Addition ASCII Binary code Boolean Byte Communicate Construction CPU Data transmission Decimal numbers Design Discovery Distance Hexadecimal Input Instructions Internet Mars Rover Moon

	Random Access Memory and acts as the computer's working memory. - To know what simple operations can be used to calculate bit patterns.	- Identify input, processing and output on the Mars Rovers. - Read binary numbers and grasp the concept of binary addition. - Relate binary signals (Boolean) to a simple character-based language, ASCII. - Learning that external devices can be programmed by a separate computer. - Recognising how the size of RAM affects the processing of data. - Learning the vocabulary associated with			Numerical data Output Planet Radio signal RAM Research Scientist Sequence Signal Simulation Space Subtraction Technology Transmit

		data: data and transmit. - Recognising that computers transfer data in binary and understanding simple binary addition. - Relating binary signals (Boolean) to the simple character-based language, ASCII. - Learning that messages can be sent by binary code, reading binary up to eight characters and carrying out binary calculations. - Understanding how data is collected in remote or dangerous places.			

		- Understanding how data might be used to tell us about a location. - Learn about different forms of communication that have developed with the use of technology.			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To identify how and why data is collected from space • I can identify a type of data which the Mars Rover may transmit back to Earth • I know the meaning of 'data' and 'transmit'	Pupils research and calculate the distance from Earth to Mars, using familiar objects, to help them visualise the journey that information has to travel to be sent and received.		**<u>Differentiation:</u>** **Pupils needing extra support:** During the activity, discuss with children what information the Mars Rover might send back. Reinforce that it has to actually send the data. The huge distance makes this a tricky task. **Pupils working at greater depth:** Could research the cost of the Curiosity mission and relate it to the value of another random item. This helps to reinforce the financial value of the data sent back from the Mars Rover. **<u>Key Questions:</u>**	• Mars Rover • Data • Space • Data transmission • Distance • Communicate • Design • Construction • Technology • Discovery • Planet • Scientist • Transmit • Internet • Research

	• I understand the challenges of transmitting data over large distances • I can give a reason why data is being collected from the Mars Rover		• What does 'data' mean? (Data is the information sent from computer to computer, or from one part of a computer to another part. It is numerical or a message written in a computer code.) • What does 'transmit' mean? (Transmit means to send. Data is transmitted or sent from one place to another – normally from one computer or device to another.) • What is the Mars Rover? • Why did NASA send a robot rather than a human? (It cost a lot less) • What information (data) can the Rover collect while it is on Mars? (Information taken from rock samples and images from the surface of Mars.)	• Moon • Signal
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To identify how messages can be sent using binary code	Pupils learn that, due to the vast distance from Mars to Earth, information collected by Mars Rover has to travel as 'data' and is translated into binary code	**Differentiation:** **Pupils needing extra support:** Pair them with a more able partner so that they can observe the able partner playing the game first, before they take a turn.	• Binary code • Numerical data • Sequence • 8-bit binary

	• To read and calculate numbers using binary code • I can identify binary as the most basic way computers communicate • I know how to read binary up to eight characters • I understand each one or zero is referred to as a bit • I can calculate binary numbers, knowing each digit is worth double the one that precedes it		**Pupils working at greater depth:** The activity is self-extending as there are two games with multiple levels. **Key Questions:** • How can we send data to/from the Mars Rover? • Can you recall the length of time it takes to send a message to the Mars Rover? • What will happen to the Mars Rover if it does not receive a message? • What will happen if the Mars Rover is not able to send its data back to Earth? • What are the problems sending a message to the Mars Rover?	• Radio signal • Transmit
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 3	• To identify the computer architecture of the Mars Rovers	Learning that the more Random Access Memory (RAM) the robot has, the more instructions it can carry out in a row, pupils play a game that simulates programming a Mars Rove	**Differentiation:** **Pupils needing extra support:** This activity is self-supporting and self-extending, but children who are likely to struggle are probably best paired with more confident	• Input • Output • Sequence • Instructions • RAM

	• I can identify sensors • I know the difference between computer input and output • I can explain how the size of random-access memory (RAM) affects the processing of data (CPU)		children so they can watch them before having their own turn. **Pupils working at greater depth:** The activity is self-extending, but children should be extended to consider why Rovers are not sent to Mars with greater RAM (cost implications) and to think of other useful sensors and output devices which could be included in the 2020 Rover. **Key Questions:** • What do you know about these words – input, processing, output? • Do any of the children have devices that are controlled by sensors? • Do they know what a CPU (Central Processing Unit) is? • Can you remember how the Rover might send data back to Earth? • Can you recall how many bits there are in a byte?	• Simulation • Byte • CPU
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To use simple operations to calculate bit patterns	Learning that computers use binary to carry out calculations, children perform their own addition and subtraction binary calculations	**Differentiation:** **Pupils needing extra support:** Instead of adding the two numbers, they could try to work out the value	• Binary numbers • Decimal numbers

	• I recall how binary can be used to represent numbers up to 255 • I recognise that computers use binary mathematically, to calculate • I can carry out binary addition (and subtraction)		of the numbers and calculate this way: E.g. 111 + 101 = ? 111 = 7 101 = 5 So, 7 + 5 = 12 And 12 in binary would be 1100 **Pupils working at greater depth:** Once they have managed to successfully add two 3-bit numbers, they should then extend to these activities: • Two 6-bit binary numbers. • Two 8-bit binary numbers. Three 8-bit binary numbers. **Key Questions:** • What can you remember about the learning from the last lesson? • Can you recall how Rovers require both RAM memory and Hard Drive memory? • What time is it? • How is binary used to send a message to the Mars Rover? • How does binary work? • Why is binary the best method for transmitting data to hard to reach places?	• Addition • Subtraction • Input • Output

			• What are the differences between RAM and a hard drive?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 5	• To represent binary as text • I recall that binary is the main means of all data transfer • I can read binary numbers to four bits • I know that data transfer needs a common language • I can use binary to create a written message	Pupils learn that as well as being used mathematically, binary can use the computer language 'ASCII', to represent characters, and use this conversion of the alphabet from binary to create their own messages	**Differentiation:** **Pupils needing extra support:** Less able children should work with a partner. They should be the ones who write the message (in English) that the astronaut wishes to send, which they then watch their partner translate into ASCII binary. They then switch roles so that they have had a chance to watch a more able student have a go before they do. **Pupils working at greater depth:** This activity is self-extending: Children should think about how to send a concise and relevant message, but also how to do so quickly and efficiently. They could also write a paragraph introducing their work, and what it means. **Key Questions:** • How many bits make a byte? (eight) • How many combinations are possible with one byte of data? (Eight bits = 255 – because eight bits of binary can be used to represent up to the number 255)	• Hexadecimal • Binary • Boolean • ASCII • Data

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
<u>Programming 2 - Micro;bit</u>	- To know that a Micro:bit is a programmable device. - To know that Micro:bit uses a block coding language similar to Scratch. - To understand and recognise coding structures including variables. - To know what techniques to use to create a program for a specific purpose (including decomposition). -	- Clip blocks together and predict what will happen. Make connections with previous programming interfaces they've used, e.g. Scratch. - Create their own images to make the animation and recognise the difference between 'on start' and 'forever'. - Recognise blocks they've used previously, identifying inputs and outputs used		English: Spoken Language – use spoken language to develop understanding through speculating, hypothesising, imagining and exploring ideas.	Algorithm Animation App Blocks Bluetooth Code block Connection Create Debug Decompose Designing Desktop Device Download Images Input Instructions Laptop Load Loop Micro:bit Outputs Pairing Pedometer

		and make predictions about how variables work. - Choose appropriate blocks to complete the program and attempt the challenges independently. - Break a program down into smaller steps, suggesting appropriate blocks and match the algorithm to the program. - Decomposing a program without support. - Predicting how software will work based on previous experience. - Writing more complex algorithms for a purpose.			Polling Predict Program Repetition Reset Sabotage Scoreboard Screen Systematic Tablet Tinkering USB Variables Wifi Wireless Wires

		- Programming an animation. - Iterating and developing their programming as they work. - Confidently using loops in their programming. - Using a more systematic approach to debugging code, justifying what is wrong and how it can be corrected. - Writing code to create a desired effect. - Using a range of programming commands. - Using repetition within a program. - Using logical thinking to explore software more independently, making			

		predictions based on their previous experience. - Identify ways to improve and edit programs, videos, images etc.			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To tinker with a new piece of software • I can predict what I think something new will do • I can explore something independently	Once children are introduced to the BBC micro:bit device, they investigate what it does and how it works		**<u>Differentiation:</u>** **Pupils needing extra support:** Focus these children on using the blocks in 'basic' including the 'on start' and 'forever' blocks that are there in the beginning. **Pupils working at greater depth:** Encourage them to build on each idea they have, before moving on to a new one. Ask them to reflect on what they've created and what they could do to make it 'even better'.	• Tinkering • Device • Micro:bit • Webpage • Tablet • Pairing • App • Menu • Instructions • Screen • Wireless • Wifi

	• I can explain what I found		**<u>Key Questions:</u>** • Why do you think we need to pair devices? • What do think is the difference is between a **wired connection** and the **wireless**, **bluetooth** connection? • What does '**coding**' mean to you? • What is '**tinkering**'? • Can you write a program with two different forms of input? • Can you make an animation on the screen?	• Bluetooth • Wires • Laptop • Desktop • Connection • USB • Download • Program • Coding • Internet • Animation • Input
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To program an animation • I can decompose an animation into a series of images • I can explain the difference between 'on start' and 'forever'	Using the BBC micro:bit, pupils work out how an animation is created before programming their own	**<u>Differentiation:</u>** **Pupils needing extra support:** Could use the icons to create the animation or give examples of 5 x 5 images to recreate on the squared paper. **Pupils working at greater depth:** Could create an animation with more images. Should control the animation by adapting the program so that it starts on an input, e.g. button a being pressed, or shake. **<u>Key Questions:</u>**	• Animation • Decompose • Animation • Images • Blocks • Program • Code • Instructions • Load • Reset • Program • Repetition • Loop

	• I can choose the blocks I need for my program		• Which one of these blocks will we use for this project and why? • How many images make up your animation? • How did you make it look like its moving? • Where did you get your idea from? • What would you do next to improve it?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 3	• To recognise coding structures • I can identify some code blocks • I can predict what a block/program does • I can explain why/how a program works	Children learn that the BBC micro:bit can be used as a polling program, recording how many people feel happy, neutral or sad about a topic	**<u>Differentiation:</u>** **Pupils needing extra support:** Encourage children to use the colours and icons to help them locate the blocks within the sections. Focus on familiarity with the blocks and interface rather than their understanding of variables at this time. **Pupils working at greater depth:** Challenge these children with sets of 'what if' questions to do with the program they create. Do they agree what will happen? What if… • there were no instructions under 'on start'? • we changed 'set [variable]' to 5?	• Polling • Program • Coding • Block • Decomposing • Designing • Predict • Variables • Animation

			• we changed 'change [variable]' to -1? we wanted to stop the same person pressing the button lots of times by accident? **Key Questions:** • What blocks do you recognise? • What do they do? • What are the inputs/outputs of the program? • Can you predict what the dark red coding blocks are for? • What do you the word '**variables**' means? • Does this make people happy, sad or neutral?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To create a program • I can recognise code blocks • I can decompose a program • I can debug a program	Children investigate how to turn the BBC micro:bit into a pedometer and work on developing their debugging skills further	**Differentiation:** **Pupils needing extra support:** Use blocks provided and focus on the sequence when combining them. **Pupils working at greater depth:** Should decompose the project independently. **Key Questions:** • Which blocks do you think we will need?	• Programming • Pedometer • Code block • Decompose • Debug • Program • Variables • Code • Programmer • Inputs

			• What inputs/outputs will your program have? • How will you use variables?	• Outputs • Systematic
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 5	• To create a program • I can decompose a program • I can write an algorithm • I can debug a program	Children get to see their coding come to life when using the BBC micro:bit as a scoreboard for a rock, paper, scissors tournament	**Differentiation:** **Pupils needing extra support:** Part of the program has been done for them to focus on the outcomes they can see. **Pupils working at greater depth:** Should be challenged to create additional features. They should try and suggest their own improvements but if they cannot think of any, ask them to program a 'reset' button. **Key Questions:** • What is an 'algorithm'? • Which blocks do you think you'll need? • What inputs/outputs will your program have? • How will you use variables?	• Programming • Scoreboard • Create • Decompose • Debug • Code blocks • Algorithm

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
<u>Creating Media - Stop Animation</u>	- To know that decomposition of an idea is important when creating stop-motion animations. - To understand that stop motion animation is an animation filmed one frame at a time using models, and with tiny changes	- Create a toy with simple images with a single movement. - Create a short stop motion with small changes between images. - Think of a simple story idea for their animation then decompose it into smaller parts to create		Art and design – develop techniques, including their control and their use of materials, with creativity and experimentation. Improve their mastery of art and design techniques, including drawing, painting and sculpture with a range of materials [for example, pencil, charcoal, paint, clay].	Animation Animator Background Character Decomposition Design Digital device Edit Evaluate Flip book Fluid movement Frames Model Moving images Onion skinning Still images Stop motion Storyboard

	between each photograph. - To know that editing is an important feature of making and improving a stop motion animation.	a storyboard with simple characters. - Make small changes to the models to ensure a smooth animation and delete unnecessary frames. - Add effects such as extending parts and titles. - Provide helpful feedback to other groups about their animations. - Decomposing animations into a series of images. - Decomposing a story to be able to plan a program to tell a story. - Using video editing			Thaumatrope Zoetrope

		software to animate.			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To understand what animation is • I understand and can explain what 'animation' means • I can explain the history of animation	Children discover the original forms of animation, including the flip book, zoetrope and thaumatrope, before having a go at making one of these toys themselves		**<u>Differentiation:</u>** **Pupils needing extra support:** Should focus on developing the *Activity: Thaumatrope template* animation. **Pupils working at greater depth:** Can add two objects/characters to their design of a zoetrope or flip book. **<u>Key Questions:</u>** • Which toy would you like to create?	• Animation • Still images • Moving images • Thaumatrope • Flip book • Zoetrope • Frames

	• I can create my own 19th century animation toy		• What animation will you show? • How will you make sure your animation is fluid? • Have you tested your animation? • Was the animation toy easy to create? • Was it easy to make the animation movements small? • How did I ensure the object was in the correct place on each image? • Did I encounter any other problems?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To understand what stop motion animation is • I understand and can explain what 'stop motion' means • I can take photos of an object	Taking inspiration from the Wallace and Gromit animations, pupils learn how to take still images using a digital camera and are shown how to edit these images together using Microsoft Photos	**<u>Differentiation:</u>** **Pupils needing extra support:** Should be given help to make small, simple movements. Encourage them to make mistakes and discuss what they could do to improve. **Pupils working at greater depth:** Should break their blob into two pieces and try to animate two blobs at a time. Remind them that they will need to move both	• Stop motion • Animation • Digital device • Digital device Frame • Editing • Photos • Still image

	• I can make small changes to my object between each photo • I can follow the steps in using an editing piece of software		blobs between every shot and to keep the movements small. **Key Questions:** • Does the plasticine move by itself? • What can you see moving in the first few seconds of the film? • What if you squish it a bit? • Can you make your changes really small to make the animation really detailed? • What happens if you make the movements too big? (The animation looks shaky and odd.) • Where do we save our images? • What duration speed works best? • Do we need to delete any frames?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 3	• To plan my stop motion video, thinking about the characters I want to use	Children plan a themed stop motion animation, thinking about the characters they want to use and the steps that will be involved in creating their brand new animation	**Differentiation:** **Pupils needing extra support:** Should be given the *Activity: Storyboard example.* Can be given an idea to work on together to decompose into a storyboard.	• Script • Animation • Frames • Storyboard • Decomposition

	• I can work collaboratively with others to plan a storyboard for an animation • I can think carefully about keeping my animation idea simple • I can decompose my story into smaller parts		**Pupils working at greater depth:** Should take a lead in their group animation. **Key Questions:** • How was the animation created? • Why was it useful to have a storyboard plan first before starting their animation? • Did anything surprise you about how the animation is created? • What will your animation be about? • Will you use one or two objects? • How will you ensure you create small movements?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To create a stop motion animation • I can create a simple animation following my storyboard plan	Children work in groups to record their animations, using their planning sheets from the previous lesson.	**Differentiation:** **Pupils needing extra support:** Can be in charge of referring back to their storyboard to make sure their group tells the story through the animation. **Pupils working at greater depth:** Should constantly review the animation to identify any	• Stop motion • Animation • Model • Character • Frame • Design • Animator • Background • Decomposition

	• I can change my plan to recognise when something is too difficult to animate • I understand the importance of keeping the camera still and making small movements between shots		frames that need to be deleted and should include multiple sets or characters in their animation. **Key Questions:** • What have you planned in your animation? • Does your plan make sense? Why? Why not? • Would you like to make any improvements since the last lesson? • Did you create what you set out to make? • What challenges were there? • How did you overcome these challenges?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 5	• To edit and assess my stop motion animation • I can create an animation project in Microsoft Photos • I can delete frames	Children edit their stop motion animations and explore ways to extend them further.	**Differentiation:** **For pupils needing extra support:** Focus just on deleting frames not needed and adding a title. **Pupils working at greater depth:** Should be able to offer a range of suggestions on how to edit and add effects to their animation and offer constructive criticism in their film reviews. **Key Questions:**	• Stop motion • Animation • Edit • Effects • Evaluate • Frames • Fluid movement

	• I can duplicate frames to extend my animation • I can add titles and effects • I can assess my animation		• How can you make those frames smoother? • Is there a way to extend your animation?	

Computing Strand & Link to National Curriculum	Progression of Knowledge	Learning Objectives & Skills Progression	Hardware & Software	Cross Curricular Links	Key Vocabulary
Skills Showcase - Mars Rover 2	- To understand that bit patterns represent images as pixels. - To understand that the data for digital images can be compressed. - To know the difference	- Create a pixel picture, explaining that a pixel is the smallest element of a digital image and that binary is used to code and transfer this data. - Save a JPEG as a bitmap and		Art & Design – art and design techniques, including drawing, painting and sculpture. English: Spoken Language – develop understanding through speculating, hypothesising, imagining and exploring ideas. RSE: Online Relationships – online friendships, sources of information including an	3D Algorithm Binary image CAD Compression CPU Data Drag and drop Fetch, decode, execute ID card Input JPEG

	between ROM and RAM. - To understand various techniques that will improve the design of a 3D object (using CAD software).	recognise the difference in file size as well as explaining how pixels are used to transfer image data. - Explain the 'fetch, decode, execute' cycle in relation to real-world situations. - Create a profile with a safe and suitable username and password and begin to use 3D design tools. - Independently take tutorial lessons, applying what they have learnt to their design and understand the importance of using an online community responsibly.		awareness of the risks of strangers.	Memory Online community Operating system Output Pixels RAM Responsible RGB ROM Safe

		- Learning the difference between ROM and RAM. - Recognising how the size of RAM affects the processing of data. - Understanding the fetch, decode, execute cycle. - Learning how the data for digital images can be compressed. - Recognising that computers transfer data in binary and understanding simple binary addition. - Understanding how bit patterns represent images as pixels. - Using logical thinking to			

		explore software more independently, making predictions based on their previous experience. - Independently learning how to use 3D design software package TinkerCAD. - Learn about different forms of communication that have developed with the use of technology.			
Lesson	Success Criteria	Lesson Outline		Differentiation and Key Questions	Key Vocabulary
Lesson 1	• To understand how bit patterns represent images as pixels	Pupils learn that a pixel is the smallest element of a digital image and that binary is used to code and transfer this data, as well as creating their own pixel art		**<u>Differentiation:</u>** **Pupils needing extra support:** Create an excel spreadsheet with the correct row/column width. These students could then be directed how to open this on their device, and spend more time filling in the pixels, rather than adjusting the size.	• Input • Output • Memory • Pixel • Binary image

	• I recall how computers transfer data in binary • I can relate 8-bit binary to 256 possibilities • I know that a pixel is the smallest possible element of a digital image • I can explain how a series of pixels are used to encode an image		**Pupils working at greater depth:** These students could adjust the column width/row height to be even smaller so that they have more "pixels", or could simply zoom out. Also, they should be encouraged to think about shading images using a range of colours, not just the primary ones. **Key Questions:** • What do you think is the most useful data that has been or could be sent back from the Mars Rover? (There is no "answer" to this, but most would suggest that the digital images are the most valuable.) • How is binary used to transfer the data of a photo?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 2	• To explain how the data for digital images can be compressed •	Pupils discover different image formats and learn why some are more appropriate for images sent from Mars, learning how compression works at a basic level.	**Differentiation:** **Pupils needing extra support:** Work in partners and observe the more able partner. Then switch after the more able partner has completed, enabling the less able partner to understand what is required of them.	• Compression • Pixels • JPEG • ID card • Data • RGB • RAM

	• I recall that images are made of pixels • I can relate the number of pixels to the size of an image. • I can explain one of the methods of JPEG compression • I can explain how to reduce the file-size of a digital image		**Pupils working at greater depth:** Should experiment with the possibilities of the style of presentation and use Excel to help them to calculate exactly how many bits there are in each version of the image. **Key Questions:** • How long would it take to reassemble the mosaic? • How much data is the Mars Rover sending in this billion pixel image? (At least one billion multiplied by 24 bits because each pixel requires 24 bits of data, so 24 billion ones and zeros)	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 3	• To identify and explain the 'fetch, decode, execute' cycle • I understand the difference between ROM and RAM	Children learn about how the Mars rover follows instructions while developing their understanding of how computers work, including their RAM and ROM	**Differentiation:** **Pupils needing extra support:** The games should be easily accessible to all and have a 'help' button. **Pupils working at greater depth:** Should be encouraged to take a screenshot of the game, paste it into a Word document, and then write an	• ROM • CPU • RAM • Fetch, decode, execute cycle • Algorithm • Operating system

	• I know what fetch, decode and execute look like in different contexts and examples • I can explain the fetch, decode, execute cycle		explanation of the fetch, decode, execute cycle. **Key Questions:** • Which groups successfully completed the challenge? Why? • What did they find most difficult about this? • Why aren't instructions sent to the Mars Rover one by one?	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary
Lesson 4	• To create a safe online profile and tinker with 3D design software • I can choose a safe and suitable username and password • I understand the importance of keeping personal information safe	Pupils design a new tyre for the Mars rover using online 3D design software	**Differentiation:** **Pupils needing extra support:** May need support in creating their profile, providing them with a username and write it down so that they don't forget it. You could also get children to write down their passwords for you so that they are not forgotten. Give these children access to the TinkerCAD tutorial video, perhaps as a web link, so that they have the chance to watch and re-watch it as they follow the steps. **Pupils working at greater depth:** Should be directed towards the 'Learn' tab at the top of TinkerCAD. Using these	• 3D • Drag and drop • CAD • RAM

	• I can begin to use 3D design software		online lessons and tutorials, they can learn all the skills they need independently (this is part of the learning for the following lesson, so note which children reach this stage in this lesson). **Key Questions:** • Why do you think the Mars Rovers have always had six wheels? (Six wheels gives greater stability and if one or two of the wheels failed, the Rover could still move.) • Can you guess the weakness of the Scarecrow Simulation Robot? (The wheels don't grip on sand and wear out relatively quickly on a rocky surface. Note all the holes in the wheels, and how the sand starts to build up inside the wheel.) •	
Lesson	Success Criteria	Lesson Outline	Differentiation and Key Questions	Key Vocabulary

Lesson 5	• To modify the design of a 3D object using CAD software • I can undertake independent online tutorial-based learning • I can name my object • I can share my object to an online community • I can discuss how to use an online community responsibly	Children take greater responsibility for developing their skills, independently taking 3D design tutorials and then applying what they have learnt to further improve their Mars rover tyre designs	**Differentiation:** **Pupils needing extra support:** Could be paired with more confident readers who can help them to access the guidance in the tutorials. **Pupils working at greater depth:** Should independently access and learn the design skills available within the software. Once they have completed their own design, challenge them to look at the 'Projects' to further develop their skills. They could also look at a design by another designer on the site and download a copy of the design and 'tinker' with it to make modifications and improvements. **Key Questions:** • What types of design work are computers used for? (Designing objects to be created, e.g. buildings, cars etc, or for animation)	• CAD • Safe • Responsible • Online community • 3D