Year 6	Topic Title: CommonSense – Don't feed the phish!	Key Vocabulary
National Curriculum Objectives: Use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.	Year 6 learners are sharing and participating online, but face risks around issues such as screen time, online privacy and navigating misinformation. The objectives below will help learners practise responsibility, respect and resilience as they engage as citizens of the digital world. **Finding Balance in a Digital World** • Reflect on common online and offline activities. ▪ Explain that connected 24/7 is part of our culture. People can be online at anytime. What are the benefits of this? ▪ Digital Media…What is it? (text, audio, images, video and devices) ▪ What are the benefits of offline activities? ▪ Explain there are positive aspects to being online and offline. Media balance is using media in a way you feel healthy and in balance with other parts of your life. • Identify ways to 'unplug' to maintain a balance between online and offline activities. ▪ Children will need to come up with as many ways as possible they can be 'unplugged' Encourage a discussion about feelings and how we can have more balance in our lives. • Use the 'Digital Habits Checkup' routine to help achieve more media balance. ▪ Digital habits are behaviours we do often and regularly with digital media and devices. Habits are done automatically, sometimes without thinking about it. Examples include: Checking your phone when you wake up, listening to music on a walk, playing video games before bed. Allow the children to discuss their digital habits. ▪ 'Digital Habits Checkup'- Children will think about what their online habits are, how they make them feel and what can we do to have more balance in our lives. This is a thinking routine that helkps learners identify their media habits and make positive changes to support their well-being. ▪ Have the children identify a digital habit that gives them a 'red flag feeling' If certain activities or habits result in feelings that make you uncomfortable then that is a red flag. It is important that children think about what is causing it and what they can do about it. ▪ One helpful way to handle a red flag feeling is to 'unplug' recheck the children's understanding of this term and what it means. Children will be able to identify their red flag habit and find ways in which they could 'unplug' in order to diffuse their feelings. ▪ Children could be set an 'unplug challenge' encouraging them to record their activities in a day where they haven't used any devices and have carried out 'unplugged' activities. **Don't Feed the Phish!** • Compare and contrast identity theft with other kinds of theft. ▪ Ask the children to discuss something they own that someone else might want to steal? Why? ▪ Explain to students that in reality, the thing you own that might be the most valuable, and most likely to get stolen, is nothing at all; it is your identity. What do you think that means? How could somebody steal your identity? Ask for the children to respond to this. They might say it means that someone can pretend to be you or someone can get your information. Follow up by asking children to explain more and clarify any misconceptions. For example, identity theft might mean that one or more pieces of information about you has been stolen, not that everything about you has been. It also doesn't mean that you no longer have what's been stolen (as in the case of a stolen object) you are still you and your identity hasn't changed.	Digital Media Media Balance Red Flag Feeling Identity Theft Internet Scam Phishing Private Information Shortened URL

	▪ Ask children what is meant by private information? What would be an example of private information? Ask the children to respond and provide them with examples. Define private information is information about you that can be used to identify you because it is unique to you (Such as your name, phone number or address) ▪ Children must understand that identity theft is important to know about because if your identity is stolen, it can lead to some pretty bad consequences. You may not even know about these consequences until var into the future. If your identity is stolen, it could potentially enable somebody to steal money from you, apply for credit cards in your name and buy things, bully someone online while pretending to be you, create false identification documents, apply for a loan, get a drivers licence or a job under your name. • Describe different ways that identity theft can occur online. ▪ One way that someone can train steal an identity on the Internet is by getting you to click a link or enter information about yourself. This is called an Internet scam. This is an attempt to trick someone, usually with the intention of stealing money or private information. ▪ One of the most common ways identity thieves get your private information is through something called Phishing. This is when someone poses as an institution, such as a bank or a school, and send you a personalised message asking you to provide private information. Children might think of Phishing as similar to fishing someone trying to catch people's private information like trying to catch a fish. ▪ Explain that some website links are not what they seem. Why do you think the links might try to trick someone? A shortened URL is a web address that has been condensed in which could potentially mislead a user into clicking into a risky website. Are risky website may instal malware on your device, steal your information, or charge you money. • Use message clues to identify examples of phishing. ▪ Children will and analyse examples of messages that use tricks to fish for your information. Summarise how checking for clues that indicate phishing can help protect you from identity theft.	
	Previous Learning Experiences:	
	FSU,Year 1, 2, 3, 4 and 5 Previous E-Safety lessons.	
Possible Community Links/trips	**Future Learning Experiences:**	
	Future E-Safety lessons as they move on to secondary school.	

Year 6	Topic Title: Introduction to Python	Key Vocabulary
National Curriculum Objectives: Design, write and debug programs that accomplish specific goals. Use sequence, selection, and repetition in programs.	• **<u>To tinker.</u>** This topic focuses on creating art using the programming language Python, which is used in business and industry. The children often like the connexion that it is a real programming language. The first 2 sessions use a simpler text-based language called logo to prepare the children for Python style commands. ▪ Before starting these sessions both 'MSWLogo' must be downloaded onto the laptops and Logotacular on iPads. ▪ As a logo and Python are text- based programming languages, typing in space are really important. To a computer, FD70 and FD space 70 are not the same thing and this will be an important part of their learning. Begin by drawing a robot, asking pupils to give you the instructions for drawing a square. Tell them that you can understand the instructions forward, backward, right, left. Forward and backwards at this stage can be given in centimetres with left and right being degrees. Give them time with a partner in a whiteboard to complete their instructions. Be pedantic with children's instructions, it's funny for the children to see the drawing going wrong, but it's also an important lesson in being specific. Encourage the children to be specific including instructions such as forward followed by a number right followed by a number. It would be even better if they might suggest repeat. ▪ Tell pupils that they are going to be learning to make use of speed and precision that a computer works out to create complicated artistic patterns with only a few lines of simple code. Explained that they will start using a programming language called logo, which was invented to help children learn to code, but that then they will go on to use the language Python, which is used in businesses all around the world. ▪ Logo doesn't understand the words forward and backward like the teacher robot did, so we have to learn the commands it knows. Start with: fd, bk, rt, lt, ask the children what they think these stand for? ▪ Explain the computers don't measure in CM like we do, they use pixels. Pixel is a small dot in a computer screen, but its actual size is different depending on how big your screen is. However, if we tell the computer to move FD10 which is forward 10 pixels, this isn't very far and you probably won't see it! 100 pixels is a better suggestion for line length. Children may be familiar with this from scratch as the move block also takes values which move in pixels. ▪ Model writing FD10 and FD100 using logo on your interactive board, so the children can see the difference. Most logo programming environments run code a line at a time, so every time you write one instruction you run it, unlike other languages where you write several instructions before running it. Set the children challenges of drawing a number of shapes using this code. ▪ Introduce the repeat command there are a few logo environments that use our PT instead of the word repeat, so cheque this is what in whatever you are using. Now that the children have the use of the repeat option, they can create all sorts of crazy designs. Challenge children to create interesting patterns using their tinkering skills, taking a look at the logo patterns for some inspiration. ▪ Share examples of the code and designs that the children have created today. Print some of the designs and add to a working display. • **<u>To understand Nested Loops</u>** ▪ Ask for a child robot volunteer who is good at following instructions and get them to stand at the front, facing away from the class and with a clear path in front of them. ▪ Explain that the child robot will be given the command 'jp' or 'fd' = 'jump' or 'take one step forward'. The child robot must wait until told to run the program (which will be written on the board so that the class can see). ▪ After the child has run the code, the rest of the class should show thumbs up/down to see if they think the robot completed the actions correctly, justifying their opinion. Start with something like: jp	Algorithm, Code, Computer Command, Decompose, Import, Indentation, Loop, Nested Loop, Random Numbers, Remix, Script Libraries, Variable.

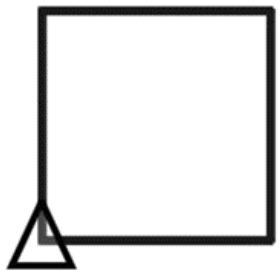
fd
fd
fd
jp
fd

- Watch the child robot and check they jump, take three steps forward, jump and then move forward one last time. Check with the class thumbs up/down to ensure the majority are understanding.
- Now choose a different robot, and this time use code with a repeat: repeat 3[fd] jp
- Watch the child robot and check they walk forward three times and then jump once. Check with the class thumbs up/down to ensure the majority are understanding.
- Repeat this again with another puzzle: repeat 3[fd jp] Watch the child robot and check they walk forward, then jump, forward, then jump, forward, then jump (three times). Check with the class thumbs up/down to ensure the majority are understanding.
- This is vital, as a common misconception is that they should move forward three and then jump three times. They should think of a repeat as a loop (where they're always going back to the beginning).
- If the children aren't confident about this, practise some more in the same way before moving on.
- Now try: repeat 3[fd repeat 2[jp]] Watch the child robot and check they walk forward, jump twice, walk forward, jump twice, walk forward, jump twice (three times). Check with the class thumbs up/down to ensure the majority are understanding. Repeat similar code examples to these as often as necessary until the children are confident in understanding nested loops (a loop inside a loop).

Key question

What is a loop?

- Ask the children to look at the following code and tell you what it does: repeat 4 [fd 100 rt 90]
- It draws a square. Run the code in Logo on the interactive board so that they can see this.
- Now ask: How could you tell the computer to draw 10 squares? What would be the easiest way to do this? They should come up with something like this: repeat 10[repeat 4[fd 100 rt 90]]
- Run the code they suggest in Logo and see what happens. It should look something like this (the small triangle is the turtle in this version of Logo):



- What happened? Why is there only one square? The answer is that all our squares were drawn in the same place, so it's drawn around that same outline 10 times. How could we fix this?
- When we've finished drawing the first square, we should turn before we start drawing the second one, and so on: repeat 10[repeat 4[fd 100 rt 90] rt 36]

- Ask the children why we would turn 36 degrees after each square if we're drawing 10 squares? To get all the way around the circle we need to turn 360 degrees in total.
- Run the code in Logo to see it in action. Then copy the same code again, but this time swap the 10 and 36 around to see the difference in shape. Can the children explain the difference? Eg: there are now more squares and therefore more lines in the drawing.
- Tell pupils to spend the rest of the lesson exploring repeating patterns with nested loops. Display the *Logo Shapes* resource as a reminder of the basic commands they can use and also to provide the internal angles for basic regular shapes so that they can experiment.
- Challenge children to create the most interesting designs, encouraging them to 'print screen' or screenshot any of their favourite designs, to share later.

Key questions

- What is a loop for?
- What instruction do we have to give to the computer for it to understand that it needs to loop?
- What do you think this code does?
- How could we improve this?
- Which instructions should be repeated?
- Which order will the instructions be run in?
- How can we make more than one square?
- Why can't we see more than one shape?
- Where are you telling the computer to turn before drawing another shape?
- What does this line of code do?

- Ask children to choose the design they most like and to open it on their screen. Then, get half of the class to walk around the room and look at the computers, whilst the other half of the class stand by their designs to answer any questions. You must also give them time to swap roles so that everyone gets a chance for their work to be looked at and discussed.

- **<u>To understand basic Python commands</u>**
  - Get pupils to work in pairs and ask one in each pair to close their eyes. Show the rest of the children the *Attention grabber image*. Tell them they are not allowed to use the word 'house'. (Point to this as you don't want the others to hear this!) Then they must give their partner instructions to create the drawing you are showing them.
  - Turn off the screen and 'Partner 1' who has seen the image then gives 'Partner 2' instructions. 'Partner 2' draws exactly what they've been told.
  - Share the creations and ask successful partners to share the instructions they gave. Hopefully, they will be something like:
- Draw a horizontal rectangle.
- Draw a triangle on the top of it.
- Draw two squares in the rectangle with a space between them.
- Draw a vertical rectangle in the middle of the horizontal rectangle to below the height of the squares.
- This has enabled the children to decompose the drawing before they tackle creating it in the code.

Key questions

- What do you need to do to draw this picture?
- What similarities and differences do you notice between Logo and Python?
- How do you make the turtle move?

- What bit of your code draws the house?
- How can you fill a shape?

- Explain to children that they are going to be working with Python, a real programming language which is used to build many websites, including YouTube and Google.

- **<u>Understanding the Python Turtle library and commands</u>**
- Show children the code and explain the code.
- The green text after the hash symbol is called a 'comment' in Python – it means text that does not run as code, but is useful information for someone else looking at your code (or to remind yourself when you forget at a later date).
- Use the comments in this code to explain what each bit does.
- The first line of the code, '**import turtle**', allows us to import the turtle library and allows all the Python turtle commands to be made available. You usually have to import libraries before writing code in Python as this allows you to run pre-written code. In this case, it allows you to use the Python turtle commands within your script. Without libraries, users would need to write hundreds of lines of code to complete simple tasks.
- Second line, we create a '**variable**' which we are calling 'tina' – you could put anything there as the title of the variable. The key thing here is that using the word 'tina' later in the code will help run the **turtle. Turtle()** command.
- The children are going to create something called a '**function**', which sets the start position of the turtle. You might spot '**setx**' and '**sety**' within the code – these refer to x and y coordinates.
- Finally, we run the function we have defined, run a clear command and set the turtle '**pen**' to be down and ready to start creating.

<u>Drawing using Python Turtle commands</u>
- Now hand out or display the *Activity: List of Python Turtle commands* and make connections with the work the children have been doing with Logo.
- Slide 8: note the need for 'tina' before instructions, as this is what their turtle is called, and the need for () after instructions. The brackets tell the computer that it is an instruction it must do rather than just some text to show on the screen. It is also worth drawing their attention to the 'misspelling' of colour. Whilst not the English spelling, color is the spelling most programming languages use.

<u>Activity one</u>
- Hand out or share the *Activity: Python Turtle commands for a house – part 1.* Then, get the children to open the 'Trinket base code'. Ask the children to either copy or type the code from the *Activity: Turtle commands for a house – part 1* into the 'Trinket base code' to see what it produces. After they have done this, get the children to discuss any findings from the code.
- Ask the children then to remix the code to produce alterations to the house.

<u>Activity two</u>
- Hand out or share the *Activity: Python Turtle commands for a house – part 2*. Then, get the children to copy or write the code into 'Trinket base code' again to initially see what it produces. Ask the children what similarities or differences they have noticed from *part 1* or *2.*
- Ask children to remix their own versions of the code to make alterations to the house.
- Note: using Python to write loops will be looked at later in the topic, so for now, stick to basic commands.

- Stop the children from creating any more code for their picture and ask them to discuss what their code does.

- This is a really important assessment opportunity that allows you to see what they understand and what they've just figured out through trial and error. Get them to comment on aspects of code such as:

- #start of house rectangle
- #house colour set to …
- #start of triangle roof
- #start of square windows
- #start of door

- Children can then share a link with you so that you can see their progress.

To use loops when programming.

- Remind the children of the work they've been doing to program art, particularly their learning in Python in the previous lesson.
- Get the children in pairs or individually on their computers to look at the code from this 'Trinket base code' - https://trinket.io/python/3aa9351fc6 which contains the following code:

```
import turtle tina = turtle.Turtle()
def home(): tina.penup() tina.setx(-140) tina.sety(15)
home() tina.clear()
tina.pendown()
```

- Explain that today they will be programming Islamic art, as it features lots of repeating patterns. They will use the shapes and colours that they recognised from the images they looked at earlier.
- Get the children to comment on the code. What does each bit do? The exact wording does not matter, but they should suggest something like:

```
import turtle #get turtle
tina = turtle.Turtle() #name the turtle tina

def home(): #a function to tell the turtle where to start
tina.penup()
tina.setx(-140)
tina.sety(15)

home() #run the code to start in the top corner
tina.clear() #always start with a clean page

tina.pendown() #get ready to draw
```

- They then run the code in this 'Trinket loop code' - https://trinket.io/python/3aa9351fc6 and 'remix' the project, so that they can explain how the code that has been added on works. In this case: for i in range(4): tina.pendown() tina.circle(50) tina.penup() tina.forward(80)

- Explain to the children the following:
- The '**for**' is a loop . It repeats four times (**(4)**). Drawing (**pendown()**) a circle with a diameter of 50 pixels (**circle(50)**), picking up a pen (**penup()**), moving forward (**forward(80)**) and then drawing another circle.

Note: The line for **i** in range(4) means that for every whole number, or **integer**, repeat the sequence. In this case, it means to repeat the sequence **four** times – the sequence will repeat as many times as you have specified in the brackets.

- You may notice that the code within both the function 'home' and the 'for' loop is indented. A lot of coding languages use indentation to indicate which code belongs to part of a function or loop. In Python, you can use the tab or space key for indentation – just be consistent with which one you use.

Tinkering challenges

Now give the children the following separate challenges to tinker with:

- Get the code to draw 6 circles for i in range(6)
- Get the code to have a 30 pixel gap between circles – tina.forward(30)
- Get the circles to be 40 pixels in diameter – tina.circle(40)
- Change the colour of the lines by altering the red, green and blue values of tina.pencolor(r, g, b)
- Fill the circles with colour by altering the red, green and blue values of tina.fillcolor(r, g, b)

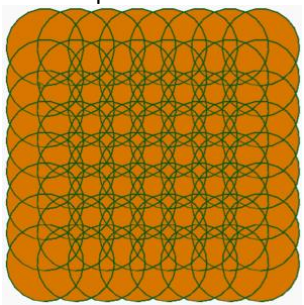
- Use the *Activity: Tinkering challenge code examples* as a reference for the code that is required to achieve each numbered challenge.

- Please note that the children should 'reset' the code after doing each challenge. This is how to achieve this:

Step1: Go to the burger menu (three lines) at the top left-hand corner.

Step 2: Press 'Reset' button.

Then stop the children and show them the following design:



- How do they think this can be recreated? Can they decompose it into smaller shapes?
- It's eight circles along, filled with orange, outlined in green, and there are eight rows down. The code for this design is located in *Activity: repeated circled design*, which comes from the 'Activity: Repeated circle design program' - https://trinket.io/python/593bc13fbf

- Draw their attention to the syntax for the previous loop that we saw. Discuss how it's made up:

- Now handout *Activity: repeated circled design* code sheet to the children to input into Trinket so they can create their own tinkered version of the repeated circles.

Note: To create the design above, the shapes were filled and then drawn again without fill so that the outline could be seen.

- Finish the session by showing children this code on 'Activity: Decagon repeated pattern'- https://trinket.io/python/00b9be52e0
- Explain that as their programming skills develop, they will be able to make more complex versions of what they are creating which will enable them to make more flexible code. Within the example above, show the children this code:

```
sides = 10
size = 30
spacing = 40
lineLength = 8
numRows = 8
```

- Explain that by changing these numbers the computer will create a unique piece of artwork.

Ask them to choose some numbers for the following:

- How many sides should the shape have?
- How wide should the shape be?
- How much space should there be between two shapes that are next to each other?
- How many shapes should there be in one line?
- How many rows should there be?

Run this a few times so that the children can see the variations it causes.

- **To understand the use of random numbers**
- Show children 'Piet Mondrian's page' on the Google Arts and Culture website, introducing the artist and viewing his work and the background information.
- Use the 'zoom' function when looking at the artwork, as the high resolution images they have used to capture these pieces mean that you can get close enough to see each brush stroke.
- If possible, give children time to explore the art on their own, drawing conclusions about their likes and dislikes of this artist's work and discussing similarities and differences across the pieces. Can they hypothesise which is an earlier piece and which a later one?
- After the initial exploration, run this program for the children. Before running it a second time, ask children to think about how the program is created – what might the code look like?
- Run it a third time and ask if there's anything else they notice. Is it always the same?

Collate basic observations through this discussion:

- Rectangles are drawn one at a time.
- Sometimes a rectangle is coloured in.
- Rectangles appear in different places around the screen.
- Sometimes rectangles overlap each other.
- When you run the code another time, the rectangle is in different places.
- What instruction do you think we could give to the computer to get it to appear in different places around the screen? Random. Computers aren't very good at being random, but most programming languages have an instruction built into them so that it will choose numbers without having to be told to.

Key questions

	• What do you think of Piet Mondrian's artwork? • Can you see any similarities in Mondrian's artwork? • What does the program do? What do you notice? • What changes in the program each time you run it? • What instructions has Tina the turtle been given? • When does the pen need to be up/down? • Why is a loop helpful in this program? • Where is the conditional used? What does it do? • How can last lesson help us with today's code? • Now, share the link with children for them to explore further. Explain that you want them to write the algorithm for how the program works – what has Tina the Turtle been asked to do? • Work with those who need support as a group, encouraging structured instructions; e.g. first Tina draws a rectangle, then she moves to a new place. • The rest of the class should be paired in mixed abilities so that they can share ideas and support each other. • Encourage the children to run the code regularly to check what it's doing rather than make assumptions/guesses. Even when they think they have their algorithm, they should run the code and check that it works. Their algorithms should look something like this: • set up turtle • 2.repeat 10 times • put pen down • draw rectangle • lift pen up • move to a random place • put pen down • draw rectangle • lift pen up • move to random place • put pen down • draw coloured rectangle • lift pen up • move to random place • Children often miss out the 'pen up' and 'pen down' instructions. To help them see this, model following their algorithm, drawing the rectangle as instructed and when told to move to the next random place, keep the pen on the board and draw that line. **<u>Mondrian remix</u>** • Show the children the code for the 'Mondrian program'. See the *Teacher resource: Code analysis* to help explain to the children what each part of the code means. • Then, give them the link and encourage them to read the comments before remixing, setting the following challenges based on abilities:	

	• The function from line 6 to line 11 draws the rectangle. If you wanted to draw a triangle, you could change it to: def triangle(triWidth): # for i in range(3): tina.forward(triWidth) tina.right(120) and change line 32 to: triangle(random.randint(30,70)) ▪ Give pupils the chance to show off their artwork to their peers. ▪ Finally, get children to instruct your amendments to the original program to create a class art piece.	
	Previous Learning Experiences:	
Possible Community Links/trips	**Future Learning Experiences:**	
Virtual artist talk Museum/gallery showing virtual art.	Future computing experiences and lessons throughout high school.	

<table>
<tr><th>Year 6</th><th>Topic Title: SATS Revision Guide</th><th>Key Vocabulary</th></tr>
<tr><td rowspan="4">National Curriculum Objectives:

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.</td><td colspan="2">In this unit, children will be designing a revision guide for their upcoming exams that they can use to help them revise. The children will be using a variety of programmes such as Microsoft Word and Microsoft PowerPoint to create a range of resources they can use in the future.

▪ The children will conduct research using various search engines for the information and the topics that they wish to revise. They will also be using a variety of hard copy revision guides so that they can get an idea of what they need to produce. Once the children have collated their information, they will then need to decide the best way to show this information and the best way in which they think they can help themselves revise. They can also use their guides for someone else and they this would be a good thing for them to think about as they are designing their revision guides so that they can make it easy for other people to use. Such as the children in their class.

▪ Once the children have collated their information, they can open programmes such as Microsoft Word to create posters that focus specifically on one individual topic they wish to revise. The children can use Microsoft Word to also create flash cards that will create small cards with questions on the front and answers on the back of a specific topic. They can create revision cards; these will break topics into manageable chunks to make them easier to learn in an A5 size format. The children will be also able to design revision notes on Microsoft Word that will share detailed notes on a specific topic for them. Using the word art and mind mapping tools on Microsoft Word the children will be able to create a mind map or a diagram that breaks the revision topic down into easier, manageable chunks.

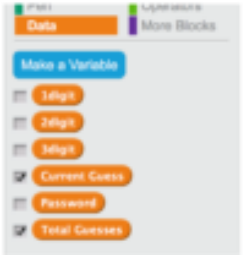
▪ Following a similar pattern, the children can create quizzes using Microsoft PowerPoint in which they can share these with their friends and classmates as a fun and exciting revision tool. The children can decide what they want their particular quiz to be about and create a PowerPoint using animations that reveals the correct answer once it has been selected. This could be used as a pair opportunity or could be used as a whole class opportunity when the children are revising for their exams.

▪ Similarly, children can use various websites such as discovery puzzle maker to create word searches and crosswords on a topic of their revision choice.

▪ This unit is designed to be used when children are studying for their exams throughout the whole of the spring term.</td><td>characters, chart, clip art, clipboard, columns, bold, italics, underline, font, size, align, heading, title, Slide, slideshow, bullet, bulleted list, design template, layout, view, transition, animations.</td></tr>
<tr><td colspan="2">Previous Learning Experiences:</td></tr>
<tr><td colspan="2">The children will have come across the use of Microsoft Word and Microsoft PowerPoint in previous year groups in computing lessons.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Possible Community Links/trips</td><td colspan="2">Future Learning Experiences:</td></tr>
<tr><td></td><td colspan="2">Future computing experiences and lessons throughout the remainder of Year 6 and high school.</td></tr>
</table>

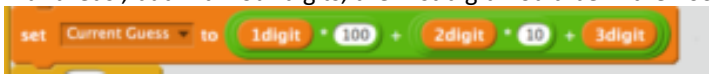
Year 6	Topic Title: Bletchley Park – Summer Term	Key Vocabulary
National Curriculum Objectives: Use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content. Select, use and combine a variety of software (including internet services) 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.	• **<u>To understand there are lots of different types of secret codes.</u>** ▪ Show 'XIZ BSF TFDSFU DPEFT VTFGVM?' on the board. Challenge the class to work out what it says (clue: try one letter backwards. This is a form of 'Caesar cipher' so it translates as 'why are secret codes useful?'). Discuss their answers as to why these are useful. ▪ Explain that codes can be used to send messages that you do not want other people to read and so can be used to hide important information. Perhaps the military does not want enemies to read their messages or you want to talk about your favourite TV show without your parents overhearing! ▪ The characters from the book 'The Demon Headmaster' by Gillian Cross use secret codes to keep their plan a secret from the headmaster. ▪ Explain that the code on the board is called a Caesar cipher. This is when we shift the letters of the alphabet in one direction or another, so in this case A becomes B, B becomes C, C becomes D, etc. The letters can actually be shifted any number of places, but you need to move all the letters the same number of places. ▪ Pig Latin is another way to try to keep information secret, especially when speaking aloud. You take the first letter of a word (or letters if it's a constant cluster such as 'ch') and move it to the end of the word then add 'ay' onto the end, for example: Dog > ogDay Car > arCay Chair > airChay ▪ If the word begins with a vowel, you don't need to move the first letter, you just add 'ay' or 'way' onto the end, e.g. out > outay. ***<u>Key questions</u>*** • Can you work out this (code) says? • Why are secret codes useful? • They can keep information private/safe Who might want to use codes? Anyone who wants to keep information secret ▪ Explain to the children that they are going to learn about some different types of cipher codes. Point out that on each table there are different types of codes to break. Some will involve moving letters around the alphabet, but some will have hidden things within the text. ▪ Ask pupils to work as a team to try and solve each code before moving on to the next table. If they finish before it's time to move, ask them to try and write a message for someone else to solve. Explain that they may not actually be able to solve them all as some are particularly fiendish! The different codes used are: • Caesar Cipher • Pigpen Cipher • Acrostic Code • Nth Letter Cipher • Date Shift Cipher If you think pupils are not close to solving a cipher, give them clues to help them figure it out! ***<u>Key questions</u>*** • Why are secret codes important?	acrostic code, brute force hacking, Caesar cypher, chip and pin system, cypher, date shift cypher, encrypt, invention, nth letter cypher, password, pig pen cypher, technological advancement, trial and error, background noise, byte, computer, CPU, memory storage, mouse, operating system, radio play, ram, ROM, sound effects comment touch screen, trackpad.

	Which kind of organisations might use secret codes and why? ▪ Tell pupils the background story of Bletchley Park, explaining how codes and codebreaking were important during the war: During World War II, both the Allies and Axis used secret codes to send messages to their troops. The Germans had a particularly difficult to crack code called the Enigma Code, which relied on a special machine called the Enigma Machine. ▪ To decipher an Enigma message, not only did you need to have an Enigma Machine, but you also need to have a special three letter start key as well as knowing the plug connection positions. Each letter typed changed the positions of the wheels on the enigma making the next letter completely different. In short, it was impossible to crack, but everyday hundreds of men and women in Bletchley Park would desperately try to solve the cipher using complex maths and incredible problem-solving skills – with 17,576 possible scrambler positions to test each day, it was an impossible task. ▪ Eventually, a man called Alan Turing suggested creating a computational thinking machine which could try to solve the code much quicker than humans could. His machine, the Bombe, is considered the forefather to modern day computers! • **<u>To understand the importance of having a secure password.</u>** ▪ Set each of the padlocks to the same unlock code and place one on each table with the padlock set back to 000 and challenge the children to unlock the padlock. ▪ Encourage them to think about logical ways to solve the code (e.g. start with 000, then 001, then 002, then 003, etc.) and link it to working systematically through maths problems. ▪ Give them five to 10 minutes to try to solve the code and then discuss whether anyone achieved it. What methods did they try? Randomly guessing or methodical? ▪ Explain that using methodical trial and error to guess a password is called Brute Force Hacking. You are literally just trying everything until it works. ***<u>Key questions</u>*** • What methods did they try? Randomly guessing or methodical? ▪ Show the children the 'Brute Force Emulator' Scratch game, which is exactly the same activity that they have just done. Explain that the padlock password was 253, so they should try using that password with the emulator and see how long it takes to figure it out. ▪ Establish that a computer can find a solution much quicker than a person can. Ask them to think about why this is. ▪ The children will remix the code for the Brute Force Emulator to try out different amounts of digits in their password. Start by asking them: • How many turns does it take if you have a four digit number? • What about if you have a five digit number? • How many digits can children add on to their password? ▪ Get them to look at the existing code and explain what they think each line of it means. If you want a detailed explanation of the code, see the accompanying teacher video. ▪ Allow children time to experiment with the existing code to create their own Brute Force Emulator and explore how to make a password more secure and easy to guess. ▪ If children need more guidance, talk them through as many of the following steps as necessary. First, they need to change the text which asks for a three digit number, then create a new variable called four digit (or similar).	



Show them that the code within the 'repeat' will need to be altered so that the fourth digit increases by one each time instead of the third digit. Then another 'if' needs to be added before the existing ones that states 'if 4digit = 10 then change 3digit by 1 and set 4digit to 0'.

'Set current guess' near the end of the script will also need to be slightly altered because currently we're assuming the first digit is in the 'hundreds', but with four digits, the first digit would be in the 1000s:



If you're not sure, take a look at the *Activity: Four digit brute force emulator*, which shows one way you can achieve this code.

Key questions

- How come a computer can find a solution much quicker than a person can?
- How can you be sure you've tried every combination?
- What do you think each line of it means?

Are there common combinations that people might use, e.g. 123?

- Discuss how much harder it was to solve a password with more digits, then explain a real world example of this: In 2006, all debit and credit cards in the UK switched to a chip and pin system because it was seen to be more secure than a signature which can easily be forged. How many different combinations of password are there for a four digit pin? 10 000 because there are 10 possible combinations for each digit so we need to calculate 10 x 10 x 10 x 10 – children might recognise that you can count up to 9999 but you also have 0000 as a password so that makes us up to 10 000.
- When you create a password for a website, sometimes they tell you it has to be at least eight characters long, why do you think that is?
- Explain that if you can choose between any of the letters or characters on a keyboard. , that means you'd have a choice of nearly 100 letters, numbers and special characters per digit of the password (if you count capital and lowercase letters as different). If you can make your password at least eight characters long and include capitals, lowercase, numbers and special characters, that means that there are 6,095,689,385,410,816 (six quadrillion, 95 trillion, 689 billion, 385 million, 410 thousand and 816) possible password combinations which would take a fast computer well over a month to solve. If you made the password one character longer, it

would take closer to nine years to solve! In comparison, a five-character password with just lowercase letters and numbers would take just 0.03 seconds to decrypt!

Key question

When you create a password for a website, sometimes they tell you it has to be at least eight characters long, why do you think that is?

- **To understand the importance of Bletchley Park to the World War II War Effort**

  - Explain to children that in this lesson, they're going to be finding out information about Bletchley Park, but they will be researching information for themselves rather than just being given information in a worksheet.
  - To get started, ask children to find the answers to the *Bletchley Quiz* (you can set them the quiz via email or in a Google Classroom). Encourage children to work with a partner to try and find out the answers to as many questions as they can. Monitor children's different approaches, e.g. searching for answers to specific questions via a search engine, scanning the information on the 'Bletchley Park website', etc.

Key questions

Questions can be found in the questionnaire

Discuss the answers that the children have found to the quiz questions:

- Were there any surprising answers?
- Was it easy to find the information they needed?
  - Remind pupils that the first electronic computers were created at Bletchley Park in order to crack German codes and help stop people being killed during World War II. Then, tell them that they are going to create an educational website using 'Google Sites' which will tell people about Bletchley Park. Stress that the main aim of the website is to teach other people their age about Bletchley Park and the information:
- Should be presented in a clear and attractive way
- Should include plenty of information
- May include a survey or questionnaire
- Should include at least three different pages with information about Bletchley that they have either found out independently or learned by solving the questionnaire at the beginning of the lesson.
  - Remind children that they shouldn't just copy and paste information they find. They should always rewrite it in their own words. Review how you know whether a website is telling the truth. Is the website reputable? E.g. BBC news or Bletchley Park's own website. Does more than one website say the same thing? Remind the class that the first link might not be the best link and it's always worth checking a few links to be sure that the information is correct – fact checking.

Key questions

- Were there any surprising answers?
- Was it easy to find the information they needed?
- How do you know whether a website is telling the truth?
- Is the website reputable?

Does more than one website say the same thing?

  - Take a look at the sites children have created. If you are comfortable doing so, publish the sites. However, make sure that they are only ever shared within the class and not made public.

	▪ Children then take a look at each other's sites and complete the *Activity: Bletchley wordsearch*. • **<u>To understand about some of the historical figures that contributed to technological advances in computing,</u>** ▪ Remind pupils about Alan Turing, who helped to create the first computer. He is seen as a computing hero, but there have been lots of other computing heroes in the last 200 years who have completely changed the face of computing. Hand out the *Activity: Historical matchmaker* sheets and ask the children, in pairs, to identify how each of the people on the sheet contributed to computing, matching each figure up with their achievement. Once they've completed this, go through the answers as a class, discussing whether they had heard of any of these people before now. ***<u>Key questions</u>*** • Can you identify how each of the people on the sheet contributed to computing? • What did they invent? • Did they have to overcome any problems? How well known are they? ▪ Explain to the class that in pairs, they are going to create presentations about historical figures relating to the world of computer science. They can either choose someone from the list of historical figures on the *Historical Matchmaker* resource, or assign them a figure to investigate. If they know of another historical figure in computing history that they are interested in researching, encourage them to do so, eg: Linus Torvalds, Charles Babbage. Explain that the goal of this lesson is to gather information about their computing hero, ready to focus on the aesthetics of their presentation in the following lesson. Use whatever software you or they choose to create their presentation, i.e. PowerPoint, Google Slides or even Prezi, encouraging them to take ownership of their work. The key information that they need to include about their figure is: • Where they were brought up (were they rich or poor?) • What their discovery was • Whether they worked with anyone else • Whether they had any struggles along the way • Why they were important to computing ***<u>Key question</u>*** How would life be different today if these historical figures hadn't invented made their various discoveries/ advancements to computer science? ▪ Ask pupils to review their presentation so far and discuss how they can make it look more interesting or make the information more digestible, explaining that just writing everything on a slide and reading it off is not very interesting or engaging. Suggest using transitions. I to make slides enter and exit in a more attractive way or adding relevant images to break up the text. The key rule for presentations is to have no more than three- five short bullet points per slide so they need to ensure that their slide information is succinct. • **<u>To tinker with sound.</u>** ▪ Ask the children what they think a radio play is. Encourage the children to think about what makes it special (there is no stage or set, so everything needs to be described). Radio plays are usually achieved by a narrator and/or sound effects. ▪ Play a couple of minutes of the radio play you have chosen (find something in the BBC Radio archives or use link: 'BBC Sounds- Gulliver's Travels by Jonathan Swift') and ask the children to listen out for sound effects and background sounds. How have the creators' used words to make it clear what is happening even though you can't see it? ***<u>Key questions</u>***	

- What is a radio play?
- How have the creators' used words to make it clear what is happening in the piece even though you can't see it?
- Show the children the video on link: 'Monty Python- How to make horse's hooves from a coconut' on Videolink (1:32 for the practical demonstration). Explain that sound effects can be made by using several different methods. In radio plays, the performers are masters of making sound effects from the simplest items such as a wooden board for thunder and lightning or coconuts for horse hooves. Show the link: 'Back of the Mike- Radio sound effects' video on Videolink.
- Show the children where to find sound effects on the 'BBC Sound Effects Archive' website; however, they may still have to make some sound effects themselves. Show them the 'Soundtrap' or 'Audacity' website and play a few of the available sound effects. Demonstrate how to record a sound, then add a second track to overlay a sound effect from the BBC archive. Finally, demonstrate how to save the editable file to your computer.

Key question

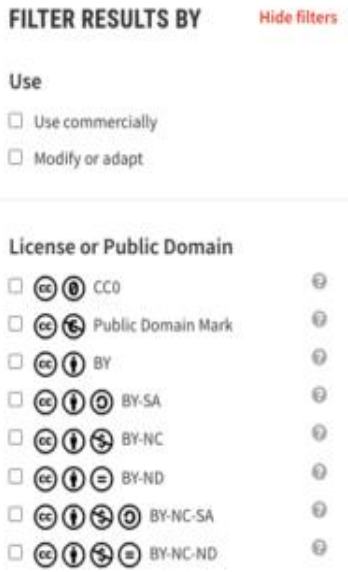
- What is a sound effect?
- How have sound effects been made?
- The children explain what they have discovered about using Soundtrap or Audacity, volunteers explain and describe how to use some of its features.
- **To understand how computers have changed and the impact this has had on the modern world.**
- Ask children to play the 'Frogger game' for a few minutes; taking it in turns and discussing the game as they play. They use the arrow keys to move the frog forwards, backwards, left or right, but try to let the children figure this out for themselves, rather than telling them. Let them hear the theme music if you can too, as this will aid the discussion. Once they have had time to play, ask the children if they enjoyed the game and how they found the animation style, controls and music. Allow children to discuss the game and then ask what computer games they currently play. Ask how graphics in the Frogger game compare to the games they usually play.
- Explain that Frogger was an arcade game in 1981 and at that time people didn't have games consoles or computers capable of playing games at home, so instead they would go to an arcade which was full of computer games that you paid to play. You could also mention Disney film 'Wreck It Ralph' which is about an arcade game character and his life outside of the game. Ask the children how and where they play computer games now. Mostly, they will play at home on computers or tablets, or even on smartphones. That wasn't possible 40 years ago because computers were too big to be used at home, but now they are tiny.

Key questions

- Did you enjoy playing the game?
- How easy was the game to play? (The controls are very easy, but it's also very easy to die and quite difficult to cross the obstacles.)
- What did you think of the graphics? (The graphics are very simple – children may even talk about pixilation of 8-bit graphics depending on whether they are familiar with some of the earlier Kapow topics.)
- How does the music sound?
- Why do you think this is? (The music sounds very annoying and tinny because, just like the graphics, the file size needs to be really small.)
- Watch the 'BBC Bitesize's How computers have changed' video and explain that we are going to be learning about early computers and finding out how they changed the modern world. remind children that Tommy Flowers built the Colossus, the first 'proper' computer, in the 1940s and it was over two metres high, five metres wide and three metres deep. Explain that it couldn't do nearly as much as a modern computer, just very simple tasks. Whereas modern computers fit into the palm of our hand, literally – a smartphone is a computer! Refer back to the Mars Rover work children have complete previously and remind them that originally

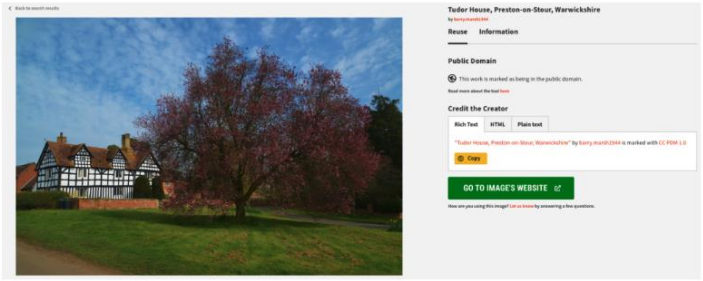
	computers dealt in bytes, then kilobytes (1024 bytes), then megabytes (1024 kilobytes) and now we talk about gigabytes (1024 megabytes) and even terrabytes (1024 gigabytes). Mobile phones often have around 64GB or gigabytes now whereas the first computer to have a hard drive was only 5MB and it cost around $10,000 per MB. ▪ Explain that not only have computers changed in size, they have changed in terms of what they can do. Computers now are much more powerful than the room-sized machines that helped put man on the moon! Hand out the *Activity: Computers to research* resource and ask children to find a photo of each device and note when each was created and what for. To challenge pupils, ask them to comment on how each new computer improved upon the previous one. Once they have all this information and hopefully the associated images, they can create a timeline of the different computers using a medium of their choice, i.e. a slide presentation, a document or a spreadsheet of information. Encourage children to be creative with the task but remind them that it is to be looked at rather than to be explained so they need to keep the information quite succinct. Show them examples of some infographic timelines to help them to picture what their timelines could look like. ***Key questions*** • How and where do you play computer games now? • What are the main features that have changed in computers over the years? ▪ Discuss what children have found out and ask them which computers they think were the most important and how they changed the world. Explain that in the next lesson they will be choosing one computer to focus on for a detailed presentation and offer them the opportunity to complete some research at home. Either assign pupils computers to research in pairs or allow them to select; however, try to make sure that no more than two groups look at the same machine. ▪ Remind them to check the reliability of their source, not to just copy and paste and that they should cite sources for any photos or images that they use. You may also want to remind the class of how to work fairly when collaborating on a document, especially if they are going to use Google Slides and work independently from home! • **To research one of the computers that changed the world and present information about it to the class.** ▪ Take children to the playground or hall and explain that you are going to measure out just how big the Colossus computer was. Use the metre stick to measure out its dimensions on the floor and ask a child to stand at each corner and put a sticker on the wall or the metre stick to show how tall it was. The Colossus measured 7ft high by 17ft wide and 11ft deep, which is around 2m high by 5m wide and 3m deep (for ease, these numbers have been rounded down). As a comparison, place a smartphone in the middle of the measured space. ▪ Take pupils back to the classroom and if you have been able to get hold of an SD card, hold it up and explain that this is an (X) GB micro SD card, which is used as the hard disk drive of a Raspberry Pi (long term memory storage). Then, show them the first 5MB hard disk drive from the 1960s and explain that it's a little bit bigger in size, whilst only having a fraction of the storage (recap that one gigabyte is 1024 megabytes – you get any keen mathematicians to calculate roughly how much more storage is on the memory card- approximately 1,600 x more). ***Key questions*** • Why do you think technology has become smaller? (There are lots of answers to this question, but mainly it's down to advancements meaning that tech can be miniaturised) • Do you think people would have had a computer this size in their home? (Definitely not, in fact, in 1943, the president of tech giant IBM said that "I think there is a world market for maybe five computers". Needless to say he was greatly mocked for this statement, especially now that many homes have at least five computers in them!)	

	▪ Remind children of the information that they found out about computers that have changed the world in the previous lesson and explain that they are now, in pairs, going to research and present information about one of the machines. Explain that the only facts that need to be on the presentation are: • When the computer was first built • What country it was built in • How they feel it changed the world Beyond this, they could also look at: • How the hardware changed the way future machines were made • How well it sold • What other devices followed on from it • What was it used for principally • Are there any versions or replicas of the device still in use today? (Some of the computers will still have versions still in use!) ▪ Watch 'Common Sense Media's Copyrights and Wrongs' video surrounding copyright. If you sign up as a teacher for free, there's also links to video discussion points. Ask: • How does this relate to the work we have been doing on researching? • Should you be writing ***exactly*** what someone else has said? • How could you be fair? • What about images for your poster – does it mean that you can not use any? • Should you say where you got them from? ▪ Copyright is the law which states that anything created (text, image, music, film, etc) belongs to the person who created it (whether they choose it or not). Creators can choose whether or not they want to let other people use their content and what stipulations they put on it, e.g. payment required, creator acknowledgement, etc. Children need to be aware that it is against the law to copy someone else's work without asking them first (and getting an answer!). ▪ Discuss the different permissions that a creator can choose for their piece of work. • **License (copyright)**: Search by using filters • **Public domain use**: Can be used by anyone in the public, but not for profit-making companies (commercial) • **Commercial use**: Can be used by profit-making companies • **Credit required ©**: Where the media has been used, you must put the copyright credit to acknowledge the creator. For example, © Author's name, source (year) ▪ Take the children to the 'Creative Commons – Tudor houses search webpage', which shows all images related to Tudor houses. On the left-hand side of the webpage, there will be a 'Filter results by' section, tell the children that they can leave the 'Use' boxes unticked for 'Use commercially' and 'Modify or adapt'. Focus on the 'License or Public Domain' section as this is where we can filter images that are permitted to be reused in an appropriate way. Click on the '?' to the first three options (CC0, Public Domain Mark, By) and readout the information. • CC0: 'This work has been marked as dedicated to the public domain.' • Public Domain Mark: 'This work is marked as being in the public domain.' • By: 'Credit the creator.'	



Then, select a box with a tick and see the media content be filtered to that specification.

- Click on a filtered image and see the 'Reuse' information, with an eye on the 'Credit the Creator' information, which you can copy and paste along with the image.



	▪ Allow children to be as creative as they want, but remind them that they only have until the end of the lesson to present their information adhering to the copyright and crediting the original author/creator guidance discussed. They can select the software that they use, such as Google Slides, Powerpoint, Prezi, etc. ***Key question*** • What are some of the main differences between the first computers and those we use today? • What does the word 'copyright' mean? ▪ How do we credit the original author/creator's piece of work? Select some groups to present their research to the rest of the class, getting other pupils to consider the success criteria and decide upon the best points and any areas for improvement. Once they have watched a selection of presentations, ask children to discuss which computer the think was the most valuable overall. • **To design a computer of the future.** ▪ Ask pupils what the parts of a computer are and what they do. Give them time to discuss this before then filling in the *Activity: Computer parts quiz.* then, go through the quiz together and support their understanding by showing the computer parts image. ▪ Remind children of what inputs into computers are (sensors, mouse clicks, touch screens, etc) and outputs too (sounds, text appearing on screen, applications opening, etc) and that all computers have some inputs and some outputs. **What does the CPU of a computer do?** The CPU is the main command centre of the computer, where all information is processed. It is effectively the 'thinking' part of a computer. **What is the difference between RAM and ROM?** RAM is memory that the computers uses when it needs more space to think. Anything that is contained in RAM is only there for a short amount of time. In contrast, ROM contains data that needs to be kept safe because it's crucial to the computer's operation. ROM never contains any user files, but it is essential for the computer to work. **What does a hard drive do?** The hard drive of a computer stores all of the user files and data on the computer. Anything you want to keep, from computer games to photos, are saved on the hard drive. ***Key questions*** • What are some examples of input devices? • What are some examples of output devices? • What does CPU stand for? (Central Processing Unit) • What does the CPU do? • What is the difference between RAM and ROM? • What does a hard drive do? • How have computers changed over time? ▪ Remind them that a micro:bit is a micro computer meaning that it has some of the features of a computer, but only limited capabilities. What makes it quite special is the selection of inputs and outputs, for example, it has: • An accelerometer which can tell if it's moving • A compass to tell what direction it's facing • A thermometer • A light sensor	

	▪ Explain that this is an example of a direction that computers are going in – smaller and less powerful, but with lots of sensors which can be used to explore the world around us. Give pupils a couple of minutes to discuss how this might be useful. In contrast, the iPhone 11 Pro or other smartphones are small but extremely powerful computers. They are expensive, but can do lots of things. They have touch screens which means that their main input is via touch and use bluetooth and wifi to communicate as well as radio waves. There are also devices like FitBits and other smart devices which monitor our body and feedback information to our phones or computers. Some really powerful computers have been built to display vast virtual reality worlds, but they have to be really powerful and most people couldn't afford to have one in their home! ▪ Discuss the computers that you have in school. How old are they? If you were to update them today, what hardware would've changed? Eg: faster processor, larger hard drive. **<u>Computer of the future</u>** ▪ Using their research into historic computers and modern computers, the children are going to design the computer of the future. They will need to consider what their computer would be for as well as its inputs and outputs; will it have a touch screen, trackpad or mouse, or will it have some other way of navigating the operating system? ▪ Explain that they can design their computers on the computer or on paper and have access to 3D modelling software if possible. They could also use presentation software such as Google Slides to describe information about their computer. ▪ Stress to pupils that they must research modern computers and find out details such as processing power, hard drive space and RAM as well as thinking carefully about how computers have developed over time. Their designs need to be realistic and based on research into what computers currently have and what potential next steps might be for example machine learning or virtual reality. **Key questions** • How old are our computers at school? • If you were to update them today, what hardware would've changed? (E.g. faster processor, larger hard drive.) ▪ Choose some children to present their 'computers of tomorrow' and encourage pupils to question the presenters about why they have included certain features. Focus the attention on pupils who have designed computers that reference the research they have done into modern computers and who can justify why their idea is a possible next step in the world of computing.	
	Previous Learning Experiences:	
	Children will be learning about WWII in history, and this will tie in with their developing knowledge of this subject. They will also have links to topics covered in Y4 from this unit.	
Possible Community Links/trips	**Future Learning Experiences:**	
Museum of Science and Industry. Computer Museums	Future computing experiences and lessons throughout high school and the remainder of Year 6.	