Digital Technologies – 3 and 4_ Data: collect, organise and create

Strand		Knowledge and understanding			Processes and production skills				
		Digital systems	Representation of data	Collecting, managing and analysing data	*Creating digital solutions by:*				
					Investigating and defining	Producing and implementing	Evaluating	Collaborating and managing	
Content Description		Identify and explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data (ACTDIK007)	Recognise different types of data and explore how the same data can be represented in different ways (ACTDIK008)	Collect, access and present different types of data using simple software to create information and solve problems (ACTDIP009)	Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010)	Implement simple digital solutions as visual programs with algorithms involving branching (decisions) and user input (ACTDIP011)	Explain how student solutions and existing information systems meet common personal, school or community needs (ACTDIP012)	Plan, create and communicate ideas and information independently and with others, applying agreed ethical and social protocols (ACTDIP013)	

Sequence of Lessons / Unit	Approx. time rq'd	Year	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Secret messages and codes	5	3	☐		☑	2	☐		☑	3	☑	3	☐		☐	

Years F-2 Achievement Standard	**Years 3 and 4 Achievement Standard**	**Years 5 and 6 Achievement Standard**
By the end of Year 2 • Students identify how common digital systems (hardware and software) are used to meet specific purposes. (1) • They use digital systems to represent simple patterns in data in different ways. (2) • Students design solutions to simple problems using a sequence of steps and decisions. (3) • They collect familiar data and display them to convey meaning. (4) • They create and organise ideas and information using information systems, and share information in safe online environments. (5)	By the end of Year 4 • Students describe how a range of digital systems (hardware and software) and their peripheral devices can be used for different purposes. (1) • They explain how the same data sets can be represented in different ways. (2) • Students define simple problems, design and implement digital solutions using algorithms that involve decision-making and user input. (3) • They explain how the solutions meet their purposes. (4) • They collect and manipulate different data when creating information and digital solutions. (5) • They safely use and manage information systems for identified needs using agreed protocols and describe how information systems are used. (6)	By the end of Year 6: • Students explain the fundamentals of digital system components (hardware, software and networks) and how digital systems are connected to form networks. (1) • They explain how digital systems use whole numbers as a basis for representing a variety of data types. (2) • Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. (3) • They incorporate decision-making, repetition and user interface design into their designs and implement their digital solutions, including a visual program. (4) • They explain how information systems and their solutions meet needs and consider sustainability. (5) • Students manage the creation and communication of ideas and information in collaborative digital projects using validated data and agreed protocols. (6)

Topic: Data: representation and presentation

Units

Year 3

Year 4

Secret messages and codes 5 hours Explore ways to represent data using the context of secret messages and codes.	**Use data to solve problems** 7 hours Use a meaningful context to collect and organise data to answer a question.

Secret messages and codes

Encoding a word or phrase is an example of representing data in a different way. Introduce encoding and decoding using secret messages. Braille is a system for representing text and other characters using combinations of flat and raised dots on paper so they can be read by touch. Morse Code represents the letters of the alphabet using dots and dashes. A QR code is another way to represent data.

Flow of activities				
Short text	Secret messages Introduce encoding and decoding using secret messages.	Braille Use symbols to represent text characters.	Morse code Create messages in Morse code and have another person decode the message.	QR codes Use QR codes to locate information for a class context.
AC alignment	Representation of data (ACTDIK008)	Representation of data (ACTDIK008)	Representation of data (ACTDIK008) Investigating and defining (ACTDIP010) Producing and implementing (ACTDIP011) Evaluating (ACTDIP012)	Representation of data (ACTDIK008)
Questions to guide exploration	*How can you code a secret message?*	*How are symbols used to represent text and other characters?*	*How are symbols, sounds or light used to represent text characters?*	*How can we use a barcode-like image to link to information?*
What's this about	Encoding a word or phrase is an example of representing data in a different way. The practice of encoding (enciphering, encrypting) and decoding (deciphering, decrypting) is called cryptography. Two simple ways of encoding are the 'backwards alphabet code' and the 'shifted alphabet code'. They are easy to code but equally easy to decode ('crack'). Knowing the 'key' helps the decoder translate the message.	Braille is a system for representing text and other characters using combinations of flat and raised dots so they can be read by touch. One way to represent braille on paper without having to make raised dots is to draw a rectangle with 6 small circles in it, and to colour in only the circles that are 'raised'. Braille is a representation using bits. That is, it contains two different values (raised and not raised) and contains sequences of these to represent different patterns. The letter m, for example, is represented vertically as: 11 00 10 where "1" means raised dot, and "0" means not raised dot. Learning about braille is a good introduction to the binary system that uses 1's and 0's to represent data in a computer.	Morse code represents the letters of the alphabet using dots and dashes. Every letter has a unique sequence of dots and dashes. Dots are created using a short pulse and dashes with a longer one. Morse code can be transmitted as symbols, sound or light. Dots and dashes are used in combination to simplify the representation for each letter, enabling each letter to be represented with a maximum of 4 symbols. Imagine if you just used dots: you would need up to 26 dots to represent all the letters of the Roman alphabet. That would slow down the sending of messages!	A QR code is another way to represent data. QR stands for Quick Response. It is a scannable barcode-like image that directs you to a particular digital location set up by the code creator. To read the code you need an app that reads QR codes and the camera on a smartphone or tablet device. The QR code image, like a barcode image, is made up of pixels. Each pixel has a specific colour. In the case of QR code it is traditionally black or white, but does not need to be, as long as the foreground and background colours are in sharp contrast with each other.
The focus of the learning (in simple terms)	1. Write a simple message coded using a substitution of a number for each letter; for example, A=1 and Z=26. See how long it takes to 'crack the code' or 'decipher the message'. 2. Print out two columns containing the letters of the alphabet. Have one column in the correct order. But for the second, offset each letter by 2. For example, A would become C. Using this method, you can code words with each letter offset by 2. So 'dog' becomes 'fqi'. 3. Students work in a group of three. One student codes a message; for example,	1. Discuss examples of where braille is seen in conjunction with other symbols or signage; for example, with lifts, toilets and public transport. 2. Provide the alphabet represented in braille. Discuss the rules of presenting text in braille. Look for patterns in the way the letters of the alphabet are represented. Create a representation of students' names or familiar words in braille. Represent each letter as a rectangle with six circles either filled or not filled.	1. Provide the alphabet represented in Morse code. 2. As a fun starter, give students two minutes to write 'My name is_____', where each letter is a dot corresponding to its place in the alphabet (a = *, b = **, c= ***). Can they do that in this timeframe? This will help embed understanding of why the dots and dashes exist, as writing 26 dots for a–z is impractical. 3. Create messages and decode them in pairs. Discuss rules for creating and interpreting words. For example, how will	1. Create QR codes for the school veggie garden or normal garden or 'smart' garden, providing information about plants, birds or insects that are of interest to students. 2. Create an internet-based scavenger hunt. Devise clues linked to a QR code. Integrate the use of directions (N, S, E, W) and measuring in steps or metres. Students use the QR code to locate the next clue. At each destination have students collect an item or a piece of information. Organise the activity so that it culminates

	reverse the order so that A =26 and Z=1, or have A=1 +1, B=2 +1, Z=26 +1. The other two students decode the message. However, only one of these two students is given the rule. Discuss how the coding is like encrypting a message with a rule. The student without the rule tries different ways to crack the code (in the way a cyber-criminal might attempt to decipher an email that has been encrypted). 4. Use a torch (switch it on or off) or hold up a black card and a white card, or use an electronics kit such as littleBits, to communicate a Yes/No answer to a series of written questions.	3. As a game, students pair up and see who gets the most correct from a series of different braille letters. 4. Have students try reading braille using their sense of touch, with text actually represented as raised dots. Discuss the challenges that visually impaired people might face in learning how to read braille.	you identify a space between letters and a space between words? 4. Use an online Morse code translator. Create the message in Morse code and translate. View the message as light or sound. 5. This practical application will require 2–3 hours to complete. Use a programming board such as CodeBug or BBC micro:bit to create and send coded messages. Students define the problem and design a digital solution for sending the message. For example, if using BBC micro:bit, create a simple code that uses 'A' button to create a dot and high pitched sound for ¼ beat and 'B' button for a dash with lower pitched sound and a beat of 1. Have one student press the 'A' and 'B' buttons to send the coded message. The other person decodes the message heard and records the letters. Note: BBC micro:bit and CodeBug's online emulator plays the sounds, but, if you use the physical devices a buzzer would need to be connected using alligator clips. Compare the original message to the decoded message. Discuss some limitations of this type of communication. Students consider how this type of communication could be used to help someone at home, school or in the local community. How does this solution help these people?	in using the collected items or information to solve a simple problem. 3. Create a class quiz with small groups generating questions and linking their answers to a QR code. 4. Bring it all together. Create a display using the different forms of representing data. For example, a student could write their own name in a variety of forms so that it emphasises the idea of the same data represented differently; for example, name in English, name in code, name in braille, name in Morse code and name represented by a QR code.
Supporting resources and tools and purpose/ context for use.	**Write Messages in Code** Use an online tool to create coded messages using an offset value. **Codes and Secret Messages** Explore encoding using these online resources.	**Braille: Deciphering the Code** This site provides a useful background to Braille.	**Morse code translator** Use the Morse code generator/decoder. http://learnmorsecode.info/ This site provides tips for beginner learners of Morse code. **Morse code** This lesson is for a CodeBug but can be also modified to suit BBC micro:bit.	**Using QR Codes in the Classroom** **Some useful ideas to stimulate learning by using the latest scanning technology.** **QR Code Reader and Scanner** An easy-to-use app for reading QR codes and barcodes.
Assessment	**Suggested approaches may include:** • A list of words showing the encoded and decoded messages or words. • Present a coded message and the students correctly decode the specific message. **Achievement standard**	**Suggested approaches may include:** • A list of words represented using Braille. **Achievement standard** **Explain** how the same data sets can be represented in different ways.	**Suggested approaches may include:** • A list of words represented using Morse code. • Demonstrating how to use BBC Micro:bit to send a message encoded using Morse code and a partner decoding the message.	**Suggested approaches may include:** • A QR code linked to information created by the QR code creator. **Achievement standard**

	Explain how the same data sets can be represented in different ways.		• List three different ways that braille could help a person or students provide a sample of their design (rules about letter representation).	**Explain** how the same data sets can be represented in different ways.
			Achievement standard **Explain** how the same data sets can be represented in different ways. **Explain** how the solutions meet their purposes.	