New world New skills

Teacher Notes: Computers and Codebreaking

PwC Primary School Toolkit

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Teacher Notes

Overview and Purpose

This lesson focuses on how basic computers work, exploring inputs, outputs and functions and how these can be reflected by real-world applications.

Students will also learn about the long history of encryption and how to encrypt a message using Caesar ciphers.

Objectives

By the end of the session, students will:

- Know how to decrypt a message in a secret code
- Know what input, output and functions are
- How to encrypt using a Caesar cipher

Key Vocabulary

Input: specific instructions in order to function properly

Output: When a computer then does something as a result of an input

Functions: specific instructions on how to do something

Encryption: A message written in code

The Caesar cipher: a simple method of encoding messages.

Preparation / Materials Needed

- A smartboard
- Download the session PowerPoint
- Print the “Caesar Cipher” handout

Lesson structure

Getting Started (5 mins)

- Our objectives
- Introduction to the topic

What is a computer? (10 mins)

- Class discussion: what is a computer?
- Explain what input, outputs and functions are
- Activity: Computer teacher

Codebreaking (10 mins)

- Explanation of code breaking and encryption
- Introduce the Caesar Cipher and explain how to create one
- Activity: Create a Caesar Cipher as a class
- Extension: Ask individuals to come up with a code for the person next to them to break

Wrap up and reflection (5 mins)

- Quiz: three questions to reflect.

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Section 1: Getting Started (5 mins)

Share the objectives for the lesson (**slide 2**).

(**Slide 3)** Today, we're exploring how basic computers work and learning about encryption. How do computers work? What are inputs and outputs? Can a computer imitate a human? How do you decrypt a message??

If students hear about something they don't understand, that's okay! There is no such thing as a silly question, so don't be afraid to ask.

Section 2: What is a computer? (15 mins)

(**Slide 4**) Spend **two minutes** asking the class to discuss what a computer is.

(**Slide 5**) How do computers work? Computers need specific instructions in order to function properly. These are known as **inputs** (E.g. pushing the 'on' button).

(**Slide 6**) When a computer then does something as a result of an **input**, this is called an **output** (E.g. the computer switches on).

(**Slide 7**) Computers use **functions** to get things done. Humans create these functions for a computer to use. However, computers are not like humans and need much more specific instructions on how to do something.

Activity: Computer Teacher (slide 8)

The aim of this activity is to teach students how to get computers to imitate human behaviour and the need to provide very specific instructions.

The teacher stands at one end of the classroom and needs to be navigated to some other point in the classroom. The teacher cannot move by themselves, they need the class to provide inputs.

It's important that the class learns that that vague directional instructions will not work. For example, if someone puts their hand up and says 'move forwards', the teacher should move forwards indefinitely until they hit a wall or table. The class needs to instead say 'move forward 2 steps'.

Try this a few times with different start and end points until the class is providing specific instructions and you are able to be navigated successfully. (**5 - 10 mins**)

Section 3: Codebreaking (10 mins)

(**Slide 9**) Now we're going to talk about codebreaking and try to crack a code.

Have you ever wanted to send a secret message to someone? If a message is written in code, we say that the message is **encrypted**. If we wanted to find out what a secret message says, we would need to **crack the code! Slide 10** illustrates how an encrypted message might look.

(**Slide 11**) Let's have a look at a type of **encryption** called a **Caesar cipher.** This was used by an ancient Roman emperor called Julius Caesar when he wanted to send messages to his soldiers.

Explain that in Roman times, messages had to be delivered by hand and therefore it was important that they were **encrypted** so that nobody else would be able to understand them.

(**Slide 12**) To make a Caesar cipher, we need to give each letter of the alphabet a number. **Who knows how many letters there are in the alphabet?**

So, we know there are 26 letters in the alphabet. Let's say 'a' is 1, 'b' is 2, 'c' is 3 and so on.
Now, we make the cipher by shifting each of these numbers by a fixed number.

(**Slide 13**) Let's use 2 for our cipher. So now we add 2 to each of these numbers, as illustrated on the slide.

Instead of an 'A', we'll now write a 'C'. Because 'C' is two letters ahead of 'A' in the alphabet.
'B' becomes 'D', 'C' becomes 'E', 'D' becomes 'F' and so on.

Activity: Caesar cipher (slide 14)
Give students **two minutes** to have a go at **encrypting** the word 'Hello' using a Caesar cipher. For an extension, challenge students to come up with a code for the person next to them to try and break. This activity is included on the handout for the session.

Move onto **slide 15** and discuss the answer. Did all the students get it right? If not, where did they go wrong?

'H' becomes 'J'
'E' becomes 'G'
'L' becomes 'N'
'L' becomes 'N'
'O' becomes 'Q'

So 'Hello' in our new code would be written as '**JGNNQ**'.

What other codes did the class come up with?

Section 3: Wrap up and reflection (5 mins)

Moving on to slide 16, let's go over what we've learned today with a few quiz questions.

- Ask the class which option (a, b or c) is an example of an input. (Answer is B - pressing the On button)
- Moving to **slide 17**, can the students remember who Julius Caesar was? (An ancient Roman emperor who used encryption to send coded messages to his soldiers - the Caesar Cipher)
- Finally, **slide 18** asks students to remember how to create a Caesar cipher. (You assign a number to each letter of the alphabet, and then shift these numbers either up or down. Replace each letter with its shifted version.)

You may decide to ask students to record the answers to these questions as evidence of what they have learnt from today's session.

Finally, ask the students whether they have any questions about what they have learnt today.