

Tackling the Technology Gender Gap Together:

Data Representation – Working in Code

Level - Third Level

Subject area/s – Computing Science



Data Representation: Working in Code

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Subject area/s-Technologies - Computing Science) and Maths - Number, Money and Measure

Experiences and Outcomes – Technologies - Computing Science

I understand language constructs for representing structured information TCH 3-14a

I can describe the structure and operation of computing systems which have multiple software and hardware levels that interact with each other TCH 3-14b

Maths (Number and Number processes)

I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions. MNU 3-03a

Benchmarks –

Computing Science: Understanding and analysing computing technology

- Understands that the same information could be represented in more than one representational system TCH 3-14a
- Understands that different information could be represented in exactly the same representation TCH 3-14a
- Demonstrates an understanding of the von Neumann architecture and how **machine code instructions are stored** and executed within a computer system TCH 3-14b
- **Demonstrate an understanding of how computers communicate and share information** over networks including the concepts of sender, receiver, address and packets. TCH 3-14b

Maths : Number and number processes

- **Solves written addition and subtraction problems accurately working with whole numbers** and decimal fractions with up to at least 3 decimal places and **selects and communicates the processes and solutions.** MNU 3-03a

- **Solves written** multiplication and **division problems accurately working with whole numbers** and decimal fractions with up to at least 3 decimal places. MNU 3-03a
- **Solves mental problems accurately** involving the four operations. MNU 3-03a
- Interprets and solves multi-step problems in familiar contexts ensuring correct order of operations. MNU 3-03a

Duration of time – 8 x 50/55min

Lesson 1	Slides 1-11
Lesson 2/3	Slides 12- 20
Lesson 4/5/6	Slide 21-32
Lesson 6/7/8	Slide 33-41

Computing Science Concepts and Approaches –

Logic: explaining why something works as it does

Algorithms: a set of rules to get something done

Encouraging **computational thinking** through:

Creating: planning, making and evaluationg

Persevering: never giving up, showing resilience and have a 'can do' approach

Prior Learning

Computing Science : Understanding and analysing computing technology

- I can understand how computers process information. TCH 1-14b
- **I understand how information is stored** and how key components of computing technology connect and interact through networks TCH 2-14b
- Demonstrates an understanding that all computer data is represented in binary e.g. numbers, text, black and white graphics. TCH 2-14b

Maths and Numeracy: Number and number processes

- I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.MNU 1-03a
- Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others. MNU 2-03a
- **Explains the link between a digit, its place and its value for whole numbers** up to at least 1 000 000. MNU 2-03a

Resources required

All resources are detailed on each Worksheet or Activity within this resource pack

Overview of learning

Trying to unveil the myth that a computer is a mystical machine when in fact it is a set of components supplied with electricity that is either on or off – the two state machine, everything it does works as off or on, 0 or 1. Introducing and constantly reinforcing this, we start to explore how we can give it instructions and it can understand.

The idea of binary is introduced first through Binary Digits as the basis for everything that a computer understands.

1. Working with **numbers** we convert integers into binary and binary into denary.

Slide	Content	Activity
1	Cover slide	
2	Links to each section	
3-16,20	Number Representation -Theory	
17-19	Number Representation – Practical	Base 10 to Base 2 Base 10 to Base 2 Division Method

2. **Letters** follow with the introduction of American Standard Code for Information Interchange (ASCII) – why it was introduced and how it works. [practical activity to create their name in binary]. Brief discussion around Unicode and why it is needed

Slide	Content	Activity
21-27,29,32	Text Representation - Theory	
28,30,31	Text Representation - Practical	Cracking the code Creative with ASCII

3. Using simple images we show how black and white **Bitmap images** are stored inside a computer, how the number of bits affects the quality of an image. [practical activity to create a simple image using Hama/Aquabeads]

Slide	Content	Activity
33-38,42	Graphics Representation - Theory	
39-41	Graphics Representation- Practical	Unplugged Extension Pixel by Pixel

The presentation included in this pack works through each of these areas in turn. Slides contain notes as required and details of the activities in the pack.

Pupil Objectives

- I can explain in basic terms what a computer is
- I can explain why computers use binary code
- I can convert numbers, text and graphics into binary code
- I can demonstrate my understanding through a range of activities

Introduction

Elicit from pupils their thoughts on a computer and how it works focussing on the electrical aspect to guide them towards the idea of off/on then on to binary.

YouTube Video : How Computer Work :Information (Part 1)

<https://youtu.be/AtqjxyV9t1I>

Main Activity

1. Working with numbers (Slides 1 – 20)

Starting the number section with a review of our decimal system sets the scene for the move to binary as the number systems operate in similar ways; place values, number of digits

There are two methods of converting from Base 10 to Base 2; using one or other or both, demonstrate how the computer changes what we input into a binary code. (Worksheet are available in this pack : Base 10 to Base 2 and Base 10 to Base 2 Division Method)

Extension questions available to encourage pupils to use some problem solving (Slide 19 – notes attached to slide)

2. Working with Text (Slides 21- 32)

With a reminder that all data inside the computer is in binary, introduce ASCII code (Slide 24,25)

On closer examination of ASCII, codes can be grouped by (slide 26,27). Focus on letters and often used characters. forms of the ASCII table as available with this pack)

Cracking the code activity (Slide 28) requires pupils to use ASCII table.(Worksheet in pack)

Referring back to work with numbers, pupils are reminded 255 is the largest number that can be represented – same ASCII, 255 characters. (Slide 29 – notes attached to slide)

Extension work involves turning ASCII into binary and this to create a visual version of their name (Worksheet in – Creative with ASCII).

For this activity they can be given to ASCII/binary table or further practice convert the ASCII to binary as they did in numbers section.



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3. Working with graphics (Slide 33-41)

Continuing the binary theme, pupils will work with bitmapped images. After an overview of this representation, pupils have a number of practical activities. Cartoon Pickle exercise works with a range of pixels to explore the relationship between the number of pixels and the quality of the image (Details are in Cartoon Pickle activity available in this pack)



Extension activity for bitmaps involves a practical element which requires careful planning and monitoring (Bits for Images activity available in this pack)

Plenary

A plenary should take place at the end of each section to ensure pupils have grasped the ideas as they are needed in the following sections.

By the end of this unit of study, pupils will have many physical reminders of binary digits.

Pupils can receive feedback via the Teacher checklist available in this pack

Differentiation

These activities tend to be differentiated by the pupils as they demonstrate their understanding and practical skills through the activities. (Extension tasks available in each section)

1. Working with numbers

Pupils could be given the blank grid, having to complete the place values themselves (Base 10 to Base 2 worksheet Pg 2 available in this pack)

2. Working with text

Two forms of the ASCII table (ASCII Letter&Code available in this pack: page 2 contain binary codes)

3. Working with Graphics

Cartoon PickleMore complex images, such as the penguin, can be given to pupils who need more of a challenge.

Extension task – more regular grids (square etc) are easier to use



Assessment Opportunities

Review, reflect and revisit.

Using the worksheets and activities at the end of each section, time can be taken to review, reflect and revisit (if necessary) to key ideas. This will be crucial for progress onto section 2 and 3 as they build on the pupil understanding of activities in section 1.

Section 1: a self assessment answer sheet is available in this pack

Section 2: creating the code and creative with ASCII worksheets will provide assessment evidence

Section 3: Cartoon Pickle exercise and the iconeditor tasks will provide assessment evidence

Teaching Notes

In this pack you will find a presentation called Data Representation which contains notes

Curriculum Links

This unit could provide evidence for the Maths outcomes using available assessment materials (Data Representation Numeracy Rubric available in this pack)

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