

Nature art

**Lessons:** 4

**Programming languages:** MakeCode

**Target age:** 7-11 yrs

**Subjects & topics:**

* Computational thinking: Abstraction, Algorithms
* Programming: Sequence, Representation
* Digital arts: Drawing

# Unit of work summary

Four lessons designed for students aged 7-8 years as an introduction to computational thinking and the BBC micro:bit. They learn how to create nature abstractions by taking a nature walk, using art materials and then using the LEDs on micro:bit.

They'll develop an understanding of several key computational thinking concepts, including logical reasoning, abstraction, algorithms and evaluation.

Students then develop their programming and debugging skills and are introduced to working with outputs.

## Overall key learning

* can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
* can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
* can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
* are responsible, competent, confident and creative users of information and communication technology

## Additional skills

Creative thinking, collaboration, problem-solving

## Lesson 1: Representing nature

In this ‘unplugged’ lesson, pupils take a nature walk and then use art techniques to represent they images they collect. They consider rules and processes of working with different materials and develop their computational thinking skills.

**Key learning:**

* To use logical reasoning when making predictions
* To abstract relevant detail from a nature image
* To create nature representations using a variety of art materials

## Lesson 2: Art algorithms

In this ‘unplugged’ lesson, pupils recap their understanding of algorithms before writing their own algorithms to show how they created their nature representations in lesson 1 of the 'Nature art' unit.

**Key learning:**

* To know and understand what algorithms are
* To write algorithms with clear instructions
* To test and debug algorithms

## Lesson 3: Digital nature representations

Pupils are introduced to the BBC micro:bit and how images can be created using the LEDs. They create visual algorithms to plan simple images before writing programs using the MakeCode editor to create their images.

**Key learning:**

* To understand that LEDs can be used to create image representations.
* To plan LED image representations.
* To construct programs to display LED image representations with the micro:bit.

## Lesson 4: Programming & evaluating representations

Pupils plan and program LED images using MakeCode to represent some of the nature they observed on their walk. They then evaluate their LED art in simple ways and reflect how they have used computational thinking in their learning.

**Key learning:**

* To use logical reasoning to predict the output of programs
* To plan and construct algorithms and programs to create LED image representations
* To evaluate programs

# Curriculum links

These lessons are mapped to the following learning objectives and standards for computing, and art and design:

## England National Curriculum

#### KS2 computing curriculum

Curriculum aims:

* can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms and data representation
* can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems
* can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems
* are responsible, competent, confident and creative users of information and communication technology

Students should be taught to:

* design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts
* use sequence, selection, and repetition in programs; work with variables and various forms of input and output
* use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs

[Read the full KS2 computing curriculum](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239033/PRIMARY_national_curriculum_-_Computing.pdf).

#### KS2 DT curriculum

* apply their understanding of computing to program, monitor and control their products

[Read the full KS2 DT curriculum](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239041/PRIMARY_national_curriculum_-_Design_and_technology.pdf).

#### KS2 art and design curriculum

Students should be taught to:

* create sketch books to record their observations and use them to review and revisit ideas
* improve their mastery of art and design techniques, including drawing, painting and sculpting with a range of materials

[Read the full KS2 art and design curriculum](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/239018/PRIMARY_national_curriculum_-_Art_and_design.pdf)

## Scotland Curriculum for Excellence

#### Technologies

* I can explore and experiment with digital technologies and can use what I learn to support and enhance my learning in different contexts (TCH 1-01a)
* I can explore and comment on processes in the world around me making use of core computational thinking concepts and can organise information in a logical way (TCH 1-13a)
* I can demonstrate a range of basic problem solving skills by building simple programs to carry out a given task, using an appropriate language (TCH 1-15a)
* I understand the operation of a process and its outcome. I can structure related items of information (TCH 2-13a)
* I can explain core programming language concepts in appropriate technical language (TCH 2-14a)
* I can create, develop and evaluate computing solutions in response to a design challenge (TCH 2-15a)

[Read the full Curriculum for Excellence: technologies](https://education.gov.scot/Documents/Technologies-es-os.pdf)

#### Expressive arts

* I can create a range of visual information through observing and recording from my experiences across the curriculum (EXA 0-04a / EXA 1-04a)
* I have the opportunity to choose and explore an extended range of media and technologies to create images and objects, comparing and combining them for specific tasks (EXA 2-02a)
* I can create and present work that shows developing skill in using the visual elements and concepts (EXA 2-03a)
* Through observing and recording from my experiences across the curriculum, I can create images and objects which show my awareness and recognition of detail (EXA 2-04a)
* Inspired by a range of stimuli, I can express and communicate my ideas, thoughts and feelings through activities within art and design (EXA 0-05a / EXA 1-05a / EXA 2-05a)

[Read the full Curriculum for Excellence: expressive arts](https://education.gov.scot/Documents/expressive-arts-eo.pdf)

## Northern Ireland Curriculum - Primary

#### Using ICT across the curriculum

Pupils should be taught to:

* express - create, develop, present and publish ideas and information using a range of digital media
* exchange - communicate using a range of contemporary methods and tools

#### KS1 - suggested curriculum ideas for art and design

* investigate and respond to direct sensory experience; including visual, verbal, spatial, and tactile dimensions, memory and imagination
* explore the visual elements of colour, tone, line, shape, form, space, texture and pattern to express ideas
* experiment with a range of media, materials, tools and processes such as: drawing, painting, printmaking, malleable materials, textiles and three-dimensional construction

#### KS2 - suggested curriculum ideas for art and design

* engage with observing, investigating and responding to first-hand experiences, memory and imagination
* develop their understanding of the visual elements of colour, tone, line, shape, form, space, texture and pattern to communicate their ideas

[Read the full Northern Ireland Curriculum - Primary](https://ccea.org.uk/downloads/docs/ccea-asset/Curriculum/The%20Northern%20Ireland%20Curriculum%20-%20Primary.pdf)

#### Primary using ICT - desirable features - computational thinking and coding

**Level 4**

Pupils should:

* create a more sophisticated coding project using a broad range of commands; and/or
* solve a given problem using commands in a programming environment.

**Programmable devices (such as Parrot Drone, micro:bit or Sphere)**

* look at and talk about examples of coding projects, including the use of motion, looks, lights or sounds, sensors, control and events such as ‘if...then’ and ‘loop until’ (or equivalent) that make the code more efficient;
* recognise that these projects are composed of different components and break the task into smaller manageable tasks (decomposition);
* in small groups, plan and storyboard their own coding project, working out what different parts of the program must do, using logical reasoning to discuss and compare the commands that are required for their algorithm;
* use a range of commands to create a project including triggering commands such as ‘if...then’ and ‘loop until’ to facilitate a more efficient method of interaction;
* test and debug at regular intervals and collaborate with others to solve problems as they arise;

**Finally**

* share their work (possibly using digital tools), respond to feedback and comment on others’ work; and
* organise files and export work in an appropriate format so that others may view it.

[Read all Primary using ICT desirable features](https://ccea.org.uk/downloads/docs/ccea-asset/Curriculum/Primary%20Using%20ICT%20Desirable%20Features%20Update%202019.pdf)

## Curriculum for Wales

#### Science and technology

Progression step 1 - computation is the foundation for our digital world:

* I can experiment with and identify uses of a range of computing technology in the world around me

Progression step 2 - computation is the foundation of our digital world:

* I can use computational thinking techniques, through unplugged or offline activities
* I can follow instructions to build and control a physical device

[Read the full Curriculum for Wales - science and technology](https://hwb.gov.wales/curriculum-for-wales/science-and-technology/descriptions-of-learning/)

#### Expressive arts

Progression step 1 - Exploring the expressive arts is essential to developing artistic skills and knowledge and it enables learners to become curious and creative individuals:

* I can explore and experiment with a variety of creative techniques, materials, processes, resources, tools and technologies

[Read the full Curriculum for Wales - expressive arts](https://hwb.gov.wales/curriculum-for-wales/expressive-arts/)

#### Digital competence framework

Progression step 1 - data and computational thinking - problem-solving and modelling:

* I can recognise and follow instructions in the appropriate order to perform a task.
* I can organise, select and use simple language to give instructions to others.
* I can control devices giving instructions.
* I can identify errors in simple sets of instructions (algorithm).

Progression step 2 - data and computational thinking - problem-solving and modelling:

* I can detect and correct mistakes which cause instructions (a solution) to fail (debug).
* I can create and record verbal, written and symbolic instructions to test ideas, e.g. the order of waking up through a diagram or flowchart.
* I can change instructions to achieve a different outcome.

Progression step 3 - data and computational thinking - problem-solving and modelling:

* I can understand the importance of the order of statements within algorithms.

Progression step 1 - producing – creating digital content:

* I can create simple digital work.

Progression step 1 - producing - evaluating and improving digital content:

* I can comment on work in relation to a single success criterion.

Progression step 2 - producing - evaluating and improving digital content:

* I can give an opinion about my own work and suggest improvements based on the success criteria.

[Read the digital competence framework](https://hwb.gov.wales/curriculum-for-wales/cross-curricular-skills-frameworks/digital-competence-framework)

## USA Code.org

#### CS Fundamentals

Courses A and B

Concepts included:

* computational thinking
* algorithms
* programming
* sequencing
* events
* debugging

[Read the full CS Fundamentals curriculum](https://code.org/educate/curriculum/elementary-school).

## USA CSTA Standards

#### Grades 3-5

* 1B-CS-01 - Describe how internal and external parts of computing devices function to form a system.
* 1B-CS-02 - Model how computer hardware and software work together as a system to accomplish tasks
* 1B-CS-03 - Determine potential solutions to solve simple hardware and software problems using common troubleshooting strategies.
* 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
* 1B-AP-15 - Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.

[Read the CSTA Standards in full](https://csteachers.org/k12standards/ ).

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