Kapow Primary™

How to approach the new Digital world units in D&T

Introduction

Our new Digital world units aim to address the key challenges and opportunities associated with the Key Stage 2 Design and technology National Curriculum objective:

When designing and making, pupils should be taught to:

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

This objective can be daunting for some, given that it is pulling on the objectives of the Computing National Curriculum and applying them to Design and technology projects. This objective encourages pupils and teachers alike to make connections between both subjects and apply their understanding of computer-based knowledge and skills to a product design problem.

It allows pupils to recognise where digital products they encounter in the wider world – at school, home, in industry and within their local community, may have started life before production. It may even enable them to consider how smart computer-controlled products and machines have been designed, developed and constructed.

Design and technology projects typically revolve around the design process* through the national curriculum objective subheadings design, make and evaluate. Technical knowledge objectives, in most units, provide a key focus for the unit – following our strands Structures, Mechanical systems, Electrical systems and Digital world (programming products).

*Excluding Cooking and nutrition specific objectives that follow the 'Food' strand.

Digital world unit summaries

The Digital world units are no exception but combine cross-curricular computing objectives and learning with the computer-based objectives in the Design and technology national curriculum. This is to ensure that the children can follow a natural progression of skills and knowledge to support them when coming to develop programmed products.

Year 3 – Electronic charm

Provide a product solution to a given scenario to develop, program, house and promote an electronic charm to use in low-light conditions. Practise 2D CAD skills.

Year 4 – Mindful moment timer

Explore what is meant by mindfulness and write design criteria to fulfil a brief to develop a programmed product for timing mindfulness moments. Apply 2D CAD skills to promote the product.

Year 5 – Monitoring devices

Discover the history of thermometers and look at the development of digital monitoring devices. Research to develop a temperature and alert-programmed system for domesticated animals and their owners. Practise using 3D CAD skills.

Year 6 – Navigating the world

Design and program a multifunctional navigation tool for a client from abroad, tailored to a specific set of requirements. Develop a 3D CAD model to pitch and explain the product to a guest panel.

The connection between Computing and Design and technology

In the Computing national curriculum, these objectives directly correlate to the Digital world units:

- Design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts
- Work with 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
- Design and create a range of programs, systems and content that accomplish given goals

Computing NC objectives:	D&T NC objectives:	Digital world activities:
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 Design and create a range of programs, systems and content that accomplish given goals Use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content	**Technical knowledge** Apply their understanding of computing to program, monitor and control their products **Design** Generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design **Evaluate** Understand how key events and individuals in design and technology have helped shape the world	Developing code block programs through familiar systems such as the Micro:bit make code editor to develop functions as part of a product concept that they can explain. Designing and creating programs that fulfil a variety of needs such as: ★ Responding to button presses. ★ Controlling LED panels. ★ Monitoring and responding to external factors such as light levels and temperature. ★ Creating an audible alert. Exploring the Digital revolution and understanding how products functions evolved from analogue to digital, including other developments in history. Applying programming principles such as: ★ Loops. ★ Booleans (and/or). ★ Commands. ★ Conditional statements.

Table 1: The connection between Computing and Design and technology.

It is not essential to have taught the programming skills from computing prior to these units as each lesson contains a detailed set of instructions and explains how each program functions through pupil and teacher videos.

The children will require less intervention when programming if they already understand certain programming principles from their lessons in Computing before approaching the Digital world projects. It is, therefore, best to teach this towards the end of the year.

Digital world unit programming

Each unit follows the design process (design, make, evaluate) and so most programming occurs in lesson 2 of each unit following the design brief and criteria in lesson 1.
See the table below for information regarding programming principles progression:

Digital world success criteria (Lesson 2):	Programming principles:
Y3 - Programming an eCharm ★ I can write a program to control (button press) and/or monitor (sense light) to initiate a flashing LED algorithm. ★ I understand what a loop is in programming. ★ I can explain the basic functionality of my eCharm program.	★ Inputs [button-press]. ★ Outputs [LED panel]. ★ Loops [LED flash]. ★ Extension: Tinker with the loop. ★ Extension: Include light sensor automation.
Y4 - Programming a timer ★ I can program a micro:bit in the Microsoft micro:bit editor, to time a set number of seconds/minutes upon button press. ★ I can test my program for bugs (errors in the code). ★ I can find and fix the bugs (debug) in my code. ★ I can evaluate my micro:bit program against points on my design criteria and amend them to include any changes I made.	★ Input [button-press]. ★ Outputs [LED panel]. ★ Variables [seconds]. ★ Debugging. ★ Extension: Addition of an input [reset button]. ★ Extension: Addition of an output [LED pattern to show that the timer has finished].
Y5 - Programming an animal monitor ★ I can program to monitor the ambient temperature and code an (audible or visual) alert when the temperature rises above or falls below a specified range. ★ I can explain key functions in my program (audible alert, visuals). ★ I can explain how my product would be useful for an animal carer.	★ Input [button-press]. ★ Outputs [LED panel and/or audio]. ★ Loops; forever loops [sensors]. ★ Conditional statements [and/or/if booleans] ★ For example: 'If 'x' is true, then perform 'y' else'. ★ Debugging. ★ Extension: Tinker with the program, such as expand it to include another input [button-press] or further functions of the pupil's choice.
Y6 - Programming a navigation tool ★ I can program an N,E, S,W cardinal compass. ★ I can explain the key functions in my program, including any additions. ★ I can explain how my program fits the design criteria and how it would be useful as part of a navigation tool.	★ Input [button-press]. ★ Outputs [LED panel]. ★ Variables [degrees]. ★ Conditional statements [and/or/if booleans] ★ For example: 'If 'x' is true, then perform 'y' else'. ★ Debugging. ★ Extension: Program a second function [pedometer]. ★ Extension: Tinker with the program, such as expand it to include another input [button-press] or further functions of the pupil's choice.

Table 2: Programming principles progression.

All units start with a 'Main program' and instructions before adding onto this to make it more complex with 'Extension' programs (tasks). You can still fulfil the D&T National Curriculum objective by completing just the main program, but the extensions will allow you to provide your pupils with stretch where necessary. Each of the programs is supported by pupil videos, presentations, quizzes and worksheets.

Links to the Kapow Primary Computing scheme

In the Kapow Primary Computing scheme, we follow a similar structure of programming principles that are included in the Digital world units. By teaching these principles in Computing first outside of a product design context, you can build pupil confidence and focus more on the experimentation side of programming in D&T.

Please see the table below for where the Computing and D&T units correlate:

Computing: Programming units	Design and technology: Digital world (lesson 2)
Year 3 - Programming Scratch ★ Tinkering with programs. ★ Introduction to code blocks. ★ Loops (repetition code). ★ Forever loops. ★ Making an animation.	Y3 - Programming an eCharm ★ I can write a program to control (button press) and/ or monitor (sense light) to initiate a flashing LED algorithm. ★ I understand what a loop is in programming. ★ I can explain the basic functionality of my eCharm program.
Year 4 - Further coding with Scratch ★ Tinkering with programs. ★ Understanding variables. ★ Using and making variables. ★ Conditional statements (ifs, ands, ors booleans). ★ Orientation. Year 4 - Investigating the weather ★ Sensors.	Y4 - Programming a timer ★ I can program a micro:bit in the Microsoft micro:bit editor, to time a set number of seconds/minutes upon button press. ★ I can test my program for bugs (errors in the code). ★ I can find and fix the bugs (debug) in my code. ★ I can evaluate my micro:bit program against points on my design criteria and amend them to include any changes I made.
Year 5 - Micro:bit ★ Writing programs. ★ Emulator bug checking and testing. ★ Debugging skills. ★ Programming a scoreboard. ★ Understanding variables. ★ Using and making variables. ★ Sensors.	Y5 - Programming an animal monitor ★ I can program to monitor the ambient temperature and code an (audible or visual) alert when the temperature rises above or falls below a specified range. ★ I can explain key functions in my program (audible alert, visuals). ★ I can explain how my product would be useful for an animal carer.
Year 6 - Skills showcase ★ Writing and adapting programs. ★ Evaluating and debugging code.	Y6 - Programming a navigation tool ★ I can program an N,E, S,W cardinal compass. ★ I can explain the key functions in my program, including any additions. ★ I can explain how my program fits the design criteria and how it would be useful as part of a navigation tool.

Table 3: Kapow Primary Computing and D&T unit correlation.

Developing staff confidence

As with anything new, there can be a fear of the unknown and it would be a good idea to complete these units with or without the practical elements (for example, programming), prior to delivering them.

You could even try teaching them to or with other members of staff, for example as part of a subject-specific staff meeting or as a team-building exercise. This will allow you to better understand the concepts you are teaching and enable you to identify any potential pitfalls that pupils may encounter.

When completing these activities yourself or with colleagues, consider:

- How long the process took you to complete.
- What difficulties you faced.
- How you may address those difficulties with staff and pupils alike.
- Ways to further develop your skills and knowledge.
- Team teaching.