Digital Devices in the Digital Technologies curriculum

VCAA Webinar
Thursday 7th June 2018

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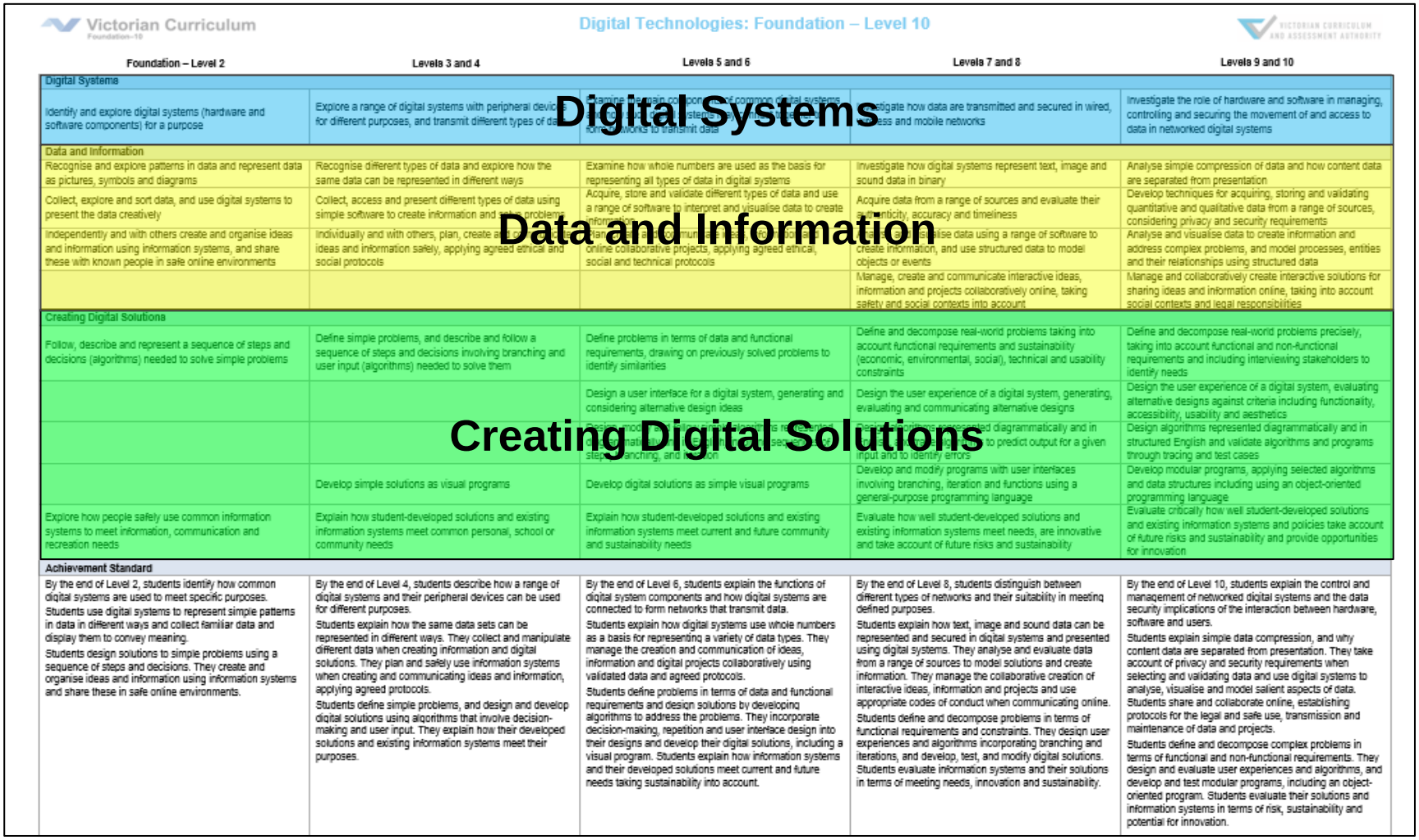
What to expect

- Strands in the Digital Technologies curriculum
- Ways of Thinking (Computational thinking)
- Using digital devices
- Approaches to teaching

Strands in Digital Technologies

Scope and Sequence



Victorian Curriculum Foundation–10

Digital Technologies: Foundation – Level 10

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Foundation – Level 2	Levels 3 and 4	Levels 5 and 6	Levels 7 and 8	Levels 9 and 10
Digital Systems				
Identify and explore digital systems (hardware and software components) for a purpose	Explore a range of digital systems with peripheral devic for different purposes, and transmit different types of da	Examine the main components of common digital systems and how networks transmit data	tigate how data are transmitted and secured in wired, ss and mobile networks	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems
Data and Information				
Recognise and explore patterns in data and represent data as pictures, symbols and diagrams	Recognise different types of data and explore how the same data can be represented in different ways	Examine how whole numbers are used as the basis for representing all types of data in digital systems	Investigate how digital systems represent text, image and sound data in binary	Analyse simple compression of data and how content data are separated from presentation
Collect, explore and sort data, and use digital systems to present the data creatively	Collect, access and present different types of data using simple software to create information and solve problems	Acquire, store and validate different types of data and use a range of software to interpret and visualise data to create information	Acquire data from a range of sources and evaluate their authenticity, accuracy and timeliness	Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements
Independently and with others create and organise ideas and information using information systems, and share these with known people in safe online environments	Individually and with others, plan, create a ideas and information safely, applying agreed ethical and social protocols	online collaborative projects, applying agreed ethical, social and technical protocols	se data using a range of software to create information, and use structured data to model objects or events	Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data
			Manage, create and communicate interactive ideas, information and projects collaboratively online, taking safety and social contexts into account	Manage and collaboratively create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities
Creating Digital Solutions				
Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems	Define simple problems, and describe and follow a sequence of steps and decisions involving branching and user input (algorithms) needed to solve them	Define problems in terms of data and functional requirements, drawing on previously solved problems to identify similarities	Define and decompose real-world problems taking into account functional requirements and sustainability (economic, environmental, social), technical and usability constraints	Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including interviewing stakeholders to identify needs
		Design a user interface for a digital system, generating and considering alternative design ideas	Design the user experience of a digital system, generating, evaluating and communicating alternative designs	Design the user experience of a digital system, evaluating alternative designs against criteria including functionality, accessibility, usability and aesthetics
		ed algorithms represented diagrammatically and in steps, branching, and iteration	to predict output for a given input and to identify errors	Design algorithms represented diagrammatically and in structured English and validate algorithms and programs through tracing and test cases
	Develop simple solutions as visual programs	Develop digital solutions as simple visual programs	Develop and modify programs with user interfaces involving branching, iteration and functions using a general-purpose programming language	Develop modular programs, applying selected algorithms and data structures including using an object-oriented programming language
Explore how people safely use common information systems to meet information, communication and recreation needs	Explain how student-developed solutions and existing information systems meet common personal, school or community needs	Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs	Evaluate how well student-developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability	Evaluate critically how well student-developed solutions and existing information systems and policies take account of future risks and sustainability and provide opportunities for innovation
Achievement Standard				
By the end of Level 2, students identify how common digital systems are used to meet specific purposes. Students use digital systems to represent simple patterns in data in different ways and collect familiar data and display them to convey meaning. Students design solutions to simple problems using a sequence of steps and decisions. They create and organise ideas and information using information systems and share these in safe online environments.	By the end of Level 4, students describe how a range of digital systems and their peripheral devices can be used for different purposes. Students explain how the same data sets can be represented in different ways. They collect and manipulate different data when creating information and digital solutions. They plan and safely use information systems when creating and communicating ideas and information, applying agreed protocols. Students define simple problems, and design and develop digital solutions using algorithms that involve decision-making and user input. They explain how their developed solutions and existing information systems meet their purposes.	By the end of Level 6, students explain the functions of digital system components and how digital systems are connected to form networks that transmit data. Students explain how digital systems use whole numbers as a basis for representing a variety of data types. They manage the creation and communication of ideas, information and digital projects collaboratively using validated data and agreed protocols. Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. They incorporate decision-making, repetition and user interface design into their designs and develop their digital solutions, including a visual program. Students explain how information systems and their developed solutions meet current and future needs taking sustainability into account.	By the end of Level 8, students distinguish between different types of networks and their suitability in meeting defined purposes. Students explain how text, image and sound data can be represented and secured in digital systems and presented using digital systems. They analyse and evaluate data from a range of sources to model solutions and create information. They manage the collaborative creation of interactive ideas, information and projects and use appropriate codes of conduct when communicating online. Students define and decompose problems in terms of functional requirements and constraints. They design user experiences and algorithms incorporating branching and iterations, and develop, test, and modify digital solutions. Students evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability.	By the end of Level 10, students explain the control and management of networked digital systems and the data security implications of the interaction between hardware, software and users. Students explain simple data compression, and why content data are separated from presentation. They take account of privacy and security requirements when selecting and validating data and use digital systems to analyse, visualise and model salient aspects of data. Students share and collaborate online, establishing protocols for the legal and safe use, transmission and maintenance of data and projects. Students define and decompose complex problems in terms of functional and non-functional requirements. They design and evaluate user experiences and algorithms, and develop and test modular programs, including an object-oriented program. Students evaluate their solutions and information systems in terms of risk, sustainability and potential for innovation.

Digital Systems

Data and Information

Creating Digital Solutions

http://victoriancurriculum.vcaa.vic.edu.au/technologies/digital-technologies/introduction/scope-and-sequence

Digital Systems

F - 2	3 - 4	5 - 6	7 - 8	9 - 10
Identify and explore digital systems (hardware and software components) for a purpose	Explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data	Examine the main components of common digital systems, and how such digital systems may connect together to form networks to transmit data	Investigate how data are transmitted and secured in wired, wireless and mobile networks	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems

Strands

Data and Information

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			Analyse and visualise data using a range of software to create information, and use structured data to model objects or events	Analyse and visualise data to create information and address complex problems, and model processes, entities and their relationships using structured data

Data and Information - continued

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Independently and with others create and organise ideas and information using information systems, and share these with known people in safe online environments	Individually and with others, plan, create and communicate ideas and information safely, applying agreed ethical and social protocols	Plan, create and communicate ideas, information and online collaborative projects, applying agreed ethical, social and technical protocols	Manage, create and communicate interactive ideas, information and projects collaboratively online, taking safety and social contexts into account	Manage and collaboratively create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities

Strands

Creating Digital Solutions

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Creating Digital Solutions - continued

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Problem solving

Creating Digital Solutions

Analyse

Define a problem, break it down, consider factors – *functional and non-functional requirements and constraints*

Design

Generate ideas for the solution – *user interface and algorithms*

Develop

Construct, program, implement solution – *write and test code*

Evaluate

Success, improvements, transferability, usability – *does the solution meet requirements?*

Problem solving

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Analyse

Design

Develop

Evaluate

In your school

- Are you familiar with the problem-solving methodology in the Creating Digital Solutions strand?

- Have you come across references to computational thinking in the Digital Technologies curriculum or support materials?

Ways of Thinking – Computational Thinking

Ways of Thinking

Students apply different ways of thinking when determining and using appropriate data, processes and digital systems to create innovative digital solutions.

These ways of thinking are:

- **Computational Thinking**
- **Design Thinking**
- **Systems Thinking**

Computational Thinking

An approach that involves breaking down problems into the smallest discrete parts, identifying and organising the data needed to solve the problem, and creating step by step sequences of instructions for implementing a solution.

Decomposition - breaking down the problem

Data - user input, gathered by sensors, time, duration, conditions...

Algorithm - sequence of instructions, may be linear initially

High level of integration with the Key Concepts (see Learning in Digital Technologies section, VCAA)

http://victoriancurriculum.vcaa.vic.edu.au/technologies/digital-technologies/introduction/learning-in-digital-technologies

Design Thinking

Using circumstances, events or identified problems to imagine creative and innovative solutions.

The process of generating ideas when developing a solution:

- What if we...
- Wouldn’t it be great if..
- How about...
- Why don’t we…

Visualise the solutions - draw, sketch, mock-up, prototype, justify, evaluate.

“Is there a better way?”

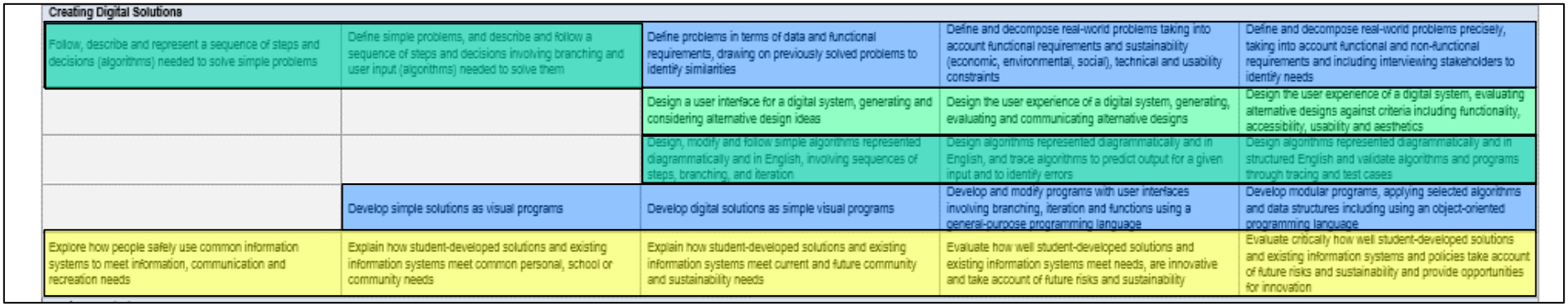
Systems Thinking

Exploring the connections and interactions between components, devices and people.

- Interactions of components or resources within one digital system (could involve peripheral devices)
- Interactions of digital systems within networks or information systems (intended vs unintended outputs)
- Interactions of people with digital systems

Impacts of digital systems on individuals, groups and society in general.

Ways of Thinking from F - 10



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Computational Thinking

Design Thinking

Systems Thinking

Key Concepts and Ways of Thinking embedded throughout the Digital Technologies curriculum.
Thinking strategies (computational and design) students rely on when creating a digital solution.

Digital Devices

In your school

- Why use digital devices to teach Digital Technologies?

- How did you choose what to use in your school?

Digital devices

- A digital system that students can program:
  - create an algorithm
  - accept user input
  - store or process data
  - produce output

- Students work towards Achievement Standards as they demonstrate understanding and application of coding concepts in combination.

- Each subsequent level adds complexity – continuum of learning.

Algorithmic development

F - 2 3 - 4	**Linear** - one path to take **User input** - step through algorithm in response to user **Branching** - user input or another condition selects a different set of instructions
5 - 6	**Iteration** - repeating part of the algorithm a set number of times or until a condition is fulfilled
7 - 8	**Functions** - discrete group of instructions that are called to action in defined conditions
9 - 10	**Modular** - reaching out to another set of instructions that have a more specific purpose or focus (methods)

A list, but not a shopping list

VCAA is not advocating any particular device that we look at today – your school context will be the biggest influence

Digital Technologies curriculum is not about devices – approximately 50% can be taught unplugged

If deciding to purchase devices, think about

- your school context
- longevity of the device use
- use in other curriculum areas

Is any other equipment essential to operate your new digital devices? (tablets, computers) How is it powered? (rechargeable/batteries)

Digital devices

BeeBot

- The BeeBot is a robot with 4 directional keys (forward, backward, turn right, turn left) that can be used to program up to 40 commands
- Useful to develop basic algorithmic understanding in F-2 students
- Limitations – cannot perform branching or looping operations

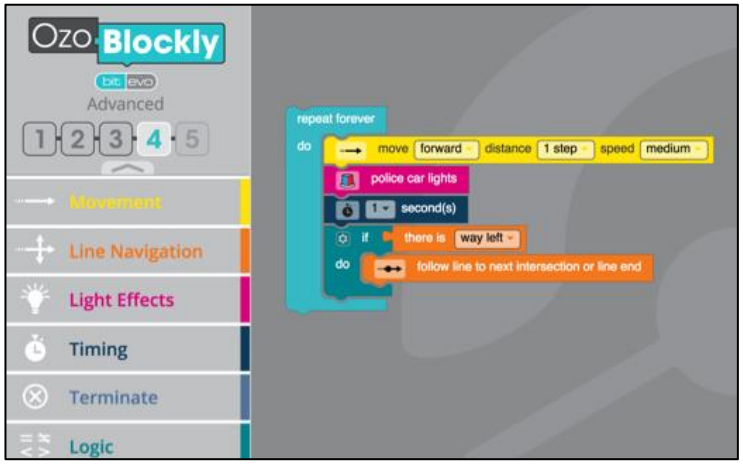
ProBot

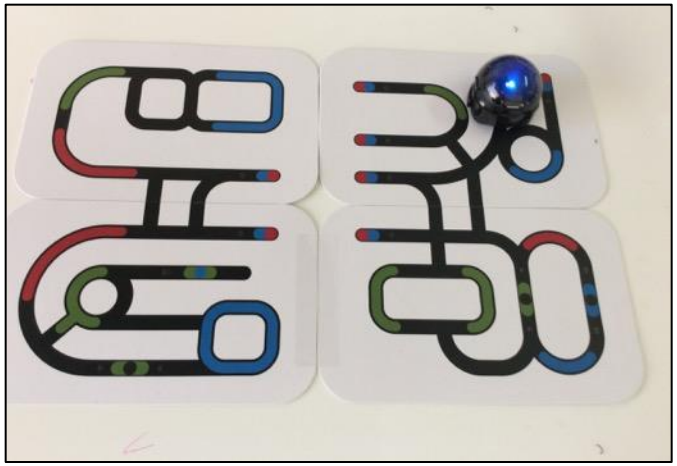
- The ProBot is the ‘big brother’ of the BeeBot
- More precision available than BeeBot, uses Logo programming language
- Programs can include procedures
- Touch, sound and light sensors
- Compatible with K-nex

Digital devices

Ozobot

- Ozobot Bit can be programmed using textas in 4 colours
- Moves on to block based coding through OzoBlockly
- iOS and Android apps, web based programming





Digital devices

Edison

A robot that can be programmed using:

- Barcodes
- Computers / block language (online Edware & Edblocks App)
- Text based online - EdPy app
- Can play music
- Can be programmed to avoid obstacles and follow lines
- Compatible with Lego

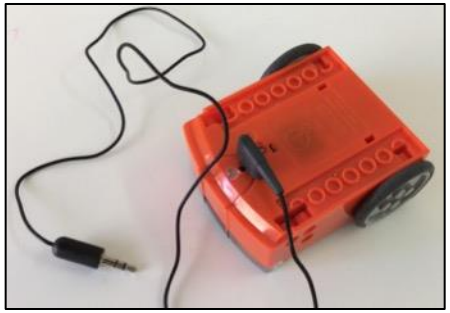
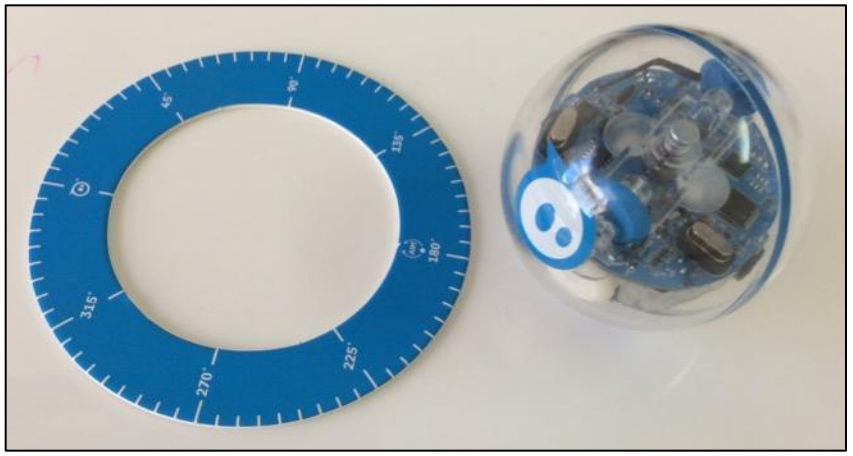


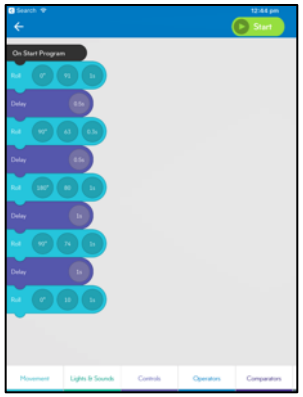
Image credit: Darrel Branson

Digital devices

Sphero Sprk+

- Paired via Bluetooth to the Sphero Edu app
- Device can be programmed by ‘drawing’ on screen
- Can use block based programming
- Output includes movement, LEDs and sound (played through tablet/smartphone)
- Can be extended through text based programming (JavaScript)
- Has a good community for lesson ideas





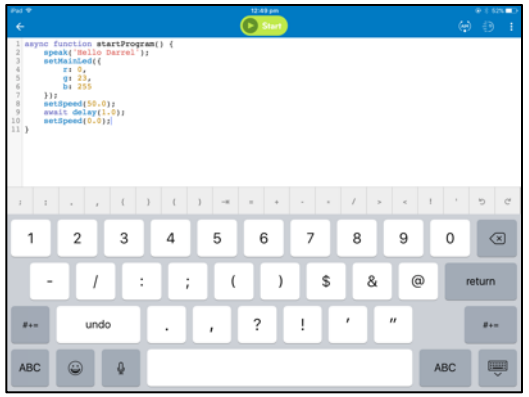
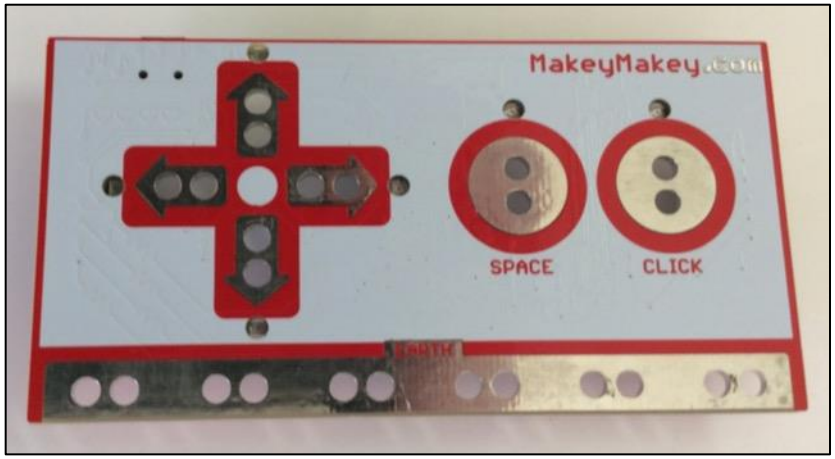
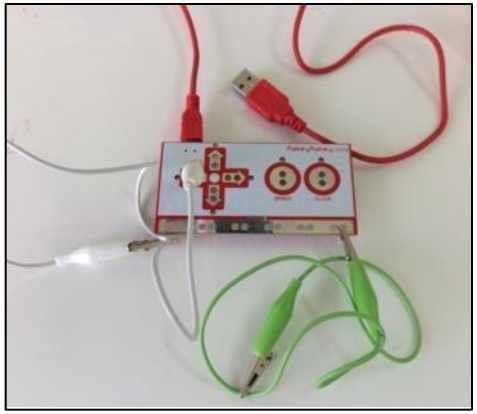


Image credit: Darrel Branson

Digital devices

Makey Makey





- Acts as an extension for a keyboard and mouse
- Other keys are accessible on reverse of board, as well as mouse movements
- Peripheral input, not processing
- Can be used in creative ways eg Game controller, reaction times, sound machine, ‘smart bins’, interactive displays

Image credit: Darrel Branson

Digital devices

BBC micro:bit

- 5 by 5 grid of LEDs
- Two input buttons
- Bluetooth, compass & accelerometer
- 3 input pins and power out
- Block based coding or JavaScript
- Connects via micro USB

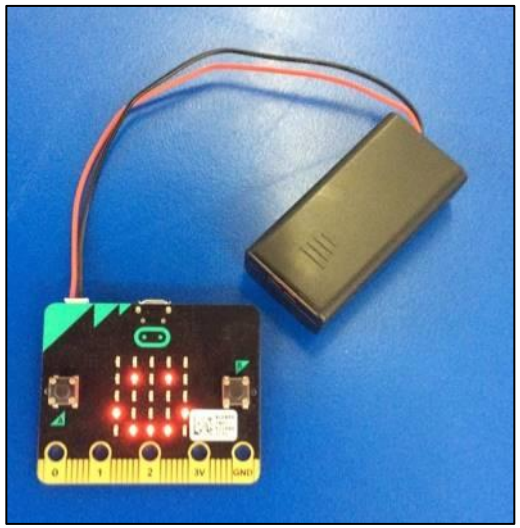
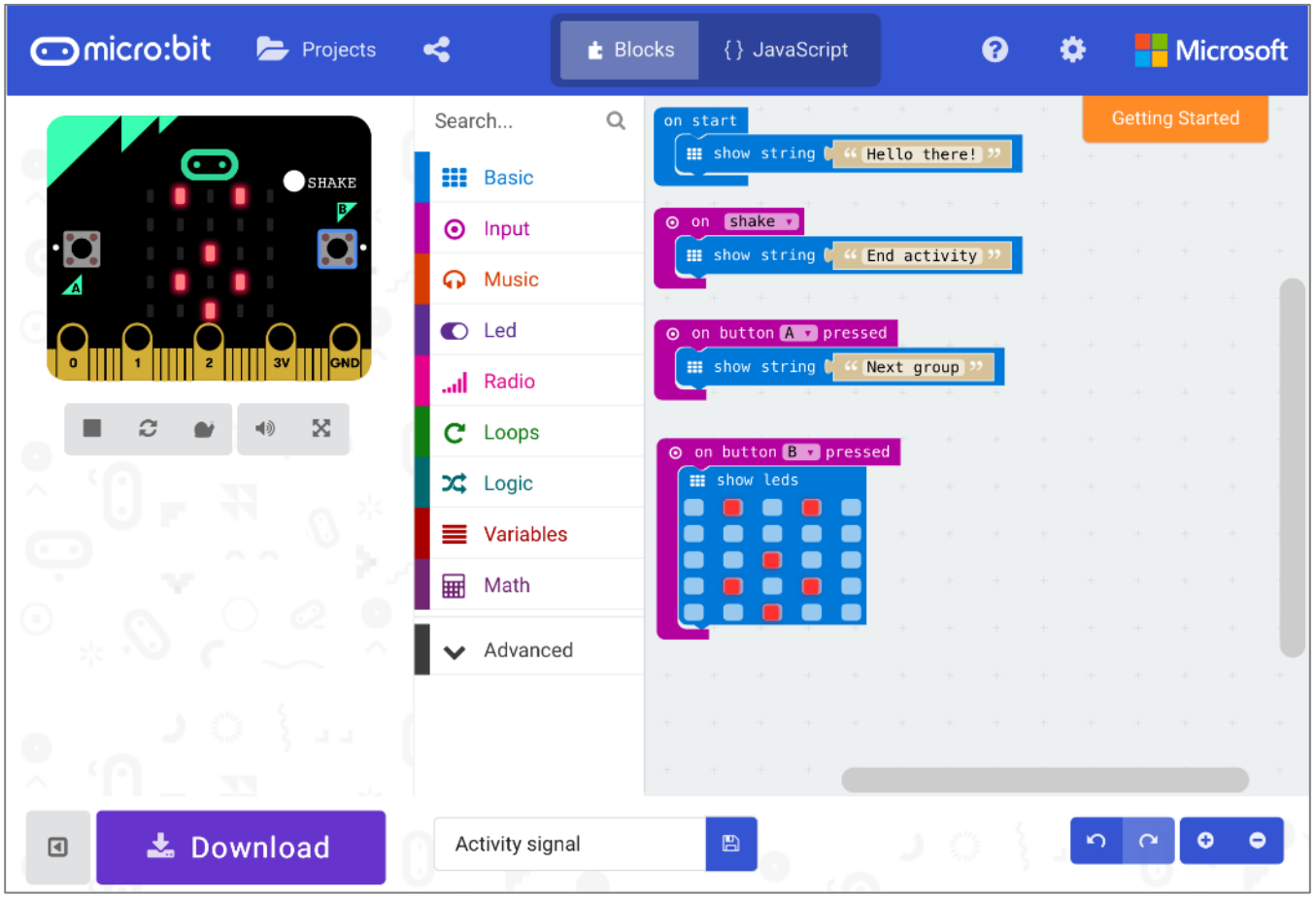


Image credit: Darrel Branson

Digital devices

Coding the BBC micro:bit

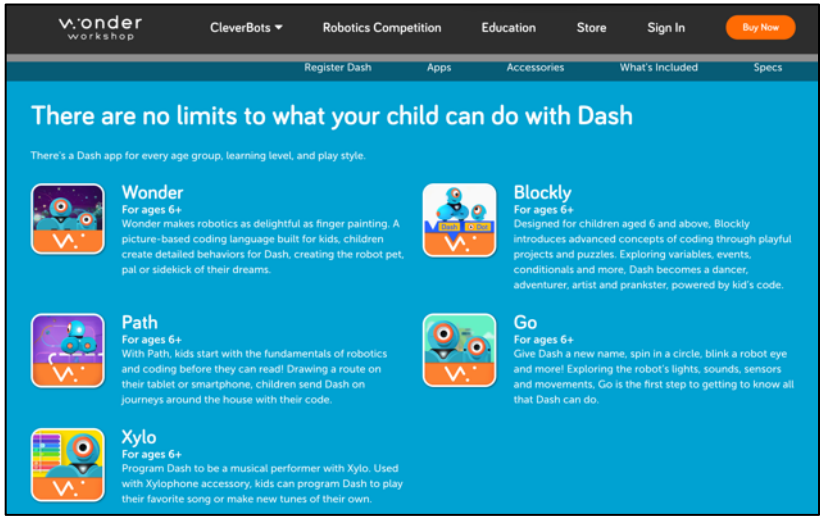


Coding environment and simulation online at https://makecode.microbit.org

Digital devices

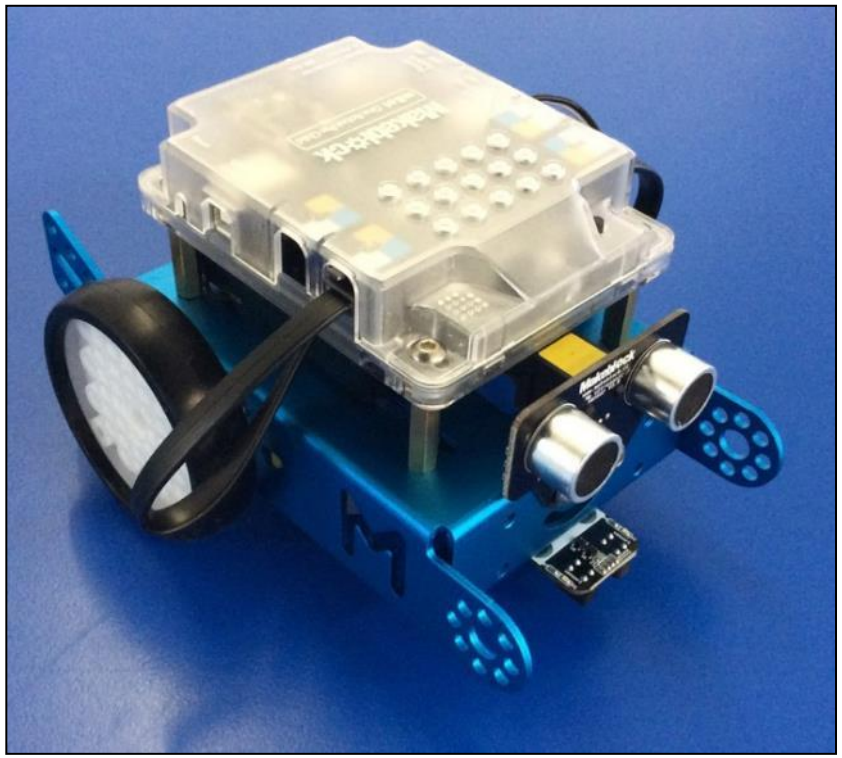
Dash & Dot

- Block based programming via tablet over Bluetooth
- Microphone, speakers, motors, lights, distance sensor
- Has a personality! (Preprogrammed behaviours and speech)
- Many iOS and Android apps



Digital devices

mBot



- Based on open source Arduino.
- Block based programming through mBlock and MakeBlock apps.
- Program on PC, Mac, iOS, Android and Chromebooks.
- Line detection, obstacle avoidance, light sensor, lights, basic sound output, IR remote.
- Connect via Bluetooth, USB or 2.4 Ghz with USB dongle
- Build your own!
- Can extend with other sensors and motors.
- Compatible with Lego

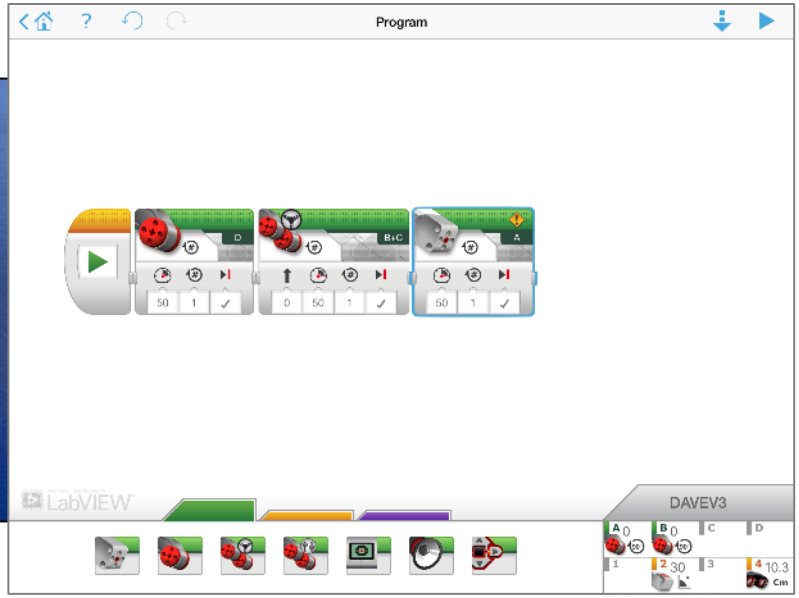
Image credit: Darrel Branson

Digital devices

Lego Mindstorms NXT and EV3

Image credit: Darrel Branson

- Program on PC, Mac, iOS, Android and Chromebooks.
- Block based programming
- Compatible with other Lego kits
- Many sensors
- Motors have rotational sensors



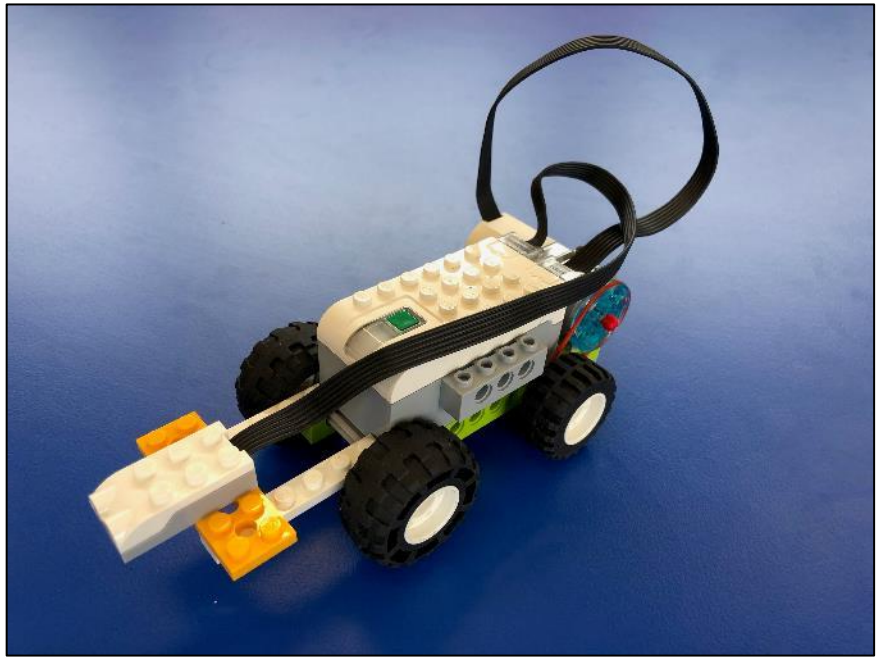
Digital devices

Hummingbird Duo Kit

- Create and program robots built from electronic components and craft materials.
- Based on open source Arduino.
- Block based programming through SNAP! and Scratch on PC and Mac. Also BirdBlox on iOS and Android (with additional Bluetooth dongle).
- A wide array of sensors – light, temperature, distance, rotation.

Digital devices

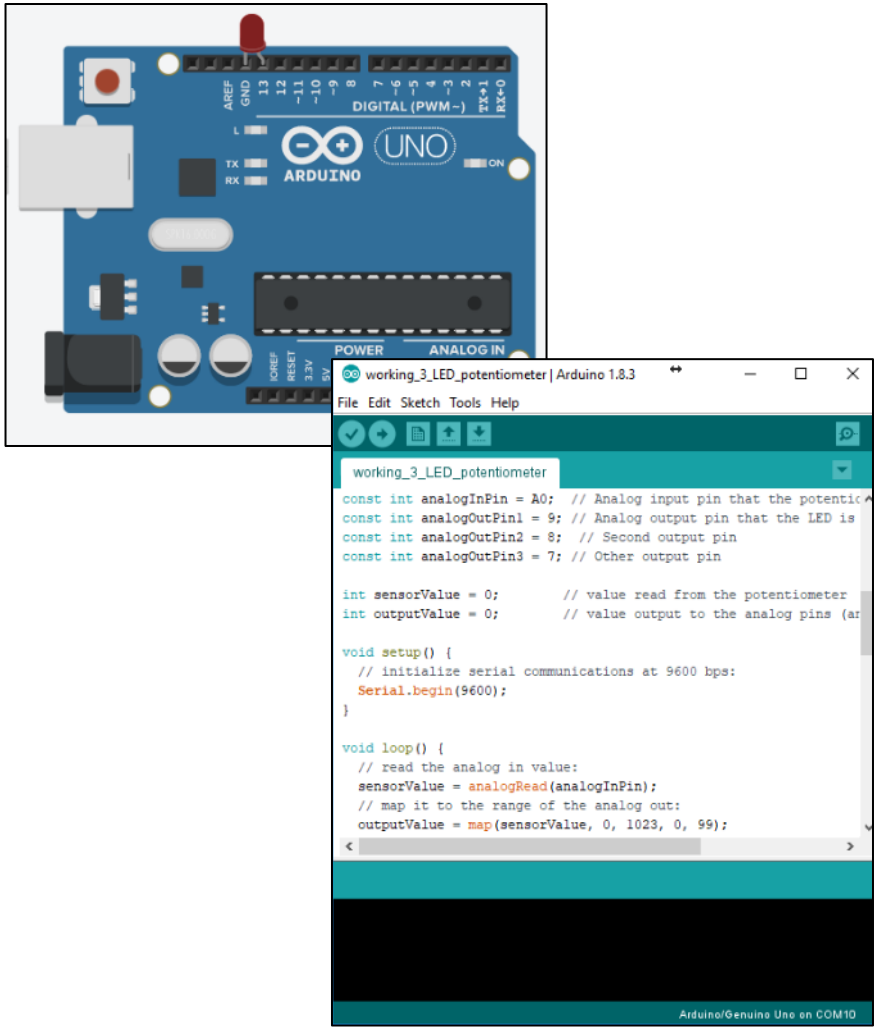
Lego WeDo



- Create objects and vehicles that are modifiable.
- Interactive through light sensor, tilt sensor and a motor (although only two slots on ‘smart brick’).
- Block based programming via Lego WeDo app (iOS).
- Also programmable through Scratch.

Digital devices

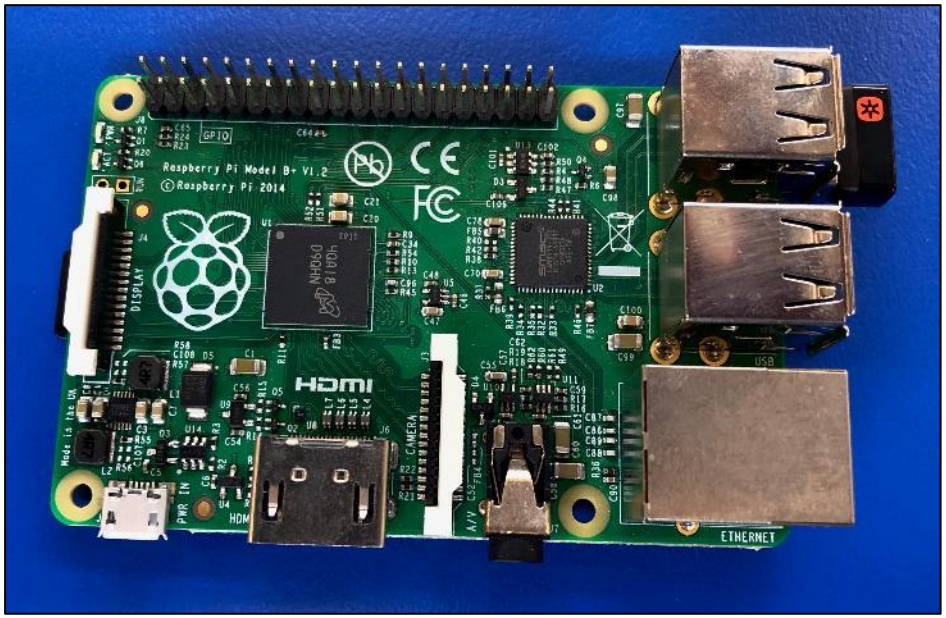
Arduino micro-controller boards



- Programmed using a C/C++ programming environment downloaded from http://www.arduino.cc
- Micro-controller that can take input, process data and produce output
- Connect to a range of sensors
- Many different models with capabilities such as Wi-fi and Bluetooth
- GPIO pins

Digital devices

Raspberry Pi



- Single board computer, usually runs on versions of Linux operating system
- HDMI and USB ports
- GPIO pins
- Version 3 and Zero-W have wireless and Bluetooth in-built
- Programmable via Scratch and Python (included in many basic software distributions)
- Requires peripherals for input and output (monitor, keyboard, mouse, etc)

Digital devices - Discussion

- Which of these Digital Devices have you used in the classroom?
- Which of these Digital Devices are brand new to you?
- What experiences have you had in the classroom that you would like to share?

Digital devices in the curriculum

Where does it fit?

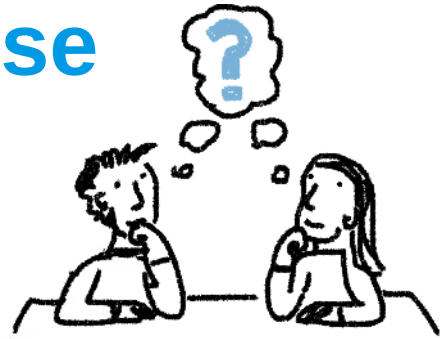
	Input/output	Branching	User input	Iteration	Functions	Modules
BeeBot	✓		✓			
ProBot	✓	✓	✓	✓	✓	
OzoBot	✓	✓	✓	✓	✓	
Makey Makey	✓					
BBC micro:bit	✓	✓	✓	✓	✓	✓
mBot	✓	✓	✓	✓	✓	✓
Lego WeDo/ NXT/EV3	✓	✓	✓	✓		

Where does it fit?

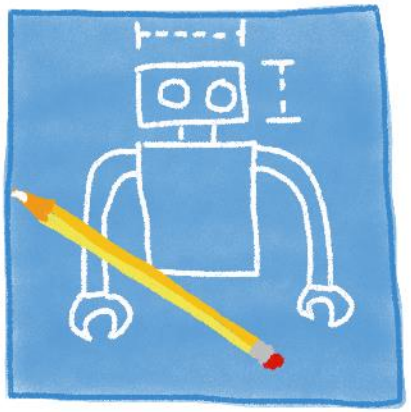
	Input/output	Branching	User input	Iteration	Functions	Modules
Sphero	✓	✓	✓	✓	✓	✓
Edison	✓	✓	✓	✓	✓	✓
Arduino	✓	✓	✓	✓	✓	✓
Raspberry Pi	✓	✓	✓	✓	✓	✓
Dash & Dot	✓	✓	✓	✓		
Hummingbird	✓	✓	✓	✓	✓	✓

Using digital devices for learning

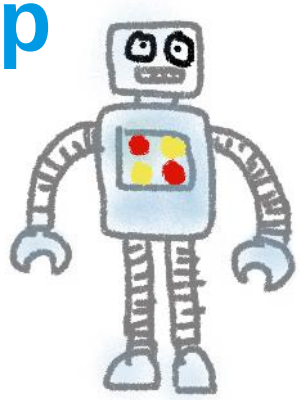
Analyse



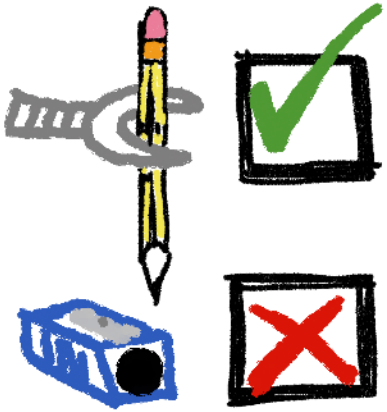
Design



Develop



Evaluate



Using digital devices for learning

- Collaborate
  - Cultivate collective expertise
  - Problem solving and ‘beta testing’
  - Simulate code by writing, flowcharting, walking through

- Audience
  - Who sees/uses/evaluates finished solution?

- Mix of plugged and unplugged learning
  - Transfer across context
  - Same concepts on multiple platforms/environments/ devices

- Cross curriculum
  - Skills that can be used to demonstrate understanding in other curriculum areas

Using digital devices for learning

- Design your assessment at the planning stage
  - What skills will students need?
  - How will those skills be demonstrated?
  - Solo/partner/group work

- Attempt your tasks first!
  - Find the tricky points where explicit teaching is necessary
  - ‘Just in time’ workshops
  - Target your time and support materials (from anchor charts to support websites or FAQs)

- Celebrate successes

- Celebrate failure!

VCAA Support

VCAA Support

www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/proflearning/complete-professional-learning.aspx

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- Health and Physical Education
- Mathematics
- Science
- Technologies

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Victorian Curriculum
Foundation–10

Professional learning

Professional learning opportunities designed to support schools and teachers familiarise themselves with the Victorian Curriculum F-10 are now available. Deep familiarisation with the curriculum is essential to enable the development of a comprehensive teaching and learning program.

The VCAA offers three modes of professional learning delivery:

- Online professional learning sessions
- Face-to-Face workshops and conference days
- On Demand sessions

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Digital Technologies and Coding

Primary	Secondary	Combined
Face-to-face	Face-to-face	Face-to-face
Online	Online	Online
On demand[1]	On demand[1]	On demand[1]

[1] Not available

VCAA Support

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Primary – Face-to-face

Introduction to the Digital Technologies Curriculum (F-6)

This full-day workshop will introduce participants to the Digital Technologies curriculum from F-6. They will become familiar with the curriculum as a continuum, ways of thinking, strands, key terms, content descriptions, achievement standards, levels and curriculum planning with some examples of how to approach the teaching. This workshop will be suitable for teachers with little or no knowledge of the curriculum.

Outline:

- Introduction to the curriculum
- Key concepts and activities
- Curriculum mapping and planning

Participants are required to bring laptops and/or any relevant digital devices.

Burwood Wednesday 2 May 9:00am-3:30pm Register Now	Moe Wednesday 13 June 9:00am-3:30pm Register Now

VCAA Support

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To get started with professional learning, select a curriculum area from the left and navigate to the sessions that interest you.

Networks of schools can also request tailored professional learning sessions. Any network or cluster of schools seeking support is requested to nominate a contact person. The contact person must complete and email the request template (doc - 85kb) to the following email address: vcaa.F-10.RFS@edumail.vic.gov.au. Upon receipt, the VCAA will contact the nominated person to discuss.

There is no cost to register for any of the professional learning sessions.

Digital Devices in the Digital Technologies curriculum

Evaluation for this webinar:

https://goo.gl/Vc7WKx

VCAA Webinar
Thursday 7th June 2018

Sean Irving
VCAA Specialist Teacher (Digital Technologies)
Lockington Consolidated School