The Victorian Curriculum
Digital Technologies

Creating Digital Solutions: Programming languages in the Digital Technologies curriculum (F-10)

Webinar – 19 October 2017

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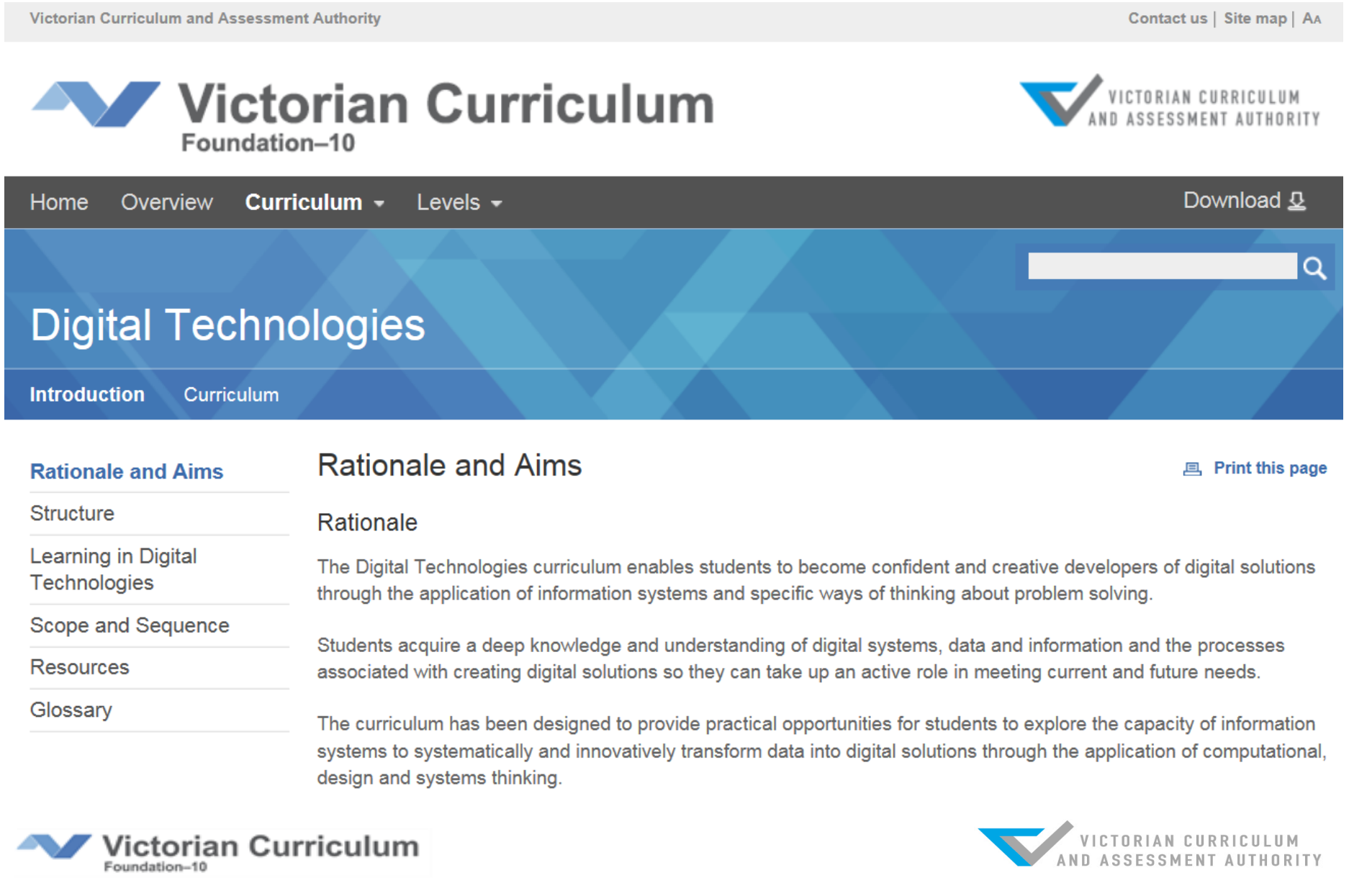
Resources

Digital Technologies Curriculum

http://victoriancurriculum.vcaa.vic.edu.au/technologies/digital-technologies/introduction/rationale-and-aims



Scope and Sequence F-10

http://victoriancurriculum.vcaa.vic.edu.au/technologies/digital-technologies/introduction/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 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
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 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	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
			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
		Design, modify and follow simple algorithms represented diagrammatically and in English, involving sequences of steps, branching, and iteration	Design algorithms represented diagrammatically and in English, and trace algorithms 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.

Planning and reporting

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/curriculumplanning.aspx

Victorian Curriculum F–10

Revised curriculum planning and reporting guidelines

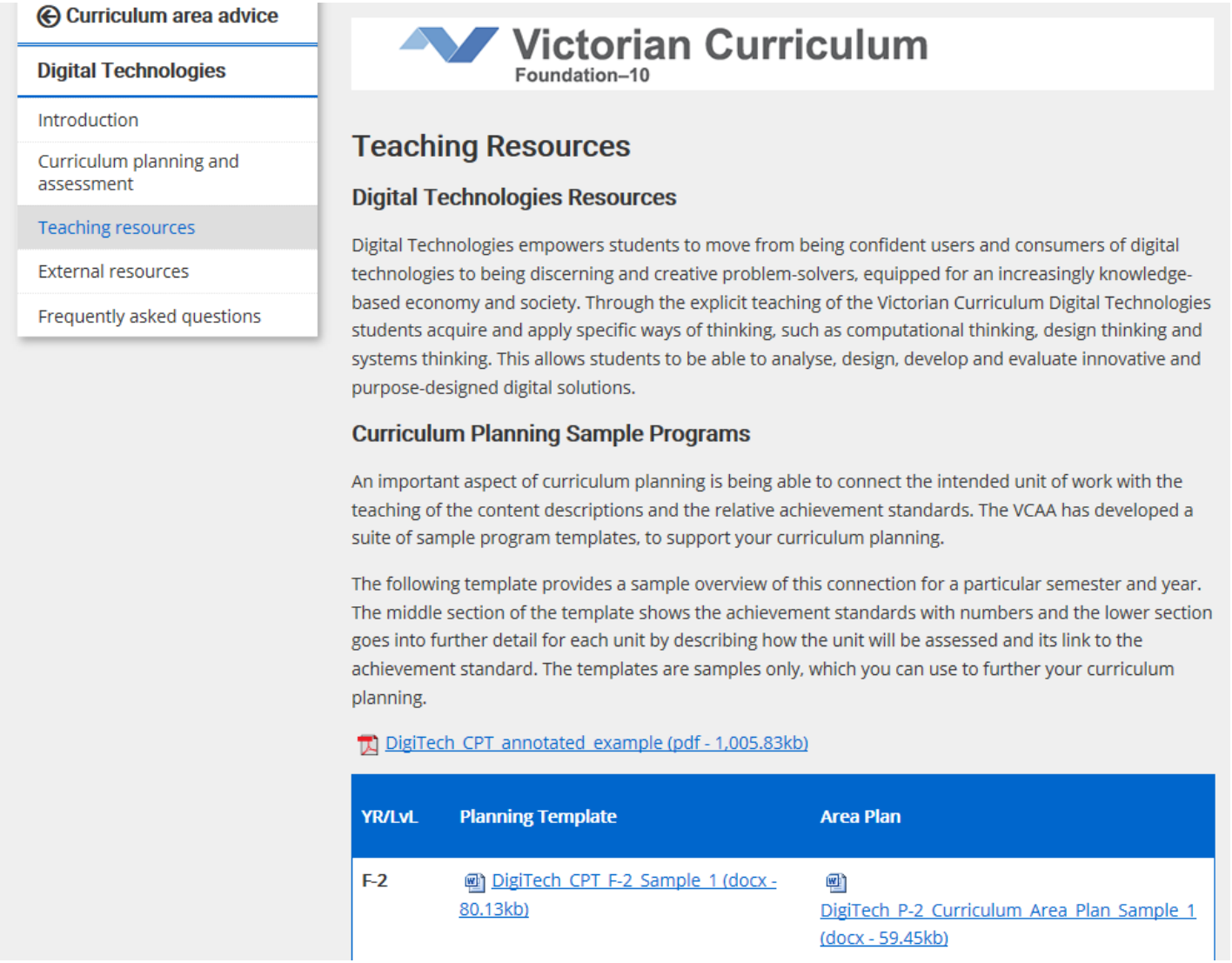
December 2015

Victorian Curriculum Foundation–10 | Victorian Curriculum and Assessment Authority | Victoria State Government

Victorian Curriculum Foundation–10 | Victorian Curriculum and Assessment Authority | Victoria State Government

Teaching Resources

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx



Curriculum area advice

Digital Technologies

- Introduction
- Curriculum planning and assessment
- Teaching resources
- External resources
- Frequently asked questions

Victorian Curriculum
Foundation–10

Teaching Resources

Digital Technologies Resources

Digital Technologies empowers students to move from being confident users and consumers of digital technologies to being discerning and creative problem-solvers, equipped for an increasingly knowledge-based economy and society. Through the explicit teaching of the Victorian Curriculum Digital Technologies students acquire and apply specific ways of thinking, such as computational thinking, design thinking and systems thinking. This allows students to be able to analyse, design, develop and evaluate innovative and purpose-designed digital solutions.

Curriculum Planning Sample Programs

An important aspect of curriculum planning is being able to connect the intended unit of work with the teaching of the content descriptions and the relative achievement standards. The VCAA has developed a suite of sample program templates, to support your curriculum planning.

The following template provides a sample overview of this connection for a particular semester and year. The middle section of the template shows the achievement standards with numbers and the lower section goes into further detail for each unit by describing how the unit will be assessed and its link to the achievement standard. The templates are samples only, which you can use to further your curriculum planning.

DigiTech_CPT_annotated_example (pdf - 1,005.83kb)

YR/LvL	Planning Template	Area Plan
F-2	DigiTech_CPT_F-2_Sample_1 (docx - 80.13kb)	DigiTech_P-2_Curriculum_Area_Plan_Sample_1 (docx - 59.45kb)

Resource samples

Curriculum Planning Templates

Victorian Curriculum Foundation–10

Curriculum Planning Template: Digital Technologies 7-8 (Sample Program 1)

Instruction: List the title of the unit of work in the first column and then tick the check box of the content description/s addressed by it, which can be done electronically. Once completed, fill out the 'Assessments' table.
For detailed notes regarding the purpose of this template and further instructions for completion, refer here

	Strand	Digital Systems		Data and Information								Creating Digital Solutions									
	Content Description	Investigate how data are transmitted and secured in wired, wireless and mobile networks (VCDTD5035)		Investigate how digital systems represent text, image and sound data in binary (VCDTDI036)		Acquire data from a range of sources and evaluate their authenticity, accuracy and timeliness (VCDTDI037)		Analyse and visualise data using a range of software to create information, and use structured data to model objects or events (VCDTDI038)		Manage, create and communicate interactive ideas, information and projects collaboratively online, taking safety and social contexts into account (VCDTDI039)		Define and decompose real-world problems taking into account functional requirements and sustainability (economic, environmental, social), technical and usability constraints (VCDTCD040)		Design the user experience of a digital system, generating, evaluating and communicating alternative designs (VCDTCD041)		Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (VCDTCD042)		Develop and modify programs with user interfaces involving branching, iteration and functions using a general-purpose programming language (VCDTCD043)		Evaluate how well student-developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability (VCDTCD044)	
Sequence of Lessons / Unit	Semester/ Year	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #	CD	Achievement standard #
Computer networks	Semester 1 / Year 7	☑	1	☐		☐		☐		☐		☐		☐		☐		☐		☐	
Data storage	Semester 1 / Year 7	☐		☑	2	☐		☐		☐		☐		☐		☐		☐		☐	
Data visualisations	Semester 1 / Year 7	☐		☐		☑	3	☑	3	☑	4	☐		☐		☐		☐		☐	
Requirements and user experiences	Semester 2 / Year 7	☐		☐		☐		☐		☐		☑	5	☑	6	☐		☐		☐	
Algorithms	Semester 2 / Year 7	☐		☐		☐		☐		☐		☐		☐		☑	6	☐		☐	
Programming	Semester 2 / Year 7	☐		☐		☐		☐		☐		☐		☐		☐		☑	6	☐	
Product evaluation	Semester 2 / Year 7	☐		☐		☐		☐		☐		☐		☐		☐		☐		☑	7

Levels 5 and 6 Achievement Standard

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.

Levels 7 and 8 Achievement Standard

Separated by line. Number in brackets, e.g. (3), can be used as an identifier in various parts of the template.

By the end of Level 8

- Students distinguish between different types of networks and their suitability in meeting defined purposes. (1)
- Students explain how text, image and sound data can be represented and secured in digital systems and presented using digital systems. (2)
- They analyse and evaluate data from a range of sources to model solutions and create information. (3)
- They manage the collaborative creation of interactive ideas, information and projects and use appropriate codes of conduct when communicating online. (4)
- Students define and decompose problems in terms of functional requirements and constraints. (5)
- They design user experiences and algorithms incorporating branching and iterations, and develop, test, and modify digital solutions. (6)
- Students evaluate information systems and their solutions in terms of meeting needs, innovation and sustainability. (7)

Levels 9 and 10 Achievement Standard

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.

Level 7 Assessments

Unit (Title)	Assessment	Achievement Standard/s
Computer networks	Report: Comparison of network types and purposes.	1
Data storage	Exercises and a test.	2
Data visualisations	Research task and report.	3, 4

Level 8 Assessments

Unit (Title)	Assessment	Achievement Standard/s
Requirements and user experiences	Folio: Requirements and user experiences.	5, 6
Algorithms	Folio: Flowcharts and pseudocode.	6
Programming	Folio: Submission of programs and evidence of working robot tasks.	6
Product evaluation	Web report: Evaluation of programming solution and working robot task.	7

SAMPLE ONLY

Curriculum Area Plans

Curriculum Area Plan: Digital Technologies - Years 5 and 6 (Sample Program 3)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 5	Semester 1												Components of digital systems – 5.1.1				Examination of whole numbers – 5.1.2		
													Digital Systems Investigation				Numbers Activity		
	Semester 2	Interpret and visualise data – 5.2.1				Online collaborative projects – 5.2.2													
		Student Survey Project a. Collect and interpret data				Student Survey Project b. Communication of findings													
Year 6	Semester 1																		
	Semester 2		Define problems – 6.2.1		Design user interface – 6.2.2			Design algorithms – 6.2.3			Develop simple visual programs – 6.2.4						How solution meets needs – 6.2.5		
			Programming Project a. Analysis - Requirements		Programming Project b. Design						Programming Project c. Development						Programming Project d. Evaluation		
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 1 hour of teaching time per week

Key: Digital Systems | Data and Information | Creating Digital Solutions | Topic, level, semester, sequence

Curriculum Area Plan: Digital Technologies - Years 9 and 10 (Sample Program 1)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 9	Semester 1	Role of hardware, software, data and networks – 9.1.1			Data compression – 9.1.2	Techniques for acquiring data – 9.1.3	Analyse and visualise data – 9.1.4	Manage and collaborate – 9.1.5			Decompose problems – 9.1.6	Design user experience – 9.1.7	Design algorithms – 9.1.8	Develop modular programs – 9.1.9					Evaluate solutions – 9.1.10
		Internet of Things			Creating web sites				Spreadsheets		Python programming								Programming evaluation
	Semester 2																		
Year 10	Semester 1																		
	Semester 2																		
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 3 x 45 minutes teaching time per week

Key: Digital Systems | Data and Information | Creating Digital Solutions | Topic, level, semester, sequence

VICTORIA State Government

Indicative Progress Examples

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/cpa.aspx

CURRICULUM AREA: Digital Technologies *toward* Level 10 Achievement Standard

Context: Legal Responsibilities
Students, who as part of a larger project are planning and developing a mobile application for a cafe or restaurant, will explore the legal responsibilities involved when collecting and storing data for use in a mobile application. The teaching and learning plan focuses on the strands of Data and Information and Creating Digital Solutions.

Content Description:

- Develop techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements (VCDTDI047)
- 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 (VCDTCD054)

Digital Technologies Level 8 Achievement Standard	Example of Indicative Progress towards Level 10 Achievement Standard	Digital Technologies Level 10 Achievement Standard
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.	**In Digital Technologies, indicative progression towards the Level 10 achievement standard may be when students:** • identify privacy and security requirements that existing social media platforms and mobile applications use when collecting personal data. • describe potential risks in the storage and access to customer personal data when the student developed mobile application is used to place an order.	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.

Still to come – Units of Work

Creating Computer Games

Levels 5 and 6

Unit overview

In this unit of work students apply the processes (analyse, design and develop) involved in creating a computer game using the visual programming language, Scratch. They explore design features of computer games and consider factors that influence the playability of games such as level of difficulty, speed and user interactions. Students prepare algorithms that identify decisions and steps to be followed in the game. They use Scratch to transform their designs into a functioning game. This unit is scheduled to take 10 weeks (three sessions each week) of teaching and learning. The teaching and learning plan focuses on the strands of Data and Information and Creating Digital Solutions.

Digital Technologies Curriculum

Digital Technologies Curriculum Content Descriptions - Levels 5 and 6

Data and Information

- Plan, create and communicate ideas, information and online collaborative projects, applying agreed ethical, social and technical protocols (VCDTDI029)

Creating Digital Solutions

- Design a user interface for a digital system, generating and considering alternative design ideas (VCDTCD031)
- Design, modify and follow simple algorithms represented diagrammatically and in English involving sequences of steps, branching, and iteration (VCDTCD032)
- Develop digital solutions as simple visual programs (VCDTCD033)

Digital Technologies Achievement Standard – Levels 5 and 6

Highlighted sections are addressed in this unit.

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.

DRAFT

Professional Learning with VCAA Specialist Teachers

Professional learning opportunities

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccur-proflearn-specialists.aspx

Victorian Curriculum
Foundation–10

Statewide Professional Learning Sessions

Victorian Curriculum F–10: Specialist Teachers sessions to support curriculum implementation

As part of the Education State support for implementation of the Victorian Curriculum F-10, professional learning sessions facilitated by Specialist Teachers are being offered. Teachers who attend the sessions will be able to examine and enhance their understanding of a specific curriculum area, and how to develop high quality teaching and learning programs.

There is no cost associated with registering for these sessions.

Ways professional learning can be delivered

Teachers in Victorian government, Catholic and independent schools will be able to access support from Specialist Teachers in one or more of the following ways:

1. Attend full day face-to-face workshops
2. Attend online sessions that are either an hour or 90 minutes duration
3. Request sessions for networks or clusters of schools.

Enquiries:

Any enquiries about Term 4 Specialist Teacher professional learning should be directed to:

Billy Nguyen, Program Officer, VCAA Curriculum Division by email: nguyen.huu.b@edumail.vic.gov.au

Funding for government schools

Additional information relating to funding support for Government Schools can be found below.

VICTORIA State Government

Types of sessions

Professional Learning Menu		
Civics*	Critical and Creative Thinking	Digital Coding
Ethical Capability	Financial Literacy	Health Education and Personal and Social Capability*
Literacy in the Early Years	Music*	STEM

Teaching to the Creating Digital Solutions strand (F-10)

This online session will explore the Creating Digital Solutions strand of the Digital Technologies curriculum. Specialist teachers will highlight the progression through the strand from F-10, and identify key ideas involved in programming with students. The session will make links between the ways of thinking involved in each level.

Outline:

- Key concepts in the Creating Digital Solutions strand
- Ways of thinking
- Algorithm development
- Representing and tracing algorithms
- Possible teaching approaches
- Transition from visual programming languages to general purpose programming languages to object oriented programming languages

Online
(via Adobe Connect)

Monday
13 November
3:45pm-4:45pm
Book Now

Online
(via Adobe Connect)

Monday
4 December
9:00am-10:00am
Book Now

Making a booking

Digital Coding Online - Teaching to the Creating Digital Solutions strand (F-10)

Teaching to the Creating Digital Solutions strand (F-10)

This online session will explore the Creating Digital Solutions strand of the Digital Technologies curriculum. Specialist teachers will highlight the progression through the strand from F-10, and identify key ideas involved in programming with students. The session will make links between the ways of thinking involved in each level.

When

Monday, 13 November 2017
3:45pm-4:45pm

Where

via Adobe Connect

Your Details

First Name

Surname

Phil Feain
Curriculum Manager, Digital Technologies

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DLTV Webinar - Thursday 19th October 2017

Creating Digital Solutions Programming Languages in the Digital Technologies Curriculum (F-10)

Megan van der Velden
VCAA Specialist Teacher (Digital Technologies)
Wooranna Park Primary School

Eduard Schaepman
VCAA Specialist Teacher (Digital Technologies)
Deepdene Primary School

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VCAA Professional Learning Support

- To find online webinars or face-to-face sessions in your area:

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccur-proflearn-specialists.aspx

- To request a session for your local network:

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccur-proflearn-specialists.aspx#request

What to expect in this Webinar

- Brief Overview of the Curriculum
- Ways of Thinking
- Introduction to the Strands
- Development of Programming Languages
- Planning Ideas to get you started
- Resources

Who's on the Webinar with Us Today?

What sector are you from?

What Year Levels are you teaching?

Have you been teaching DigiTech this year or will you be teaching this curriculum area for the first time next year?

The Digital Technologies Curriculum

A Brief Overview

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY
VICTORIA State Government

Digital Technologies F-10

- New Curriculum Area
- Not a replacement for ICT (students use technology to create digital solutions)
- Can be taught over two years (3 years F-2)
- All students undertake Digital Technologies to Years 7 and 8
- Digital Technologies to be offered to students in Years 9 and 10
- Designed for about 50% to be taught unplugged (without technology)

Progression of Programming Skills F-10

Visual Programming (Levels 3-6)

- Block based, for example:
  - Scratch or other block based programming software

General Purpose (Levels 7 and 8)

- Language based, for example:
  - Python, Java Script, Visual Basic

Object Oriented (Levels 9 and 10)

- Visual Basic, C++

Why Digital Technologies?

Key Concepts

Key Concepts

Concept	Definition
Abstraction	
Data Collection	
Specification, algorithms and development	
Digital Systems	
Interactions and impacts	

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

Ways of Thinking

Computational Thinking

A **problem-solving** method that involves various techniques and strategies in order to solve problems that can be implemented by digital systems, such as:

- organising data logically
- breaking down problems into components
- the design and use of algorithms, patterns and models

Design Thinking

Purposeful use of strategies for:

- understanding **design problems** and **opportunities**
- **visualising and generating** creative and innovative ideas
- **analysing and evaluating** those ideas that best meet the criteria for success and planning

Systems Thinking

A holistic approach to the **identification** and **solving** of problems where

- **parts** and **components** of a **system** are analysed
- **interactions** and **interrelationships** between **information system components** (data, processes, people and digital systems) are analysed to see how they influence the functioning of the whole system
- students **understand systems** and work with **complexity, uncertainty and risk**

Ways of Thinking

- How are you going about teaching the Ways of Thinking at the moment?

- What changes would you make to your delivery of the curriculum now?

Creating Digital Solutions Strand

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Creating Digital Solutions

- Students engage in the four processes of:
  - Analysing
  - Designing
  - Developing
  - Evaluating

Creating Digital Solutions

Creating Digital Solutions requires:

- skills in using digital systems
- computational, design and systems thinking
- interacting safely by using appropriate technical and social protocols

Creating Digital Solutions Levels F-6

Levels F-2	Levels 3 and 4	Levels 5 and 6
Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems	Define problems in terms of functional requirements	Define problems in terms of data and functional requirements, drawing on previously solved problems to identify similarities
	Design a user interface	Design a user interface for a digital system, generating and considering alternative design ideas
	Develop algorithms with branching and iteration	Design, modify and follow simple algorithms represented diagrammatically and in English, involving sequences of steps, branching, and iteration
	Develop simple visual programs	Develop digital solutions as simple visual programs
Explore how people safely use common information systems to meet information, communication and recreation needs	Explain how student-developed solutions meet needs	Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs

Creating Digital Solutions 7-10

Levels 7 and 8	Levels 9 and 10
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 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**
Design **algorithms represented diagrammatically and in English**, and trace algorithms 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 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**
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**

Creating Digital Solutions F-2

- Follow, describe and represent a sequence of steps and decisions (**algorithms**) needed to solve **simple problems**

- Explore how people safely use common information systems to meet information, communication and recreation needs

Algorithms F-2

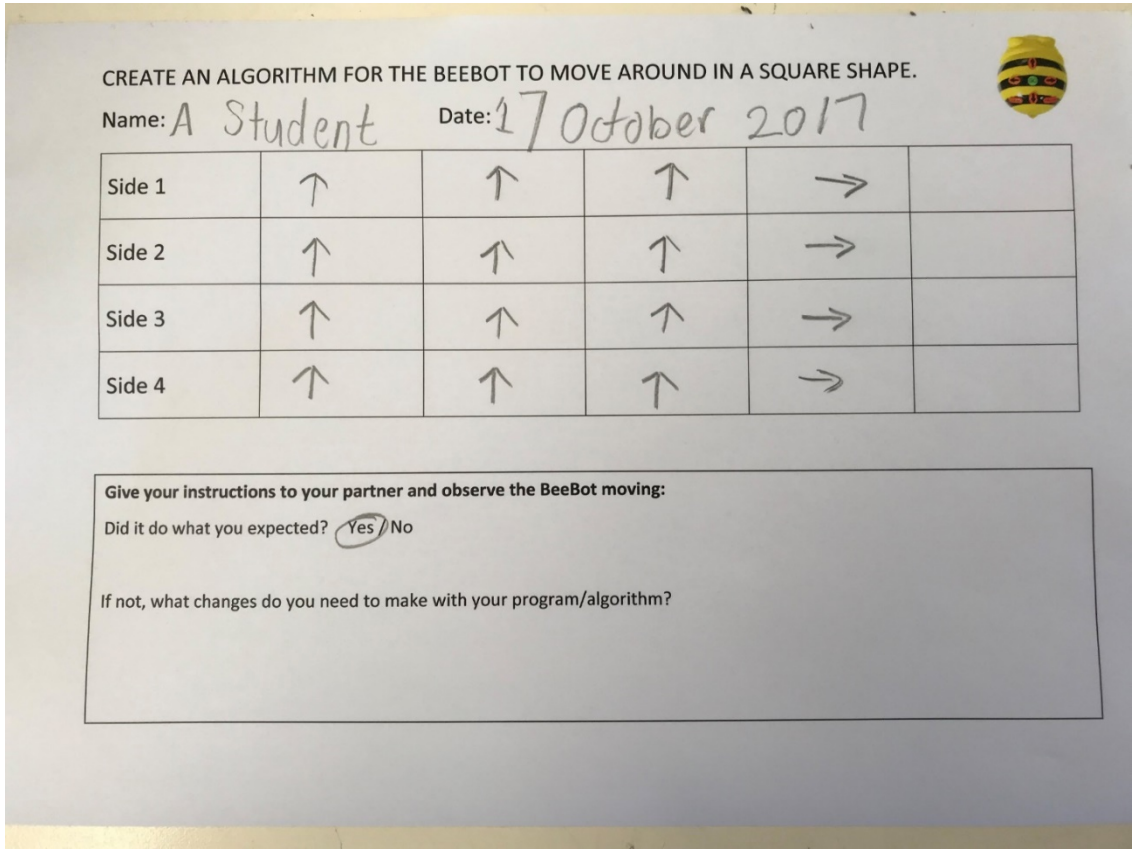
- **Start with something your students know well:**
  - Instructions for cleaning teeth
  - Morning routine
  - Crossing the road
  - Making a sandwich

Morning Routine

1. Enter the classroom
2. Place Bag on hook
3. Take out diary and reader
4. Sit at table reading quietly

Represent a Simple Problem as an Algorithm

Problem:
Move the Bee-Bot around in a square shape using arrows to show the direction of movement.



CREATE AN ALGORITHM FOR THE BEEBOT TO MOVE AROUND IN A SQUARE SHAPE.

Name: A Student Date: 17 October 2017

Side 1	↑	↑	↑	→	
Side 2	↑	↑	↑	→	
Side 3	↑	↑	↑	→	
Side 4	↑	↑	↑	→	

Give your instructions to your partner and observe the BeeBot moving:

Did it do what you expected? (Yes) / No

If not, what changes do you need to make with your program/algorithm?

Image: Megan van der Velden

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Creating Digital Solutions
Levels 3 and 4

- Define simple problems, and describe and follow a sequence of steps and decisions involving **branching** and **user input** (algorithms) needed to solve them

- Develop simple solutions as **visual programs**

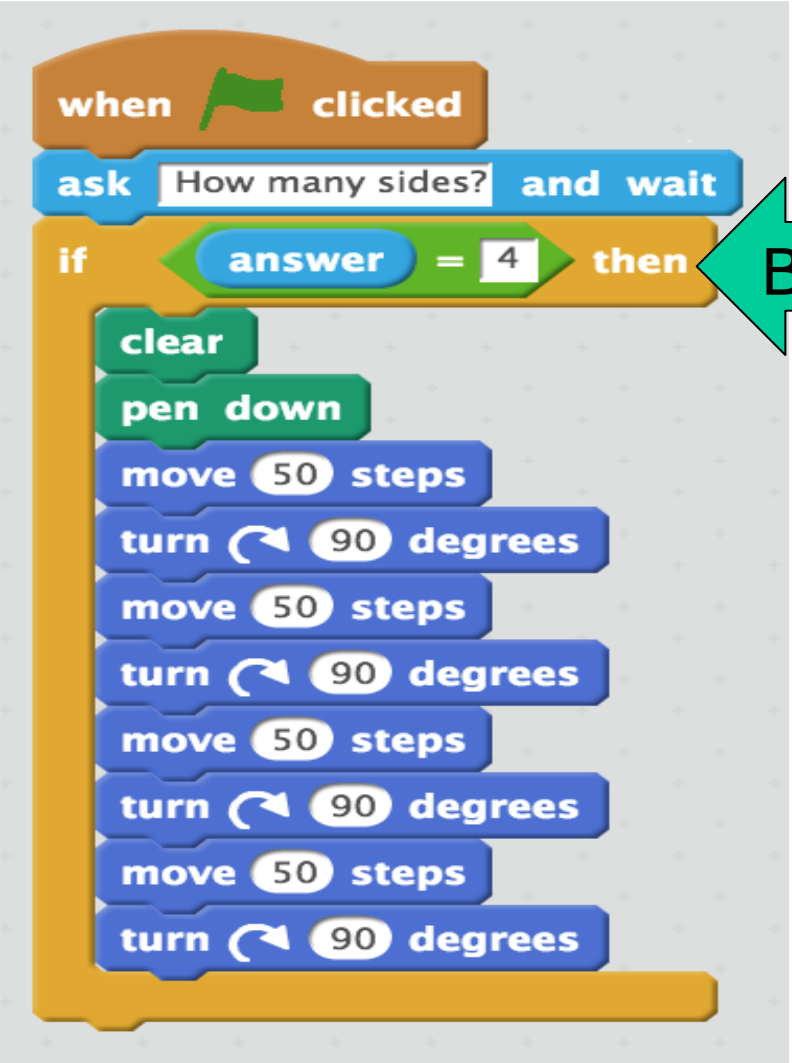
- Explain how **student-developed** solutions and existing **information** systems meet **common personal, school or community needs**

Visual Programming

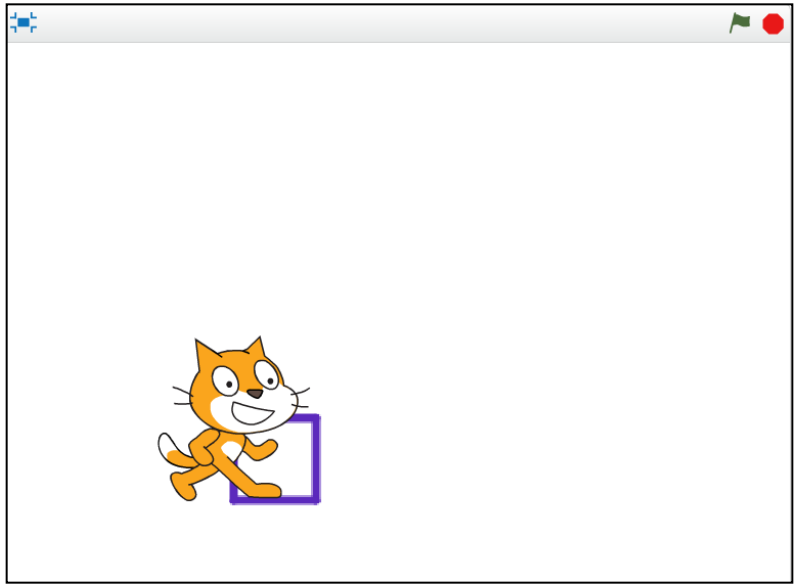
- A programming language or environment where the program is **represented and created visually** rather than as text.

- *A visual programming language should not be confused with programming languages for creating visualisations or programs with user interfaces, for example, Processing or Visual Basic.*

Introducing Branching – Levels 3 and 4



Branching IF... THEN...



Program and Screenshots: Megan van der Velden & Eduard Schaepman

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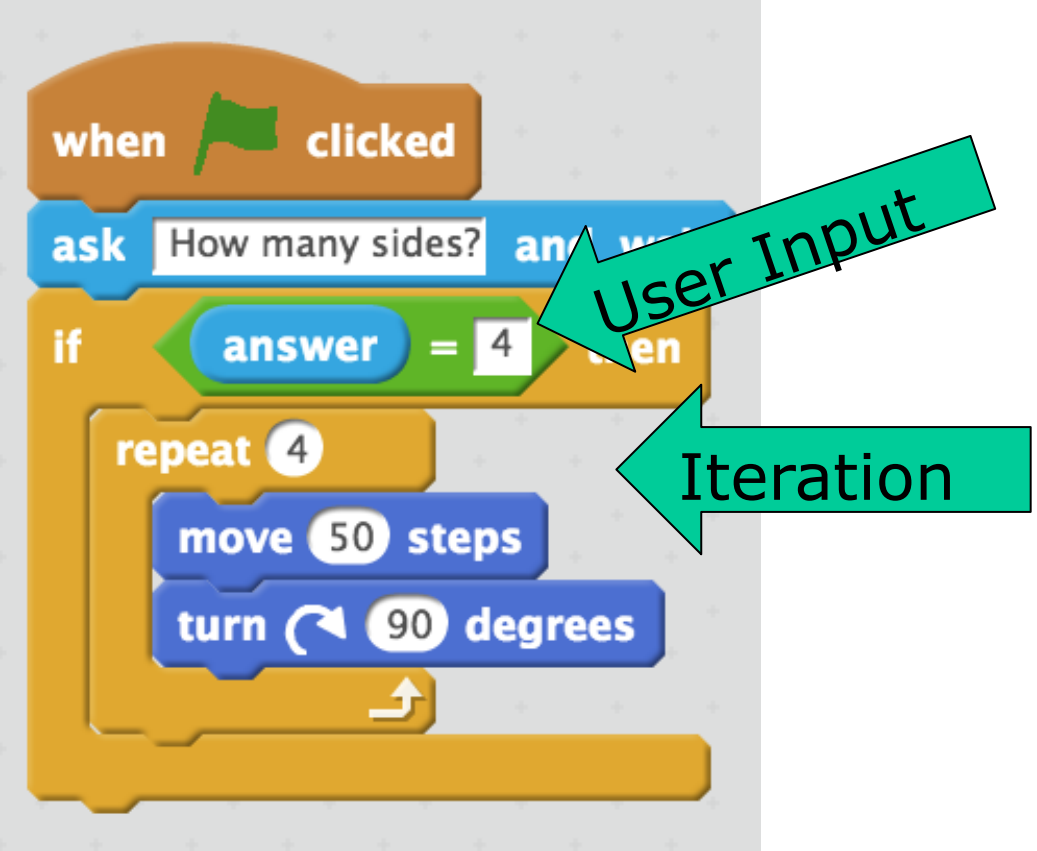
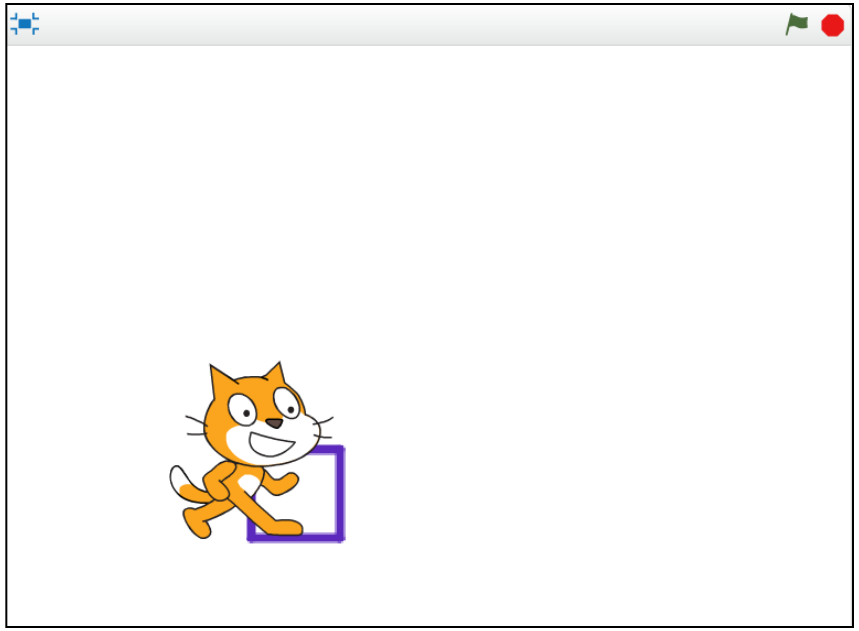
Creating Digital Solutions Levels 5 and 6

- Define problems in terms of data and **functional requirements**, **drawing on previously solved problems to identify similarities**
- Design a **user interface** for a digital system, generating and considering **alternative design ideas**
- Design, modify and follow simple algorithms represented **diagrammatically** and in English, involving sequences of steps, branching, and **iteration**
- Develop simple solutions as visual programs
- Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs

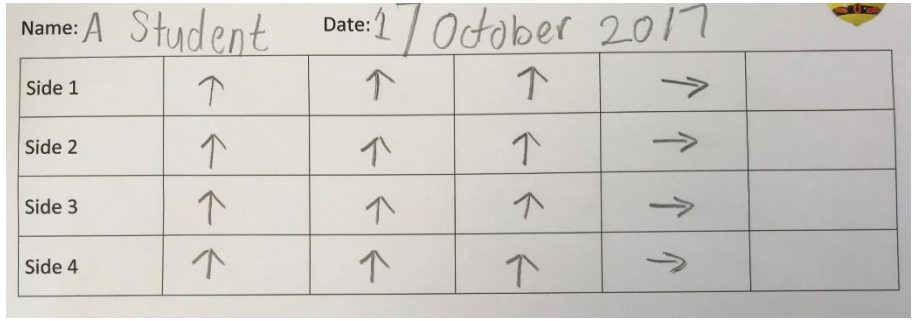
Let's Add Some Iteration and User Input





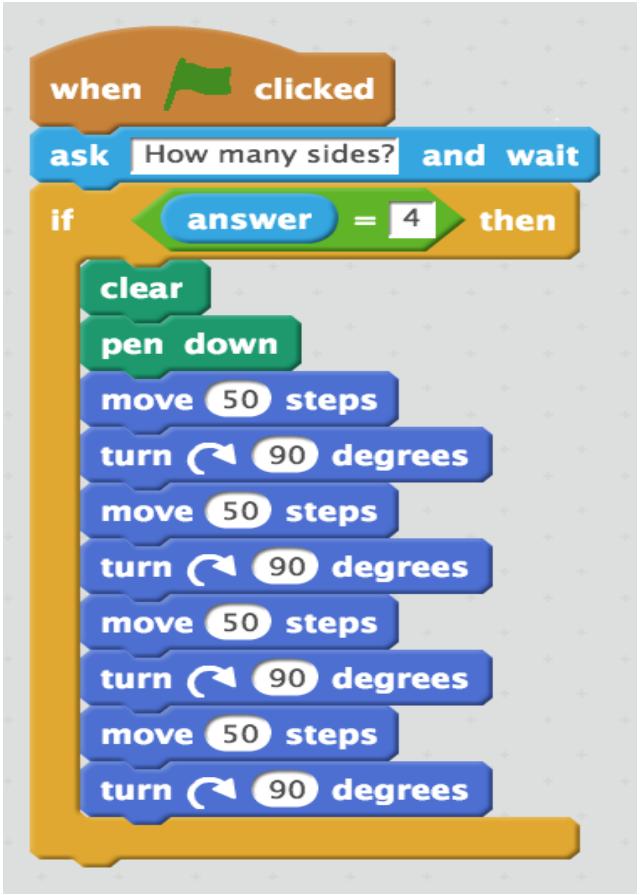
Program and Screenshot: Megan van der Velden & Eduard Schaepman

Algorithm Progression Levels F-6

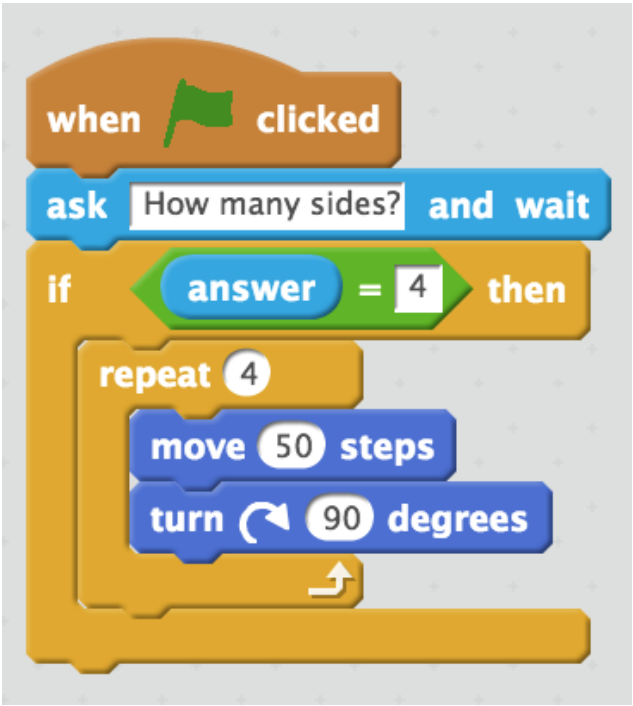

Name: A Student Date: 17 October 2017

Side 1	↑	↑	↑	→	
Side 2	↑	↑	↑	→	
Side 3	↑	↑	↑	→	
Side 4	↑	↑	↑	→	

Levels F-2 – Simple Representation

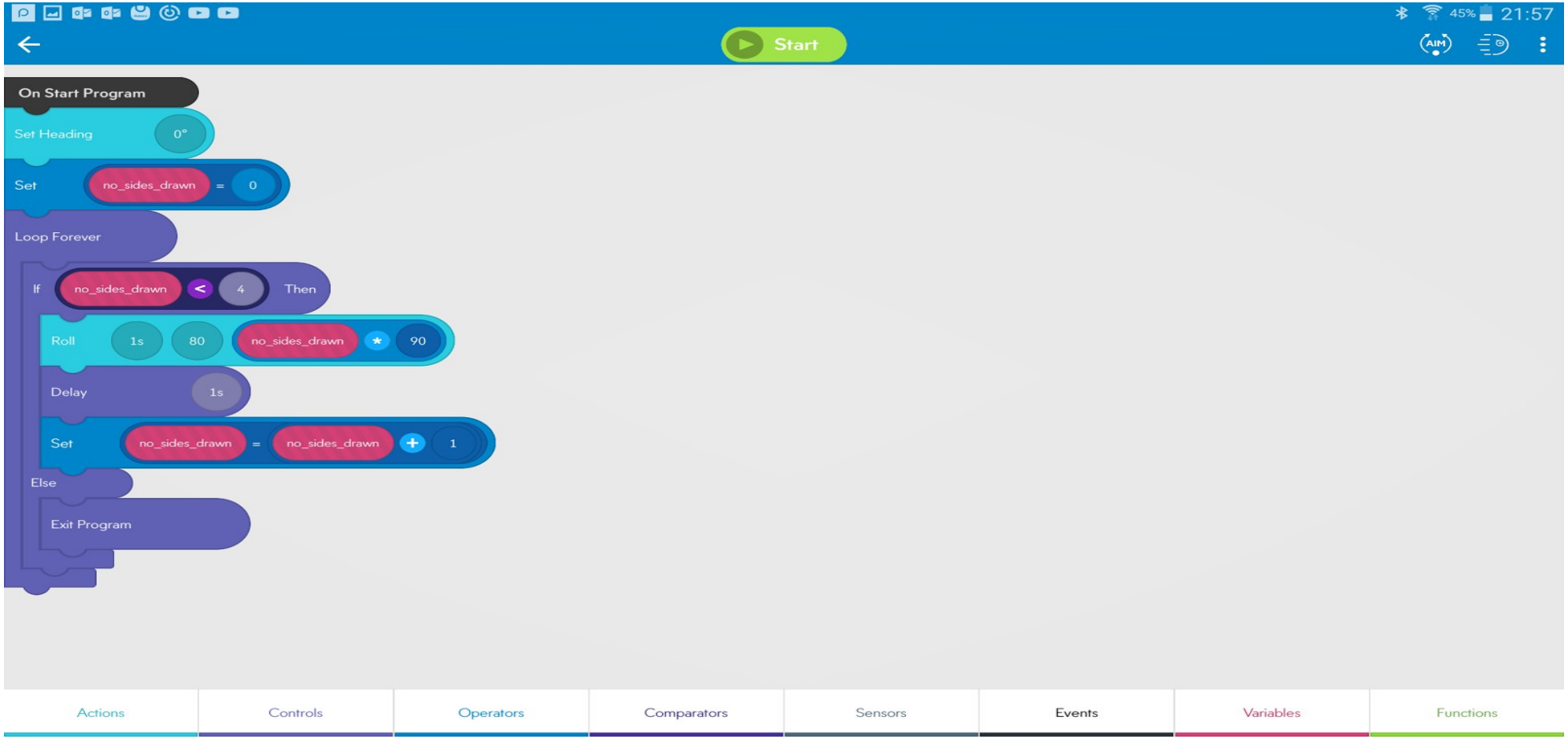


Levels 3 and 4 - Branching



Levels 5 and 6 – Iteration and User Input

Same Task – Digital Device



Program: Eduard Schaepman

Creating Digital Solutions
Levels 7 and 8

- Define and **decompose** real-world problems taking into account functional requirements and sustainability (economic, environmental, social), technical and usability constraints
- Design the **user experience** of a digital system, generating, evaluating and communicating alternative designs
- Design algorithms represented diagrammatically and in English, and **trace algorithms** to **predict output for a given input and to identify errors**

Creating Digital Solutions
Levels 7 and 8

- Develop and modify programs with user interfaces involving **branching, iteration and functions** using a **general-purpose** programming language
- Evaluate how well student-developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability

General Purpose Programming

“A programming language designed to solve a wide range of programming problems.

It includes **procedural**, **functional** and **object-oriented** programming languages. It includes **scripting** and/or **dynamically typed** languages such as Python and Ruby.

Examples include C#, C++, Java, JavaScript, Python, Ruby and Visual Basic.”

(Digital Technologies Glossary, VCAA)

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General Purpose Programming

So, which programming language?

Questions to consider

- What hardware platform do I have?
- What are my goals?
- What is offered in Levels 9 and 10?

General Purpose Programming

Goal	Possible platform and/or programming language
Robotics, other devices	Arduino, Raspberry Pi/Python
Web Development	Java, Javascript, PHP, Ruby
Mobile App Development	Swift (iOS), Java (Android)
Desktop Application Development	Visual Basic, C, C++

Back to Our Example (Python)

(Text and Functions)

python-drawing_shapes.py

```
# Program to draw a variety of shapes
# Eduard Schaepman 2017

from turtle import *

# Draw a square
def drawSquare (numSides):
    print ('Drawing a square.')
    while numSides > 0:
        numSides = numSides - 1
        forward(50)
        left(90)

# Main part of program
def main():

    # Ask user to enter the number of sides of the shape to draw
    numSides = int(input('Number of sides: '))

    # Determine what shape to draw
    if (numSides == 4):
        drawSquare(numSides) # Draw a square
    else:
        # Display a message when program can't draw a particular shape.
        print ("Can't draw a shape with", numSides, "sides.")

# Start the program
main()
```

Function – A part of the code that completes a specific task.

This function draws a square.

This function is the main part of the program.

Program: Eduard Schaepman

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Back to Our Example (Python)

(A follow through)

python-drawing_shapes.py

```
1  # Program to draw a variety of shapes
2  # Eduard Schaepman 2017
3
4  from turtle import *
5
6  # Draw a square
7  def drawSquare (numSides):
8      print ('Drawing a square.')
9      while numSides > 0:
10         numSides = numSides - 1
11         forward(50)
12         left(90)
13
14 # Main part of program
15 def main():
16
17     # Ask user to enter the number of sides of the shape to draw
18     numSides = int(input('Number of sides: '))
19
20     # Determine what shape to draw
21     if (numSides == 4):
22         drawSquare(numSides) # Draw a square
23     else:
24         # Display a message when progra                    e.
25         print ("Can't draw a shape with
26
27 # Start the program
28 main()
29
```

Counts down the number of sides drawn, until there's no more

Requests User Input

User enters data

If the number of sides entered is '4', then draw a square; otherwise display a message

Calls the 'drawSquare' function to draw the square.

Program: Eduard Schaepman

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Creating Digital Solutions
Levels 9 and 10

- Define and decompose real-world problems precisely, taking into account functional and **non-functional** requirements and including **interviewing stakeholders** to identify needs
- Design the user experience of a digital system, **evaluating** alternative designs **against criteria** including **functionality, accessibility, usability and aesthetics**

Creating Digital Solutions
Levels 9 and 10

- Design algorithms represented diagrammatically and in structured English and **validate algorithms and programs through tracing and test cases**
- Develop **modular programs**, applying selected algorithms and data structures including using an **object-oriented programming language**
- 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

Object Oriented Programming

"In object-oriented programming, objects represent a combination of data (the **attributes** of an object) and the actions that can be performed on or with that data (the **methods** of the object)."

(Digital Technologies Glossary, VCAA)

Object Oriented Programming

e.g. Think of your car as an object

It has attributes e.g.

make: “VW”
model: “Beetle”
seats: 5

colour: “green”
year: 2015

Object Oriented Programming

- Object-oriented is not a different language, it is a different way of working with existing languages, so can be considered an extension.

- This means you can continue with languages learnt in Levels 7 and 8.

Object Oriented Programming

Some Programming Languages that support OOP:

- Python
- Java
- JavaScript
- PHP
- Swift
- C++, C#
- VB.NET (Visual Basic)

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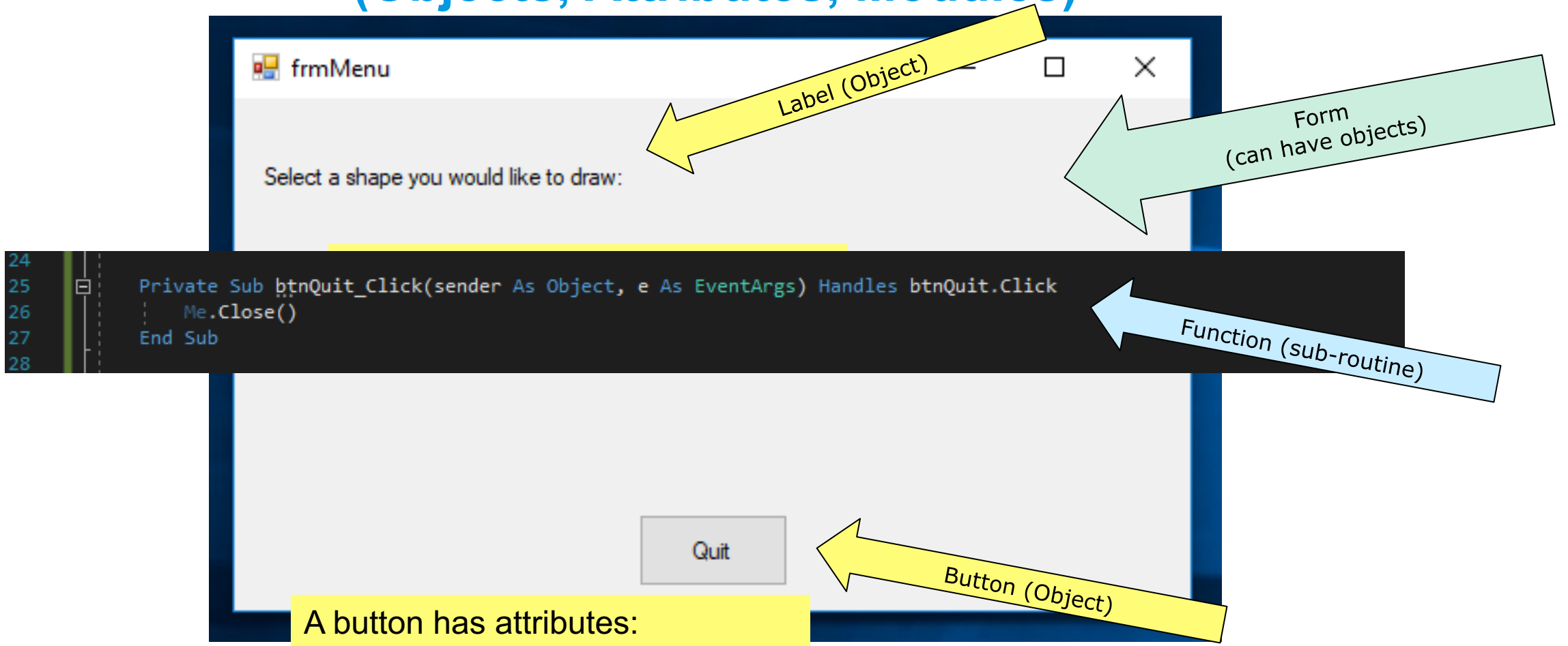
Back to Our Example (Visual Basic)

(Objects, Attributes, Modules)




```
24
25      Private Sub btnQuit_Click(sender As Object, e As EventArgs) Handles btnQuit.Click
26          Me.Close()
27      End Sub
28
```

A button has attributes:
Eg Name, size, colour, text, etc

Program and screenshot: Eduard Schaepman

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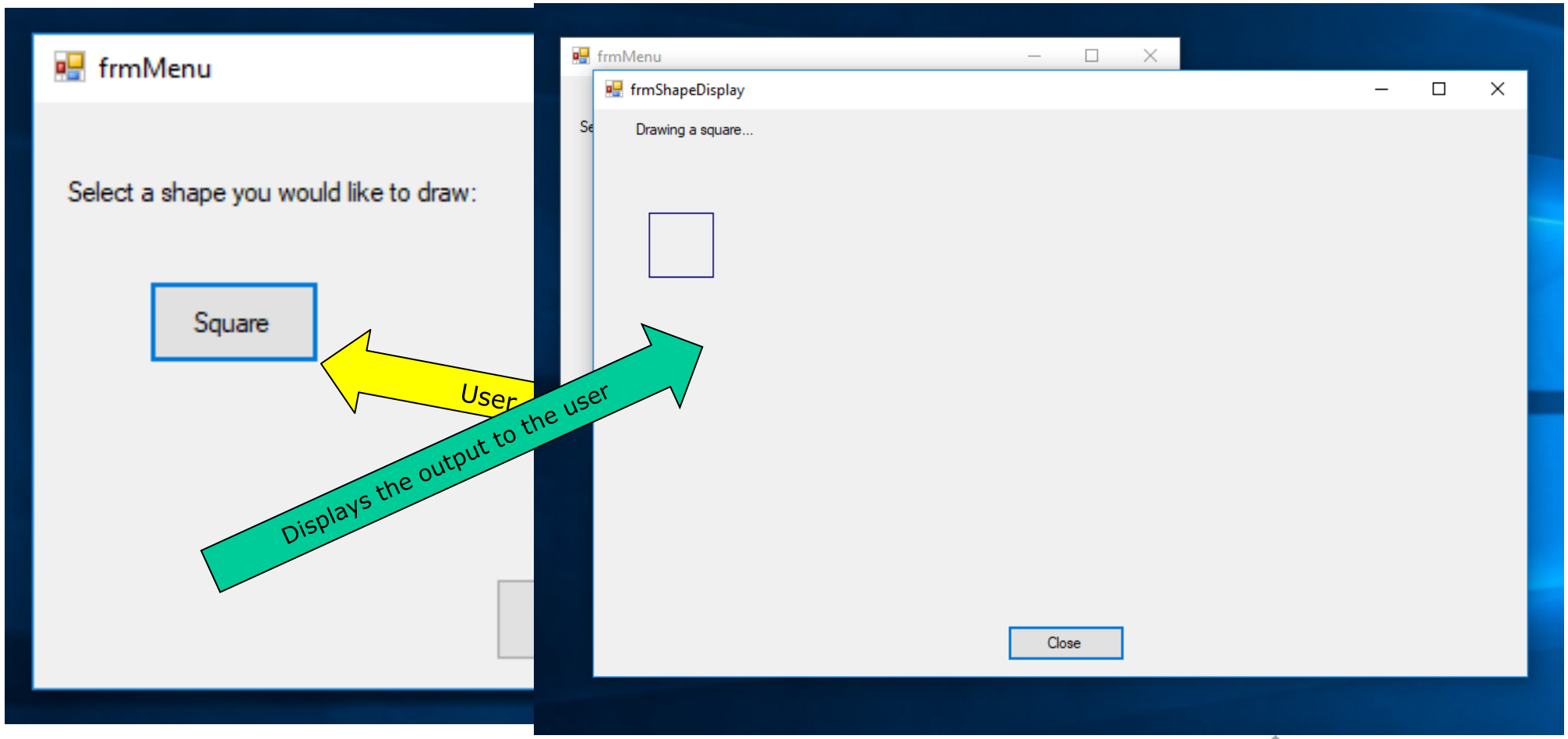
Back to Our Example (Visual Basic)

(A follow through)



Screenshots: Eduard Schaepman

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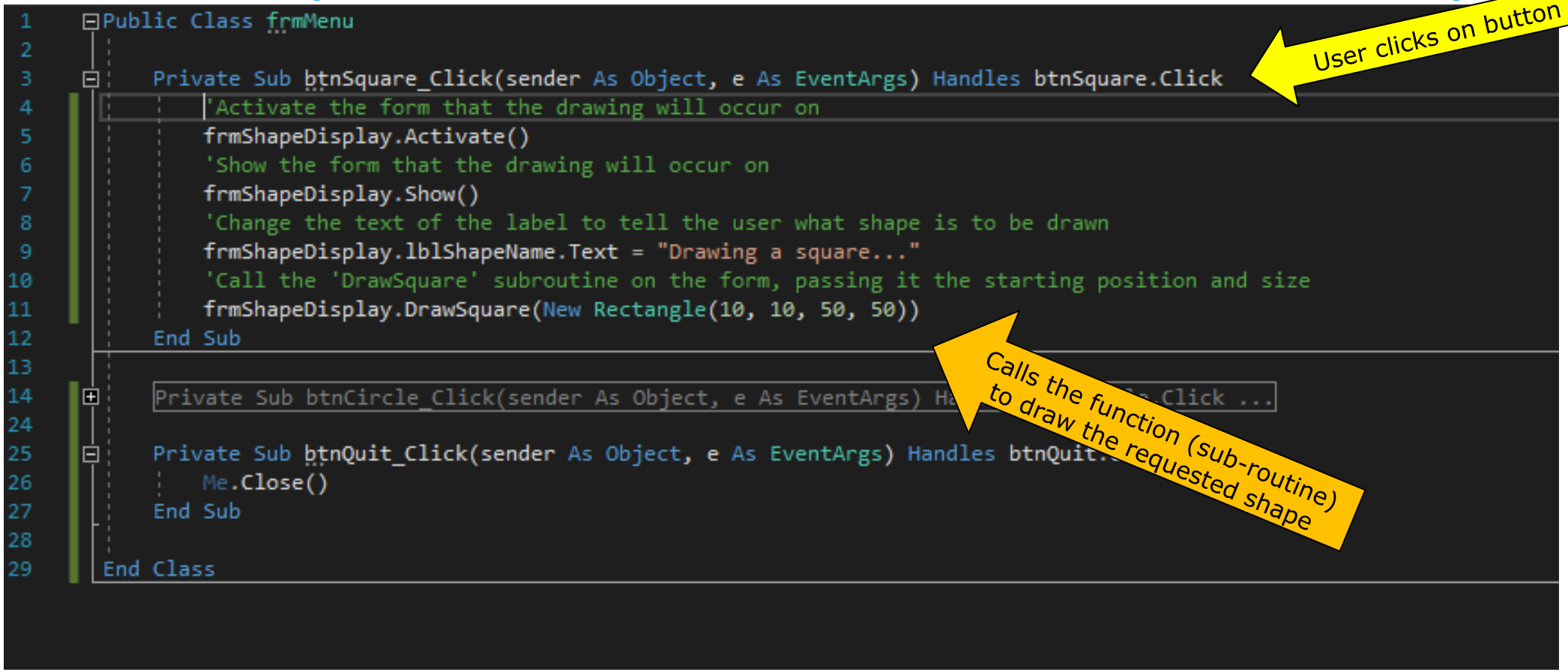
Back to Our Example (Visual Basic)

(A look at the code – Menu Form & Buttons)




```
Public Class frmMenu

    Private Sub btnSquare_Click(sender As Object, e As EventArgs) Handles btnSquare.Click
        'Activate the form that the drawing will occur on
        frmShapeDisplay.Activate()
        'Show the form that the drawing will occur on
        frmShapeDisplay.Show()
        'Change the text of the label to tell the user what shape is to be drawn
        frmShapeDisplay.lblShapeName.Text = "Drawing a square..."
        'Call the 'DrawSquare' subroutine on the form, passing it the starting position and size
        frmShapeDisplay.DrawSquare(New Rectangle(10, 10, 50, 50))
    End Sub

    Private Sub btnCircle_Click(sender As Object, e As EventArgs) Ha          Click ...

    Private Sub btnQuit_Click(sender As Object, e As EventArgs) Handles btnQuit.
        Me.Close()
    End Sub

End Class
```

Program: Eduard Schaepman

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Back to Our Example (Visual Basic)

(A look at the code – Functions & Modules)

```
1   Public Class frmShapeDisplay
2       Sub DrawSquare(square As Rectangle)
3
4           'Create a drawing image at the same size as the picture box
5           Dim image As New Bitmap(picCanvas.Width, picCanvas.Height)
6
7           'Draw on the created image
8           Using canvas As Graphics = Graphics.FromImage(image)
9               'Draw the square with specified starting point and size
10              canvas.DrawRectangle(New Pen(Color.Navy), square)
11          End Using
12
13          'Display the complete image/shape in the picture box
14          picCanvas.Image = image
15
16      End Sub
17
18      Sub DrawCircle(circle As Rectangle) ...
34
35      Private Sub btnClose_Click(sender As Object, e As EventArgs) Handles btnClose.Click
36          Me.Close()
37      End Sub
38  End Class
```

Function (sub-routine) to draw shape

Displays the output to the user

Modules: A number of functions may be kept externally to the program. Often kept in 'libraries'.

Visual Basic has built-in modules to draw a variety of shapes. In this case 'DrawRectangle'.

Program: Eduard Schaepman

Planning Ideas

Sample Curriculum Area Plan Levels F-2

Curriculum Area Plan: Digital Technologies - Prep to Year 2 (Sample Program 1)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year F	Semester 1																		
	Semester 2											Identify and explore digital systems – F.2.1							
												Our computers							
Year 1	Semester 1					Recognise and explore patterns – 1.1.1													
						Finding patterns													
	Semester 2					Present data using digital systems – 1.2.1													
						Sharing data													
Year 2	Semester 1											Create and organise ideas – 2.1.1							
												Sharing our work							
	Semester 2				Represent a sequence of steps and decisions – 2.2.1							Explore how to safely use information systems – 2.2.2							
					Programming a partner							Devices in our lives							
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 1 hour of teaching time per week

Key	Digital Systems	Data and Information	Creating Digital Solutions	Topic, level, semester, sequence

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

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Sample Curriculum Area Plan Levels 3 and 4

Curriculum Area Plan: Digital Technologies - Years 3 and 4 (Sample Program 1)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 3	Semester 1				**Recognise data types – 3.1.1**				**Create information and solve problems – 3.1.2**						**Explore digital systems – 3.1.3**		**Create and communicate ideas – 3.1.4**		
					Communication – Let's talk a. Non-verbal communication				Communication – Let's talk b. Communication survey						Communication – Let's talk c. Investigate a communication device		Communication – Let's talk c. Investigate a communication device		
	Semester 2							**Describe steps and decisions – 3.2.1**				**Develop visual programs – 3.2.2**						**How solutions meet needs – 3.2.3**	
								Create-a-Bot a. Create an algorithm				Create-a-Bot b. Create code						Create-a-Bot c. Reflection	
Year 4	Semester 1																		
	Semester 2																		
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 1 hour of teaching time per week

Key	Digital Systems	Data and Information	Creating Digital Solutions	Topic, level, semester, sequence

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

Sample Curriculum Area Plan Levels 5 and 6

Curriculum Area Plan: Digital Technologies - Years 5 and 6 (Sample Program 1)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 5	Semester 1						Components of digital systems – 5.1.1						Examination of whole numbers – 5.1.2						
							Digital Systems Communicate a. Data: Here to there						Digital Systems Communicate b. Data representation						
	Semester 2						Interpret and visualise data – 5.2.1			Online collaborative projects – 5.2.2									
							Our World Habitat analysis												
Year 6	Semester 1				Define problems – 6.1.1		Design user interface – 6.1.2		Design algorithms – 6.1.3			Develop simple visual programs – 6.1.4						How solutions meet needs – 6.1.5	
					Draw-a-Shape a. Define a problem		Draw-a-Shape b. Create interface and algorithms					Draw-a-Shape c. Create code based on algorithms						Draw-a-Shape d. Reflection	
	Semester 2																		
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 1 hour of teaching time per week

Key	Digital Systems	Data and Information	Creating Digital Solutions	Topic, level, semester, sequence

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

Sample Curriculum Area Plan Levels 7 and 8

Curriculum Area Plan: Digital Technologies - Years 7 and 8 (Sample Program 2)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 7	Semester 1																		
	Semester 2																		
Year 8	Semester 1	Data transmission – 8.1.1			Digital systems investigation – 8.1.2			Acquiring data – 8.1.3		Analyse and visualise data – 8.1.4				Manage, create and communicate ideas – 8.1.5					
		Networking			Binary and computers			Research - Sourcing		Research - Infographic				Research - website					
	Semester 2	Decompose problems – 8.2.1	Design user experience – 8.2.2		Design algorithms – 8.2.3			Develop and modify programs – 8.2.4											Evaluate solutions – 8.2.5
		Project - Decompose	Project – Creating designs		Project - Algorithms			Project - Solutions											Project - Evaluation
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

* Based on 3 hours teaching time per week

Key	Digital Systems	Data and Information	Creating Digital Solutions	Topic, level, semester, sequence

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

Sample Curriculum Area Plan Levels 9 and 10

Curriculum Area Plan: Digital Technologies - Years 9 and 10 (Sample Program 3)

	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Year 9	Semester 1	Role of hardware, software, data and networks - 9.1.1					Data compression - 9.1.2					Techniques for acquiring data - 9.1.3				Analyse and visualise data - 9.1.4			
		Network Theory					Image Editing					Community Project a. Research and data collection				Community Project b. Creating posters			
	Semester 2																		
Year 10	Semester 1	Manage and collaborate - 10.1.1		Decompose problems - 10.1.2		Design user experience - 10.1.3		Design algorithms - 10.1.4		Develop modular programs - 10.1.5								Evaluate solutions - 10.1.6	
		Programming Project a. Project management		Programming Project b. Analysis - Requirements		Programming Project c. Design and development												Programming Project d. Evaluation	
	Semester 2																		
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

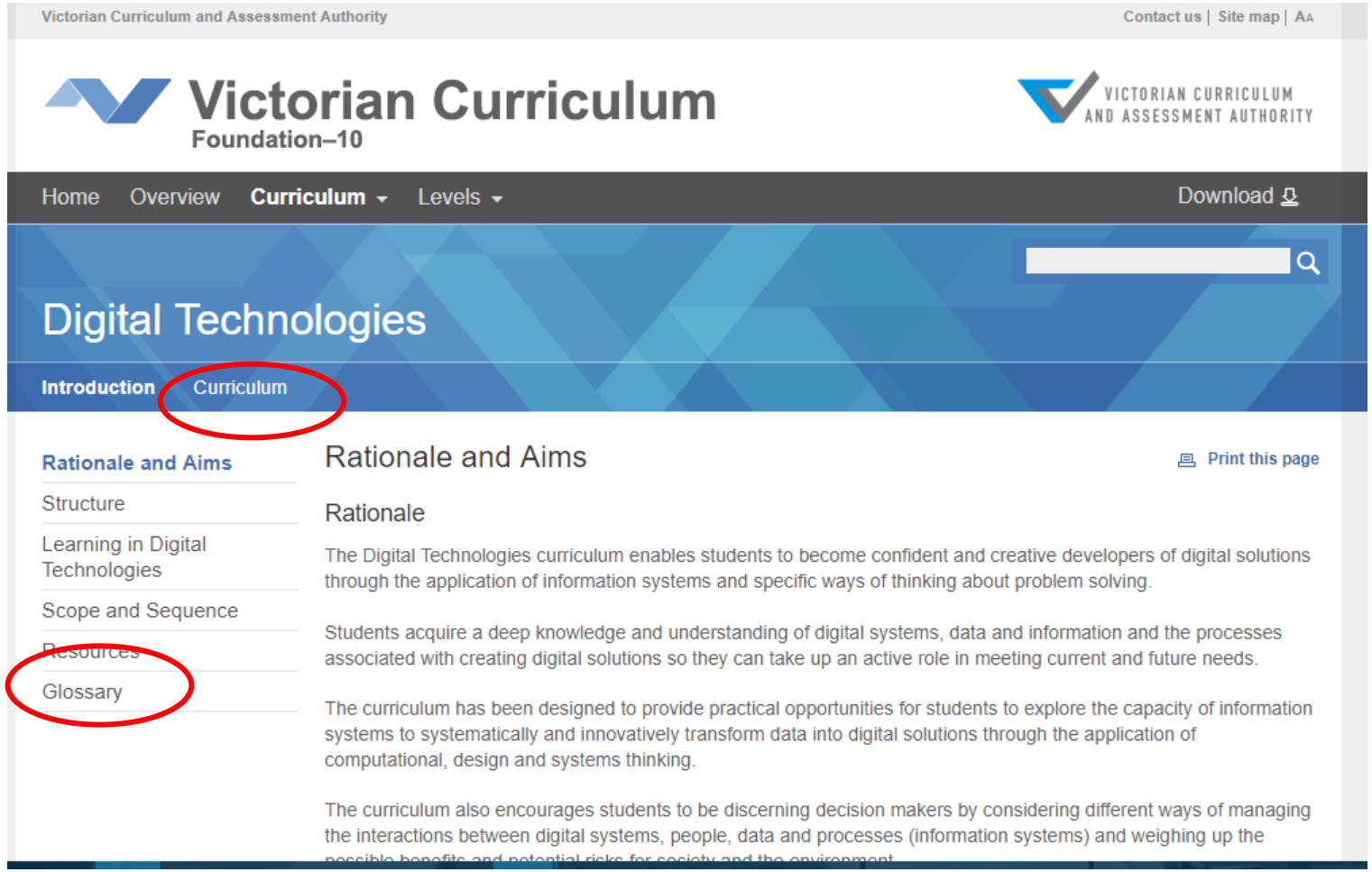
* Based on 3 x 45 minutes teaching time per week

Key	Digital Systems		Data and Information		Creating Digital Solutions		Topic, level, semester, sequence

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

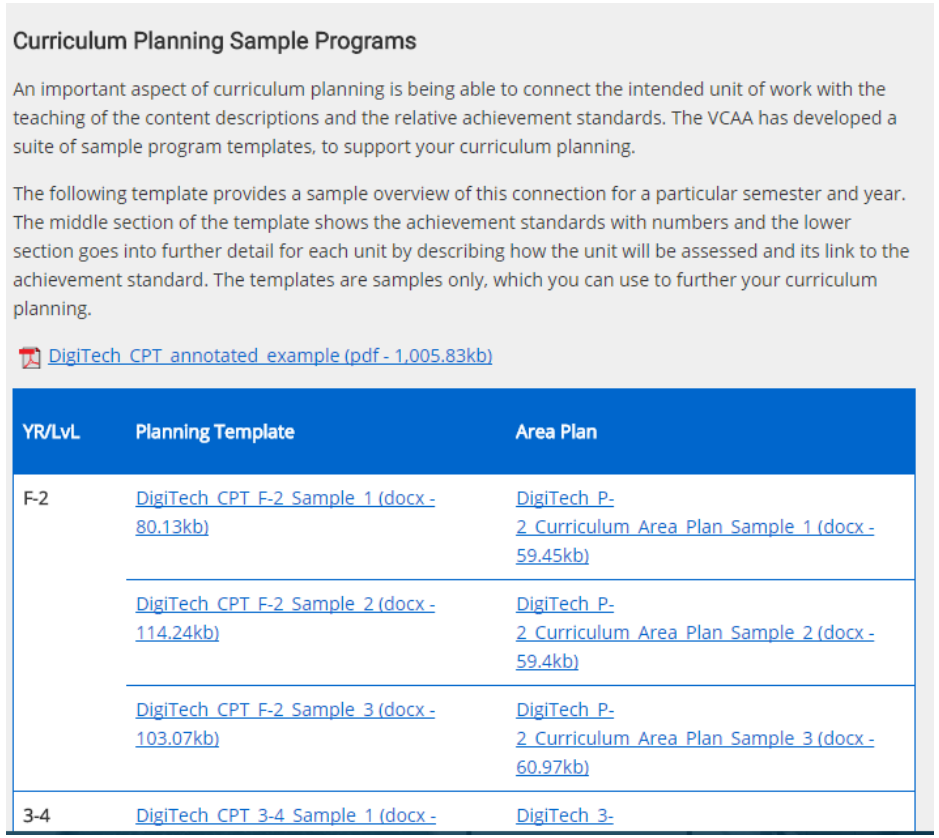
Resources

Victorian Curriculum – Digital Technologies



http://victoriancurriculum.vcaa.vic.edu.au/technologies/digital-technologies/introduction/rationale-and-aims

New Digital Technologies Resources



Curriculum Planning Sample Programs

An important aspect of curriculum planning is being able to connect the intended unit of work with the teaching of the content descriptions and the relative achievement standards. The VCAA has developed a suite of sample program templates, to support your curriculum planning.

The following template provides a sample overview of this connection for a particular semester and year. The middle section of the template shows the achievement standards with numbers and the lower section goes into further detail for each unit by describing how the unit will be assessed and its link to the achievement standard. The templates are samples only, which you can use to further your curriculum planning.

DigiTech_CPT_annotated_example (pdf - 1,005.83kb)

YR/LvL	Planning Template	Area Plan
F-2	DigiTech_CPT_F-2_Sample_1 (docx - 80.13kb)	DigiTech_P-2_Curriculum_Area_Plan_Sample_1 (docx - 59.45kb)
	DigiTech_CPT_F-2_Sample_2 (docx - 114.24kb)	DigiTech_P-2_Curriculum_Area_Plan_Sample_2 (docx - 59.4kb)
	DigiTech_CPT_F-2_Sample_3 (docx - 103.07kb)	DigiTech_P-2_Curriculum_Area_Plan_Sample_3 (docx - 60.97kb)
3-4	DigiTech_CPT_3-4_Sample_1 (docx -	DigiTech_3-

- Sample Planning Templates (previously called Mapping Templates)
- Sample Area Plans

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/teachresources.aspx

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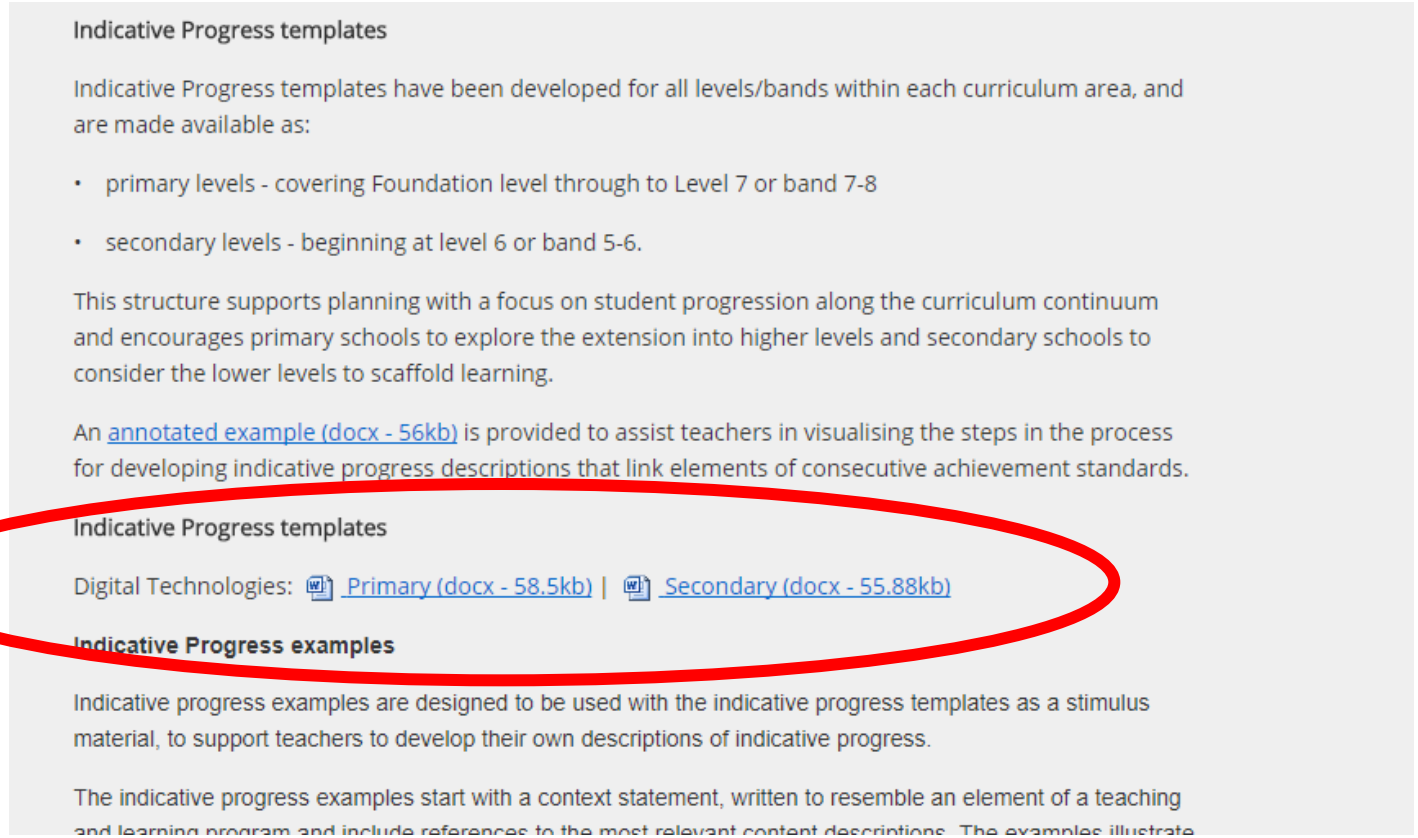
VCAA Website – Indicative Progress



Indicative Progress templates

Indicative Progress templates have been developed for all levels/bands within each curriculum area, and are made available as:

- primary levels - covering Foundation level through to Level 7 or band 7-8
- secondary levels - beginning at level 6 or band 5-6.

This structure supports planning with a focus on student progression along the curriculum continuum and encourages primary schools to explore the extension into higher levels and secondary schools to consider the lower levels to scaffold learning.

An annotated example (docx - 56kb) is provided to assist teachers in visualising the steps in the process for developing indicative progress descriptions that link elements of consecutive achievement standards.

Indicative Progress templates

Digital Technologies: Primary (docx - 58.5kb) | Secondary (docx - 55.88kb)

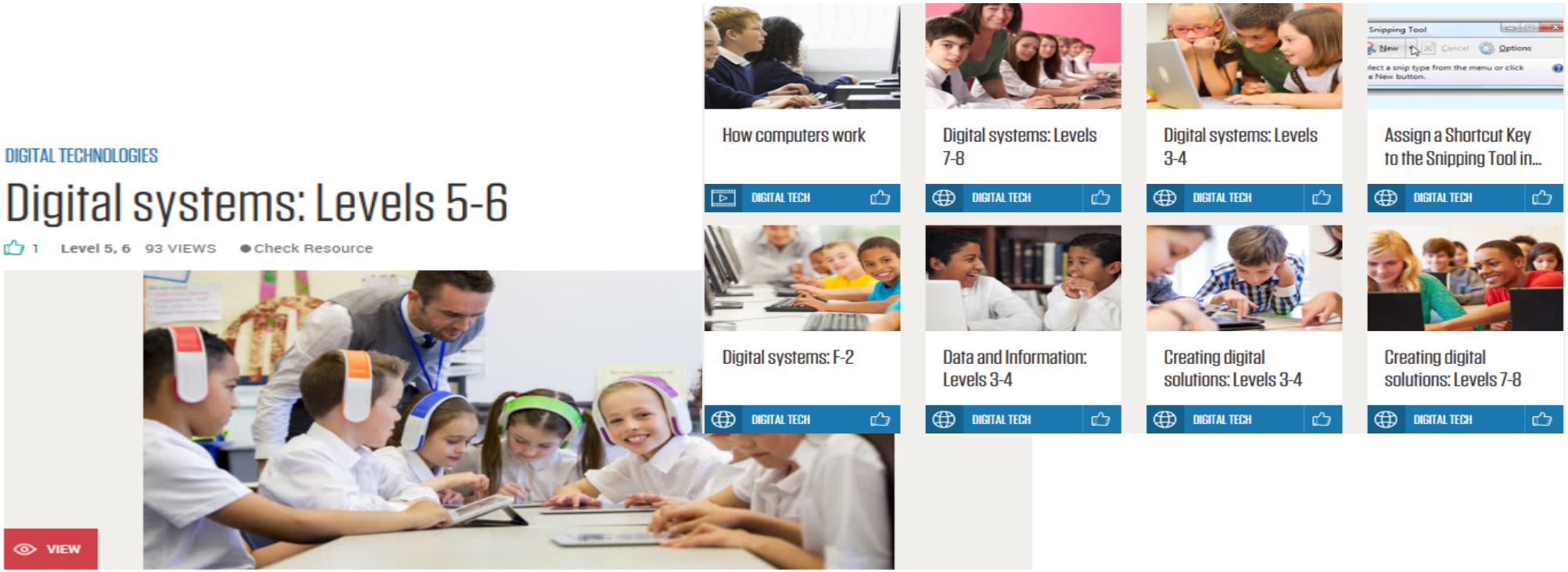
Indicative Progress examples

Indicative progress examples are designed to be used with the indicative progress templates as a stimulus material, to support teachers to develop their own descriptions of indicative progress.

The indicative progress examples start with a context statement, written to resemble an element of a teaching and learning program and include references to the most relevant content descriptions. The examples illustrate

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/cpa.aspx

Fuse



http://www.digipubs.vic.edu.au/pubs/digitaltechnologies/digital-technologies-L5_L6_digital_systems

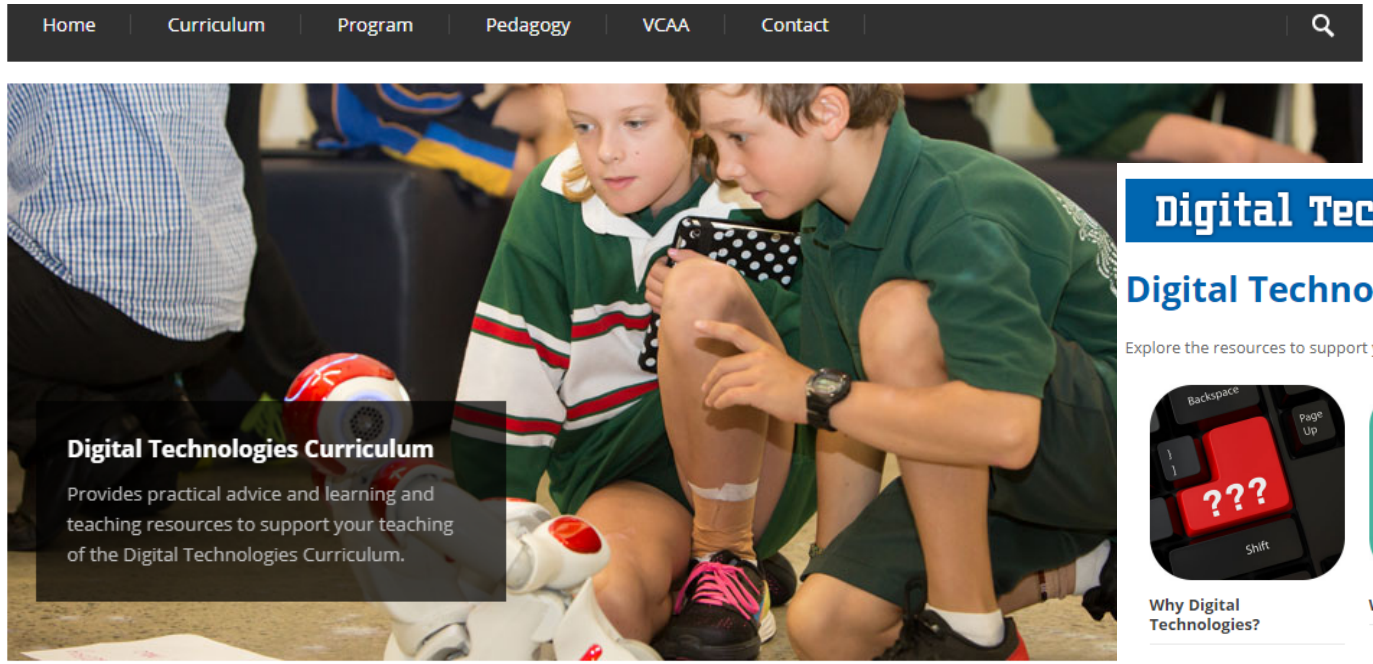
Examine the main components of common digital systems, and how such digital systems may connect together to form networks to transmit data.

https://fuse.education.vic.gov.au/Teacher

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

VICTORIA State Government

DIGIPUBS



Welcome to DigiPubs

DigiPubs are digital publications which provide practical advice and resources that can be accessed online on any device throug

http://www.digipubs.vic.edu.au/pubs/digitaltechnologies/digital-technologies-curriculum

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Programming Languages

- Scratch - http://scratch.mit.edu
- Python - https://www.python.org/
- Visual Basic (part of Microsoft's Visual Studio) - https://www.visualstudio.com/
- Swift Playgrounds - Apple App Store

- Code.org - https://studio.code.org/

Some Useful Books to Get you Started

- **DK Series**
  - Computer coding Games for Kids
  - Computer Coding for Kids
  - Computer Coding Projects for Kids
- **Made by the same people who make the *for Dummies books***
  - *Designing Digital Games*
  - *Getting Started with Coding*
  - *Writing Computer Coding*

Useful Resources

Victorian Curriculum website
http://victoriancurriculum.vcaa.vic.edu.au/)
VCAA DigiTech resources
http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/digitech/digitech.aspx)
VCAA Professional learning
(http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccurr-proflearn.aspx)
ACARA Work Samples
(http://resources.australiancurriculum.edu.au/)
Digital Technologies Hub (Education Services Australia)
(https://www.digitaltechnologieshub.edu.au/)

Useful Resources (cont)

DigiPubs (DET)
(http://www.digipubs.vic.edu.au/)

CS Unplugged (University of Canterbury, NZ)
(http://csunplugged.org)

CSER MOOC (University of Adelaide)
(http://csermoocs.adelaide.edu.au/moocs/)

Digital Learning News (DET)
(http://diglearning.global2.vic.edu.au/)

VCAA Professional Learning Support

- To find online webinars or face-to-face sessions in your area:

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccur-proflearn-specialists.aspx

- To request a session for your local network:

http://www.vcaa.vic.edu.au/Pages/foundation10/viccurriculum/viccur-proflearn-specialists.aspx#request

Thank you for joining us this afternoon

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