THINKING PATHWAYS
SCIENCE AND TECHNOLOGY PROGRAM

Stage:	1	Year:	1 & 2	Unit Name:	Digital Technologies	Term:		Duration:	10 Weeks

Unit Description	Inquiry Questions
This unit focuses on digital systems and their components. Students investigate how digital systems display data and use a sequence of steps and decisions (algorithm) to solve problems. This unit helps develop students' understanding of how digital systems use algorithms to communicate.	What components might make up a digital system? What is data and how can we store and represent it? How can we record instructions for others to follow and understand?

Outcomes	Working Scientifically → ST1-1WS-S	Design and Production → ST1-2DP-T
A student: ❑ **ST1-2DP-T** Uses materials, tools and equipment to develop solutions for a need or opportunity ❑ **ST1-3DP-T** describes, follows and represents algorithms to solve problems ❑ **ST1-11DI-T** Identifies the components of digital systems and explores how data is represented	The following **working scientifically skills** have been integrated into the unit: **Questioning and predicting** ● **Planning and conducting investigations** ● **Processing and analysing data** ● *use a range of methods to sort and collate information* ● *represent information using drawings and simple tables, including digital representation methods* **Communicating** • *represent and communicate observations and ideas in a variety of ways*	The following **design and production skills** have been integrated into the unit: **Identifying and defining** ● *follow a sequence of steps and decisions (algorithms) to solve problems* ● *segment, describe and represent a sequence of steps and decisions (algorithms) needed to solve problems* **Researching and planning** ● **Producing and implementing** ● *collaborate to develop designed solutions* ● *perform strategic roles within a group to solve a problem* ● *collect, sort, organise and present data to communicate information* **Testing and evaluating** • *explore how people safely use information systems to meet information, communication and recreation needs*

Learning Across the Curriculum

The following highlighted Cross-Curriculum Priorities are embedded in this inquiry unit:

- Aboriginal and Torres Strait Islander Histories and Cultures
- Asia and Australia's engagement with Asia
- Sustainability

The following highlighted General Capabilities are embedded in this inquiry unit:

- Information and Communication Technologies
- Literacy
- Numeracy
- Critical and Creative Thinking
- Work and Enterprise
- Ethical Understanding
- Intercultural Understanding
- Difference and Diversity
- Personal and social capability
- Civics and citizenship

Thinking Skills

The following highlighted Thinking Skills are embedded in this inquiry unit:

Computational thinking – ComT

Computational thinking is a process where a problem is analysed and solved so that a human, machine or computer can effectively implement the solution. It involves using strategies to organise data logically, break down problems into parts, interpret patterns and design and implement algorithms to solve problems.

Design thinking – DesT

Design thinking is a process where a need or opportunity is identified and a design solution is developed. The consideration of economic, environmental and social impacts that result from designed solutions are core to design thinking. Design thinking methods can be used when trying to understand a problem, generate ideas and refine a design based on evaluation and testing.

Scientific thinking – SciT

Scientific thinking is purposeful thinking that has the objective to enhance knowledge. A scientific thinker raises questions and problems, observes and gathers data, draws conclusions based on evidence, tests conclusions, thinks with an open mind and communicates research findings appropriately.

Systems thinking – SysT

Systems thinking is an understanding of how related objects or components interact to influence how a system functions. Students are provided with opportunities to recognise the connectedness of, and interactions between phenomena, people, places and events in local and wider contexts and consider the impact of their decisions. Understanding the complexity of systems and the interdependence of components is important for scientific research and for the creation of solutions to technical, economic and social issues.

Curriculum Learning Links

Outcomes from other Key Learning Areas have been integrated to support the development of understanding and skills in this inquiry unit:

Mathematics

- ❑ **MA1-1WM** describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols
- ❑ **MA1-16MG** represents and describes the positions of objects in everyday situations and on maps
- ❑ **MA1-17SP** gathers and organises data, displays data in lists, tables and picture graphs, and interprets the results

English

- ❑ **EN1-2A** plans, composes and reviews a small range of simple texts for a variety of purposes on familiar topics for known readers and viewers

Assessment For/ As/ Of Learning

Learning Sequence 1

Identifying Hardware and Software Assessment For Learning **ST1-11DI-T**

Learning Sequence 2

Gathering and Representing Data Assessment For Learning **ST1-11DI-T ST1-2DP-T**

Representing Data Digitally Assessment For Learning **ST1-11DI-T ST1-2DP-T**

Explaining Data Assessment Of Learning **ST1-11DI-T ST1-2DP-T**

Learning Sequence 3

Procedure of an everyday task Assessment For Learning **ST1-3DP-T**

Dare to Square Game Assessment For Learning **ST1-3DP-T ST1-2DP-T**

Creating algorithms with unifix blocks Assessment Of Learning **ST1-3DP-T ST1-2DP-T**

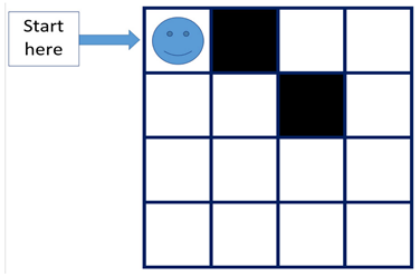
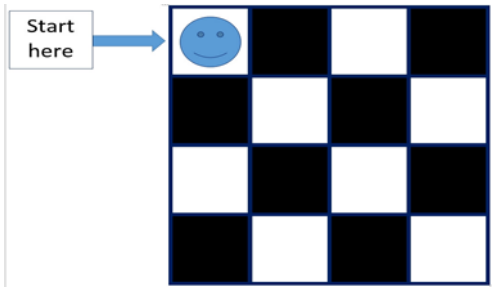
Introducing a robot device Assessment For Learning **ST1-3DP-T ST1-2DP-T**

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 1	EVALUATION	RESOURCES
What components might make up a digital system? Students: ● Identify hardware and software components of digital systems ● Identify a variety of uses for digital systems, for example: ○ Recording information ○ Storing information ● Communicate, collaborate and share information safely, using digital systems, for example: ○ Email ○ Online collaboration tools <u>Curriculum Links:</u>	**<u>Tuning In:</u>** *What learning experiences will be used to spark curiosity, ascertain prior knowledge and understand student wonderings?* ❑ Examine a range of devices - these can be both past and present, such as iPad, Chromebook, phone, digital camera etc. These can be observed through either images or artefacts. ❑ Use the thinking routine See Think Wonder to help you scaffold a discussion around: ❑ *What do you see, observe or notice?* ❑ *What do you think it is used for?* ❑ *What questions or puzzles do you have?* ❑ Explore the purpose of these devices and generate ideas about the types of things we can do with these devices. For example: ❑ Record information by taking a digital photograph ❑ Store information by saving a digital file e.g. to Google Drive **<u>Shared Inquiry:</u>** *What learning experiences and questions will be used to develop understanding and skills? What assessment opportunities will help us monitor student learning and inform future practice? What differentiation (Support/ Extension) will be needed?* ❑ Introduce the inquiry question: *What components might make up a digital system?* ❑ Explore difference between hardware and software. Use a T chart to help scaffold this exploration. ❑ *How do computers know what to do?* ❑ *What programs or apps do we use to……?* ❑ Discuss what a peripheral device is based on a set of images, e.g. projector, printer, PlayStation controller, camcorder. *What is the purpose of these devices? Why do you think we can group these devices together?* Lead to all being able to be plugged into a device. ❑ Provide students with opportunities to experiment, explore and identify hardware and software components, e.g. drawing on an iPad compared to a Chromebook etc. ❑ Identifying Hardware and Software - what's the difference (This may be done with buddy class support) **Assessment For Learning** ❑ Capture images of hardware and software at school and/or home ❑ Save the images ❑ Use presentation software to create a simple presentation to show the difference between hardware and software, e.g. Google slides, iMovie, keynote, Popplet ❑ Label each image using text ❑ Communicate, collaborate and share information safely ❑ Login in to a device ❑ Use Google Apps for education to share information with the teacher ❑ Work with a partner or in a small group using an online collaborative tool - GSuite		<u>Digital Technologies Hub:</u> ● Clever computers lesson ● Data is all around us unit thinking routine See Think Wonder a range of devices T chart scaffold Range of images Digital devices Buddy class

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2	EVALUATION	RESOURCES
What is data and how can we store and represent it? Students: ● identify how data is represented as pictures, symbols and diagrams ● collect, explore and sort data, and use digital systems to present the data creatively ● explore and identify patterns in data Curriculum Links: **Mathematics:** → Data MA1-17SP	**Tuning In:** *What learning experiences will be used to spark curiosity, ascertain prior knowledge and understand student wonderings?* ❑ Examine a graph that shows data for the most popular item in a range, e.g. the most popular ice cream flavour in the class. ❑ Use the thinking routine See Think Wonder to help you scaffold a discussion around: ❑ *What do you see, observe or notice?* ❑ *What do you think it is used for?* ❑ *What questions or puzzles do you have?* **Shared Inquiry:** *What learning experiences and questions will be used to develop understanding and skills? What assessment opportunities will help us monitor student learning and inform future practice? What differentiation (Support/ Extension) will be needed?* ❑ Introduce the inquiry question: *What is data and how can we store and represent it?* ❑ Pose the question: What is the most common pet for students in the class? If they don't own a pet, have a student choose one they would like to own. (**LINK: Mathematics**) ❑ *How can we find out which animal is the most common pet for students in the class?* ❑ *What do we need to do to find the answer?* ❑ Encourage students to consider effective methods of collecting usefully recording information ❑ *Who will we ask?* ❑ *What questions will we ask them?* ❑ *How will we remember the information we gather?* ❑ *How should we collect the information so that we remember it?* ❑ Brainstorm suggestions for collecting and recording data using a think, pair, share. Choose an efficient method for collecting the information. ❑ *How many categories will we need? Do we need one category for every pet?* ❑ *How can we make sure everyone has given an answer?* ❑ *If someone has more than one cat, should that be counted as one or two in the cat category?* ❑ Collect data using a table. Support students to arrive at a conclusion that tally marks are most efficient method of recording ❑ Determine the most common animal ❑ Discuss ways we might collate and represent the data. Model and/or have the students represent the information in different ways: **Assessment For Learning** (**LINK: Mathematics**) ❑ Picture graph - draw the correct number of animal images in each category ❑ Column graph - colour squares to create a column graph ❑ Table - insert numbers below each pet category		Useful source: ● Data detective lesson Data image thinking routine See Think Wonder

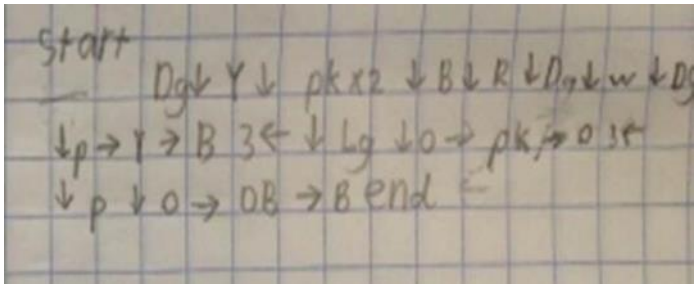
	❑ Pose and discuss the question: *What is Data?* ❑ Use a digital system to represent data **Assessment For Learning** (**LINK: Mathematics**) ❑ *How can we use hardware to display our findings digitally?* ❑ *What software, tools, devices would be best to use?* ❑ Model using software to represent data - e.g. Google sheets, slides, Teaching Graphs App ❑ Create and present their data display to the class and provide an explanation of: **Assessment Of Learning** ❑ *How they collected their data* ❑ *Why they chose to present it this way* ❑ *Anything they found surprising or unexpected about the data* ❑ *What they might do differently next time* ❑ Extending learning: Ask students to consider the following questions ❑ *'Is it easier to answer the question about which pet is more popular by looking at the picture graph, table, pie chart or bar graph?' 'Why do you think this pet is the most common?'* ❑ *'Would all classes in the school have the same answer to the question: What is the most common pet?'* ❑ *'Which pet do you think would be the most common across the whole school? Why?'* ❑ *'Would you change the way you represented your findings if you were to do it again? Why or why not?*		Digital devices

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 3	EVALUATION	RESOURCES
How can we record instructions for others to follow and understand? Students: ● follow and represent sequences of steps and decisions (algorithms) to solve problems, for example: ○ controlling a digital device remotely ○ presenting a sequence of instructions ● test and evaluate the effectiveness of steps and decisions (algorithms) in solving a problem Curriculum Links: **Mathematics** → Working Mathematically **MA1-1WM** → Position **MA1-16MG** → Data **MA1-17SP** **English** → Writing and Representing 1 **EN1-2A**	**Tuning In:** *What learning experiences will be used to spark curiosity, ascertain prior knowledge and understand student wonderings?* ❑ Read texts or examine videos that show everyday tasks we perform that follow a sequence of steps ❑ Brainstorm a range of everyday tasks we perform that follow a sequence of steps, e.g. brushing teeth, making vegemite toast **Shared Inquiry:** *What learning experiences and questions will be used to develop understanding and skills? What assessment opportunities will help us monitor student learning and inform future practice? What differentiation (Support/ Extension) will be needed?* ❑ Introduce the inquiry question: *How can we record instructions for others to follow and understand?* ❑ Jointly create the steps for brushing teeth. Remind them to sequence steps in a logical sequence (**LINK: English**) ❑ Rearrange the sequence of steps. Support students to understand why sequence is important when undertaking some tasks. Ask students to identify times when the correct sequence is very important. ❑ Provide the class with the steps to making a vegemite sandwich (out of order). Ask students to arrange the sequence in the correct order, asking students to justify reasons. (**LINK: English**) ❑ Give students a number of everyday tasks to choose from that follow a sequence. Students independently write the sequence of steps needed to complete the task. Students could illustrate each step. Extend the task by having students record the steps using a digital platform, such as Google slides, Popplet, Telegram etc. **Assessment For Learning** (**LINK: English**)		A range of stimulus texts or videos Vegemite sandwich ordering cards Digital devices 4x4 grid

	❑ Wash the dog ❑ Make a paper plane ❑ Make a cup of milo ❑ Make breakfast ❑ Make the bed <u>Dare To Square Game:</u> **Assessment For Learning** (**LINK: Mathematics**) ❑ Model the process of the game using the following example >>>>>>>>>>>>>>>>>>>>>>>>>>>> ❑ Group students in pairs and provide a 4x4 grid. ❑ Option A: students create instructions to describe how the two squares were pre-coloured ❑ Option B: students provide instructions to direct a partner to colour two squares in the grid ❑ Provide each student/ group with a new grid with more squares coloured. Students create a set of instructions to colour the correct squares. >>>>>>>>>>>>>>>>>>>>>>>>>>>> ❑ Invite them to share their instructions ❑ Support students to move towards the use of symbols as an alternative to writing down instructions, specifically the use of arrows ❑ Students create their own pattern and create instructions for a partner to recreate it using the arrow symbol instructions. ❑ Discuss how computers use symbols to follow instructions. ❑ Introduce the term 'algorithm' and link it to student understanding about following a logical sequence of instructions to perform a task. Display on the wonderwall. <u>Creating Algorithms with Unifix Blocks</u> **Assessment Of Learning** (**LINK: Mathematics**) ❑ Students create a model using up to 20 unifix blocks. Encourage a range of designs so that you have many variations across the class. ❑ Students to write a code so that someone else can build the exact model with the same colours and number and position of blocks. ❑ Discuss colour code key and using directional arrows. ❑ Provide grid paper for students to complete the task of developing a key and writing their code. ❑ **Support:** teacher creates a two-colour code using only 5 unifix blocks. Students copy image into books and develop a code to match image. Then move to 3-	 Example grid 1 Suggestion: a. Move one square to the right. b. Colour the square c. Move one square to the right. d. Move one square down. e. Colour the square. 	4x4 grid Unifix blocks Grid paper

colours and eight blocks.

- ❑ **Extension:** create, represent and develop a code for a 3-dimensional model using isometric paper
- ❑ **NB:** this is an open-ended task that allows for a variety of model shapes and configurations; exploring students' ability to:



  - ❑ Demonstrate two steps or instructions in the algorithm.
  - ❑ Verbalise some instructions and compare them to the stated algorithm. (This shows understanding by the reader and any errors, if appropriate, by the creator of the algorithm.)
  - ❑ Use an appropriate code to represent instructions in the algorithm.

Instructing a Robot Device (plugged experience) **Assessment For Learning** (**LINK: Mathematics**)

- ❑ Introduce the sphero robot device and explain that we will be controlling the robot by giving it instructions from the iPad
- ❑ Model how you control the sphero using the iPad app. This could be screen mirrored using the Apple TV. Discuss different observations about the sphero robot using the thinking routine See

Sphero or other robot device

thinking routine See Think Wonder

	Think Wonder ❏ *What can you see the sphero doing?* ❏ *How fast is it performing these instructions?* ❏ *How do you think the sphero is performing these instructions?* ❏ *The sphero can be driven around the floor - I wonder what other things you think it can do?*  ❏ Allow students a short period of time to explore and experiment with the sphero robot (5 mins max.) ❏ Model using the four key controls they need to be aware of: ❏ Main controller (1) ❏ Tail light (2) use at the start so the blue tail light faces you ❏ Colour picker (3) ❏ Speed (4) ❏ Group students in groups of 3 (one controller, one to give directions, one to retrieve sphero) and allow time to experiment with the 4 main controls, allowing each student a turn at controlling sphero. ❏ You can give students the option to test the other controls during the experimentation phase but ask them to record what they notice. ❏ Groups create a sequence of instructions (flash cards can be used) and control sphero to follow the sequence. Students could use the following roles: One student makes up a sequence using the cards, another reads it step-by-step, and another controls the Sphero to follow the instructions. Swap roles so each student can try each of the tasks. ❏ **Extend:** groups create and navigate a maze using a set of instructions (large butchers' paper.		flash cards