OUR LADY OF THE ROSARY, THE ENTRANCE
SCIENCE & TECHNOLOGY PROGRAM

Stage:	2	Year:	4	Unit Name:	Data and Digital Systems - Digital Technologies	Term:	4	Duration:	10 Weeks

Unit Description

This unit focuses on digital systems and how they transmit data. Students explore different types of data, have the opportunity to learn how to interpret patterns and develop skills in visual programming. Students will further develop their knowledge and understanding of computational thinking and abstraction.

Key Inquiry Questions

1. How do digital systems share information and instructions?
2. Why do we represent data in different ways?
3. How are algorithms used to develop digital systems?

Outcomes & Content

ST2-2DP-T selects and uses materials, tools and equipment to develop solutions for a need or opportunity
ST2-3DP-T defines problems, describes and follows algorithms to develop solutions
ST2-11DI-T describes how digital systems represent and transmit data

- identify and explore a range of digital systems and peripheral devices
- explore how digital systems transmit different types of data
- investigate digital and information systems, and explore how they meet personal, school or community needs
- recognise that numbers, text, images, sounds, animations and videos are all forms of data when stored or viewed using a digital system
- investigate how the same data can be represented in different ways, eg codes and symbols
- collect, access and present different types of data using simple software to create information and solve problems
- plan, create and communicate ideas and information, applying agreed ethical and social protocols
- describe and follow a sequence of steps and decisions (algorithms) to solve defined problems involving branching and user input
- design and produce digital solutions using a visual programming language

CROSS-CURRICULUM LINKS:

Maths

- **MA2-17MG** uses simple maps and grids to represent position and follow routes, including using compass directions
- **MA2-6NA** uses mental and informal written strategies for multiplication and division

English:

- **EN2-1A:** communicates in a range of informal and formal contexts by adopting a range of roles in group, classroom, school and community contexts
- **EN2-2A:** plans, composes and reviews a range of texts that are more demanding in terms of topic, audience and language
- **EN2-11D** responds to and composes a range of texts that express viewpoints of the world similar to and different from their own

PDHPE:

- **PD 2-7:** describes strategies to make home and school healthy, safe and physically active spaces

Skills Focus

Working Scientifically → **ST2-1WS-S**

Processing and Analysing Data

- use a range of methods to represent data, including tables and column graphs
- identify patterns and trends in gathered data
- compare results with predictions
- suggest possible reasons for findings

Design & Production → **ST2-3DP-T**

Identifying and defining

- consider potential resources in defining design needs and opportunities
- investigate and research materials, components, tools and techniques to produce design solutions
- define simple problems by determining and defining a process
- develop a sequence of steps and decisions (algorithms) to solve a problem

Producing and implementing

- generate visual programs using algorithms to create simple digital solutions
- organise and perform strategic roles within a group to solve a problem
- collect, access and present data, using software to present and communicate information and solve problems

Testing and evaluating

- develop criteria to evaluate the environmental impact of a design with guidance
- explain how existing information systems meet common personal, school or community needs

Assessment: ***For/ As/ Of*** **Learning → Throughout this unit a range of assessment tasks and types will be used to gauge students' knowledge and understanding.**

- Digital systems collage and labelled diagram (**Assessment For Learning**)
- Bee-Bot challenge and reflection (**Assessment For Learning** and **Assessment As Learning**)
- Sugar Investigation and reflection (**Assessment For Learning** and **Assessment As Learning**)
- Visual Programming Project (**Assessment Of Learning** and **Assessment As Learning**)

THINKING SKILLS (Page 35)

Highlight the thinking skills this unit promotes.

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.

CROSS CURRICULUM PRIORITIES AND GENERAL CAPABILITIES (Page 38)

Highlight the general capabilities this unit promotes.


Aboriginal and Torres Strait Islander histories and cultures


Asia and Australia's engagement with Asia


Sustainability

Highlight the cross-curriculum priorities this unit promotes.


Critical and creative thinking


Ethical understanding


Information and communication technology capability


Intercultural understanding


Literacy

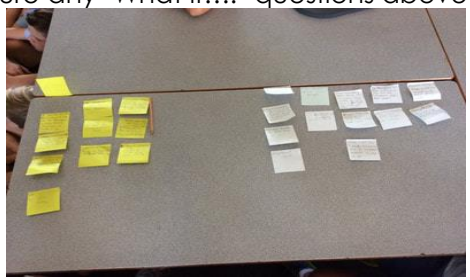

Numeracy


Personal and social capability


Civics and citizenship


Difference and diversity

Work and enterprise

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 1 *Digital Systems & the Transmission of Data*	EVALUATION	RESOURCES
How do digital systems share information and instructions? Students: • identify and explore a range of digital systems and peripheral devices • explore how digital systems transmit different types of data • investigate digital and information systems, and explore how they meet personal, school or community needs **Curriculum Links:** **English:** • **EN2-1A** Speaking and Listening I • **EN2-11D** Expressing Themselves	**Tuning In:** ❏ Watch the clip Digital Systems ❏ Pause 13sec - students generate a list of ways they have used technology so far during the day. ❏ Pause 34sec - engage in a discussion about the purpose of a computer, extending with the thinking routine *What makes you say that?* Record student thinking. **Shared Inquiry:** ❏ Investigate the different digital systems within the classroom and/or school. **Assessment For Learning** ❏ Pairs use the camera on an iPad device to take snapshots of a range of input, output and storage devices. ❏ Use the application Pic Collage to sort and create a collage highlighting the difference between input, output and storage systems present in the school environment. ❏ Share findings with peers, displaying student collages. ❏ Create a labeled diagram of a computer highlighting the input, output and possible storage device systems present, explaining how they work to communicate with the computer and the kind of data being communicated. ❏ Display a wireless mouse and one that needs a cable to connect. What are some benefits to using each type of peripheral device? What are some of the sustainability issues? ❏ Use the thinking routine Tug-of-War to examine the 'pull' of different forces determining which one might be better for a purpose. (LINK: English) ❏ Identify the two opposing sides ❏ Generate as many 'tugs' that pull towards a certain side ❏ Determine the strength of each tug by ordering them ❏ Capture any 'What if….' questions above the tug of war 		Digital Systems clip What is a computer? Clip IPad devices Pic Collage application Workbooks /or/ paper Wireless mouse Cabled mouse Teacher resource

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2 *Representation and Analysis of Data*	EVALUATION	RESOURCES
Why do we represent data in different ways? Students: • recognise that numbers, text, images, sounds, animations and videos are all forms of data when stored or viewed using a digital system • investigate how the same data can be represented in different ways, eg codes and symbols • collect, access and present different types of data using simple software to create information and solve problems • plan, create and communicate ideas and information, applying agreed ethical and social protocols	**Tuning In:** ❑ Write a simple message coded using a substitution of a number for each letter; for example, A=1 and Z=26. See how long it takes to 'crack the code' or 'decipher the message'. ❑ Explain that computers take an encoded message, decode it and represent the message in the form of data. **Shared Inquiry:** ❑ Investigate different ways to encode a message using numbers, text and/or symbols through a variety of plugged and unplugged experiences, such as: ❑ Experiment with a 'backwards alphabet code', a 'shifted alphabet code' or an 'offset code' and have a partner decipher the message. For example, A =26 and Z=1, or A=1 +2, B=2 +2, Z=26 +2, or offset each letter by 2 such as the word DOG becomes FQI. (**Unplugged Experience**) ❑ Support: experiment with forwards and backwards alphabet codes ❑ Extension: experiment with hexadecimal code OR ❑ Apply mathematical understanding to crack the dairy farm code involving numeral and word problems (LINK: Maths & PDHPE) (**Unplugged Experience**) ❑ Support: use simplified mathematical problems or utilise concrete materials to support development of understanding ❑ Extension: increase complexity of problems. *Discover:* Are there instances where this type of code is applied in real life? OR ❑ Experiment with using symbols to create code, such as Morse code and have a partner decipher it. (**Unplugged Experience**) ❑ Discuss rules for creating and interpreting words for example, how will you identify a space between letters and a space between words? ❑ Use an online Morse code translator. Create the message in Morse code and translate. View the message as light or sound. (**Plugged Experience**) AND ❑ Bee Bot Balloon Challenge: Design a challenge course using the Bee bots that ends with a balloon being popped. A peer will attempt to complete the course. (**Plugged Experience**) **Assessment For Learning** ❑ *Planning*: work in groups to design a course for a Bee-Bot to move through, considering things such as materials, Bee-Bot movement (eg. Length of each move), level of difficulty within the course, etc. ❑ Watch the You Tube clip Bee-Bot Battle for examples ❑ *Constructing:* use the available materials to build the Bee-Bot course		NESA ICT & CODING RESOURCES Codes & Secret Messages Resources Concrete objects Digital devices Digital devices Bee bots Balloons Pins Craft supplies Bee bot rulers

Curriculum Links: **PDHPE:** • **PD2-7** Healthy, Safe & Active Lifestyles **Maths:** • **MA2-17MG** Position	❑ *Testing:* write an algorithm to help people manoeuvre the Bee-Bot throughout the course. Test the algorithm and course, debugging and reassessing along the way. ❑ *Sharing:* Groups buddy up with another group and try their courses. There is an opportunity to invite students from other classes to try the courses also. ❑ *Reflecting:* Groups engage in a reflection of the process, using guiding prompts: **Assessment As Learning** ❑ *What did you see, observe or notice about your course and algorithm during the sharing phase?* ❑ *What parts of the challenge were the hardest?* ❑ *Was the solution algorithm achieved?* ❑ *What occurred during the creation of your algorithm?* ❑ *What would you do differently next time?* ❑ *How could you have made the course more challenging or have extended the course?* ❑ *How well did your group work together?* ❑ *How might you improve group collaboration next time?*		

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 2 *Representation and Analysis of Data*	EVALUATION	RESOURCES
Why do we represent data in different ways? Students: • collect, access and present different types of data using simple software to create information and solve problems • plan, create and communicate ideas and information, applying agreed ethical and social protocols **Curriculum Links:** **PDHPE:** • **PD2-7** Healthy, Safe & Active Lifestyles **Maths:** • **MA2-6NA** Multiplication & Division • **MA2-17MG** Position **English:** • **EN2-2A** Writing & Representing I	*This component of the unit links with the PDHPE unit My Lunchbox Rules! Focusing on Learning and Teaching Sequence 3* (LINK: PDHPE / Maths) **Tuning In:** ❏ View the BTN Episode: Sugar Tax ❏ How might we gather data about the amount of sugar in different drinks? ❏ How might we represent this data? ❏ What digital tools could we use to record, represent and analyse this data? **Shared Inquiry:** ❏ Investigate different ways to gather and represent data using numbers and graphs on a digital device. (**Assessment For Learning**) ❏ *Collecting:* provide a variety of drink containers for students to work with, such as a juice box, coca-cola, lemonade, sports drink, chocolate milk, glee drink, water etc. Small groups collect a variety of containers to investigate and determine the amount of sugar in each container. ❏ *Gathering:* gather data about the amount of sugar present in each of the drink items and determine a way to record and categorise the preliminary data. ❏ *Recording:* use Google Sheets to input the data into a spreadsheet, placing related data into the same column. ❏ *Representing:* create a graph of data digitally to represent the information gathered. Compare it to the conventional hand-drawn and coloured graphs. Compare the same data set and modify data, sort the data or organise the data in a different way to show the benefits of using a computer and spreadsheet software. ❏ *Informing:* Explore some of the formats used to present information, such as charts, tables, infographics, digital presentations, digital stories and videos. Decide on a suitable way to present information to a particular audience for a purpose, such as infographic (Canva/ Piktochart), Y chart, video, presentation, digital story. (LINK: English) ❏ *Analysing:* Compare data sets and representations with another group and reflect on their learning. (**Assessment As Learning**) ❏ How does the way your data is represented influence others? ❏ What challenged you about this task? ❏ What would you do differently next time? ❏ How does your data set compare to the data set of another group?		BTN Episode: Sugar Tax Variety of drink containers Calculators Digital devices Google Sheets Sugary Drinks Calculator Possible Applications Infographic apps - canva, piktochart Google Slides IMovie Book Creator

CONTENT FOCUS	LEARNING & TEACHING SEQUENCE - 3 *Visual Programming Project*	EVALUATION	RESOURCES
How are algorithms used to develop digital systems? Students: • describe and follow a sequence of steps and decisions (algorithms) to solve defined problems involving branching and user input • design and produce digital solutions using a visual programming language **Curriculum Links:** **Maths:** • **MA2-16MG** Angles **English:** • **EN2-4A** Reading Viewing I	**Tuning In:** ❑ Display a sphero robot. Discuss how we make this form of digital technology move independently? ❑ Model encoding (programming) the sphero robot using the free movement and programming blocks options. Use an Apple TV to project the iPad screen. ❑ Provide an opportunity for small groups to experiment with the different ways we can program the Sphero robot in order to receive different output data, such as movement, sound, lights. **Shared Inquiry:** *adapted from Sphero and the Chocolate Factory* ❑ Investigate ways to use visual programming to retell a familiar story with a Sphero Robot (**Assessment Of Learning & Assessment As Learning**) ❑ Small groups choose a well-known imaginative text, such as a fairytale, Roald Dahl books etc. ❑ *Collecting:* Use the camera function on the iPad to capture examples of each process. This will be used to create a digital project portfolio at the end of the project. ❑ *Gathering Data:* Create a storyboard of the main parts of the story, providing an explanation of each part. ❑ *Designing:* Create a proposed design for the story layout and model that the sphero will move through. ❑ *Constructing:* Use a range of materials to construct the parts of the story. ❑ *Programming:* Use the programming blocks on the Lightning Lab application to experiment with programming the Sphero to move in a sequential order through the story, including lights, movements and sounds at key points of the story for emphasis. Reassessing and debugging as they go. Capture a screenshot of the programming blocks. ❑ *Sharing:* Retell the story through Sphero to a group of peers. Capture photos or videos of final solution. ❑ *Reflecting:* Reflect on the project through guiding prompts: ❑ What challenged you during this task? ❑ If you had more time how would you improve your project? ❑ What challenges did you face when using block coding? How did you overcome these? ❑ How well do you think your project conveyed the main parts of the story? What makes you say that? ❑ What input and output was used during this project? ❑ *Portfolio:* Compile a digital portfolio to document and explain the process the group engaged in, including multimedia to support the explanation. Use the app/website Book Creator.		Sphero robots IPad devices Lightning Lab App Apple TV Storyboard template Sphero robots IPad devices Lightning Lab App Paper Pens Cardboard boxes Sticky tape Glue Book Creator App/ Website