

This unit of work was created in collaboration with the STEM teacher from Pakenham Springs Primary School, Pakenham, Victoria

### Unit Overview

This unit focuses on programming Spheros. In groups, students will design create and program the Sphero to complete a 'Olympic style event'. Students will take ownership of the event, ensuring the code is correct and assist their peers where possible. Students leading the event will also be responsible for collecting appropriate data. This data will be used to create a leader board. Student will collect the data and use software to create information and make meaningful interpretations. The data they collect will be dependent on the event they design; however, they will need to an agreed system in place to award first, second and third.

### Other Curriculum Targeted Areas

Other curriculum areas can be targeted and assessed within this unit.

Other areas of interest may include:

- Design and Technology
- Mathematics (Data)

Further investigation into these areas is required to ensure they align with the following activities. Activities may need to be modified to ensure content descriptions and achievement standards are met.

### Australian Curriculum Alignment

The following sessions have been created using the Australian Curriculum: Digital Technologies Curriculum. Tasks may need to be modified to ensure state Digital Technologies Curriculum content descriptions and achievement standards are met. ACS has support and documents to help align this unit to other Digital Technology Curricular.

### Session

'Session' has been used to define the order of tasks to complete the unit. It does not define a set time required to complete the task. Time allocated to complete a session is the teacher's discretion. This allows for flexibility for the teacher to drive the duration of the task and make modifications if necessary. Sessions can be merged into one set period or sessions may run over multiple periods.

### Key Preparation

#### Robotics

Spheros have been used as a suggested tool to use for this unit. The robotics used for this unit will depend on the school's access to robotics. The digital devices for this unit can be changed. Modifications to the resources aligned to Sphero skill development will change to align with the robotics available at the school.

#### ACS Resources

Resources have been created to help teachers and students unpack and understand topics found within the Digital Technologies Curriculum. These give brief explanations of the topic and the expectations to teach the topic at the curriculum year level. It is intended the information is presented in a way that will set the foundation for further research. ACS has resources to support the teaching of the Digital Technologies Curriculum from Foundation to Year 10. Access the resources via: <https://www.acs.org.au/ict-educators.html>

### Key Understandings

Students will:

- Identify and explain the relationship between the software and hardware and data movement between the software and Sphero.
- Generate algorithms to program the Sphero to demonstrate branching, iteration and user input.
- Use a flowchart to show the design and sequence of steps.

### Key Questions

- What are necessary components of the digital system? How does the Sphero transmit data?
- What task will you create for your Sphero to complete? How will you design your event? What skills do you need to build to successful complete on of the projects?
- What code have you created to program the Sphero to show branching, iteration and user input?
- How can you display the data you have collected so it is meaningful and easy to interpret?

### Key Vocabulary

Systems thinking, Hardware, software, networks, digital components, binary code, design thinking, computational thinking, algorithms, Flowchart, visual programming branching, user input, iteration, data collection, data representation, interpretation.

Session Number	Session Topic Focus	Learning Intention and Success Criteria	Introduction/Teacher Instruction	Whole Class Activity
1.	Online collaboration	<p><b>Learning Intention</b> Students will identify a set of protocols to follow when working in online spaces.</p> <p><b>Success Criteria</b> I can generate a list of dos and don'ts and explain why they are important protocols to follow. When working in online spaces, I am an active member of my team and the workload is shared evenly between us.</p>	Discuss the similarities and differences of working in the classroom and online and the importance of continually abiding by these protocols (rules).	Students work in small groups and connect with each other in an online document that allows them to collaborate. They create a list of 'dos and don'ts' to successfully work online. They explain why it is important that the protocols are upheld.
<b>Session Resources</b>	<p><b>Student Resource</b></p> <ul style="list-style-type: none"> <li>ACS Student Resource: Online Collaboration</li> </ul>		<p><b>Teacher Resource</b></p> <ul style="list-style-type: none"> <li>ACS Teacher Resource: Online Collaboration</li> <li>A digital platform to allow users to collaborate online</li> </ul>	
2.	Components of a Sphero	<p><b>Learning Intention</b> Students will identify different digital components. They will explain how these components work together to create a network.</p> <p><b>Success Criteria</b> I can identify the hardware and software that is used to create a Sphero. Can explain how things parts work to create a network.</p>	<p>Students will brainstorm all the different parts to their laptop or digital device they have access to.</p> <p>Create a list of parts and categorise them into hardware and software.</p>	Students look at the Sphero and look They look at the system as a whole and look at how the system has been created. Students create a list of all the different components that are used to enable the Create a similar graphic organiser as the introduction session. They will explain how the Sphero, once connected to a laptop, is part of a network.
<b>Session Resources</b>	<p><b>Student Resources</b></p> <ul style="list-style-type: none"> <li>ACS Student Resource: Common Components</li> <li>ACS Student Resource: Data Transmission</li> <li>ACS Student Resource: Networks</li> <li><a href="#">How It Works Daily – How Sphero Works</a></li> </ul>		<p><b>Teacher Resources</b></p> <ul style="list-style-type: none"> <li>ACS Teacher Resource: Components of a Digital System</li> </ul>	

Session Number	Session Topic Focus	Learning Intention and Success Criteria	Introduction/Teacher Instruction	Whole Class Activity
3.	Binary code	<p><b>Learning Intention</b> Students will identify and explain how binary code is used to represent data in digital systems</p> <p><b>Success Criteria</b> I can investigate how binary code is used to represent data in digital systems</p>	<p>Students pair up again and this time write a note only using abbreviated language. Give students a limit of characters they can use to send a message.</p> <p>Students create 'code' for the same sentence e.g.: How are you today? Focus how letters, spaces and characters are represented.</p>	<p>Students share their message with the class and look at the different messages that are used. Students read through information about binary code. Students will use this knowledge to further understand how the natural disaster digital system operates and sends data as binary code. They identify the type of data it will send and articulate that the data is sent as whole numbers (if the system monitors sound – the data is represented as binary code).</p>
<b>Session Resources</b>	<p><b>Student Resources</b></p> <ul style="list-style-type: none"> <li>ACS Student Resource: Binary Code</li> </ul>		<p><b>Teacher Resources</b></p> <ul style="list-style-type: none"> <li>ACS Teacher Resource: Whole Number Representation</li> </ul>	
4.	Sphero Skills	<p><b>Learning Intention</b> Students will use visual program language to code the Sphero to complete a range of tasks.</p> <p><b>Success Criteria</b> I can write code to program the Sphero to complete different tasks.</p>	<p>Students are given the opportunity to explore the functions of the Sphero.</p>	<p>Students will complete a range of tasks that will enable them to be skilled up with programming the Sphero to complete different activities. These activities will help them design an event.</p>
<b>Session Resources</b>	<p><b>Student Resources</b></p> <ul style="list-style-type: none"> <li></li> </ul>		<p><b>Teacher Resources</b></p> <ul style="list-style-type: none"> <li>Sphero Tasks (A collection of Sphero tasks collated to ensure they are aligned to the curriculum programming expectations)</li> </ul>	

Session Number	Session Topic Focus	Learning Intention and Success Criteria	Introduction/Teacher Instruction	Whole Class Activity
5.	Designing an event	<p><b>Learning Intention</b> Students will design an activity for the Sphero and include branching user input and iteration.</p> <p><b>Success Criteria</b> I can design an event for the Sphero Sports. The code for the event will include branching, user input and iteration.</p>	Introduce students to the concept of creating a Sphero Sports.	<p>Students will design and create a for a Sphero style Sports.</p> <p>Students will need to include branching, user input and iteration in the design of their event and ensure it is include in their code.</p>
<b>Session Resources</b>	<p><b>Student Resources</b></p> <ul style="list-style-type: none"> <li>ACS Student Resource: Algorithms</li> </ul>		<p><b>Teacher Resources</b></p> <ul style="list-style-type: none"> <li>ACS Teacher Resource: Algorithms</li> </ul>	
6.	Algorithms (flowcharts)	<p><b>Learning Intention</b> Students will explain the digital system that operates using algorithms in the form of a flowchart.</p> <p><b>Success Criteria</b> I can create a flowchart explains how a user will navigate through my slide show. It will include branching, user input and iteration.</p>	Introduce students to a flowchart as an option to present the commands and actions within their presentation. Using the example provide follow the flowchart.	Students transfer the design of their Sphero event into a flowchart. The flowchart will explicitly show where branching, user input and iteration are present in the code.
<b>Session Resources</b>	<p><b>Student Resources</b></p> <ul style="list-style-type: none"> <li>ACS Student Resource: Algorithms</li> <li>ACS Student Resource: Flowcharts</li> </ul>		<p><b>Teacher Resources</b></p> <ul style="list-style-type: none"> <li>ACS Teacher Resource: Algorithms</li> </ul>	

Session Number	Session Topic Focus	Learning Intention and Success Criteria	Introduction/Teacher Instruction	Whole Class Activity
7.	Visual programming	<p><b>Learning Intention</b> Students will use the visual programming software to program the designed task.</p> <p><b>Success Criteria</b> I can write the code to correctly program my designed event.</p>	Students share their flowchart with another group and 'walk through' the flowchart. The focus is to pick up any potential errors.	Using the visual programming software, students code their event. Over the course of coding, students test it to ensure the correct output is generated.
<b>Session Resources</b>	<b>Student Resources</b>		<b>Teacher Resources</b>	
8.	Coding their first task	<p><b>Learning Intention</b> Students will use the visual programming software to program a given task.</p> <p><b>Success Criteria</b> I can write code to program the Sphero to complete a designated task.</p>	Introduce students to the 'opening ceremony challenge'. This task will be designed by the teacher.	Students complete the 'opening ceremony' task in the visual programming software. Over the course of the events, students will collect and collate data to interpret.
<b>Session Resources</b>	<b>Student Resources</b>		<b>Teacher Resources</b>	
			<ul style="list-style-type: none"> <li>ACS Teacher Resource: Visual Programming</li> </ul>	

**For the remainder of the unit, each student group will be responsible for running and leading a robot event**

9.	Data Collection	<p><b>Learning Intention</b> Students will collect, represent and interpret data.</p> <p><b>Success Criteria</b> I can collect data about each event and use software to interpret it.</p>	Introduce students to data collection and graphing using spreadsheet software.	Data will be collected when students lead and organise an event. Each group will collect and interpret and share the data they have collected from the session.
<b>Session Resources</b>	<b>Student Resources</b>		<b>Teacher Resources</b>	
10.	Data Analysis	<p><b>Learning Intention</b> Students will collect, represent and interpret data.</p> <p><b>Success Criteria</b> I can collect data about each event and use software to interpret it.</p>	Introduce students to data collection and graphing using spreadsheet software.	Students will collect and collate the data through ongoing and live graphs. Students can choose the style of graph they choose to display their results in. Focus on discussing the difference and positive s and negatives of using different graphs to display data.
<b>Session Resources</b>	<b>Student Resources</b>		<b>Teacher Resources</b>	
			<ul style="list-style-type: none"> <li>ACS Teacher Resource: Data</li> </ul>	

Sphero Tasks			
Activity Number	Activity Name	Summary	Resources
1.	Walk the line (sequence of steps)	Have different lengths of straight lines. Create code that will stop at the exact point of the line.	<a href="https://edu.sphero.com/cwists/preview/5646x">https://edu.sphero.com/cwists/preview/5646x</a>
2.	Roadblocks (branching)	Create a section of roadblocks in a path the Sphero has to take. Program the Sphero to stop when it sensors a roadblock.	<a href="https://edu.sphero.com/cwists/preview/18045x">https://edu.sphero.com/cwists/preview/18045x</a>
3.	Rules and Patterns (user input)	Create a mathematical rule. User will input a number and the Sphero will use the preorganised rule to create an answer.	<a href="https://edu.sphero.com/cwists/preview/25481x">https://edu.sphero.com/cwists/preview/25481x</a>
4.	Hot potato game (iteration)	Repeat lights and sounds to turn off and on. Play the game hot potato, person who is holding the Sphero when it the lights and sounds go off is out.	<a href="https://edu.sphero.com/cwists/preview/6933x">https://edu.sphero.com/cwists/preview/6933x</a>
5.	Bullseye (sequence of steps)	Code the Sphero to roll onto the bullseye – players win by collecting the most points	<a href="https://edu.sphero.com/cwists/preview/114x">https://edu.sphero.com/cwists/preview/114x</a>
6.	Sumo Wrestling (branching, user input)	Code the Spheros to be pushed outside of a ring.	<a href="https://edu.sphero.com/cwists/preview/104x">https://edu.sphero.com/cwists/preview/104x</a>
7.	Soccer Sphero (branching, user input, iteration)	Make a soccer pitch and code the Spheros to play soccer. First goal scored wins the game.	<a href="https://www.youtube.com/watch?v=Vr-VC8Su1UY">https://www.youtube.com/watch?v=Vr-VC8Su1UY</a>
8.	Golf (branching, user input)	Create a cup for the Sphero to fit into. Code the Sphero to move into the cup. Groups that gets it into the cup will minimal moves wins.	<a href="https://edu.sphero.com/cwists/preview/143x">https://edu.sphero.com/cwists/preview/143x</a>
9.	Maze Runner (branching)	Create a maze for the Sphero to go through. Students program to navigate through the maze.	<a href="https://edu.sphero.com/cwists/preview/177-maze-mayhem-stem-challengex">https://edu.sphero.com/cwists/preview/177-maze-mayhem-stem-challengex</a>
10.	Which ramp makes Sphero go furthest. (iteration)	Create different size ramps and code the Sphero to roll down each. Find out which ramp allows the Sphero to roll the quickest/longest (conditions to be determined by the teacher).	



## Sphero Event Planner

What activities and code do you need to organise to ensure you run a successful event?

Have a Sphero event organised and ready to explain to your peers.

Skill to complete:

Skill to complete:

Skill to complete:

Skill to complete:

Skill to complete:

Skill to complete:

Assessment – Australian Digital Technologies Curriculum			
Content Description	Session Number	Assessment Piece	Assessment Statement
Examine the main components of common digital systems and how they may connect together to form networks to transmit data (ACTDIK014)	2	Explanation of the components of a Sphero	Students investigated the different components that make a Sphero. They investigated how these parts work together to connect the software to the Sphero and how the code will control the Sphero.
Examine how whole numbers are used to represent all data in digital systems (ACTDIK015)	3	Explanation of binary code	Students studied at how the data is transmitted from Laptop to the Sphero and articulated how the data from the laptop and the Sphero is represented as Binary Code.
Acquire, store and validate different types of data, and use a range of software to interpret and visualise data to create information (ACTDIP016)	9	Data collection of results	As students led a task, they collected data. Students collated the data and used software to visual the data to make it easy to read and interpret.
Define problems in terms of data and functional requirements drawing on previously solved problems (ACTDIP017)	N/A		
Design a user interface for a digital system (ACTDIP018)	N/A		
Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input (ACTDIP020)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Explain how student solutions and existing information systems are sustainable and meet current and future local community needs (ACTDIP021)	N/A		
Plan, create and communicate ideas and information, including collaboratively online, applying agreed ethical, social (ACTDIP022)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.

Assessment – Victorian Digital Technologies Curriculum			
Content Description	Session Number	Assessment Piece	Assessment Statement
Examine the main components of common digital systems, and how such digital systems may connect together to form networks to transmit data (VCDTDS026)	2	Explanation of the components of a Sphero	Students investigated the different components that make a Sphero. They investigated how these parts work together to connect the software to the Sphero and how the code will Control the Sphero.
Examine how whole numbers are used as the basis for representing all types of data in digital systems (VCDTDI027)	3	Explanation of binary code	Students studied at how the data is transmitted from Laptop to the Sphero and articulated how the data from the laptop and the Sphero is represented as Binary Code.
Acquire, store and validate different types of data and use a range of software to interpret and visualise data to create information (VCDTDI028)	9	Data collection of results	As students led a task, they collected data. Students collated the data and used software to visual the data to make it easy to read and interpret.
Plan, create and communicate ideas, information and online collaborative projects, applying agreed ethical, social and technical protocols (VCDTDI029)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.
Define problems in terms of data and functional requirements, drawing on previously solved problems to identify similarities (VCDTCD030)	N/A		
Design a user interface for a digital system, generating and considering alternative design ideas (VCDTCD031)	N/A		
Design, modify and follow simple algorithms represented diagrammatically and in English, involving sequences of steps, branching, and iteration (VCDTCD032)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Develop digital solutions as simple visual programs (VCDTCD033)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs (VCDTC034)	N/A		

Assessment – New South Wales Science and Technology Syllabus (Stage 3)			
Outcomes and Objectives	Session Number	Assessment Piece	Assessment Statement
Explains how digital systems represent data, connect together to form networks and transmit data (ST3-11DI-T)	2	Explanation of the components of a Sphero	Students investigated the different components that make a Sphero. They investigated how these parts work together to connect the software to the Sphero and how the code will control the Sphero.
Acquire, store, access and validate different types of data, and use a range of software to present, interpret and visualise data (ACTDIP016)	9	Data collection of results	As students led a task, they collected data. Students collated the data and used software to visual the data to make it easy to read and interpret.
Examine and critique needs, opportunities or modification using a range of criteria to define a project define a need or opportunity according to functional and aesthetic criteria Consider availability and sustainability of resources when defining design needs and opportunities Examine and determine functional requirements to define a problem	N/A		
Identify data required to formulate algorithms to improve a process (ACTDIP017)	N/A		
Defines problems, and designs, modifies and follows algorithms to develop solutions (ST3-3DP-T) Design, modify and follow simple algorithms extend sequences of steps to provide a series of possibilities through branching Develop solutions through trialling and refining using iterations (ACTDIP019)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Implement digital solutions as visual programs involving branching, iteration and user input (ACTDIP020)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Plans and uses materials, tools and equipment to develop solutions for a need or opportunity (ST3-2DP-T) negotiate criteria for success, based on defined needs, sustainability and aesthetics Develop appropriate and fair processes to test a designed solution according to criteria			
Explain how students' solutions and existing information systems meet current and future local community needs (ACTDIP021)	N/A		
Work collaboratively to share, appraise and improve ideas to achieve design purposes Identify, organise and perform strategic roles within a group to solve a problem	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.

### Assessment – Western Australian Digital Technologies Syllabus

#### Year 5

Content Description	Session Number	Assessment Piece	Assessment Statement
Digital systems have components with basic functions that may connect together to form networks which transmit data (ACTDIK014)	2	Explanation of the components of a Sphero	Students investigated the different components that make a Sphero. They investigated how these parts work together to connect the software to the Sphero and how the code will control the Sphero.
Data is represented using codes (ACTDIK015)	3	Explanation of binary code	Students studied at how the data is transmitted from Laptop to the Sphero and articulated how the data is represented as Binary Code.
Collect, store and present different types of data for a specific purpose using software (ACTDIP016)	9	Data collection of results	As students led a task, they collected data. Students collated the data and used software to visual the data to make it easy to read and interpret.
Design solutions to a user interface for a digital system (ACTDIP018)			
Design, follow and represent diagrammatically, a simple sequence of steps (algorithm), involving branching (decisions) and iteration (repetition) (ACTDIP019)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Implement and use simple programming environments that include branching (decisions) and iteration (repetition) (ACTDIP020)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Create and communicate information, including online collaborative projects, using agreed social, ethical and technical protocols (codes of conduct) (ACTDIP022)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.
Define a problem, and set of sequenced steps, with users making a decision to create a solution for a given task (WATPPS27)	6	Flowchart	Students created a flowchart to visualise the sequence of steps to program a task for the Sphero robot to complete.
Identify available resources (WATPPS28)	N/A		
Develop and communicate alternative solutions and follow design ideas, using annotated diagrams, storyboards and appropriate technical terms (WATPPS29)	6	Flowchart	Students created a flowchart to visualise the sequence of steps to program a task for the Sphero robot to complete.
Select, and apply safe, procedures when using components and equipment to make solutions (WATPPS30)	N/A		
Develop negotiated criteria to evaluate and justify design processes and solutions (WATPPS31)	N/A		
Work independently, or collaboratively when required, to plan, develop and communicate ideas and information for solutions (WATPPS32)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.

Assessment – Western Australian Digital Technologies Syllabus			
Year 6			
Content Description	Session Number	Assessment Piece	Assessment Statement
Digital systems have components with basic functions and interactions that may be connected together to form networks which transmit different types of data (ACTDIK014)	2	Explanation of the components of a Sphero	Students investigated the different components that make a Sphero. They investigated how these parts work together to connect the software to the Sphero and how the code will control the Sphero.
Whole numbers are used to represent data in a digital system (ACTDIK015)	3	Explanation of binary code	Students studied at how the data is transmitted from Laptop to the Sphero and articulated how the data is represented as Binary Code.
Design, modify, follow and represent both diagrammatically, and in written text, simple algorithms (sequence of steps) involving branching (decisions) and iteration (repetition) (ACTDIP019)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Implement and use simple visual programming environments that include branching (decisions), iteration (repetition) and user input (ACTDIP020)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Manage the creation and communication of information, including online collaborative projects, using agreed social, ethical and technical protocols (ACTDIP022)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.
Define a problem, and a set of sequenced steps, with users making decisions to create a solution for a given task (WATPPS33)	6	Flowchart	Students created a flowchart to visualise the sequence of steps, (that included branching and iteration) to program a task for the Sphero robot to complete.
Identify available resources (WATPPS34)	N/A		
Design, modify, follow and represent both diagrammatically, and in written text, alternative solutions using a range of techniques, appropriate technical terms and technology (WATPPS35)	4 & 7	Sphero task & Sphero event	Students used the Sphero visual programming software to code a designed task for the Sphero robot to complete.
Select, and apply safe, procedures when using a variety of components and equipment to make solutions (WATPPS36)	N/A		
Develop collaborative criteria to evaluate and justify design processes and solutions (WATPPS37)	N/A		
Work independently, or collaboratively when required, considering resources, to plan, develop and communicate ideas and information for solutions (WATPPS38)	1	Shared work completed in an online environment	Students used a digital platform to generate and communicate their ideas to develop their event design.

# SPHERO SPORTS

Levels 5-6

