Phase 1- Coding a Dance Sequence | Stage 1 | Science and Technology K-6

Summary

In this unit students use skills in Working Technologically to develop ideas about engineering, coding and a process of design. They utilise the science skills of observing, questioning, predicting and communicating and use mathematical skills in patterns and algebra, and data, to analyse the effectiveness of their design solutions. They explore the use of patterns to develop a code for a dance sequence and begin to use Scratch Jr. Students also investigate the role of scientists and engineers in society.

Duration

Sample term

5 weeks

Detail: End of Stage 1

Teacher background information

The focus of this unit is for students to use a process of design to develop a repeated coding pattern and program it using Scratch Jr. When Working Scientifically, students should identify questions, make predictions and investigate everyday phenomena. When Working Technologically, students are guided with a structured design process that includes the opportunities to produce a solution in response to a need. Students should generate and develop design ideas using their own research to guide their design solution. They should communicate their design ideas using plans, drawings and models.

For students to fully understand and appreciate the concept of patterning and to search for, generate and create patterns, they must be given opportunities to explore both the regularity and repetition in patterns involving movement, colour, position and quantity. This involves students recognising, describing, extending, transferring and creating patterns. By providing experiences which extend and modify pre-existing knowledge, students are better able to construct meaning and build understanding, which can be applied to new situations such as generating simple algorithms or computer code. Patterns are the basis for computer coding and how all programmable devices work. These links should be made apparent to students throughout the unit by highlighting connections to devices that can be found in the classroom and in the students' homes, such as computers or tablet devices.

To facilitate effective STEM teaching and learning, it is important to develop a class culture that accepts mistakes, encourages innovation, has an improvement perspective and is able to give and receive constructive feedback.

Key inquiry questions

- What is a process of design?
- What are some examples of technology that we use in everyday life?
- What do you think is the purpose of a program like Scratch Jr? Who might use it and how?

Vocabulary

Adaptation, angles, coding, computer, cone, cube, cylinder, communicate, compare, curved surface, design, engineer, error, evaluate, experiment, face, feedback, flat surface, horizontal, length, invention, imagery, label, linking chain, measure, modify, observe, pattern, predict, process, prototype, question, robot, refine, repeated pattern, prism, society, scientist, side, specification, sphere, symbol, test, retest, technology, trial and error, vertex, vertical.

Outcomes

Science K-10 (inc. Science and Technology K-6)

- ST1-4WS investigates questions and predictions by collecting and recording data, sharing and reflecting on their experiences and comparing what they and others know
- ST1-5WT uses a structured design process, everyday tools, materials, equipment and techniques to produce solutions that respond to identified needs and wants
- ST1-15I describes a range of familiar information sources and technologies and how their purposes influence their design

Mathematics K-10

- MA1-1WM describes mathematical situations and methods using everyday and some mathematical language, actions, materials, diagrams and symbols
- MA1-2WM uses objects, diagrams and technology to explore mathematical problems
- MA1-8NA creates, represents and continues a variety of patterns with numbers and objects
- MA1-17SP gathers and organises data, displays data in lists, tables and picture graphs, and interprets the results

English K-10

- ENe-1A communicates with peers and known adults in informal and guided activities demonstrating emerging skills of group interaction
- ENe-10C thinks imaginatively and creatively about familiar topics, simple ideas and the basic features of texts when responding to and composing texts

Content	Teaching, learning and assessment	Student diversity
Stage 1 - Speaking and listening 1 Students: ▪ respond to and compose texts ▪ engage in conversations and discussions, using active listening behaviours, showing interest, and contributing ideas, information and questions (ACELY1656) ▪ use a comment or a question to expand on an idea in a discussion ▪ use some persuasive language to express a point of view ▪ contribute appropriately to class discussions	**Lesson 1: A process of design** Using a stimulus such as *Engibear's Dream*, students identify the role of an engineer and how a process of design is used by posing and responding to questions such as: ▪ What do you think the book might be about? ▪ How do you know? ▪ What clues tell us this? **Whole-class discussion** ▪ use of pictures ▪ grids in the background ▪ construction site in the background ▪ use of colour. Why are his feet left blank? ▪ title. What is an engineer? How do we know? What would we like to know about engineering? *Resources: 'Engibear's Dream'* by Andrew King and Benjamin Johnston *'Engibear's Dream'* also available through iTunes https://itunes.apple.com/au/book/engibears-	**Support** ▪ Provide the stimulus (eg *Engibear's Dream*) prior to the lesson to allow a student to become familiar with the content. ▪ Provide opportunities for the question(s) and response(s) to be prepared in advance of the lesson to support participation, confidence or to address individual goals.

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	dream/id585155857?mt=11 Read the text and during reading, discuss: ▪ the use of imagery ▪ the purpose of the book ▪ what the book is trying to teach us. How do we know? **Individual / group / paired activity** Explain to the students that the book teaches us about a process of design. Designers and engineers use this process to create the buildings and products we use every day. Students think, pair, share and discuss: ▪ Is the first attempt always the best? Why/Why not? ▪ What are actions we can take to improve? (experimenting, trying new things, adding, modifying). Students study the pictures of Bearbots 1 to 10 ▪ students identify the features that are changed (modified) or added to each version of the Bearbots ▪ students discuss the reasons for each modification Students report back to the class at the end of the activity. **Whole-class evaluation** Ask students to briefly summarise the key points from their think, pair, share activity. ▪ What was similar in our discussions? ▪ Can we define a process for designing? Discuss how scientists and engineers use this process. To invent something, they: ▪ experiment ▪ test ▪ modify ▪ and test again. Explain to students they are going to: ▪ solve some design problems ▪ make modifications, change some ideas and maybe make mistakes	

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	▪ use peer feedback to improve their designs, using a design process like engineers and designers ▪ experiment, test, modify and try again.	
Stage 1 - Information There is a range of information sources and technologies. Students: ▪ interact with an information source or technology to explore the ways that different forms of information are combined, including text, image and sound, eg a website or digital game The purposes of information sources and technologies influence their design. Students: ▪ interact with a range of familiar information sources and technologies and identify their purposes, eg television programs, websites, digital games, newspapers and magazines ▪ describe how the purpose of a specific information source or technology influences its design, eg a website or game Stage 1 - Two-Dimensional Space 1 Students: ▪ identify vertical and horizontal lines in pictures and the environment and use the terms 'vertical' and 'horizontal' to describe such lines	**Lesson 2: What is a Scientist? What is an Engineer?** **Whole-class discussion** Reflect back to the stimulus from last lesson Discuss: ▪ What does a scientist do? ▪ What does an engineer do? ▪ Was Engibear a scientist or an engineer? Why? ▪ What amazing things could Engibear's Bearbot do? ▪ Why do you think he made the Bearbot? ▪ What do you think was the purpose of the Bearbot? **Key inquiry questions** Pose the following questions: ▪ How could engineers and scientists work together? What sorts of things do they create to help us in our daily lives? ▪ What are some of the inventions we rely on in everyday life? For example, motor vehicles such as cars; household appliances such as the oven and television; food items such as bread; and important lifesaving medicines and technologies. **Small group discussion** ▪ In what ways would our world be different if people didn't innovate and invent things? ▪ How important are scientists and engineers in keeping us safe/healthy? Why? ▪ How important are scientists and engineers in providing us with things to help us and entertain us? Why? **Whole-class discussion** Discuss how scientists and engineers design/invent/build something new.	**Support** ▪ Discuss in greater detail the steps required to create a 'Bearbot' using the Engibear website. **Extension** ▪ Highlight the term 'cross-section'. Create a shared definition and ask students to create a cross-section drawing of their own design.

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	Individual / group / paired activity Ask students to think about making a 'Bearbot'. What would they make their bear do if they could create any design they wanted? Remind students to think about the way Engibear drew his Bearbot on the last page of the book. If possible, provide an enlargement for students to reference. Draw attention to: ▪ the graph paper used. Show a sample of the paper they will use from the Engibear website and discuss the layout and features. How will the graph paper help us with our drawings? Which lines are 'vertical'? Which lines are 'horizontal'? ▪ the labelling of the Bearbot features. Why is this important? Graph paper http://engibear.com/wp-content/uploads/2013/12/Graph-Paper.pdf Engibear drawing a 'Bearbot' http://engibear.com/wp-content/uploads/2013/12/Bearbot-Drawing.pdf **Individual activity** Students design and draw their own Bearbot using graph paper and label key features. Ask students to consider: ▪ What problems/needs will the Bearbot be able to address? ▪ What will your Bearbot solution look like? ▪ What will your Bearbot need to be able to do? Why will it need to do those things? ▪ What specifications/descriptions are needed on your design? ▪ How could the Bearbot be controlled by a computer?	
Stage 1 - Working Technologically Students evaluate by: ▪ explaining the strengths and limitations of what they did and what could have been done differently to improve the solution ▪ identifying how their solution meets the needs and wants of users/audiences	**Lesson 3: Designing a Bearbot** Provide students with the opportunity to share their 'Bearbot' designs with the class or in small groups. They should be encouraged to share: ▪ the key features of their 'Bearbot' ▪ their design ideas and how they changed ▪ what worked well and what didn't work well	**Support** ▪ Students may participate in a discussion using prepared responses; pointing to pictures; matching or combining pictures, words and/or symbols.

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	Students should provide feedback to their peers View 'Austin's Butterfly' https://vimeo.com/38247060 or https://www.youtube.com/watch?v=PZo2PIhnmNY This video shows children can providing feedback to improve work. **Student self-assessment opportunity** Students may reflect on: ▪ what they have learnt about the design process ▪ what it is like to be a scientist and/or engineer ▪ what they learned from receiving feedback from others.	
Stage 1 - Information There is a range of information sources and technologies. Students: ▪ interact with an information source or technology to explore the ways that different forms of information are combined, including text, image and sound, eg a website or digital game The purposes of information sources and technologies influence their design. Students: ▪ interact with a range of familiar information sources and technologies and identify their purposes, eg television programs, websites, digital games, newspapers and magazines ▪ describe how the purpose of a specific information source or technology influences its design, eg a website or game Stage 1 - Working Scientifically Students: question and predict by responding to and posing questions (ACSIS024, ACSIS037)	**Lesson 4: Computer coding** **Teacher background information** *The focus of this activity is for students to think about patterns in computer coding. They will interact with Scratch Jr to develop their understanding about coding. In the process, they learn to solve problems, design projects, and express themselves creatively using ICT.* **Whole-class discussion** Refer back to the stimulus. ▪ How do you think Engibear could make his Bearbot perform all of those actions? ▪ Discuss how small computers that are inside many working objects tell the object what to do: ▪ a washing machine has a computer inside it to tell it how to wash the clothes ▪ a microwave has a computer inside to tell it how to cook the food ▪ toys that talk or move have small computers inside them to organise the sounds and move the appropriate parts. Brainstorm a class list of some more objects that use computers to help them move/talk/perform. **Small group activity** Explain to students that ALL of these small computers inside these objects have codes inside them that tell	**Support** ▪ Students can participate in discussion using speech, sign, gesture, symbols or with assistive technology.

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	them what to do. ▪ Students will investigate how basic coding works. ▪ *Optional: View Intro to Scratch 2.0 for an overview (Duration 1min 37secs.)* ▪ Individually or in pairs, look at Scratch Jr. ▪ View videos in Scratch Jr. Class PMI: plus, minus and interesting Students use brainstorming to discover the positive (plus), negative (minus) and interesting aspects of using Scratch Jr. It is a useful reflection tool and also encourages students to look at other points of view. The 'interesting' column contains ideas that may require further research or discussion. **Class evaluation** ▪ After using Scratch 2.0, what were the information sources you saw being combined? For example, text, image, sound. ▪ What are the possibilities of using Scratch 2.0? For example, students can program their own interactive stories and games. ▪ What do you think is the purpose of a program like Scratch 2.0? Who might use it and how? **Resources:** ▪ Scratch Jr - iPad app or Scratch Jr - ▪ Getting started with Scratch https://cdn.scratch.mit.edu/scratchr2/static/__c3a644f04973cd6efc60c516fcdcff38__/pdfs/help/Getting-Started-Guide-Scratch2.pdf ▪ Scratch cards https://scratch.mit.edu/help/cards/ ▪ Video tutorials https://scratch.mit.edu/help/videos/ ▪ Sample Scratch Jr videos https://scratch.mit.edu/studios/63586/ ▪ Scootle resources ▪ Intro to Scratch 2.0 http://www.scootle.edu.au/ec/resolve/view/M018461 ▪ Scratch Jr - iTunes app http://www.scootle.edu.au/ec/resolve/view/M019648	
Stage 1 - Patterns and Algebra 1 Students:	**Lessons 5/6: Coding patterns** *The focus of this activity is for students to develop their current understanding about patterns and create a*	**Support** ▪ Students can communicate

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Investigate and describe number patterns formed by skip counting and patterns with objects (ACMNA018) ▪ identify and describe patterns when skip counting forwards or backwards by ones, twos, fives and tens from any starting point ▪ recognise, copy and continue given number patterns that increase or decrease, eg 1, 2, 3, 4, … 20, 18, 16, 14, … ▪ create, record and describe number patterns that increase or decrease ▪ recognise, copy and continue patterns with objects or symbols ▪ create, record and describe patterns with objects or symbols Describe a repeating pattern of objects or symbols in terms of a 'number' pattern	*repeated pattern.* *They will interact with Scratch Jr to make a coding pattern.* **Whole-class discussion** Recap the key understandings about Scratch Jr from the previous lesson. **Whole-class activity** ▪ Use different shaped blocks to generate a pattern. Ask students to allocate a movement to each block shape. ▪ Draw some shapes on the board and give the shapes a sound for example:=clap,=stomp,=sing. ▪ Draw the shapes into a pattern and ask students to sound them out, for example: ▪ What will come next in this pattern? ▪ How do you know? **Small group activity** Explain to students that they will be making their own pattern through dance. ▪ What criteria for assessing our own and others' learning can we make to help us create our own pattern? ▪ Jointly develop criteria. Support: Draw on the board three symbols and ask students to suggest a dance movement for each symbol. For example, ! = arms up, ^ = jump and clap, < = slide left Create and draw a pattern to dance to. For example, !!!^^^<<<!!^^<<!!!^^^<<< ▪ What would come next in my dance pattern? ▪ How do you know? Students work in small groups to create their own dance pattern using 3-5 symbols. After the patterns have been created, copy to computers/tablet devices and share with group members for the following lesson. **Whole-class activity** Students present their pattern to the class, and: ▪ describe their pattern as a number pattern ▪ explain how it works (why it is a repeated pattern)	patterns using in a variety of ways. Responses may be oral, written, signed or in symbols. ▪ Dance moves may be substituted with hand gestures. Alternatively students may draw patterns or generate them using assistive technology.

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	▪ teach it to the class. **Class evaluation** Students may wish to have their presentation recorded. This may enable them to reflect on their learning and how well they understand repeating patterns. **Resources:** Scratch Jr - http://www.scratchjr.org/ **Scootle resources** **Scratch Jr -** http://www.scootle.edu.au/ec/resolve/view/M019648	
Stage 1 - Patterns and Algebra 1 Students: ▪ identify and describe patterns when skip counting forwards or backwards by ones, twos, fives and tens from any starting point ▪ create, record and describe number patterns that increase or decrease ▪ describe a repeating pattern of objects or symbols in terms of a 'number' pattern ▪ make connections between repeating patterns and counting, eg a 'three' pattern and skip counting by threes (Communicating, Reasoning) Stage 1 - Information There is a range of information sources and technologies. Students: ▪ interact with an information source or technology to explore the ways that different forms of information are combined, including text, image and sound, eg a website or digital game The purposes of information sources and technologies influence their design.	**Lessons 7/8: Making a repeated coding pattern in Scratch Jr** **Teacher background information** *The focus of this activity is for students to use Scratch Jr to make a repeated coding pattern. Prior to the lesson, investigate the Scratch Jr iPad app (Options - Scratch can be downloaded via the internet for laptops or Lego Mindstorm).* Teacher: explain the relationship of repeating patterns and computer coding using *Scratch Jr* examples. **Whole-class activity** Demonstrate, as appropriate to the class, how to: ▪ choose a character ▪ set up a code ▪ press Play to see it in action ▪ return to amend the code. As a class, discuss and decide on the criteria for assessing learning. Explain that this will help students create their dance sequence as well as provide feedback to their peers. **Individual / group / paired activity** Students may wish to have their presentation recorded. This may enable them to reflect on their learning and how well they understand repeating patterns. Allow students time to experiment with the Scratch Jr program.	**Support** ▪ Students may draw patterns or generate them using assistive technology.

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	Pose the questions: ▪ What should you do if your computer character can't do exactly the same dance move you did in the dance pattern? *It is important to remember even though your computer character can't do the exact dance moves you did in your dance pattern, you can still chose a different movement for your symbol but keep the same pattern.* ▪ How will we know when we have a repeated pattern? ▪ How will we recognise if there is an error in our pattern? ▪ Students should begin to use the codes available to re-create the repeated dance pattern they made last lesson. **Whole-class activity** Students share their work with the class and justify their pattern. Students: ▪ provide feedback in relation to the criteria for each dance ▪ teach their dance pattern to a friend to replicate **Whole-class evaluation** View some examples of how some older students have used patterns to generate computer code. Schools can enter a robotic competition where the purpose is to make their robots dance so they are judged on their robot's dance moves. The students design a digital/virtual robot and make them dance by entering codes just like you have done today. ▪ View Robocup dance competitions on Youtube **Resources:** ▪ Scratch Jr ▪ ABC Splash 'Create an interactive holiday card' Code: ACTDIK007 **Scootle resources** **Scratch Jr - iTunes app** http://www.scootle.edu.au/ec/resolve/view/M019648	
Stage 1 - Working Scientifically Students plan investigations by:	**Lessons 9/10: Linking chains and patterns** **Teacher background information**	

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▪ identifying the purpose of the investigation ▪ suggesting some types of activities that need to be undertaken during the processes of Working Scientifically ▪ suggesting observations that could be made to collect data and/or information about their questions and predictions ▪ recognising that the results of investigations can inform the processes of Working Technologically Students conduct investigations by: ▪ working cooperatively and individually when participating in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas, and accessing information sources, surveys and fieldwork (ACSIS025, ACSIS038) ▪ using a range of methods to gather data and/or information, including using their senses to make observations safely and carefully, using simple tools and equipment ▪ using informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate (ACSIS026, ACSIS039) ▪ making and recording observations and measurements honestly, using tally marks and informal units Students process and analyse data and information by: ▪ describing changes in objects and events observed in investigations (ACSHE021, ACSHE034)	*The focus of this activity is for students to investigate other forms of technology that rely on a repeating pattern. For example,* ▪ *Bee-bots* ▪ *Little Bits* *iPad apps* ▪ *Bee-Bot App from TTS Group https://itunes.apple.com/au/app/bee-bot/id500131639?mt=8* ▪ *Daisy the Dinosaur by Hopscotch Technologies* ▪ *Move The Turtle http://movetheturtle.com/* ▪ *Cargo-Bot by Two Lives Left http://twolivesleft.com/CargoBot/* *Board game* ▪ *ThinkFun Robot Turtles http://thinkfun.com/products/robot-turtles/* ▪ *Internet game* ▪ *Tynker games https://ww.tynker.com/hour -of-code/teacher* Scootle resources Daisy the Dinosaur - iTunes app TFL-ID M019680 http://www.scootle.edu.au/ec/resolve/view/M019680 The buzz about bee robots TFL-ID M018484 http://www.scootle.edu.au/ec/resolve/view/M018484 Bee-Bot TFL-ID M017192 http://www.scootle.edu.au/ec/resolve/view/M017192	

Assessment overview

- Produce a variety of work samples, including designated assessment activities. These should be evaluated to determine students' level of achievement and understanding.
- Engage in peer assessment, based on jointly derived criteria for activity completion.
- Use observational checklists, anecdotal records and analysis of contributions to class discussions.

Evaluation

Questions to guide reflection

- To what level did students achieve the learning outcomes?
- How effective were the activities in helping students to understand key concepts and achieve the learning outcomes?
- Did teaching strategies and activities facilitate high levels of student engagement? Why/why not?
- How could the unit be improved to enhance student engagement and learning?

Students may reflect on:

- what they have learnt throughout the unit
- what they would like to know more about
- what it is like to be a scientist and/or engineer
- why scientists and/or engineers are important for our society now and in the future
- the process of Working Technologically to create a design, test and modify
- their achievement in relation to the jointly constructed criteria
- what they learned from working with others in a group.