

Teacher Notes

Themes

- Digital technologies
- Computational thinking
- Artificial intelligence
- Digital art and music
- Data collection and analysis

Key learning outcomes

- Apply basic coding skills to create practical projects using Scratch, micro:bit and App Inventor
- Develop problem solving and computational thinking
- Learn about current technologies such as artificial intelligence, natural language processing, computer modelling, sensors and encryption
- Understand ways that people use technology every day
- Learn about digital careers

Key curriculum areas

- Digital technologies: Processes and production skills
- Science: Physical sciences, Science as a Human Endeavour, Science Investigation
- Mathematics: Number and algebra, Statistics and probability
- English: Language, Literature, Literacy
- The Arts: Visual arts, Music

Publication details

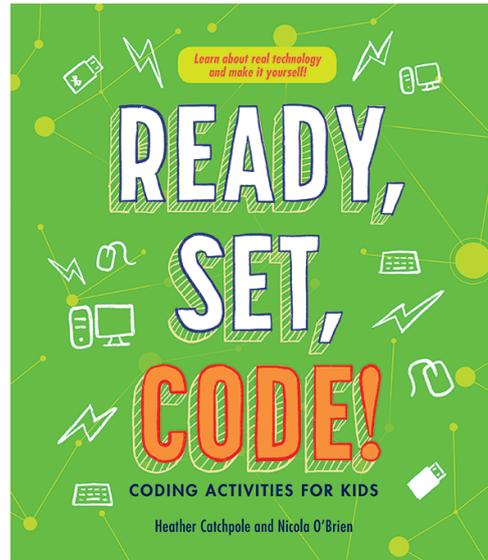
Ready, Set, Code! Coding Activities for Kids
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CSIRO Publishing
Locked Bag 10
Clayton South, VIC 3169, Australia

Website: www.publish.csiro.au
Tel: 1300 788 000 (local call in Australia)
Email: publishing.sales@csiro.au

Teacher notes prepared by Lauren Webb



Ready, Set, Code!

Coding Activities for Kids

Heather Catchpole and Nicola O'Brien

Ready, Set, Code! explains how cutting-edge digital technology works and its surprising uses now and in the future. Filled with interesting examples, each chapter explores a different topic, such as artificial intelligence, sensors and data, and applies it with a fun, hands-on coding project. You will learn how to create your own chatbot, translate messages into different languages, construct a burglar alarm, make digital art and music, and launch a citizen science project. Plus, you'll learn how to protect yourself online and much more.

Readers in Years 3 to 6



PUBLISHING

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About the authors

Heather Catchpole is a children's author and founder of the phenomenally successful *Careers with Code* magazines. Produced in partnership with Google, over 1.5 million copies of these magazines have been distributed in the USA, New Zealand and Australia. Heather is a passionate advocate for science, technology, engineering and maths and an entrepreneur and co-founder of Refraction Media. Her goal is to create a digital future with humanity and creativity.

Nicola O'Brien is the founder of Code Rangers, a start-up that teaches kids to code and helps teachers to bring coding to their schools. She currently works at the Australian Computing Academy, University of Sydney. She is a computing education specialist tasked with creating and delivering engaging curriculum-aligned content on digital technologies.

Pre-reading activities

1. Explain that coding is a way of giving instructions to a computer or device to tell it what to do. Ask students to brainstorm an everyday task and write instructions to teach somebody who has never done that task how to do it. How detailed would the instructions need to be? Prompt students with an unexpected circumstance the person performing the task might encounter. How could the student describe what to do when the unexpected circumstance arises in their instructions, so that the person performing the task doesn't get stuck? (e.g. They might use the word 'If,' then give more instructions.)
2. As a group, brainstorm different digital technologies that students use in their lives. Prompt children to think broadly, perhaps by considering different rooms in their houses or hobbies they have.

Discussion questions

Digital Technologies

1. Ask students to think of some other ways that chatbots could be used at school besides taking lunch orders. (Ch. 2)
2. User input is information that a person gives to a program that determines what happens next (p. 22). In the chatbot activity (Ch. 2), the user input is the lunch order (e.g. pizza). What types of user input might be needed to create some of the chatbot ideas that students discussed for Question 1?

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3. Branching is the way that a program makes decisions. In Scratch, we can use ‘if’ and ‘else’ blocks to make our code do different things in response to user input or different conditions (pp. 22, 41). What would happen in the chatbot program (Ch. 2) if we didn’t use ‘if/else’ blocks?
4. Read about how sensors are used in technology on page 37. Ask students to think about sensors that are in the technology they use. What types of sensors are most important in their lives?
5. Discuss the ethical questions about sensors in the ‘What next?’ box on page 42. What do the students think and why?
6. A variable is a way of storing information in a coding project (pp. 48, 83). The information that is stored can be changed, replaced or used in other places in the code. The book says that a variable is like a container. What other containers that store information can students think of? (e.g. book, USB stick, TV show)
7. What are some things that flying robots could be used for in the future? Why might it be important to teach flying robots how to move together? (pp. 64–65)
8. Is it okay to collect data about somebody without asking permission? (p. 85) Why or why not?
9. Ask students what they know about staying safe online. Discuss different types of dangers such as cyberbullying, addiction and hacking. Talk about ways to minimise these dangers (p. 86).

Science

1. In the sensor activity in Chapter 4, what happens when you connect the headphone jack to the micro:bit using the alligator clips? Explain to students how the alligator clips transfer the electrical signal from the micro:bit to the headphones, allowing you to hear the sound.
2. Radio waves are a type of electromagnetic radiation. We can’t see them but we use them in lots of different technologies. Read about radio waves on page 56–57. Discuss why we need two micro:bits for the bike alarm in Chapter 6 to work.
3. Discuss why some animals move in swarms (p. 66). Why might scientists want to understand more about how living things move together?
4. Why is it important to collect data about animal populations (p. 76)?

Mathematics

1. Music and coding both use repeated patterns (p. 44). Can students think of some songs that use repeating patterns of notes?

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2. Data is information that helps us to understand the world around us. It can be used to make decisions and solve problems. What are some ways that students could collect data? What types of things would they be interested in collecting data about? (pp. 75–77)
3. Citizen science allows people to collect data which scientists can use to understand more about the world. Imagine you are a scientist studying bee populations to see if the number of bees is changing over time. Once you have collected data for many years, what do you think would be the best way to present the data? (p. 76)

English

1. Natural language processing is the ability of technology to understand us when we speak. Ask students what languages other than English they speak at home. What are some of the differences between these languages and English? Is it easy to translate from one to the other? (p. 97)
2. Read about coding careers in Chapter 11. What type of persuasive language did the coders use to show how much they love their work and why students might love coding careers too?
3. At the back of *Ready, Set, Code!* there is a glossary of terms which students might or might not understand already. Ask the students to select three new words from the glossary to use in sentences about technology.

The Arts

1. Look at more artwork created by artificial intelligence at: obvious-art.com/gallery.html. Discuss with the class what signs they see that tell them the art is not made by a human. Do they think the artwork still has meaning? (Ch. 3)
2. Which students in the class can play musical instruments? What do they play? What advantages might there be to learning to code music instead of playing a physical instrument? (Ch. 5)

Activities

Digital technologies

Branching banter (Chs 2 and 5)

Students can practise computational thinking by writing out a pretend conversation. Start the activity by giving the students a question, for example ‘What are you doing after school today?’ Ask them to think about possible answers to that question (user input) and what types of responses would be appropriate for each answer. Use ‘if’, ‘then’ and ‘else’ to organise their conversation (pp. 22, 41).

Colour by code (Ch. 3)

When we do art, we can make new colours by mixing paint, but the colours that we see on digital devices are made by code. Different ways to code colours are RGB (which stands for Red, Green, Blue and specifies an amount of each colour to mix) and HEX (which uses a six-digit code containing letters and numbers to specify shades) (p. 35).

Ask students to make a ‘colour by numbers’ artwork for somebody else to colour in.

First draw a picture using a black pen (don’t colour it in!). Then write the same number on parts of the picture that should be coloured the same colour (e.g. write ‘1’ on every part of the picture that should be green). Do this for as many colours as needed.

At the bottom of the picture make a key. Write down a list of numbers used in the picture (e.g. 1 to 10). Then use the website htmlcolorcodes.com to find out the RGB code of the colour you want that number to be. Write the RGB code next to the number in your key.

Once everyone has made their pictures, have students swap pictures and colour them in, using the website htmlcolorcodes.com to decode the key.

Cybersafety (Ch. 9)

Watch the animated Cybersmart Challenge videos and make use of the associated teacher resources at: bit.ly/e-safetyGov

Watch the video on cybersecurity by PBS here: bit.ly/CyberCrashCourse

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Science

Virtual tour of the Square Kilometre Array (Chs 6 and 8)

The Square Kilometre Array is the biggest group of radio telescopes ever planned for construction. The SKA uses radio waves to study the universe and it will produce 100 times more data than is produced by internet use across the entire world.

Take a virtual tour of the SKA here: www.icrar.org/outreach-education/mrovt

Citizen science data (Ch. 8)

Vote on a citizen science project to participate in as a class (p. 84) and chart the results. Discuss the type of data that will be collected for the chosen project and how that data will be used to grow scientific knowledge or solve problems.

Mathematics

Cartesian sprites (Ch. 5)

In Scratch, we can make things happen depending on where our sprite is on the screen. The position of the sprite is expressed as coordinates on a Cartesian plane. Show students the picture on page 48 of the book, then draw a Cartesian plane on the class whiteboard or smartboard. Give students colourful sticky notes on which are written x,y coordinates and ask them to stick them on the plane in the appropriate position.

Charting data (Ch. 8)

Once students have made the citizen science project in Chapter 8 and have collected their data, show students how to put their data into Excel and make a simple bar chart to share with the class. Younger students could draw the bar chart on paper.

English

Bot or not? (Ch. 2)

Read students some of the poems on botpoet.com and ask them to guess whether the poems were written by a bot or by a human. What makes them think 'bot'? What makes them think 'human'?

Were they right or wrong?

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Coding careers roleplay (Ch. 11)

Ready, Set, Code! contains four short stories about people who write code as part of their work.

Working in pairs, invite students to roleplay an interview with each coder, where one student is asking questions and the other is responding as if they were that coder.

Ready, Set, Code! review

Collect some book reviews from different sources. *Double Helix* magazine contains book reviews written by kids in every issue – order some back copies to share.

Discuss with students what details they might want to know in a review. Break them down into ‘things that are objective’, like the length of the book, what topics it includes or facts about the authors, and ‘things that are subjective’, like their personal opinion about how much they enjoyed reading it.

Have students write a review for *Ready, Set, Code!*

The Arts

No mess art (Ch. 3)

Provide students with some time to create digital artwork with Silk (weavesilk.com), Bomomo (bomomo.com) or Kano Art (art.kano.me/challenges).

Discuss with students the way that digital tools in these programs are similar or different to physical art tools like paint, ink, pencil, clay or fabric. Are they able to express themselves in the same way or do the digital tools give them different ways to express themselves?

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Australian Curriculum Links

Year level	Learning area: Digital technologies	Other learning areas
Year 3/4	<p>Digital technologies: Knowledge and understanding</p> <ul style="list-style-type: none"> Identify and explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data (ACTDIK007) Recognise different types of data and explore how the same data can be represented in different ways (ACTDIK008) <p>Digital technologies: Processes and production skills</p> <ul style="list-style-type: none"> Collect, access and present different types of data using simple software to create information and solve problems (ACTDIP009) Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010) Implement simple digital solutions as visual programs with algorithms involving branching (decisions) and user input (ACTDIP011) Explain how student solutions and existing information systems meet common personal, school or community needs (ACTDIP012) Plan, create and communicate ideas and information independently and with others, applying agreed ethical and social protocols (ACTDIP013) 	<p>Science</p> <ul style="list-style-type: none"> Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061) With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge (AC SIS053, AC SIS064) <p>Mathematics</p> <ul style="list-style-type: none"> Recognise, represent and order numbers to at least tens of thousands (ACMNA052, ACMNA072) Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095) <p>English</p> <ul style="list-style-type: none"> Listen to and contribute to conversations and discussions to share information and ideas and negotiate in collaborative situations (ACELY1676) Understand how texts vary in complexity and technicality depending on the approach to the topic, the purpose and the intended audience (ACELA1490) <p>The Arts</p> <ul style="list-style-type: none"> Use materials, techniques and processes to explore visual conventions when making artworks (ACAVAM111) Create, perform and record compositions by selecting and organising sounds, silence, tempo and volume (ACAMUM086)
Year 5/6	<p>Digital technologies: Knowledge and understanding</p> <ul style="list-style-type: none"> Examine the main components of common digital systems and how they may connect together to form networks to transmit data (ACTDIK014) Examine how whole numbers are used to represent all data in digital systems (ACTDIK015) <p>Digital technologies: Processes and production skills</p> <ul style="list-style-type: none"> Define problems in terms of data and functional requirements drawing on previously solved problems (ACTDIP017) Design a user interface for a digital system (ACTDIP018) Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019) Implement digital solutions as simple visual programs involving branching, iteration (repetition), and user input (ACTDIP020) Plan, create and communicate ideas and information, including collaboratively online, applying agreed ethical, social and technical protocols (ACTDIP022) 	<p>Science</p> <ul style="list-style-type: none"> Light from a source forms shadows and can be absorbed, reflected and refracted (ACSSU080) Electrical energy can be transferred and transformed in electrical circuits and can be generated from a range of sources (ACSSU097) Scientific knowledge is used to solve problems and inform personal and community decisions (ACSHE083, ACSHE100) Decide variables to be changed and measured in fair tests, and observe, measure and record data with accuracy using digital technologies as appropriate (AC SIS087, AC SIS104) <p>Mathematics</p> <ul style="list-style-type: none"> Investigate everyday situations that use integers. Locate and represent these numbers on a number line (ACMNA124) Introduce the Cartesian coordinate system using all four quadrants (ACMMG143) Pose questions and collect categorical or numerical data by observation or survey (ACMSP118) <p>English</p> <ul style="list-style-type: none"> Use comprehension strategies to analyse information, integrating and linking ideas from a variety of print and digital sources (ACELY1703) Analyse how text structures and language features work together to meet the purpose of a text (ACELY1711) Select, navigate and read texts for a range of purposes, applying appropriate text processing strategies and interpreting structural features, for example table of contents, glossary, chapters, headings and subheadings (ACELY1712) <p>The Arts</p> <ul style="list-style-type: none"> Develop and apply techniques and processes when making their artworks (ACAVAM115)