

Teacher Notes

Themes

- Robots and rescue
- Human–robot teamwork
- Ethics and emerging technologies

Key learning outcomes

- Explain how robots can be designed to work in different environments and support humans in dangerous situations.
- Describe and compare the roles of people who design, build and use robots.
- Identify and discuss ethical questions raised by robotics.
- Create explanations, arguments or creative responses about how robots might be used in the future.

Key curriculum areas

- **Science:** Science Understanding (Biological sciences); Science as a Human Endeavour
- **English:** Language; Literature; Literacy
- **HASS:** Civics and citizenship; Question and researching; Concluding and decision-making

Publication details

Robot Responders: Rescue Missions to Space Adventures

ISBN: 9781486318421

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Teacher notes prepared by David Benton.

CSIRO Publishing
Private Bag 10
Clayton South, VIC 3169, Australia

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



Robot Responders

Rescue Missions to Space Adventures

Smriti Daniel

About the book

Meet the robots that dare to go where humans can't!

From blazing fires and crumbling buildings to radioactive zones and stormy seas, rescue robots are on the front lines – saving lives, exploring the unknown and tackling tasks too dangerous for people. Whether they're diving to the ocean floor, fixing satellites or cleaning hospitals, robots are redefining what's possible.

Behind every heroic robot is brilliant design and cutting-edge technology. Think flexible joints, precision flight, lasers for mapping, and fire-fighting abilities to spray hundreds of litres of water in seconds. But success also depends on seamless teamwork between humans and machines.

Explore the fascinating world of robotic innovation in *Robot Responders*. Uncover how nature inspires engineers, discover the latest life-saving technologies, and get a glimpse of the next generation of robots that are already in development.

Recommended for

Readers aged 8 to 12 (Years 3 to 7)



PUBLISHING

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About the author

Smriti Daniel isn't a roboticist, but she had a lot of fun interviewing several of them for this book. She's a journalist, editor and presenter, and this is her second book for younger readers.

Pre-reading questions or activities

Think-pair-share

1. Ask students 'What is a "robot" to you?' and have an open discussion for a couple of minutes.
2. Ask students to draw what they think of when they hear the word 'robot'.
3. Then compare with a partner.
4. Ask students to raise their hand if their robot is doing a job that humans already do.

Discussion prompt

Where might robots be most useful in real life?

Brainstorm situations that are dirty, dangerous or dull (e.g. cleaning up pollution, fighting fires or repeating the same action over and over). Which of these jobs would you rather a robot did instead of a person?

Discussion questions

Science

1. How do robots help humans work more safely in dangerous environments?

Students might refer to robots working in nuclear power plants (Fukushima) or inside volcano vents (VolcanoBot), bushfire robots in the SILVANUS Project, deep-sea ROVs, space rovers, medical robots and microrobots delivering medicine.

Key idea: Robots can go where it is too hot, toxic, deep, cramped or risky for humans, and send data back.

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2. Why do different robots need different designs for land, water, air, space and inside the body?

Because each environment has different challenges: pressure and darkness underwater; heat, ash and steep slopes on volcanoes; vacuum and radiation in space; tight blood vessels or organs in the body. Robots need specific shapes, materials, sensors and power systems to survive and move in those conditions.

3. What is biomimicry, and how does the book show robots inspired by nature?

Biomimicry is copying ideas from living things to solve problems. Examples: Omni-Roach inspired by cockroaches, gecko-like gripping, lily-pad-inspired nuclear inspection robot, iRat modelled on rat movement and behaviour, robots that swarm like ants or bees.

4. How can robots help scientists collect better data about animals and ecosystems?

Examples: SnotBot collecting whale snot for DNA and hormone tests; GUS detecting poachers and spotting koalas with thermal cameras; deep-sea ROVs mapping seamounts; drones counting animals or tracking shark and whale movements; Reef Sweeper controlling lionfish; robots listening to frog calls.

5. What is autonomy in robotics, and why is it especially important for space or disaster robots?

Autonomy means the robot can sense, decide and act without constant human control. In space or deep underground there are delays or blocked signals, so robots such as Mars rovers, Fukushima robots or CADRE rovers must make some decisions on their own to continue their missions safely.

English

1. How does the author combine factual information with storytelling to keep readers engaged?

The book uses case studies, personal stories of roboticists, 'Did you know?' fact boxes, ethical question boxes and vivid descriptions of real events (e.g. Notre-Dame fire, Fukushima, DARPA Challenge, bushfires). This blends narrative elements with explanations and technical details.

2. Choose one robot (e.g. SnotBot, iRat, Reef Sweeper, A-PUFFER or Colossus). How does the text and imagery help you visualise what it does and why it matters?

Students should mention headings, labelled photos/illustrations, action verbs and context (where it works, what problem it solves, who uses it). They can talk about emotional or persuasive language (saving whales, protecting koalas, keeping firefighters safe).

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HASS

1. How do place and environment influence how robots are designed and used?
For example, bushfire robots must cope with heat, smoke and rough terrain in Australian forests; GUS must handle African parks and Australian plantations; deep-sea ROVs must cope with pressure and darkness; lionfish ROVs target a specific invasive species; space robots must deal with no air and big temperature swings. Environment shapes technology.
2. Who should make decisions about how robots are used in communities (e.g. police Digidog, medical robots, conservation bots)?
Students might suggest governments, local communities, scientists, ethicists, First Nations groups, or combinations of these. They can discuss fairness, consultation and the need for clear rules and accountability.

Activities

ACTIVITY 1 – Robot environment design challenge

Areas: Science, English

Goal: Students design their own specialised robot for an environment and problem.

Planning: Tell students that they need to decide on:

- An environment from the book (e.g. deep sea, volcano, bushfire zone, space, hospital/inside body).
- The problem that it solves (e.g. exploring the ocean or space, fighting fires, delivering medicine). Encourage students to think of a problem that has not been described in the book.
- How it moves.
- The sensors or other tools that it needs.
- How it communicates with humans (or maybe even other robots!).

Extension: Older students can write a short 'spec sheet' or persuasive text pitching their robot to a funding body.

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Optional: Rather than drawing, students could use arts and crafts to create a model of their robot using toilet paper rolls, cardboard boxes, sticky tape/glue and coloured paper (or other materials available to your class).

Safety note: If creating a model, ensure students take care with scissors, especially when cutting through cardboard.

ACTIVITY 2 – Ethics corners: ‘What should robots be allowed to do?’

Areas: HASS, English

1. Label/assign corners of the room ‘Strongly agree / Agree / Disagree / Strongly disagree’.
2. Read a statement from below, then ask students to move to a corner of their choosing and briefly justify their choice using evidence from the text. You could have students discuss this in pairs, but also choose some students from each corner.
3. Emphasise respectful discussion and listening.

Statements for discussion:

- Police should be allowed to use robots like Digidog in public places if it helps keep people safe.
- Robots should be allowed to enter private land or homes during emergencies, such as bushfires or floods, without asking first.
- It is okay for robots like Reef Sweeper to kill invasive animals if it helps protect native species.
- Robots should replace humans in very dangerous jobs, even if it means some people lose their jobs.
- Drones and robots should be allowed to watch animals and people from above if it helps scientists collect important information.
- Medical robots should be allowed to work inside the human body if they can treat people faster and more safely than doctors alone.
- Robots should be used in war if it means fewer human soldiers are harmed.
- Robots that collect information (photos, sounds or data) should always ask for permission first, even in emergencies.
- If a robot makes a mistake and causes harm, the people who designed it should be responsible.
- Robots should only be used to help humans and the environment, not to make money or gain power.

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ACTIVITY 3 – Rescue robot case study jigsaw

Areas: Science, English, HASS

1. Assign each group a different robot from the book (e.g. GUS, VolcanoBot, Reef Sweeper, SnotBot, A-PUFFER, microrobots, bushfire robots).
2. Each group creates a one-page poster summarising:
 - a. The problem the robot solves.
 - b. Where it works.
 - c. Key design features (movement, sensors, power).
 - d. One ethical or environmental question raised.
3. Groups then teach their peers in a jigsaw share-back:
 - a. Each group becomes the expert on their robot or scenario.
 - b. Reform new groups so that one member from each original group is in each new group.
 - c. Take turns explaining your robot or ethical issue to the group.
 - d. Share:
 - i. What the robot does.
 - ii. The benefits.
 - iii. The ethical concern or dilemma.
4. Listen carefully while others present – you may ask one clarifying question.

By the end, everyone should understand all robots, not just their own.

ACTIVITY 4 – Future robot reflection: ‘From here to the future’

Areas: English, Science

After reading the final chapter, students write or draw a response to one of these prompts:

‘A robot that could help my community would ...’

‘In 20 years, I hope robots will ...’

‘It is important that people who develop robots consider ...’

Encourage them to include one scientific idea from the book (e.g. sensors, autonomy, environment) and one ethical idea (e.g. fairness, safety, privacy, environment).

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ACTIVITY 5 – Robot interview

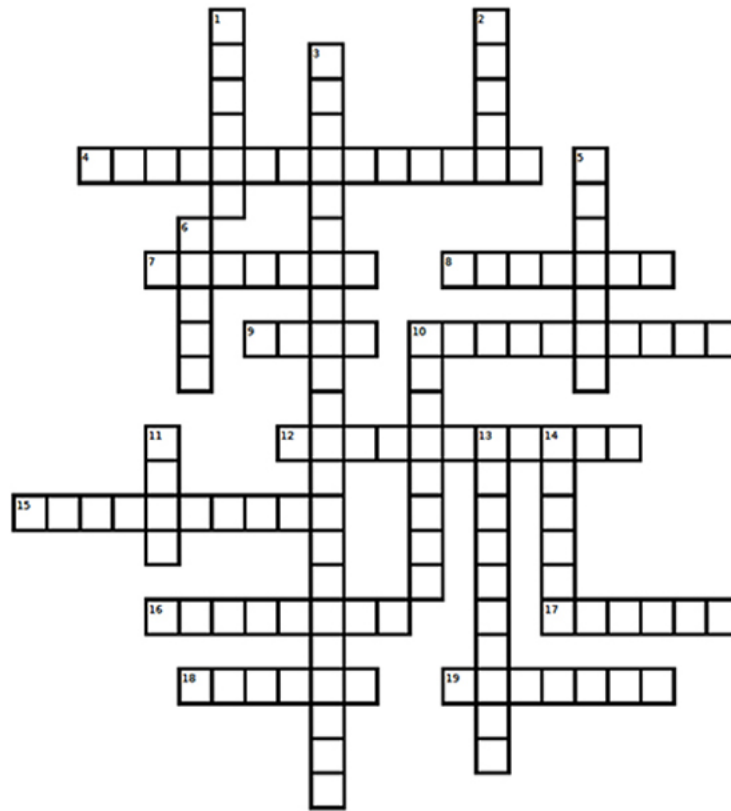
Area: English

In pairs:

1. One student is a journalist.
2. One student is the robot (or the roboticist).
3. The journalist asks questions such as:
 - What problem do you solve?
 - What science helps you work?
 - What ethical concerns exist about your use?(Students must answer using information from the text.)

Optional: Give students some time to prepare, and then have volunteers perform in front of the class. Encourage robot voices and actions from the robots!

Robot Responders crossword puzzle



Across:

4. The duty to make careful choices about how robots are designed and used.
7. A person's right to keep their personal life and information protected.
8. A flying robot (drone) that collects whale snot so scientists can study whale health without touching them.
9. When a system or person treats some people unfairly because of limited or unbalanced information.
10. Able to work independently without constant human control.
12. The surroundings where a robot or living thing operates, such as space or ocean.
15. The prevention and treatment of illness to keep people healthy. (two words)
16. A large, uncontrolled fire that spreads through bush or forest areas.
17. The condition of being protected from danger, harm or risk.
18. A small robot that folds up like origami and explores places larger robots cannot reach.
19. A robotic dog used to explore dangerous places where humans might get hurt.

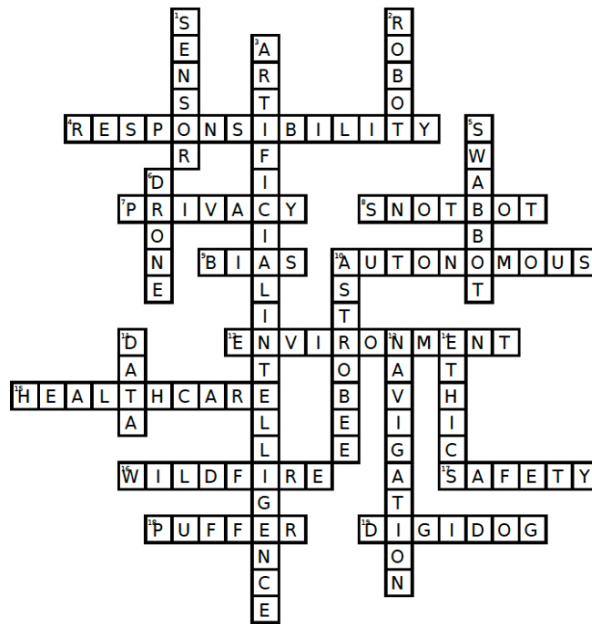
Down:

1. A device on a robot that helps it collect information, such as images or movement.
2. A machine designed to carry out tasks automatically or with guidance from humans.
3. Computer systems that can learn, make decisions or solve problems. (two words)
5. A robot that takes throat swab samples for medical testing safely and consistently.
6. A flying robot that can be controlled remotely or programmed to fly on its own.
10. A free-flying robot that helps astronauts on the International Space Station.
11. Information collected by robots and scientists to help them understand the world.
13. The process of finding and following a path from one place to another.
14. Ideas about what is right and wrong when using technology like robots.

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Crossword answer key:



Across:

- The duty to make careful choices about how robots are designed and used.
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- When a system or person treats some people unfairly because of limited or unbalanced information.
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- Information collected by robots and scientists to help them understand the world.
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- Ideas about what is right and wrong when using technology like robots.

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Australian Curriculum Links (Version 9.0)

Year level	Learning area: Science	Other learning areas
Years 3/4	<p>Science Understanding: Biological sciences</p> <ul style="list-style-type: none"> Compare characteristics of living and non-living things and examine the differences between the life cycles of plants and animals (AC9S3U01) <p>Science as a Human Endeavour: Use and influence of science</p> <ul style="list-style-type: none"> Consider how people use scientific explanations to meet a need or solve a problem (AC9S3H02) <p>Science as a Human Endeavour: Nature and development of science</p> <ul style="list-style-type: none"> Examine how people use data to develop scientific explanations (AC9S4H01) 	<p>English: Language: Language for interacting with others</p> <ul style="list-style-type: none"> Understand that cooperation with others depends on shared understanding of social conventions, including turn-taking language, which vary according to the degree of formality (AC9E3LA01) <p>English: Literature: Creating literature</p> <ul style="list-style-type: none"> Create and edit literary texts by developing storylines, characters and settings (AC9E4LE05) <p>English: Literacy: Interacting with others</p> <ul style="list-style-type: none"> Use interaction skills to contribute to conversations and discussions to share information and ideas (AC9E3LY02) <p>HASS: Civics and citizenship</p> <ul style="list-style-type: none"> Who makes rules, why rules are important in the school and/or the local community, and the consequences of rules not being followed (AC9HS3K06) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none"> Develop questions to guide investigations about people, events, places and issues (AC9HS4S01)
Years 5/6	<p>Science Understanding: Biological sciences</p> <ul style="list-style-type: none"> Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01) <p>Science as a Human Endeavour: Nature and development of science</p> <ul style="list-style-type: none"> Examine why advances in science are often the result of collaboration or build on the work of others (AC9S5H01) <p>Science as a Human Endeavour: Use and influence of science</p> <ul style="list-style-type: none"> Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S5H02) 	<p>English: Language: Language for interacting with others</p> <ul style="list-style-type: none"> Understand the uses of objective and subjective language, and identify bias (AC9E6LA02) Identify and explain how images, figures, tables, diagrams, maps and graphs contribute to meaning (AC9E6LA07) <p>English: Literacy: Interacting with others</p> <ul style="list-style-type: none"> Use interaction skills and awareness of formality when paraphrasing, questioning, clarifying and interrogating ideas, developing and supporting arguments, and sharing and evaluating information, experiences and opinions (AC9E6LY02) <p>HASS: Questioning and researching</p> <ul style="list-style-type: none"> Develop questions to investigate people, events, developments, places and systems (AC9HS5S01) <p>HASS: Concluding and decision-making</p> <ul style="list-style-type: none"> Propose actions or responses to issues or challenges and use criteria to assess the possible effects (AC9HS5S06)
Year 7	<p>Science as a Human Endeavour: Nature and development of science</p> <ul style="list-style-type: none"> Investigate how cultural perspectives and world views influence the development of scientific knowledge (AC9S7H02) <p>Science as a Human Endeavour: Use and influence of science</p> <ul style="list-style-type: none"> Examine how proposed scientific responses to contemporary issues may impact on society and explore ethical, environmental, social and economic considerations (AC9S7H03) 	<p>English: Language: Language for interacting with others</p> <ul style="list-style-type: none"> Understand how language expresses and creates personal and social identities (AC9E7LA01) <p>English: Language: Language for expressing and developing ideas</p> <ul style="list-style-type: none"> Investigate the role of vocabulary in building specialist and technical knowledge, including terms that have both everyday and technical meanings (AC9E7LA08) <p>English: Literacy: Analysing, interpreting and evaluating</p> <ul style="list-style-type: none"> Use comprehension strategies such as visualising, predicting, connecting, summarising, monitoring, questioning and inferring to analyse and summarise information and ideas (AC9E7LY05) <p>HASS: Civics and citizenship</p> <ul style="list-style-type: none"> Analyse information, data and ideas about political, legal or civic issues to identify and explain differences in perspectives and potential challenges (AC9HC7S03) Create descriptions, explanations and arguments using civics and citizenship knowledge, concepts and terms that reference evidence (AC9HC7S05)

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Related books from CSIRO Publishing

- *Bots and Bods: How Robots and Humans Work, from the Inside Out* (<https://www.publishing.csiro.au/book/8013>)
- *Computer Technology for Curious Kids: An illustrated introduction to software programming, artificial intelligence, cyber-security—and more!* (<https://www.publishing.csiro.au/book/8162>)
- *How to Survive on Mars* (<https://www.publishing.csiro.au/book/8011>)
- *The Great Australian Science Book* (<https://www.publishing.csiro.au/book/8083>)

Other CSIRO resources

CSIRO has developed and delivered a broad range of high-quality STEM education programs and initiatives for nearly 40 years. Our programs aim to inspire the pursuit of further STEM education among students and the community, to equip the emerging workforce with tomorrow's skill sets, and to strengthen collaboration between industry and classrooms across Australia. For more information visit: <https://www.csiro.au/en/Education>