

## Robotics Teaching and Learning Program Example

### Essential question:

**What are Robots and Why do we need them in society?**

#### Big idea:

- Robotics
- Artificial Intelligence

#### Related Concepts:

- Project Management
- Digital Systems
- Materials and Technology
- Engineering Principles and Systems

## Desired Results

**Australian Curriculum Content Descriptions: See attached document**

*General Capabilities and Cross Curriculum Priorities can be applied to many aspects of robotics*

#### General Capabilities (Check ACARA)

-  Literacy
-  Ethical Behaviour
-  Numeracy
-  Personal and Social Competence
-  ICT
-  Intercultural Understanding
-  Critical and Creative Thinking

#### Cross Curriculum Priorities (Check ACARA)

-  Aboriginal & Torres Strait Islander Histories and Cultures
-  Asia and Australia's Engagement with Asia
-  Sustainability

#### Example Problems Questions:

- What types of robots do we have in society?
- How do robots work?
- How do you make a robot?
- What helps robots make decisions?

#### Enduring Understandings: (From ACARA Achievements standards Year 9/10 example)

##### Design and Technology

They identify the changes necessary to designed solutions. When producing designed solutions for identified needs or opportunities students evaluate the features of technologies and their appropriateness for purpose for one or more of the technologies contexts. Students create designed solutions for one or more of the technologies contexts based on a critical evaluation of needs or opportunities. They create and connect design ideas and processes of increasing complexity and justify decisions. Students communicate and document projects, including marketing for a range of audiences. They independently and collaboratively apply sequenced production and management plans when producing designed solutions, making adjustments to plans when necessary. They select and use appropriate technologies skilfully and safely to produce high quality designed solutions suitable for the intended purpose. Students explain the control and management of robotic digital systems and the interaction between hardware, software and humans.

##### Digital Technology

Students plan and manage digital projects using an iterative approach. They define and decompose complex problems in terms of functional and non-functional requirements. Students design and evaluate algorithms. They design and implement modular programs, including an object-oriented program, using algorithms and data structures involving modular functions that reflect the relationships of real-world data and data entities. Students test and predict results and implement digital solutions. They evaluate information systems and their solutions in terms of risk and potential for innovation and enterprise. They share and collaborate and manage projects.

#### Knowledge: *Students will know...*

- The use, development and impact of Robotics
- Technologies and design across a range of technologies contexts.
- The components of Robotic digital systems: hardware, software and their use.

#### Skills: *Students will be able to...*

##### Creating designed solutions by:

- investigating
- generating
- producing
- evaluating
- collaborating and managing

##### Creating digital solutions by:

- defining
- designing
- implementing
- evaluating
- collaborating and managing

## Assessment Evidence Examples

<b>Diagnostic Assessment</b> <i>Prior knowledge and skills?</i>	<b>Formative Assessment</b> <i>How will students demonstrate achievement of the desired results?</i>	<b>Summative Assessment</b> <i>Through what authentic performance task will students demonstrate the desired understandings? What specific considerations will be given to support individual learning and assessment?</i>
<p>Expert groups – Students into groups of 4, talk about robotics, Research about what they know.</p> <p>Produce a pictorial representative of their knowledge</p>	<p>Discussion forum with questions</p> <p>Programming Task (Algorithms, flowcharts Pseudo Code, Visual programming language)</p> <p>Log book for major project (individual or group task)</p> <p>Week to week robotic games and challenges</p>	<p>Research Task – What are robots and why do we use them in society.</p> <p>Rich Task – design and build a robot to the challenge presented for RobocupJunior Australia.</p> <p>Logbook – Using the RCJA template as a guide.</p>

## Learning Planning

### Teaching and Learning Experiences

<b>Topics</b>	
	<p>How do Asimov' 3 laws of robotics impact society and does it influence the development of robotics and artificial intelligence?</p> <p>How does the design process influence software, hardware and mechanical development?</p> <p>Can you apply programming concepts to real world problems?</p> <p>Is automation different from autonomy?</p> <p>How do you create a robot for a specific solution?</p>

### Adjustments and General Accommodations

*What adjustments will be made to the learning experiences to cater for the varied needs, abilities and interests of students?*  
**Additional information can be found at: Positive Partnerships- Support materials**

<b>Classroom accommodations</b>	<b>Presentation of lesson</b>
<ul style="list-style-type: none"> <li>Use support groups/ cooperative learning</li> <li>Role cards</li> <li>Use of stations</li> <li>Arrange classroom for safe visibility, accessibility and movement</li> </ul>	<ul style="list-style-type: none"> <li>Use visual aids with oral presentation</li> <li>Give clear behavioral objectives</li> <li>Use high-impact game-like materials</li> <li>Give reminders for students to stay on task, monitor students work weekly</li> </ul>
<b>Alternative testing/evaluation procedures</b>	<b>Note-taking</b>
<ul style="list-style-type: none"> <li>Reduce the number of test items</li> <li>Arrange for oral testing</li> <li>Adjust grading criteria based on the individual</li> </ul>	<ul style="list-style-type: none"> <li>Provide students the means of audio or video recording</li> <li>Train students on how to take notes</li> </ul>
<b>Organisational strategies</b>	<b>Support services</b>
<ul style="list-style-type: none"> <li>The use of project time lines</li> <li>Use logbooks and checklists</li> <li>Time management specific lessons</li> </ul>	<ul style="list-style-type: none"> <li>Peer tutoring</li> <li>Cross-age tutoring</li> <li>Conflict resolution strategies</li> </ul>

## Activities and Resources – Australian Events, Books and Websites

### RoboCupJunior Australia – Workshops, online resources and Challenge Events

RoboCupJunior is a project-oriented educational initiative that sponsors local, regional and international robotic events for young students. It is designed to introduce RoboCup to primary and secondary school children, as well as undergraduates who do not have the resources to get involved in the Major leagues. The focus in the junior league is on education.

<http://www.robocupjunior.org.au/>

### Modern Teaching Aids – Robotics Equipment, workshops and support

MTA is the largest supplier of early childhood, primary and secondary school resources, teacher resources, school supplies, childcare supplies and classroom resources in Australia. We stock an extensive range of art & craft materials, mathematics equipment, literacy resources, educational toys, furniture and storage solutions as well as books, readers, science equipment, puzzles, games, construction and robotics sets.

<http://www.teaching.com.au/home>

### Damien Kee – Robotics Educator, books and online resources

Damien Kee is an independent technology education expert, who specialises in bringing technology concepts to teachers and educators around the world. Focusing primarily on Robotics, and with a strong interest in other areas of Technology Education, he works to educate teachers on the benefits and relative ease with which technology can be embedded into their daily classroom activities. His workshops for teachers and students have been run internationally and extensively throughout Australia.

<http://www.damienkee.com/>

### Educate NXT - books and online resources

Educate NXT is the ultimate NXT robotics resource for teachers and students. Graded Student worksheets are accompanied by extensive Teacher sections covering topics including Navigation, Line follow, and Sumo. This is further supported by animated PowerPoint presentations, ideal for teachers new to robotics, or teachers with experience wishing to extend their students.

<http://www.educatenxt.com/>

### Club Engineer - online resources

Our aim is that all the Club Engineer lessons will be available online, for free, for your or your young Engineer to work through at school, at home or anywhere there is Internet access.

<http://www.clubengineer.org/>

### Kidtechnic - Workshops

Today's children have grown up in a world where technology is a norm. They show incredible intuition when asked to interact with all sorts of devices. In particular, with computers they frequently surpass the skills of their adult teachers, mentors and carers. Many of our kids are looking for a place to expand their knowledge and be challenged.

<http://www.kidtechnic.com/>

## Activities and Resources - International Events, Books and Websites

### RoboCupJunior International – Events, Resources and Workshops

project-oriented educational robotics for students up through age 19, with a focus on providing a hands-on, scaffold environment where learners can grow by expanding their knowledge of, sparking their curiosity about and increasing their comfort with technology. RCJ has three challenges: soccer, rescue, dance each emphasising cooperative problem-solving; each designed to reach creative young minds with a range of interests, and skills.

<http://rcj.robocup.org/>

### Texas Tech University - Robotics Lessons and Activities

The activities and lessons serve as a backbone to a robotics curriculum and provides teachers a basic scope and sequence for leading students through the exploration of the Mindstorm system. When used in the classroom, the lessons and activities listed here provide opportunities for students to apply the knowledge and skills of construction and programming as well as providing students the opportunity to explore STEM concepts.

[http://www.depts.ttu.edu/tstem/curriculum/robotics/robotics\\_content.php](http://www.depts.ttu.edu/tstem/curriculum/robotics/robotics_content.php)

### ASIMO – Educational Materials

ASIMO's design, development and operation rely on many different disciplines including Mathematics, Physics, Anatomy, Engineering and Computer Science. The Teaching Resources Center provides information about ASIMO and robots that are sure to spark your students' interests in robotics, sciences, and more.

<http://asimo.honda.com/education-materials/>

#### **STEM Works**

Robots are everywhere these days! Have you ever wondered what they are all about? For the most part, they are just like us - sometimes they even have a body complete with muscles, a power source, sensors and a brain. They are designed to be as much like us as possible!

<http://stem-works.com/subjects/1-robotics/>

#### **Carnegie Mellon – Robotics Academy**

The Robotics Academy develops tools for teachers that make it easier to implement robotics curriculum into today's classrooms. Our curriculum is research-based, aligns with standards, and focuses on the development of 21st century skill sets in students.

<http://www.education.rec.ri.cmu.edu/index.htm>

#### **NASA – Robotics**

Innovation, creativity, problem solving -- the world of robotics at NASA is all of these things. Spend some time on this site to see if robotics might be in your future.

Things you can do on this site:

- Answer the question: What Is Robotics?
- Practice your programming skills with the interactive robotic activity.
- Watch and download video and multimedia features about robotics.
- Follow a timeline tracing the history of robotics.
- Check out lesson plans for your classroom.
- Stay up-to-date with information about NASA-supported robotics competitions.
- Visit the Robotics Image Gallery.
- Explore other worlds with NASA through robotic spacecraft discoveries.
- Read about scientists and engineers who design and test robots.
- Browse NASA websites for information about robotics.

<http://www.nasa.gov/audience/foreducators/robotics/about/index.html>

#### **Computer Science Unplugged – Artificial Intelligence**

This activity explores what it means for a computer to be intelligent, but having the students interact with a piece of paper that contains rules for playing a perfect game of noughts-and-crosses (tic-tac-toe). The activity contains some thought provoking (and humorous) discussion questions.

<http://csunplugged.org/intelligent-paper>

#### **LEGOengineering**

The aim of this site is to inspire and support teachers to go beyond the basics in bringing LEGO-based engineering to all students.

<http://www.legoengineering.com/>