Science and technologies in the Australian Curriculum: Making the connections for primary students

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Overview

• Overview of Australian Curriculum: Science and Technologies
• Key ideas
• Systems
• Opportunities for integration
• Implementation and resources
Australian Curriculum: Science
Science curriculum

Curriculum has been developed:

- from Foundation to Year 10
- from Years 11 to 12 in four subjects: biology; chemistry; earth and environmental science, and physics
Science: Organisation

Overarching ideas

Science understanding
- Biological sciences
- Chemical sciences
- Earth and space sciences
- Physical sciences

Science as a Human Endeavour
- Nature and development of science
- Use and influence of science

Science Inquiry Skills
- Questioning and predicting
- Planning and conducting
- Processing and analysing data and information
- Evaluating
- Communicating

acara
AUSTRALIAN CURRICULUM, ASSESSMENT AND REPORTING AUTHORITY
Overarching ideas

• Patterns, order and organisation
• Form and function
• Stability and change
• Scale and measurement
• Matter and energy
• Systems

www.australiancurriculum.edu.au/Science/The-overarching-ideas
Key messages

The science curriculum…

– emphasises an inquiry approach
– has been written to encourage integration of the three strands
– utilises six overarching ideas to provide a conceptual frame for learning across F-10
– integrates the cross-curriculum priorities and the general capabilities
Technologies curriculum

Curriculum has been developed:

• from Foundation to Year 8 in two subjects: design and technologies, and digital technologies

• from Years 9 to 10 in two optional subjects: design and technologies, and digital technologies
Design and technologies

Comprises two related strands:

• Design and technologies knowledge and understanding – the use, development and impact of technologies and design ideas across a range of technologies contexts: engineering principles and systems; food and fibre production; food specialisations; materials and technologies specialisations

• Design and technologies processes and production skills – the skills needed to design and produce designed solutions.
Digital technologies structure

Comprises two related strands:

• Digital technologies knowledge and understanding – the information system components of data, and digital systems (hardware, software and networks)

• Digital technologies processes and production skills – using digital systems to create ideas and information, and to define, design and implement digital solutions, and evaluate these solutions and existing information systems against specified criteria.
ICT in the Australian Curriculum

• the capability assists students to become effective *users* of ICT
• the digital technologies curriculum assists students to become confident *creators* of digital solutions
Design and Technologies (Available for use; awaiting final endorsement)

Foundation to Year 2

Foundation to Year 2 Band Description
Learning in Design and Technologies builds on concepts, skills and processes developed in the Early Years Learning Framework, revisiting, strengthening and extending these as needed.

By the end of Year 2 students will have had the opportunity to create designed solutions at least once in each of the following technologies contexts: Engineering principles and systems; Food and...

Read full description

Foundation to Year 2 Content Descriptions

Design and Technologies knowledge and understanding

Identify how people design and produce familiar products, services and environments and consider sustainability to meet personal and local community needs (ACTDEK001)

Explore how technologies use forces to create movement in products (ACTDEK002)

Explore how plants and animals are grown for food, clothing and shelter and how food is selected and prepared for healthy eating (ACTDEK003)

Explore the characteristics and properties of materials and components that are used to produce designed solutions (ACTDEK004)

Design and Technologies processes and production skills

Explore needs or opportunities for designing, and the technologies needed to realise designed solutions (ACTDEP005)

Visualise, generate, develop and communicate design ideas through describing, drawing and modelling (ACTDEP006)

Use materials, components, tools, equipment and techniques to safely make designed solutions (ACTDEP007)

Use personal preferences to evaluate the success of design ideas, processes and solutions including their care for environment (ACTDEP008)

Sequence steps for making designed solutions and working collaboratively (ACTDEP009)
Design and Technologies (Available for use; awaiting final endorsement)

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Curriculum

Jump to: F-2 3-4 5-6 7-8 9-10

Foundation to Year 2

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Read full description ▶

Foundation to Year 2 Content Descriptions

Design and Technologies knowledge and understanding

Identify how people design and produce familiar products, services and environments and consider sustainability to meet personal and local community needs (ACTDEK005)

Explore how technologies use forces to create movement in products (ACTDEK002)

Explore how plants and animals are grown for food, clothing and shelter and how food is selected and prepared for healthy eating (ACTDEK003)

Design and Technologies processes and production skills

Explore needs or opportunities for designing, and the technologies needed to realise designed solutions (ACTDEP005)

Visualise, generate, develop and communicate design ideas through describing, drawing and modelling (ACTDEP006)

Use materials, components, tools, equipment and techniques to safely make designed solutions (ACTDEP007)

Use personal preferences to evaluate the success of design ideas, processes and solutions including their care for environment (ACTDEP008)
Key ideas
National priorities

- Food and water security
- Health and wellbeing
- Knowledge economy
- Engineering, construction and manufacturing
- Innovation
Systems thinking

• Holistic approach to the identification and solving of problems
• Components of a system, and their interactions and interrelationships
• Throughout design processes, students need to understand systems and work with complexity, uncertainty and risk
• To design digital solutions students need to understand the complexity of information and digital systems and the interdependence of components.
Systems
Systems…

- Are a way of making connections
- Are human constructs
- Are related to other systems
- Involve interacting components
- Enable us to describe, compare, analyse and make predictions

*When we try to pick out anything by itself, we find it is tied to everything else in the universe.*

John Muir (1838-1914)
Progression of ideas about systems…

*Atlas of Science Literacy (2007)*

**F-2**

- Most things are made of parts
- Something may not work if its parts are missing
- When parts are put together, they do things that they couldn’t do by themselves
Years 3-5

• Something may not work well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected

• If something consists of many parts, the parts usually influence one another

• Collections of pieces (e.g. wooden blocks) may have properties that individual pieces don’t have
Years 6-8

• Any system is usually connected to other systems both internally and externally. Thus a system may be thought of as containing sub-systems and as being a sub-system of a larger system

• The output from one part of a system can become the input to other parts

• Thinking about things as systems means looking for how every part relates to others
What do we know about student learning in science?

- Developmental sequences are less well articulated in science than in other domains like English or mathematics.
- Research often emphasises learning of particular concepts and doesn’t necessarily seek to identify the prior learning that underpins those concepts.
- Learning science content doesn’t necessarily require previous learning for success, but learning science concepts does.
- The better students’ understanding of how ideas are connected in science, the richer their learning.
Why a systems approach?

Systems thinking supports students to learn science as connected concepts, rather than a collection of facts

Scientific literacy should be approached not as a collection of isolated abilities and bits of information, but as a rich fabric of mutually supporting ideas. (AAAS, 2001)
Supporting learning

• Science and technologies understanding doesn’t develop linearly.
• Developing science and technologies understandings depends on developing a network of ideas and making connections between those ideas.
• Students develop science and technologies ideas that are initially naive and become more sophisticated as students gain experiences and refine their thinking.
Opportunities for integration
<table>
<thead>
<tr>
<th>Design and technologies processes and production skills strand</th>
<th>Science inquiry skills sub-strands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating designed solutions by:</td>
<td></td>
</tr>
<tr>
<td>Investigating</td>
<td>Questioning and predicting</td>
</tr>
<tr>
<td>Generating</td>
<td>Planning and conducting</td>
</tr>
<tr>
<td>Producing</td>
<td>Processing and analysing data and information</td>
</tr>
<tr>
<td>Evaluating</td>
<td>Evaluating</td>
</tr>
<tr>
<td>Collaborating and managing</td>
<td>Communicating</td>
</tr>
</tbody>
</table>
Engineering principles and systems
Engineering principles and systems

Engineering ‘contextualises mathematics and science principles and promotes design processes, but can also enrich students’ learning in their studies of technology, literacy, history and geography.’
(English et al, 2013: 2)
<table>
<thead>
<tr>
<th>Design and technologies: engineering principles and systems</th>
<th>Science: physical sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explore how technologies use forces to create movement in products</strong> (ACTDEK002)</td>
<td>The way objects move depends on a variety of factors, including their size and shape (ACSSU005) A push or a pull affects how an object moves or changes shape (ACSSU033)</td>
</tr>
<tr>
<td><strong>Investigate how forces and the properties of materials affect the behaviour of a product or system</strong> (ACTDEK011)</td>
<td>Forces can be exerted by one object on another through direct contact or from a distance (ACSSU076)</td>
</tr>
<tr>
<td><strong>Investigate how forces or electrical energy can control movement, sound or light in a designed product or system</strong> (ACTDEK020)</td>
<td>Electrical circuits provide a means of transferring and transforming electricity (ACSSU097)</td>
</tr>
</tbody>
</table>
Design task – Amusement park ride

Annotations

- Identifies that friction slows the person on the slide down.
- Identifies that a push can initiate movement.
- Identifies that gravity pulls the person down the slide.

Annotations (Overview)

The student completes a simple report, including an annotated diagram, to communicate ideas and findings.
Design an electrical switch that is both safe and is able to be switched on and off repeatedly.
Engaging girls

• Engineers make a world of difference.
• Engineers are creative problem solvers.
• Engineers help shape the future.
• Engineering is essential to our health, happiness and safety.

www.powerofengineering.org/
Food and fibre production
Food and fibre production/food specialisations

• Food and fibre production is addressed across the curriculum through geography, science and technologies.

• In Design and Technologies there is a content description at each band focussed on food and fibre production.

• In F-4 it is combined with food specialisations.
<table>
<thead>
<tr>
<th>Design and technologies: food and fibre production</th>
<th>Science: biological sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore how plants and animals are grown for food, clothing and shelter and how food is selected and prepared for healthy eating (ACTDEK003)</td>
<td>Living things have basic needs, including food and water (<a href="#">ACSSU002</a>) Living things have a variety of external features (<a href="#">ACSSU017</a>) Living things grow, change and have offspring similar to themselves (<a href="#">ACSSU030</a>)</td>
</tr>
<tr>
<td>Investigate food and fibre production and food technologies used in modern and traditional societies (<a href="#">ACTDEK012</a>)</td>
<td>Living things can be grouped on the basis of observable features and can be distinguished from non-living things (<a href="#">ACSSU044</a>) Living things have life cycles (<a href="#">ACSSU072</a>)</td>
</tr>
<tr>
<td>Investigate how and why food and fibre are produced in managed environments (<a href="#">ACTDEK021</a>) Investigate the role of food preparation in maintaining good health and the importance of food safety and hygiene (<a href="#">ACTDEK022</a>)</td>
<td>Living things have structural features and adaptations that help them to survive in their environment (<a href="#">ACSSU043</a>) The growth and survival of living things are affected by the physical conditions of their environment (<a href="#">ACSSU094</a>)</td>
</tr>
</tbody>
</table>
Worksheet: Life stages

Life stages
Draw lines to match the life stages of these living things:

A

B

Annotations

Choose one picture from column A and explain how it turns into the picture in column B.

It starts off as a tadpole then it gets legs and then it is a frog.

Describes some life stages of a frog.
Pamphlet: Plant life cycle

1. This seed starts off the life cycle of plants because when the seed gets put in the ground it starts to grow.

2. After a few weeks the seed starts to sprout. But the seed should never get too much water or it shall draw and not be able to grow for much longer.

3. After another 2-3 weeks the seed will be come more like a plant not a seed. But that doesn’t mean we don’t want it we will have too water it all its life.

Annotations

Draws a labelled diagram of a seed showing structural features.

Constructs labelled diagrams showing germination and growth.
Materials and technologies specialisations

- Focused on a broad range of traditional, contemporary and emerging materials and specialist areas that typically involve extensive use of technologies (e.g., architecture, electronics, graphic technologies, fashion)
<table>
<thead>
<tr>
<th>Design and technologies: materials and technologies specialisations</th>
<th>Science: chemical sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore the <strong>characteristics</strong> and properties of <strong>materials</strong> and components that are used to produce <strong>designed solutions</strong> <em>(ACTDEK004)</em></td>
<td>Objects are made of materials that have <strong>observable</strong> properties <em>(ACSSU003)</em>. Everyday materials can be physically changed in a variety of ways <em>(ACSSU018)</em>. Different materials can be combined, including by mixing, for a particular purpose <em>(ACSSU031)</em>.</td>
</tr>
<tr>
<td>Investigate the suitability of <strong>materials</strong>, <strong>systems</strong>, components, tools and equipment for a range of purposes <em>(ACTDEK013)</em></td>
<td>A change of state between solid and liquid can be caused by adding or removing heat <em>(ACSSU046)</em>. Natural and <strong>processed materials</strong> have a range of physical properties; These properties can influence their use <em>(ACSSU074)</em>.</td>
</tr>
<tr>
<td>Investigate <strong>characteristics</strong> and properties of a range of <strong>materials</strong>, <strong>systems</strong>, components, tools and equipment and evaluate the impact of their use <em>(ACTDEK023)</em></td>
<td>Changes to materials can be reversible, such as melting, freezing, evaporating; or irreversible, such as burning and rusting <em>(ACSSU095)</em>. Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques <em>(ACSSU113)</em>.</td>
</tr>
</tbody>
</table>
Investigation report: Insulation

Explaining results

Write a statement to summarise your findings.

In the end, we found out that the car insulation was the best and the foil and the control were the worst. These are the materials from best to worst:

1. Car insulation (foil on the outside)
2. Car insulation (foil on the inside)
3. Styrofoam cup
4. Bubble wrap and hessian
5. Felt
6. The control and foil

Why did this happen?
The control didn’t work very well because it had no materials and the foil is made for keeping things warm.

Did the results match your prediction? Why or why not?
Yes, the results matched my prediction as the car insulation was the best.

Evaluating the investigation

What challenges did you have doing this investigation?
It was hard to cut the materials in the right shape to fit into the ice chest.

How could you improve this investigation?
We could run the investigation more than once with different materials.

Annotations

Interprets data to order materials with reference to insulation effectiveness.

Identifies that repeating the investigation could improve the data.
Implementation and resources
Implementation

• Facilitating implementation support discussions with stakeholders
• Developing work sample portfolios
• Working with ESA to identify resources on Scootle to support content descriptions
**Content description**

- Explore how technologies use forces to create movement in products

**Elaborations**

- Exploring how the principles of push and pull are used in the design of toys, for example in a spinning toy such as an Aboriginal mammandur
- Identifying, and playing and experimenting with, components such as wheels, balls, slides, springs and available local materials, tools and equipment to solve problems requiring movement
- Selecting materials to demonstrate how material properties are appropriate for particular designed solutions, for example materials that enable sliding or floating
- Exploring a system such as a marionette or Indonesian wayang kulit shadow puppet to see that by combining materials with forces movement can be created
- Combining materials and using forces in design, for example designing the door on a cage or a simple conveyor belt to move materials short distances
- Exploring how to manipulate materials using a range of tools, equipment and techniques to create movement, for example when constructing a toy boat that floats and moves

**Code**

ACTDEK002

**ScOT catalogue terms**

Engineering; Mechanical energy
Primary connections

[Table with categories and examples for Print, Digital, Supplementary, Complete Packages, and Kits]

- **Year Foundation**
  - Biological Sciences: Staying alive
  - Chemical Sciences: What's it made of?
  - Earth and Space Sciences: Weather in my world
  - Physical Sciences: On the move

- **Year 1**
  - Biological Sciences: Schoolyard safari
  - Chemical Sciences: Spot the difference
  - Earth and Space Sciences: Up, down and all around
  - Physical Sciences: Look! Listen!

- **Year 2**
  - Biological Sciences: Watch it grow!
  - Chemical Sciences: All mixed up
  - Earth and Space Sciences: Water works
  - Physical Sciences: Push-pull

[Website URL: https://primaryconnections.org.au/]

[acara logo and website URL]
Scientists in Schools welcomes you...

Scientists and Mathematicians in Schools is a national program that creates and supports long-term partnerships between primary or secondary school teachers and scientists or mathematicians. Partnerships are flexible to allow for a style and level of involvement that suits each participant. Check out the showcases to see what some partnerships have been doing.

Scientists

Information | Register

Teachers

Information | Register

We asked CSIRO: scientists in schools
EngQuest

powered by imagination

Over 100,000 students participated in 2013!
CREST

• CREativity in science and technology (CREST) is a non-competitive awards program supporting students to design and carry out their own open-ended science investigation or technology project.

• This education program provides a range of support material for both teachers and students.

• Email: crest@csiro.au
CREativity in Science and Technology

Three Introductory CREST Award levels:
• Green: structured and scaffolding is provided to help the students
• Orange: structured and scaffolding is provided to help the students
• Blue: more self-directed

The topics for Green and Orange cover:
• consumer science
• the needs of pets and other animals and their effects on the environment
• the effects of the wind
• colour and how colouring can be achieved
• food, preservatives and packaging
• the effects of the sun
• rocks and minerals.
School resources

Primezone provides teachers with single-point access to a range of primary industries education resources. This website is an initiative of the Primary Industries Education Foundation, a national not-for-profit company with government, industry and education membership.

These resources are about agriculture, forestry and fisheries industries, including related topics such as exporting and sustainable farming. Resources are added regularly. To recommend resources that are not on this site, please contact us.

Select one or more school levels AND/OR one or more learning areas to filter and return a set of resources.

Schooling Level
- All years
- F2
- 3-4
- 5-6
- 7-8
- 9-10
- 11-12

Learning Area
- All teaching areas
- Business and economics
- Geography
- Languages
- Mathematics
- Health and physical education
- Chics and citizenship
- Technologies
- The Arts

Search
Primary Industries Partnerships in Schools (PIPS)

The partnering cycle

Creating new education partnerships or growing existing ones can be made easier by following a simple process.

The partnering process recommended by PIEF (based on The Partnering Initiative) consists of three phases: Creating, Managing and Sustaining, represented in graphic below.

Creating
- scoping
- identifying
- building
- planning

Managing
- structuring
- mobilising
- delivering

Sustaining
- measuring
- reviewing & revising
- scaling or moving on

Entry point
Exit point
Do you follow?

<table>
<thead>
<tr>
<th>Social Media Platform</th>
<th>ACARA account</th>
<th>Website link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twitter</td>
<td>@acara.eduau and @ACARA_CEO</td>
<td><a href="http://www.acara.edu.au">www.acara.edu.au</a></td>
</tr>
<tr>
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