Queensland Science Network guide to developing curriculum resources K–10

The Queensland Science Network (QSN) is a collaboration of more than 20 not-for-profit societies based in Queensland, Australia. These societies include the Astronomical Association of Queensland, Birds Queensland, the Queensland Mycological Society, the Queensland Naturalists' Club, The Royal Society of Queensland and the Wildlife Preservation Society of Queensland. QSN members are actively engaged with science through research, field work, publishing, advocacy, policy formulation and other strategic activities to further science.

The purpose of the QSN network is to:

- foster collaboration among the community science sector
- promote the value of science to Queenslanders, including school children and their families.

This guide is designed to assist member organisations prepare support resources for teachers and educators from Kindergarten to Year 10 (K–10). These resources aim to:

- engage teachers, students and their families with their natural environment and universe
- enable students to develop their science inquiry skills e.g. observing, questioning, investigating research questions ethically, collecting and analysing data, evaluating results, and drawing critical, evidence-based conclusions, solving problems, effectively evaluating claims
- empower students to become the evidence-based decision makers of the future
- enhance student well-being through place-based experiential learning experiences
- engender a sense of wonder in their world.

Promoting educational resources

The QSN Educational resources webpage is a portal to promote reports, field guides, articles, newsletters and curriculum resources, mainly generated by member societies. The resources could be stored on the QSN or member groups' websites. This portal will be promoted to the educational jurisdictions and affiliations e.g. Queensland Department of Education (DoE), Queensland Catholic Education Commission (QCEC), Independent Schools Queensland, Queensland Curriculum and Assessment Authority (QCAA) and relevant teacher associations.

Audiences

While curriculum resources are written primarily for teachers, there are other potential users of these resources including pre-service teachers in universities, home-schoolers, STEM club facilitators, youth groups, conservation and catchment groups.

Types of resources

There is a range of resource types that the QSN members already have or could develop to support the science, technology, engineering and technology (STEM) learning in schools. QSN resources can present unique Queensland contexts and perspectives to build student (and teacher) understanding. Many member organisations have existing community resources that would be very useful for teachers in their current form or tweaked for classroom or field excursion use.

Existing resources could include:

- field guides
- 'how to' manuals
- reports about interesting issues or phenomenon
- academic papers with information that can be extracted for a non-specialist audience
- datasets or research that exemplify interesting and scientific concepts relevant to the curriculum.

Although helpful, it is not essential that QSN member groups themselves produce school-specific resources. Schools could enhance their curriculum delivery and resources, even if they simply have access to the organisations' data or information in an easily searchable way, preferably free of copyright fees.

While the inclusion of curriculum links would be useful for teachers (see text below and also Curriculum resources), curriculum linking can be completed by others.

Promoting curriculum resources to schools

As mentioned above, the educational jurisdictions can promote resources via their school networks. For instance, the Queensland Department of Education (DoE) promotes STEM educational resources and events through a range of means.

The main promotional methods for state schools are the:

- STEM discussion list
- Bulletin Board that provides information on the DoE internal OnePortal website
- fortnightly State Schools Update
- regional STEM champion network who then share the information with their school networks.

Normally this is done using a short message of two or three sentences with a link to the organisation's website. The DoE STEM team resist sending documents as attachments as these can overfill people's inboxes. The DoE STEM team can be contacted by email.

The QSN will explore partnership with the Queensland Curriculum and Assessment Authority and the other educational jurisdictions to promote quality Queensland science resources into schools.

Curriculum resources

If QSN members are interested in developing curriculum resources written specifically for classroom use, the resources need to substantially address the requirements of the relevant curriculum or learning guideline. Curriculum resources can include a:

- stand-alone activity
- lesson plan with at least two sequential activities
- lesson sequence: series of lesson to be taught consecutively
- teacher guide: a themed set of lessons or activities that do not need to be taught in a specific order.

Education Services Australia (ESA) is the national not-for-profit company owned by the State, Territory and Australian Government education ministers that provides technology-

based services for education. ESA staff advise that a range of curriculum resource models or formats will work for teachers. The key element is that the resources explicitly link to the Australian Curriculum. In addition, teachers will be attracted to a resource that delivers a learning experience that aligns with teaching and learning approaches e.g. student-centred and inquiry based.

Whether the resource is an extended unit or simply a short sequence of activities, aligning it to the curricular expectations of knowledge, concepts and skills strengthens the resource. Other formats also work. Video, interactives or apps are popular, but the useability of these resources is always strengthened if they are accompanied by some form of teaching advice, again, aligned to the curriculum. To ignore that doesn't mean a resource won't get used, it just means it is less attractive to users who may not have a passion for the topic.

While staff in Queensland Curriculum and Assessment Authority (QCAA) and the state educational jurisdictions do not directly endorse curriculum resources developed by external providers, they may be able to quality assure resources then promote them through their school networks (see Promoting curriculum resources to schools above).

Teacher input

To write effective classroom resources, an author requires input from a teacher experienced in teaching the subject area and year levels being targeted. A QSN member group may have suitably qualified members or be able to partner with interested schools. Full-time teachers typically do not have extra capacity to spend time developing resources themselves but may be interested in advising, planning and reviewing resources.

The following information provides QSN members with a starting point for developing draft curriculum resources which could then be reviewed and edited by teachers.

Navigating the curriculum

Kindergarten

Research indicates that engaged young children can understand quite complex concepts and be powerful agents of change in their families. Early learning centres are keen to use resources which meet their licensing requirements. The licensing and quality assurance processes for early learning services in Australia are based on the National Quality Framework. Specifically, *Quality area 1: Educational program and practice* 'focuses on ensuring that the educational program and practice is stimulating and engaging and enhances children's learning and development' through active learning experiences.

In addition, the national framework requires that early learning services 'foster children's capacity to understand and respect the natural environment and the interdependence between people, plants, animals and the land. Educators and children work together to show respect, care and appreciation for the natural environment' (Standard 3.3, Element 3.3.2).

Kindergarten is the school year in Queensland before children enter the Preparatory year; the children are at least four years old. Approved Queensland kindergartens use the revised Queensland Kindergarten Learning Guideline (QKLG) which was developed by the Queensland Curriculum and Assessment Authority (QCAA) to align with the national Early Years Learning Framework.

The QKLG has five learning and development areas, one of which is *active learning*[1]. The key foci of active learning are:

- building positive dispositions towards learning
- showing confidence and involvement in learning
- using technologies for learning and communication.'

Kindergarten teachers are enthusiastic about curriculum resources that engage their children in active learning strategies including 'play-based, inquiry-based and project-based' activities in real-life contexts. Children 'develop understandings of themselves and their world and create their ideas through imaginative and dramatic play'. Particularly, if the children are 'showing an interest in technologies and the uses of different technologies'. Developing curriculum resources for young children is a great way of engaging both the children and their families.

Australian Curriculum: Foundation to Year 10

The ongoing development of the Australian Curriculum is managed by the Australian Curriculum, Assessment and Reporting Authority (ACARA), an independent statutory authority charged with improving learning outcomes for all Australians. The Australian Curriculum: Foundation–Year 10 was endorsed by Australia's education ministers in 2015. Note that *Foundation* is the national generic term for the school year before Year 1. The term for this year varies across Australia. In Queensland, it is called the Preparatory year.

The content and skills to be taught in the Australian Curriculum F–10 are described in content descriptions, usually categorised by *Knowledge and Understanding* or *Inquiry and Skills* strands. For Science, there is a third sub-strand, *Science as a Human Endeavour* which provides the 'real-world' context for the science the students learn. Note that this sub-strand is not assessed but is expected to be embedded in classroom activities where possible. The learning or subject areas relevant for the QSN include Science, Geography and Design and Technology.

In addition to the domain-specific content, teachers need to incorporate elements of the cross-curriculum priorities, where relevant. The three cross-curriculum priorities are:

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

Again, the cross-curriculum priorities are not directly assessed but should be embedded in the resources where relevant.

Teachers are looking for resources that authentically fulfil the requirements of the learning or subject area content descriptions they need to teach. For instance, in Science, this means substantially addressing at least one Knowledge and Understanding content description and a Science as a Human Endeavour content description (if relevant), in addition to a cross-curriculum priority where possible.

The way in which students learn these content descriptions is informed by the 'inquiry and skills' content descriptions relevant to each learning or subject area. These inquiry skills must be incorporated into the learning experiences a curriculum resource uses to teach the topic. The learning experiences should also develop students' general capabilities which encompass the knowledge, skills, behaviours and dispositions that equip students to 'live and work successfully in the twenty-first century'. The general capabilities are literacy, numeracy, information and communication (ICT) capability, critical and creative thinking, personal and social capability, ethical understanding, intercultural understanding.

[1] Reproduced from: The State of Queensland (Queensland Curriculum and Assessment Authority), *Queensland Kindergarten Learning Guideline* 2018, p. 22. Further information, including any updates, is available at www.qcaa.qld.edu.au .

Curriculum resources should be student-centred; avoid teacher-centred approaches that focus on transmitting knowledge from teacher (the expert) to student (the empty vessel). There is much research to indicate that this approach is less effective, unless the learner is already highly engaged in the topic.

The Australian Curriculum F–10 can be updated at irregular intervals; the current version (v8.4) was updated in 2018. This means that curriculum links in published curriculum resources should be reviewed annually to ensure that they are current.

To be effective, classroom resources should (where possible):

- be engaging for students (and teachers)
- be age and stage appropriate
- include interactive or hands-on activities
- present a real-world purpose for the learning
- explore an inquiry question or a problem that needs to be solved
- link to Australian Curriculum content descriptions and deliver what the resource claims
- develop the inquiry skills valued by the Australian Curriculum.

Using Australian Curriculum content descriptions

Curriculum alignment is a key element of a curriculum resource. Research conducted by ESA in relation to the Australian Curriculum links indicates that:

- less is more: aim for one or two principal learnings or subjects[2]
- identify the content descriptions that the resource **substantially** addresses; ESA recommends three but no more than six.

Teachers say that they would rather find nothing than resources that don't deliver what they promise. So it is better to link to only one content description than to make vague links to many year levels, subjects and content descriptions.

For the curriculum resources QSN members are developing it is enough to include the relevant content descriptions for the Knowledge and Understanding and Science as a Human Endeavour[1] strands (if relevant). The Australian Curriculum also specifies the inquiry skills that students should be taught in each subject and year level. The inquiry skills content descriptions are not explicitly listed in the teacher guide because there are normally too many of them and teachers don't normally search by skills. However, they are an important element of the curriculum resource and at least some of the relevant skills they should be evident in each activity.

[2] A “learning area” is a discipline with distinct knowledge, skills and understanding. Learning areas include Science, Humanities and Social Sciences, The Arts and Technologies. Some learning areas have multiple subjects. For instance, Humanities and Social Sciences has five subjects: Geography, History, Humanities and Social Sciences (HASS), Civics and Citizenship and Economics.

Copyright

Australian Curriculum copyright

When you quote Australian Curriculum text e.g. content descriptions, you need to include the following citation:

"© Australian Curriculum, Assessment and Reporting Authority (**ACARA**) 2010 to present, unless otherwise indicated. This material was downloaded from the Australian Curriculum website (www.australiancurriculum.edu.au) (**Website**) (accessed [insert date]) and [was][was not] modified. The material is licensed under CC BY 4.0 (https://creativecommons.org/licenses/by/4.0). Version updates are tracked in the 'Curriculum version history' section on the 'About the Australian Curriculum' page (http://australiancurriculum.edu.au/about-the-australian-curriculum/) of the Australian Curriculum website.

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This hefty citation can be included as a footnote on the first page that Australian Curriculum content descriptions are quoted in your resource—in small font.

Copyright licensing your resources

Many organisations are keen to develop education resources to schools to promote community understanding about their areas of interest. However, a lack of understanding about the impact of copyright policies relating to educational resources may mean that some organisations inadvertently publish curriculum resources under copyright licences that can cost the educational jurisdictions of the schools that use those resources. The Australian education sector pays over $700 million a year in copyright fees. Some of this money is paid to organisations who think that their resources are 'free for educational use'.

For more information, refer to Open Educational Resources [hyperlink to this PDF document] which explains that Creative Commons licences are the preferred copyright licences to ensure that your educational resources are free for educational use. There are a range of Creative Commons licences that enable you to choose the terms of use.

Getting started

As mentioned above, there are many curriculum resource formats that work for teachers. Appendix A provides a template that captures key information in a simple layout. Appendix B provides a template for a teacher guide or sequence of activities, lessons etc. Adjust the template to your needs and the advice received from teachers.

A teacher guide typically comprises between two and five teaching ideas and each teaching idea can be made up of multiple activities. A teaching idea explains how a Knowledge and Understanding content description can be taught in the classroom. It incorporates a range of activities which also address relevant inquiry skills content descriptions.

In the case of the science curriculum, Science as a Human Endeavour content descriptions can also be addressed but should also reference at least one Knowledge and Understanding content description for that year level. A teaching idea can also address one or more of the cross-curriculum priorities if relevant.

Appendix A Activity template

This simple template is designed for a single activity or lesson plan. Adapt as required.

Title

The title of the resource should be short, descriptive and give the user a sense of what the resource does.

Year level and Subject area/s

Australian Curriculum links[3]

Science: [Content description and code]

Etc.

Introduce the resource. Describe (i) what the resource is, (ii) what it does and (iii) how it works.

- *Keep the overview brief and ensure it is descriptive.*
- *You should not use language that evaluates, judges or promotes the resource. Don't offer specific suggestions for classroom use here.*

Equipment

For the class

[bulleted list]

For each group

[bulleted list]

For each student

[bulleted list]

Preparation

Activity steps

Use a numbered list. Use imperative statements i.e. Ask students …, Display the …, Focus on what the student needs to do at each step.

Add any student worksheets(numbered) on separate pages.

[3] Insert the current copyright acknowledgement as per the ACARA Copyright and Terms of use

Appendix B Teacher guide or lesson sequence or template

Title

The title of the resource should be short, descriptive and give the user a sense of what the resource does.

Year level and Subject area/s

Australian Curriculum links[4]

Science: [Content description and code]

Etc.

Introduce the resource. Describe (i) what the resource is, (ii) what it does and (iii) how it works.

- *Keep the overview brief and ensure it is descriptive.*
- *You should not use language that evaluates, judges or promotes the resource. Don't offer specific suggestions for classroom use here.*
- *Explain the how the teaching ideas link together to make a coherent story.*

Outline the teaching ideas

- *Provide a numbered list of the teaching ideas.*
- *Describe each teaching idea in a single sentence.*
- *The teaching idea title could be a focus question.*

Activity 1 *Heading*

Briefly describe what the students will do in this activity in the context of the Australian Curriculum content descriptions it addresses—in one sentence.

Equipment

For the class *[bulleted list]*

For each group *[bulleted list]*

For each student *[bulleted list]*

Preparation

Activity steps

Use a numbered list. Use imperative statements i.e. Ask students …, Display the … Use direct, economical language that clearly outlines each step from a teacher's perspective.

Focus on what the student needs to do at each step. Ideally the activities should provide a variety of student-centred activities which develop higher order thinking skills. Avoid curriculum resources which merely provide 'fill in the blank' student worksheets designed to test simple recall. Embed hyperlinks in text.

Add any student worksheets(numbered) on separate pages. In teacher guide or lesson sequence, these would typically be at the end of the resource.

[4] Insert the current copyright acknowledgement as per the ACARA Copyright and Terms of use