



# **Science and Technology K-6**

## **Writing Brief**

2008

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Published by  
Board of Studies NSW  
GPO Box 5300  
Sydney NSW 2001  
Australia

Tel: (02) 9367 8111  
Fax: (02) 9367 8484  
Internet: [www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au)

October 2008

ISBN 978 174147 8563

2008652

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## 1 Background

The *Science and Technology K–6 Syllabus* (1991) is being revised within the context of the Board’s *K–10 Curriculum Framework*, using the Board’s syllabus development process.

### 1.1 The K–10 Curriculum Framework

The *K–10 Curriculum Framework* establishes parameters for Board of Studies NSW curriculum for the compulsory years of schooling. It identifies the learning essential for all students and guides the evaluation and revision of individual syllabuses. The framework draws on an understanding of contemporary teaching and learning that emphasises outcomes and standards.

The primary focus of the *K–10 Curriculum Framework* is to ensure that the curriculum is coherent, challenging and allows for developmental continuity.

The framework provides a purpose statement, broad learning outcomes and principles to guide learning for all students attending schools in NSW.

Syllabuses developed through the framework will appropriately challenge students to meet high but realistic expectations as they move through their schooling guided by professional pedagogy. The syllabuses will clearly articulate standards that show what students are expected to know and be able to do at each stage from Kindergarten to Year 10. This provides the context for meaningful assessment and reporting of student achievement.

The *K–10 Curriculum Framework* is available on the Board’s website [www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au)

### 1.2 The Board’s syllabus development process

The Board’s syllabus development process uses a project management approach and involves four phases – syllabus review, writing brief development, syllabus development and implementation. It provides opportunities for wide consultation with teachers and other interest groups in order to receive the highest quality advice from across the education community.

The review of the *Science and Technology K–6 Syllabus* is now completed and at its meeting on 11 December 2007 the Board of Studies endorsed a set of broad directions to guide the development of this writing brief.

A copy of the full Evaluation Report for Science and Technology K–6 is available on the Board’s website at [www.boardofstudies.nsw.edu.au](http://www.boardofstudies.nsw.edu.au).

The process and timelines for the development of the syllabus are provided below.

### 1.3 Timeline for the development of the syllabus package for Science and Technology K–6

Steps in the Syllabus Development Process	Date
<b>Syllabus Review:</b>	
Board Curriculum Committee established to monitor the syllabus development process	Established on 4 May 2007
Research including a literature review and a review of national and international practice	Completed October 2007
Evaluation of existing syllabus against criteria approved by the Board of Studies	Completed November 2007
Board endorsement of the broad directions for syllabus revision	Endorsed on 11 December 2007
<b>Writing Brief Development:</b>	
Draft writing brief and survey	Completed 11 April 2008
Consultation (6 weeks)	From 28 April 2008 to 6 June 2008
Consultation report and amended writing brief to Board of Studies	16 September 2008
Final Writing Brief published on Board of Studies website	<b>We are here</b>
<b>Syllabus Development:</b>	
Draft syllabus and survey	February 2009
Consultation (6 weeks)	From 23 February 2009 to 3 April 2009
Consultation report and amended draft Syllabus to Board of Studies	July 2009
Distribution of syllabus	Term 3 2009

## **2. Information on the Writing Brief**

### **2.1 Purpose**

The Writing Brief provides the proposed direction for the new syllabus. It provides the detailed blueprint for the development of a draft syllabus in phase 3 of the syllabus development process.

### **2.2 Structure**

The Writing Brief (outlined in section 3) is structured according to the elements of a K–6 syllabus. These elements are:

- The K–10 Curriculum
- Rationale
- Place of the Science and Technology K–6 Syllabus in the K–12 Curriculum
- Aim
- Objectives for Early Stage 1 to Stage 3
- Outcomes for Early Stage 1 to Stage 3
- Content (the Writing Brief provides examples of content)
- Continuum of Learning in Science and Technology K–10
- Assessment.

Each subsection of the writing brief addresses a syllabus element and includes an explanation of the element’s purpose.

### 3 The Writing Brief

#### 3.1 The K–10 Curriculum

ī for your information

*The text in this section is generic. It states the purpose of learning from the K–10 Curriculum Framework and outlines how other aspects of the K–10 Curriculum Framework are reflected in the syllabus.*

This syllabus has been developed within the Board of Studies NSW *K–10 Curriculum Framework*. This framework ensures that K–10 syllabuses and curriculum requirements are designed to provide educational opportunities that:

- engage and challenge all students to maximise their individual talents and capabilities for lifelong learning
- enable all students to develop positive self-concepts, and their capacity to establish and maintain safe, healthy and rewarding lives
- prepare all students for effective and responsible participation in their society, taking account of moral, ethical and spiritual considerations
- encourage and enable all students to enjoy learning, and to be self-motivated, reflective, competent learners who will be able to take part in further study, work or training
- promote a fair and just society that values diversity
- promote continuity and coherence of learning and facilitate transition between primary and secondary schooling.

The framework also provides a set of broad learning outcomes that summarise the knowledge, skill, understanding, values and attitudes essential for all students to succeed in and beyond their schooling.

These broad learning outcomes indicate that students will:

- understand, develop and communicate ideas and information
- access, analyse, evaluate and use information from a variety of sources
- work collaboratively with others to achieve individual and collective goals
- possess the knowledge and skills necessary to maintain a safe and healthy lifestyle
- understand and appreciate the physical, biological and technological world and make responsible and informed decisions in relation to their world
- understand and appreciate social, cultural, geographical and historical contexts, and participate as active and informed citizens
- express themselves through creative activity and engage with the artistic, cultural and intellectual work of others
- understand and apply a variety of analytical and creative techniques to solve problems
- understand, interpret and apply concepts related to numerical and spatial patterns, structures and relationships
- be productive, creative and confident in the use of technology and understand the impact of technology on society
- understand the work environment and be equipped with the knowledge, skills and understanding to evaluate potential career options and pathways
- develop a system of personal values based on their understanding of moral, ethical and spiritual matters.

The way in which learning in the Science and Technology K–6 syllabus contributes to the curriculum and to the student’s achievement of the broad learning outcomes is outlined in the syllabus Rationale.

In accordance with the *K–10 Curriculum Framework*, the syllabus takes into account the diverse needs of all students. It clearly identifies essential knowledge, skills and understanding, values and attitudes. It enunciates clear standards of what students are expected to know and be able to do at each of its stages. It provides structures and processes by which teachers can provide continuity of study for all students, particularly to ensure successful transition from Years 5 to 10. It offers advice to teachers on ways of addressing the needs of students who have not achieved Stage 2 or 3 outcomes. It also enables students to maximise their achievement by acquiring additional knowledge, skills, understanding, values and attitudes

### 3.2 Rationale for Science and Technology K–6

! for your information

The **Rationale** describes the nature of the subject in broad terms and outlines its relationship to the contemporary world and current practice. It explains the place and purpose of the subject in the curriculum, particularly how it contributes to the *K–10 Curriculum Framework Purpose Statement* and broad learning outcomes.

#### **The proposed Rationale is:**

Participation in our rapidly changing world requires people who willingly and actively engage with issues and ideas as informed, reflective, responsible, scientifically and technologically literate citizens.

Science and technology are human activities. Associated with each discipline are distinctive processes as well as evolving bodies of knowledge. This syllabus provides opportunities for students to actively engage with both disciplines, to think critically and creatively in problem-solving processes in ways that foster their sense of wonder and curiosity about the natural and made world, and to develop lifelong capabilities in working scientifically and technologically.

Science enables people to make better sense of their world. By engaging in a process of investigating scientifically, students learn to ask questions, plan and conduct first-hand investigations, critically analyse data and information, evaluate issues and problems, and draw and communicate evidence-based conclusions.

Technology enables people to manage, shape and alter their environment to improve their quality of life at home, at school, in work places and in the broader community. By engaging in a process of designing and producing, students learn to create and evaluate solutions that respond to identified opportunities, needs and wants and that influence their own quality of life and that of others, now and in the future. They learn to responsibly, safely and creatively use and select materials, tools and techniques.

Students develop their understanding of the nature of science and technology. By bringing both scientific and technological perspectives to bear on their classroom experiences, they develop an understanding of the relationships between the two disciplines. They explore the implications and impacts of science and technology on society and the environment. By reflecting on the contribution of science and technology to society, they move towards being able to respond appropriately to social, economic, environmental and ethical issues and participate responsibly in the shaping of preferred and sustainable futures.

#### *Notes to writers:*

- *revise the Rationale to:*
  - *articulate the interrelationship between science and technology*
  - *reflect the nature and scope of science and of technology in K–6 for NSW*
  - *more clearly emphasise that students engage with real life science and technology issues and interests relevant to K–6, including social and environmental issues*
  - *provide a clear explanation of the place and purpose of Science and Technology K–6 in the curriculum and how it contributes to the K–10 Curriculum Framework broad learning outcomes*
  - *clarify the selection and use of technologies in science learning*
- *develop the intent of the Rationale consistently through the Aim, Objectives and Outcomes.*

### **3.3 The Place of the Science and Technology K–6 Syllabus in the K–12 Curriculum**

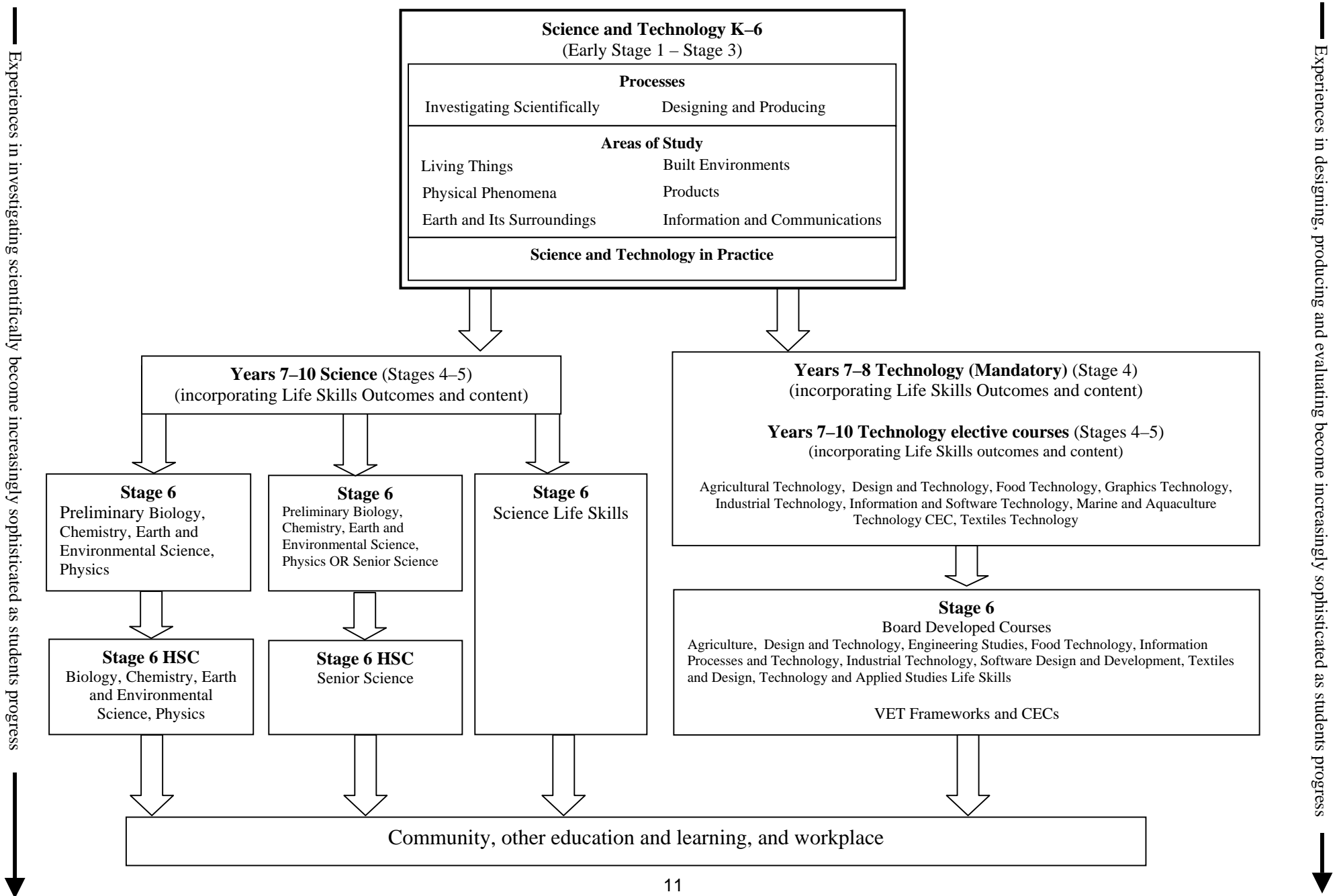
**i** for your information

This section places the *Science and Technology K–6 Syllabus* in the K–12 curriculum as a whole. It:

- indicates pathways of learning in the subject
- outlines how relevant areas of cross-curriculum content are addressed in the *Science and Technology K–6 Syllabus*
- identifies areas of equivalent content in other syllabuses and illustrates ways in which the Science and Technology K–6 content complements that of other syllabuses.

**3.3.1 The proposed pathways for learning in Science and Technology K–12 are provided in the diagram that follows.**

Science and Technology K–6 Writing Brief



*Note to writers:*

- *revise to more clearly represent the pathways for learning in Science and Technology K–12.*

### **3.3.2 The proposed description of cross-curriculum content is:**

Cross-curriculum content assists students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework* and is incorporated within the content of the *Science and Technology K–6 Syllabus*. The cross-curriculum content may be addressed both explicitly and implicitly and could include:

- Aboriginal and Indigenous
- Gender
- Difference and Diversity
- Multicultural
- Information and Communication Technologies
- Work, Employment and Enterprise
- Civics and Citizenship
- Environment
- Key Competencies
- Literacy
- Numeracy.

*Note to writers:*

- *revise to clearly identify how cross-curriculum content is explicitly embedded in the content of the syllabus.*

### **3.3.3 The proposed description of relationships with other syllabuses is:**

The Board of Studies document, *Some Guiding Principles for the Primary Curriculum* (1996), defines curriculum integration as being the purposeful planning, by teachers, of strategies and learning experiences to facilitate and enhance learning across key learning areas. Curriculum integration also refers to the demonstration, by students, of knowledge and understanding, skills, values and attitudes that transcend individual key learning areas (KLAs).

To assist teachers make connections between KLAs, complementary or supplementary Outcomes in other KLA syllabuses have been listed against the relevant Outcomes of this syllabus and can be found on pages describing the content of the syllabus.

The intention is to enable teachers to plan learning experiences that:

- enhance the context and depth of learning
- avoid unnecessary duplication and ensure that where repetition occurs it is purposeful
- promote the transferability of learning.

A KLA connection is described as *complementary* when an outcome in the same stage in another key learning area contributes to learning in Science and Technology. In addition to the identified complementary KLA connections, Science and Technology learning

experiences provide a variety of opportunities that contribute to addressing English syllabus Outcomes within the stage.

A KLA connection is described as *supplementary* when an outcome in another key learning area could support learning in Science and Technology. The intention is for supplementary links to facilitate the connection of Outcomes within the stage or with prior learning in a school-specific way.


*Notes to writers:*

- *revise KLA Connections to remove the division into Complementary and Supplementary Connections*
- *revise KLA Connections to incorporate a wider range of KLAs, including explicit links to literacy and numeracy Outcomes K–6.*

### 3.4 Aim

**i** for your information

The **Aim** provides a succinct statement of the overall purpose of the *Science and Technology K–6 Syllabus* by indicating the general educational benefits that are to accrue for students from programs based on the syllabus.

 consult

#### **The proposed Aim is:**

The Aim of the *Science and Technology K–6 Syllabus* is to provide learning experiences that will:

- engage students’ sense of wonder and curiosity about the world around them
- develop students’ capacities and creativity in working scientifically (‘making sense’) and working technologically (‘making stuff’)
- enable students to responsibly and creatively engage with science and technology in their learning, their personal lives, the community and in shaping the future.

*Notes to writers:*

- *revise to remove the terms ‘making sense’ and ‘making stuff’*
- *revise to reflect the nature and scope of science and of technology in K–6 for NSW*
- *revise to more clearly emphasise that students engage with real life science and technology issues and interests relevant to K–6, including social and environmental issues.*

### 3.5 Science and Technology K–6 Objectives for Early Stage 1 to Stage 3

**i** for your information

**Objectives** provide specific statements of the intentions of the syllabus. They amplify the Aim by indicating in broad terms the knowledge and understanding; skills, and values and attitudes fundamental to the subject. They act as organisers of the intended Outcomes. The same Objectives may apply across stages in a key learning area or subject.

 consult

#### **The proposed Objectives are:**

##### **Knowledge, understanding and skills**

Students will develop knowledge and understanding about and skills in:

- investigating scientifically
- designing and producing, including the selection and use of tools, equipment, materials and techniques.

##### **Knowledge and understanding**

Students will develop knowledge and understanding about:

- living things, physical phenomena, the Earth and its surroundings
- built environments, products, information and communications
- the practice of science and technology in society.

##### **Values and attitudes**

Students will develop positive values and attitudes towards themselves, others, science, technology and the environment.

##### *Notes to writers:*

- *revise the proposed groupings to indicate more clearly in broad terms the knowledge, understanding, skills, values and attitudes fundamental to Science and Technology K–6*
- *revise the proposed groupings to better reflect the interrelationship between science and technology*
- *revise to more appropriately reflect and amplify the Aim*
- *revise to reflect the scope of working scientifically and working technologically, including the selection and use of technologies in science learning*
- *revise the Science and Technology in Practice objective to emphasise the importance of students engaging with real life issues and interests relevant to K–6, including social and environmental issues, that present science and technology as interrelated and familiar*
- *expand the Values and Attitudes objective to define more clearly the intentions of the syllabus in developing student interest and enthusiasm for science and technology.*

### 3.6 Outcomes for Early Stage 1 to Stage 3

 for your information

Syllabus **Outcomes** express the specific intended student learning that results from the teaching of the syllabus. They are derived from the Objectives and content of the syllabus. Outcomes provide clear statements of the knowledge, skills and understanding expected to be gained by most students as a result of effective teaching and learning of a key learning area or subject by the end of a stage.

 consult

The proposed Outcomes are:

<b>Early Stage 1 Outcomes</b> A student:	<b>Stage 1 Outcomes</b> A student:	<b>Stage 2 Outcomes</b> A student:	<b>Stage 3 Outcomes</b> A student:
<b>Investigating Scientifically</b> Helps explore their immediate surroundings by sharing what they already know, observing, questioning and reporting.	<b>Investigating Scientifically</b> Helps investigate their environment by comparing what they already know, predicting, collecting and recording data, and suggesting possible explanations.	<b>Investigating Scientifically</b> Helps investigate their questions, problems and ideas by taking into account scientific information, testing, analysing data, drawing conclusions, communicating findings and reflecting on fairness.	<b>Investigating Scientifically</b> Identifies testable questions that they can investigate by taking into account scientific explanations, devising fair tests, drawing evidence-based conclusions, reflecting on and communicating procedures and explanations.
<b>Designing and Producing</b> Uses imagination, trial and error and play to produce designs with classroom tools, equipment, materials and techniques for an identified purpose.	<b>Designing and Producing</b> Responds imaginatively to an exploration of needs and wants to produce solutions using some specialised tools, equipment, materials and techniques.	<b>Designing and Producing</b> Helps establish design criteria addressing needs and wants of the user or audience, to produce and evaluate solutions using specialised tools, equipment, materials and techniques.	<b>Designing and Producing</b> Establishes design criteria addressing responsible consideration of wider social issues to produce and evaluate solutions, selecting and using specialised tools, equipment, materials and techniques.
<b>Living Things</b> Demonstrates an understanding of the difference between living and non-living things through investigating their characteristics and needs.	<b>Living Things</b> Demonstrates an understanding of growth, change and diversity in living things through investigating differences and similarities.	<b>Living Things</b> Demonstrates an understanding of biodiversity through investigating how adaptations allow living things to survive in particular environments	<b>Living Things</b> Demonstrates an understanding of the importance of interdependence through investigating interactions within a variety of ecosystems.
<b>Earth and its Surroundings</b> Demonstrates an understanding of familiar changes at the Earth's surface through investigating conditions that affect them.	<b>Earth and its Surroundings</b> Demonstrates an understanding of patterns of change at the Earth's surface through investigating variations observed over time.	<b>Earth and its Surroundings</b> Demonstrates an understanding of processes and events in the land, water, atmosphere or in space through investigating their predictability.	<b>Earth and its Surroundings</b> Demonstrates an understanding of causes of change at the Earth's surface through investigating processes and events in the land, water, atmosphere or in space.
<b>Physical Phenomena</b> Demonstrates an understanding of how energy, forces and materials are used through investigating a range of familiar objects, situations and events.	<b>Physical Phenomena</b> Demonstrates an understanding of the effects of energy and forces and the properties of materials through investigating their purposeful use.	<b>Physical Phenomena</b> Demonstrates an understanding of how energy, forces and materials can be manipulated through investigating their purposeful use.	<b>Physical Phenomena</b> Demonstrates an understanding of how forces can act at a distance and of transformation of energy and materials through investigating their practical applications.

<p><b>Early Stage 1 Outcomes</b></p> <p>A student:</p>	<p><b>Stage 1 Outcomes</b></p> <p>A student:</p>	<p><b>Stage 2 Outcomes</b></p> <p>A student:</p>	<p><b>Stage 3 Outcomes</b></p> <p>A student:</p>
<p><b>Built Environments</b> Demonstrates an understanding of purpose, layout and conditions in spaces, through designing and modeling familiar or imaginary environments.</p>	<p><b>Built Environments</b> Demonstrates an understanding of people's needs, construction methods and the influence of natural conditions through designing and constructing small outdoor spaces.</p>	<p><b>Built Environments</b> Demonstrates an understanding of structures and building materials, tools and techniques through designing, modeling and/or modifying small buildings or spaces.</p>	<p><b>Built Environments</b> Demonstrates an understanding of the influence of technological change over time and the development of specialist building materials and techniques through designing, modeling and/or constructing small or temporary spaces.</p>
<p><b>Products</b> Demonstrates an understanding of purpose and some properties of classroom materials through designing and making or modeling useful products.</p>	<p><b>Products</b> Demonstrates an understanding of the source of some common materials and their processing through designing and making useful products.</p>	<p><b>Products</b> Demonstrates an understanding of materials, production techniques and processes, and the influence of technological change through designing and producing useful products.</p>	<p><b>Products</b> Demonstrates an understanding of principles of mass manufacture, production techniques and processes, and the influence of technological change through designing and modeling processes of authentic production.</p>
<p><b>Information and Communications</b> Demonstrates an understanding of uses and different features of information and communications products through designing and making their own publications.</p>	<p><b>Information and Communications</b> Demonstrates an understanding of the use of different media, production techniques and publishing software through designing and producing their own publications.</p>	<p><b>Information and Communications</b> Demonstrates an understanding of different media, production techniques and publishing software through designing and producing their own publications.</p>	<p><b>Information and Communications</b> Demonstrates an understanding of systems used to create and manage information and communications, and how information can be manipulated to create meaning and perception through designing and publishing their own products.</p>
<p><b>Science and Technology in Practice</b> Recognises that investigating scientifically and designing and producing can help satisfy their curiosity and needs in exploring the world around them.</p>	<p><b>Science and Technology in Practice</b> Describes how scientific information and technological know-how is useful in their class work and relates their work to what people do in the community.</p>	<p><b>Science and Technology in Practice</b> Uses scientific investigation to inform design tasks, uses technologies to enhance scientific investigations and evaluates the possible social, cultural and environmental implications of their work.</p>	<p><b>Science and Technology in Practice</b> Describes the interaction of Science and Technology in their class work and in society and recognises roles and responsibilities in responding to local and global issues.</p>

*Notes to writers:*

- *reduce the number of Early Stage 1 Outcomes*
- *review and revise the Outcomes in terms of the balance between the Processes and Areas of Study*
- *revise the Outcomes to more clearly express the specific intended student learning for each stage*
- *revise the Outcomes to provide a clearer progression K–6 that reflects stage-appropriateness and the scope of intended learning*
- *revise the Outcomes to more explicitly incorporate key science and technology issues in the lives of K–6 students, their families and societies (including sustainability)*
- *revise the Outcomes to more clearly incorporate student interest and positive affect as intended results of learning*
- *revise the Outcomes to make learning in the area of matter/materials more explicit.*

### 3.7 Content (Writing Brief sample)

 for your information

**Content** describes the knowledge, skills, understanding and values to be studied by students over a stage or stages in a syllabus. It describes the development of processes of learning so that students are encouraged to be effective learners. Content will therefore be expressed in syllabuses in the form of:

- *Students learn to ...*
- *Students learn about ...*

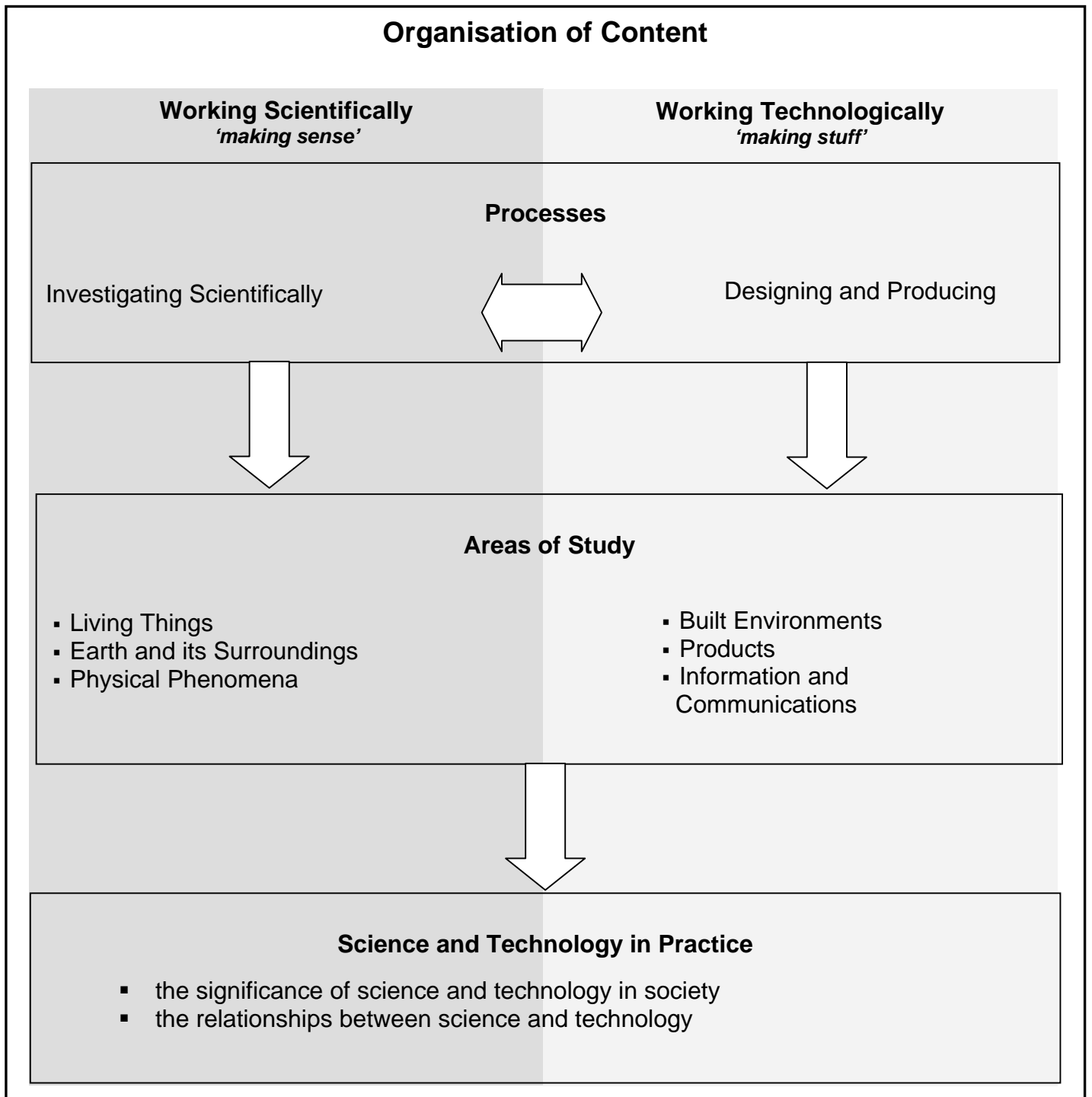
In keeping with the principles of the *K–10 Curriculum Framework*, the syllabus will clearly identify content that enables all students to move to Stage 4.

 consult

#### 3.7.1 The proposed organisation of content is outlined below:

The organisation of Outcomes and their underpinning content reflects the fact that this syllabus brings together two distinct but nevertheless closely interdependent disciplines. The content organisation (see Figure 1) explicitly reflects the nature of each discipline as having a distinctive process, an evolving body of knowledge and social and environmental significance. It also incorporates the relationships that can exist between science and technology in practice. Therefore the process of *Investigating Scientifically* and the areas of study to which it will most readily be applied are grouped together under the heading *Working Scientifically* (‘making sense’) while the process of *Designing and Producing*, and the areas that most easily lend themselves to its application, are grouped under the heading *Working Technologically* (‘making stuff’). *Science and Technology in Practice* focuses on the social and environmental significance and interrelatedness of the two disciplines and contributes to both *Working Scientifically* and *Working Technologically*.

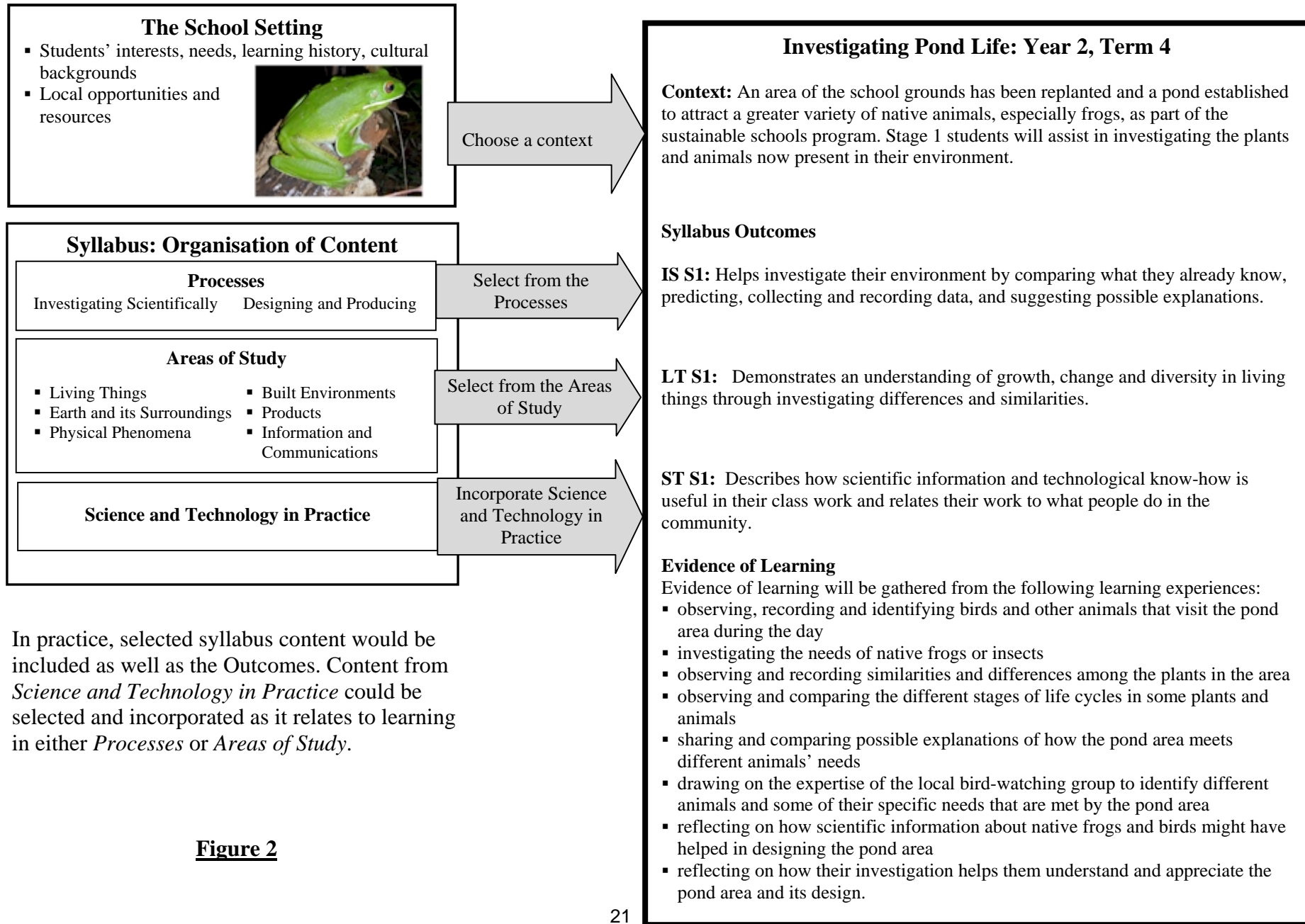
The syllabus content organisation (Figure 1) also provides a manageable and accessible structure to help guide teachers in planning and programming by clearly illustrating how the different elements of the syllabus relate. It is intended that learning experiences will contribute towards the achievement of at least one Process outcome, one Area of Study outcome and one aspect of Science and Technology in Practice. Students develop their understanding of the processes by applying them to the Areas of Study. Their understanding of scientific and technological knowledge will be developed through the processes of *Investigating Scientifically* and *Designing and Producing*. Through relating their learning about Science and Technology in Practice to learning in either Processes or Areas of Study, they will come to understand the social and environmental significance as well as the interrelatedness of Science and Technology. Students should be provided with a reasonable opportunity to engage in and demonstrate their level of achievement of *Investigating Scientifically* and *Designing and Producing* Outcomes each year. The teaching and learning program should provide a range of experiences through which students can demonstrate their level of achievement of all other syllabus Outcomes over each stage.



**Figure 1**

The syllabus Outcomes and associated content describe in broad terms what students are to learn. Syllabus content is expressed as ‘learn to’ and ‘learn about’ statements. While the inclusion of all content statements in teaching and learning programs is not mandatory, they do indicate key elements of learning that contribute to a student’s achievement of the outcome. Teachers have the flexibility to plan learning experiences set in contexts that are appropriate for their own students. Contexts are devised by the teacher to frame learning in ways that are meaningful and engaging to their students, taking into account such factors as students’ interests, learning history and cultural backgrounds as well as local resources and opportunities. Carefully chosen contexts provide motivation, encourage students to build on prior learning, make connections beyond the classroom and see the relevance of their work in science and technology. The context draws together content related to Processes, Areas of Study, and Science and Technology in Practice in a coherent way.

A key question that teachers should ask in planning and programming is ‘what evidence of learning is required?’ Figure 2 illustrates how learning experiences could then be developed to gather this evidence for the selected syllabus Outcomes that have been combined within a meaningful context relevant to a particular school.



In practice, selected syllabus content would be included as well as the Outcomes. Content from *Science and Technology in Practice* could be selected and incorporated as it relates to learning in either *Processes* or *Areas of Study*.

**Figure 2**

The syllabus Outcomes are displayed below for each stage consistent with the organisation described above:

Early Stage 1

<b>Working Scientifically</b> <i>'making sense'</i>	<b>Working Technologically</b> <i>'making stuff'</i>
<b>Processes</b>	
<p><b>Outcome: Investigating Scientifically</b> Helps explore their immediate surroundings by sharing what they already know, observing, questioning and reporting.</p>	<p><b>Outcome: Designing and Producing</b> Uses imagination, trial and error and play to produce designs with classroom tools, equipment, materials and techniques for an identified purpose.</p>
<b>Areas of Study</b>	
<p><b>Outcome: Living things</b> Demonstrates an understanding of the difference between living and non-living things through investigating their characteristics and needs.</p> <p><b>Outcome: Earth and its surroundings</b> Demonstrates an understanding of familiar changes at the Earth's surface through investigating conditions that affect them.</p> <p><b>Outcome: Physical phenomena</b> Demonstrates an understanding of how energy, forces and materials are used through investigating a range of familiar things, situations and events.</p>	<p><b>Outcome: Built Environments</b> Demonstrates an understanding of purpose, layout and conditions in spaces, through designing and modeling familiar or imaginary environments.</p> <p><b>Outcome: Products</b> Demonstrates an understanding of purpose and some properties of classroom materials through designing and making or modeling useful products.</p> <p><b>Outcome: Information and Communications</b> Demonstrates an understanding of uses and different features of information and communications products through designing and making their own publications.</p>
<b>Science and Technology in Practice</b>	
<p><b>Outcome: Science and Technology in Practice</b> Recognises that investigating scientifically and designing and producing can help satisfy their curiosity and needs in exploring the world around them.</p>	

Stage 1

<b>Working Scientifically</b> <i>'making sense'</i>	<b>Working Technologically</b> <i>'making stuff'</i>
<b>Processes</b>	
<p><b>Outcome: Investigating Scientifically</b> Helps investigate their environment by comparing what they already know, predicting, collecting and recording data, and suggesting possible explanations.</p>	<p><b>Outcome: Designing and Producing</b> Responds imaginatively to an exploration of needs and wants to produce solutions using some specialised tools, equipment, materials and techniques.</p>
<b>Areas of Study</b>	
<p><b>Outcome: Living things</b> Demonstrates an understanding of growth, change and diversity in living things through investigating differences and similarities.</p> <p><b>Outcome: Earth and its surroundings</b> Demonstrates an understanding of patterns of change at the Earth's surface through investigating variations observed over time.</p> <p><b>Outcome: Physical phenomena</b> Demonstrates an understanding of the effects of energy and forces and the properties of materials through investigating their purposeful use.</p>	<p><b>Outcome: Built Environments</b> Demonstrates an understanding of people's needs, construction methods and the influence of natural conditions through designing and constructing small outdoor spaces.</p> <p><b>Outcome: Products</b> Demonstrates an understanding of the source of some common materials and their processing through designing and making useful products.</p> <p><b>Outcome: Information and Communications</b> Demonstrates an understanding of the use of different media, production techniques and publishing software through designing and producing their own publications.</p>
<b>Science and Technology in Practice</b>	
<p><b>Outcome: Science and Technology in Practice</b> Describes how scientific information and technological know-how is useful in their class work and relates their work to what people do in the community.</p>	

Stage 2

<b>Working Scientifically</b> <i>'making sense'</i>	<b>Working Technologically</b> <i>'making stuff'</i>
<b>Processes</b>	
<p><b>Outcome: Investigating Scientifically</b> Helps investigate their questions, problems and ideas by taking into account scientific information, testing, analysing data, drawing conclusions, communicating findings and reflecting on fairness.</p>	<p><b>Outcome: Designing and Producing</b> Helps establish design criteria addressing needs and wants of the user or audience to produce and evaluate solutions, using specialised tools, equipment, materials and techniques.</p>
<b>Areas of Study</b>	
<p><b>Outcome: Living things</b> Demonstrates an understanding of biodiversity through investigating how adaptations allow living things to survive in particular environments.</p> <p><b>Outcome: Earth and its surroundings</b> Demonstrates an understanding of processes and events in the land, water, atmosphere or in space through investigating their predictability.</p> <p><b>Outcome: Physical phenomena</b> Demonstrates an understanding of how energy, forces and materials can be manipulated through investigating their purposeful use.</p>	<p><b>Outcome: Built Environments</b> Demonstrates an understanding of structures and building materials, tools and techniques through designing, modeling and/or modifying small buildings or spaces.</p> <p><b>Outcome: Products</b> Demonstrates an understanding of materials, production techniques and processes, and the influence of technological change through designing and producing useful products.</p> <p><b>Outcome: Information and Communications</b> Demonstrates an understanding of different media, production techniques and publishing software through designing and producing their own publications.</p>
<b>Science and Technology in Practice</b>	
<p><b>Outcome: Science and Technology in Practice</b> Uses scientific investigation to inform design tasks, uses technologies to enhance scientific investigations and evaluates the possible social, cultural and environmental implications of their work.</p>	

Stage 3

<b>Working Scientifically</b> <i>'making sense'</i>	<b>Working Technologically</b> <i>'making stuff'</i>
<b>Processes</b>	
<p><b>Outcome: Investigating Scientifically</b> Identifies testable questions that they can investigate by taking into account scientific explanations, devising fair tests, drawing evidence-based conclusions, reflecting on and communicating procedures and explanations.</p>	<p><b>Outcome: Designing and Producing</b> Establishes design criteria addressing responsible consideration of wider social issues to produce and evaluate solutions, selecting and using specialised tools, equipment, materials and techniques.</p>
<b>Areas of Study</b>	
<p><b>Outcome: Living things</b> Demonstrates an understanding of the importance of interdependence through investigating interactions within a variety of ecosystems.</p> <p><b>Outcome: Earth and its surroundings</b> Demonstrates an understanding of causes of change at the Earth's surface through investigating processes and events in the land, water, atmosphere or in space.</p> <p><b>Outcome: Physical phenomena</b> Demonstrates an understanding of how forces can act at a distance and of transformation of energy and materials through investigating their practical applications.</p>	<p><b>Outcome: Built Environments</b> Demonstrates an understanding of the influence of technological change over time and the development of specialist building materials and techniques through designing, modeling and/or constructing small or temporary spaces.</p> <p><b>Outcome: Products</b> Demonstrates an understanding of principles of mass manufacture, production techniques and processes, and the influence of technological change through designing and modeling processes of authentic production.</p> <p><b>Outcome: Information and Communications</b> Demonstrates an understanding of systems used to create and manage information and communications, and how information can be manipulated to create meaning and perception through designing and publishing their own products.</p>
<b>Science and Technology in Practice</b>	
<p><b>Outcome: Science and Technology in Practice</b> Describes the interaction of Science and Technology in their class work and in society and recognises roles and responsibilities in responding to local and global issues.</p>	

*Notes to writers:*

- *revise the content organisation and Figure 1 to:*
  - *remove the terms ‘making sense’ and ‘making stuff’*
  - *better reflect the interrelationship between science and technology, and between the strands/organisers*
- *within Figure 1, present Science and Technology in Practice to better reflect its overall importance in engaging students with real life issues and interests relevant to K–6, including social and environmental issues, and to contextualise science and technology as interrelated and familiar*
- *make more explicit the scope of the terms ‘working scientifically’ and ‘working technologically’ and clarify their relationship to ‘investigating scientifically’ and ‘designing and producing’*
- *review and revise the organisation of the Areas of Study for clarity and simplicity*
- *incorporate overviews of each of the strands/organisers*
- *clarify the status of content, including the flexibility teachers have to select from the content in addressing Outcomes.*

### 3.7.2 Sample Content

The proposed page layout for content that addresses each outcome is:

**[Stage]**

**[Organiser]**

**Outcome:**

**Students learn about:**

**Students learn to:**

Description of content

**KLA Connections:**

**Complementary:** Outcomes in other KLAs that contribute to learning in Science and Technology.

**Supplementary:** Outcomes in other KLAs that could support learning in Science and Technology, and that may be considered in school-specific planning and integrating.

**Background Information:**

May provide information and advice for teachers, including about:

- key differences and similarities between this and the corresponding outcome in the preceding and subsequent stages
- other factors that influence the progression of children’s learning such as the developmental context, common misconceptions and difficulties, depth of treatment.

**Language:**

May provide information and advice for teachers about language that may assist the student’s engagement and understanding of the content.

Further support for teachers on [organiser] will be found on [page] of the Support Document.

Sample Content for Stage 1 is:

## Stage 1

### Investigating Scientifically

#### Outcome:

Helps investigate their environment by comparing what they already know, predicting, collecting and recording data, and suggesting possible explanations.

#### Students learn about:

- scientific investigation as a process involving stages of planning, conducting, processing and evaluating in which they are guided or have informal involvement
- the nature of scientific investigation as a process for finding out, involving skills in observing, questioning, predicting, collecting and recording data, and suggesting possible explanations
- the value of scientific investigation as a way of finding things out in their environment.

#### Students learn to:

##### Plan investigations by:

- comparing what they already know with the class to help work out what needs to be investigated
- making predictions based on their own observations and suggesting evidence that could be collected as part of testing predictions.

##### Conduct investigations by:

- carrying out investigations using a small number of steps
- manipulating and observing objects to test their predictions
- using observations and measurements with informal units eg. to record growth and change.

##### Process data by:

- sharing observations of one aspect of the investigation by writing, re-telling, acting out, or drawing what happened
- suggesting possible explanations based on their observations and measurements
- gathering, recording and displaying data using tally marks, concrete materials and pictorial representations
- interpreting information eg rainfall data presented in picture graphs and column graphs.

##### Evaluate investigations by:

- reflecting on where an investigation went well or poorly and explain why they feel that way
- suggesting explanations for why parts of their investigation were conducted in a particular way
- reflecting on the value of specific technologies (equipment/resources, eg. magnifying glass) in helping investigate
- describing and reflecting on the way investigating allows them to find things out in their environment.

#### KLA Connections:

**Complementary:** Mathematics DS1.1 Gathers and organises data, displays data using column and picture graphs, and interprets the results.

**Supplementary:** Mathematics (measurement) MS1.1, MS1.2, MS1.3, MS1.4, MS1.5.

#### Background Information:

In stage 1 students continue to observe, question and explore as in the previous stage. In addition they contribute suggestions about how the investigation is to be carried out, make predictions, collect and record data in ways appropriate to their developing literacy and numeracy skills, and suggest possible explanations of their findings. As well as what they know individually, they think about what other students know. Students begin to recognise scientific investigation as an identifiable process with particular characteristics, and to appreciate its usefulness in exploring their world. In Stage 2 students are able to recognise the stages of scientific investigations and independently implement aspects of their investigations. In planning and evaluating their investigations, they reflect on fairness and develop skills in recording and interpreting data in tables, column graphs and picture graphs.

Teachers may choose to focus on particular aspects of investigating scientifically in tasks. However, students should be made aware of the integrity of the whole process. For instance, if the scientific investigation involves significant planning by the teacher, this should be done in cooperation with the student group or else the task should be introduced to students with a brief narrative about doing that planning.

#### Language:

The term ‘data’ for the results of observations and measurement should be introduced. Students may have difficulty distinguishing between their data and what they thought about it, their explanations and reflections.

Further support for teachers on Investigating Scientifically will be found on [page] of the Support Document.

## Stage 1

### Designing and Producing

**Outcome:**

Responds imaginatively to an exploration of needs and wants to produce solutions using some specialised tools, equipment, materials and techniques.

**Students learn about:**

- the value of designing and producing as an organised process that is used to create built environments, information products and other products
- the nature of designing and producing as a process that is guided by a design brief and that involves exploring needs and wants, generating and developing ideas and producing solutions
- drawing and modelling as means of exploring and developing their own design concepts.

**Students learn to:**

**Explore and define the task by:**

- considering what is needed in a design situation
- exploring the features of existing products and/or places and suggesting how well the features of their design meet the needs of users.

**Generate and test ideas by:**

- developing design concepts through drawing and modelling
- sharing their design concepts with others and responding to feedback.

**Produce solutions by:**

- preparing materials and resources to be used in production
- using a range of constructing and modelling equipment, tools and techniques including some specialist equipment
- shaping, assembling, joining and finishing using modelling and making materials
- working cooperatively and safely, and following procedures to produce models, products and spaces
- exploring ways people in the community design and produce things that are similar to those being produced in the design task.

**Content relating to planning, managing and evaluating the design task is incorporated under each of the above headings as is appropriate.**

**KLA Connections:**

**Supplementary:** Mathematics WMS1.2 Uses objects, diagrams, imagery and technology to explore mathematical problems

**Background Information:**

During Stage 1, students become more methodical in their approach to designing and recognise phases of a design process. They are more willing to draw and model ideas before settling on a final solution. They start to appreciate how the purpose of products and built environments influence their design, i.e. how the design responds to people’s needs. Students work co-operatively in the class setting, following classroom procedures, sharing resources and helping others where necessary.

At Stage 2, it is expected that students are better able to talk about the processes of design. They describe how they will go about a task and suggest better ways of proceeding. During Stage 2 students start to appreciate the importance of seeing a design task from point of view of a user or audience.

Teachers may choose to focus on particular aspects of designing and producing in tasks. However, students should be made aware of the integrity of the whole process. For instance, if the designing and producing involves significant planning by the teacher, this should be done in cooperation with the student group or else the task should be introduced to students with a brief narrative about doing that planning.

Further support for teachers on Designing and Producing will be found on [page] of the Support Document.

## Stage 1

### Area of Study: Living Things

**Outcome:** Demonstrates an understanding of growth, change and diversity in living things through investigating differences and similarities.

**Students learn about:**

- differences and similarities in the structure of living things, including both plants and animals.
- differences and similarities in the way living things, including both plants and animals, grow and develop
- differences and similarities in the life cycles of living things, including both plants and animals
- how adult offspring are similar to their parents.

**Students learn to:**

- investigate the obvious structural features of a variety of living things including both plants and animals
- devise groupings based on observable characteristics
- investigate the basic needs of different living things
- investigate how different organisms change in different ways as they grow
- observe similarities between adult offspring and their parents
- compare the reproductive processes and life cycles of a variety of living things.

**KLA Connections:**

**Supplementary:** PDHPE GDS1.9 Describes the characteristics that make them both similar to others and unique.

**Background Information:**

Students move from distinguishing living from non-living things in Early Stage 1 to examining differences and similarities among the living things they investigate. They realise these characteristics may provide a basis for grouping, although they do not yet use accepted systems of classification. Students appreciate general aspects of growth and change in plants and animals, including some important differences, e.g. that plants and animals have specific needs for growth. In Stage 2 they will explore how physical structure and other characteristics function to enable living things to survive in particular environments.

Students at this Stage commonly understand living things as all things that move and/or grow and need energy or food without understanding that living things also have the capacity to reproduce. Students commonly understand that plants take their food from the soil, rather than understanding plants as producers of their own food.

**Language:**

Students commonly understand a ‘plant’ as something that is small enough to grow in a garden, rather than understanding ‘plants’ as a category that includes, for example, vegetables, seeds, weeds and trees. Students need to understand that all living things are either ‘plants’ or ‘animals’ and that a seed, for example, which grows into a particular kind of plant during its life-cycle is also a ‘plant’.

Further support for teachers on Living Things will be found on [page] of the Support Document.

## Stage 1

### Area of Study: Built Environments

**Outcome:** Demonstrates an understanding of people’s needs, construction methods and the influence of natural conditions through designing and constructing small outdoor spaces.

**Students learn about:**

- different purposes for which outside spaces are used and how they influence their design
- the influence of natural conditions including aspect, sun, wind and shade on the design of outside spaces
- drawing and modeling spaces to express relationships between different elements within those spaces
- how some specialised tools and equipment are designed for use in constructing particular outdoor spaces (e.g. light gardening tools)
- some materials which are suitable for use in outdoor spaces and some properties that make them suitable
- how natural features of outdoor spaces e.g. plantings, mulch, may change over time and often require maintenance

**Students learn to:**

- take into account the needs of different people and/or groups when designing outdoor spaces
- sketch ideas for outdoor spaces and explain what their sketches mean
- model ideas for outdoor spaces recognising relationships between features of the design
- help construct/arrange an outdoor space according to an agreed plan
- safely use light tools and equipment to set out, construct/plant and maintain their own small outdoor space
- consider conservation of resources used in the construction and maintenance of outdoor spaces

**KLA Connections:**

**Supplementary:**

HSIE ENS1.5 Compares and contrasts natural and built features in their local area and the ways in which people interact with these features.

HSIE ENS1.6 Demonstrates an understanding of the relationship between environments and people.

HSIE SSS1.7 Explains how people and technologies in systems link to provide goods and services to satisfy needs and wants.

Mathematics MES1.2 Describes area using everyday language and compares areas using direct comparison

**Background Information:**

In Early Stage 1 students examined the design and purpose of places and spaces within their immediate experience. In Stage 1 students develop an appreciation of a wider range of built environments and are able to distinguish between environments that people construct or modify, and those that are natural. When designing and producing spaces in Stage 1 they take more account of the needs of others and the nature of the site. They focus on shared outdoor spaces e.g. playground areas, local parks. In Stage 2 students focus on the way our developing knowledge of techniques, materials and structure has influenced our design and construction of built environments.

**Language:**

Students may confuse ‘space’ in built environments with ‘space’ beyond Earth. The idea of an environment as a ‘space’ with certain qualities is very important at this Stage and teaching should encourage students to appreciate the nature of these qualities, e.g. sunny, comfortable, warm, safe, fun.

Further support for teachers on Built Environments will be found on [page] of the Support Document.

## Stage 1

### Science and Technology in Practice

**Outcome:** Describes how scientific information and technological know-how is useful in their class work and relates their work to what people do in the community.

#### Students learn about:

- the work of people in their wider community who investigate scientifically, who design things and who make things
- some ways scientific information about living things, physical phenomena or Earth and its surroundings is useful in their own lives (eg caring for pets, growing vegetables, drying the washing, choosing clothes) and how it is necessary for some design tasks
- some ways technological know-how is useful in their own lives (eg preparing food, riding a bike, communicating) and how technological know-how can assist scientific investigations.

#### Students learn to:

##### Consider the significance of Science and Technology by:

- recognising the use of scientific information in their everyday activities
- recognising the role of technological know-how (and associated tools/equipment) in their everyday activities
- identifying and responding to the costs and benefits of school-based design tasks for themselves, other students, family and/or friends
- drawing upon the expertise of people in the wider community and questioning how their scientific and technological expertise is used for creative or productive purposes
- recognising some types of traditional technological expertise of Aboriginal and Indigenous peoples
- using resources in a way that respects the limited nature of their availability on Earth (sustainability)

##### Relate Science and Technology by:

- recognising the importance of technological know-how, basic tools and equipment for improving observations and making measurements in their own scientific investigations
- identifying relevant points in their own design tasks where information about living things, physical phenomena or Earth and its surroundings is required.

#### KLA Connections:

##### Supplementary:

HSIE ENS1.5 Compares and contrasts natural and built features in their local area and the ways in which people interact with these features.

HSIE ENS1.6 Demonstrates an understanding of the relationship between environments and people.

HSIE SSS1.7 Explains how people and technologies in systems link to provide goods and services to satisfy needs and wants.

#### Background Information:

At Stage 1 students extend their understanding from the personal significance of Science and Technology to include wider implications in their immediate world. At later stages, students move toward a more global appreciation of its significance including its implications for the future.

While students at Stage 1 will not have a conceptual understanding of Science and of Technology, they will have an idea of investigating as a process that applies to Science and of designing as a process that applies to Technology. Initial understanding of the relatedness of Science and Technology is established when students identify the relevance of some types of scientific information in the process of developing a design task and when they identify the use of some types of technological know-how to assist in the process of investigating scientifically. At Stage 2 students extend their understanding to include the use of scientific investigation to find information necessary for designing and they consider the development of specialised technological know-how to enhance processes of investigating.

#### Language:

At this stage it is important that students do not limit their understanding of the term ‘technology’ by simply referring to tools and equipment (including computers) as ‘technology’. At later stages students develop a more conceptual understanding of ‘technology’ as the know-how associated with the manipulation of resources (albeit often with the assistance of tools and equipment).

Further support for teachers on Science and Technology in Practice will be found on [page] of the Support Document.


*Notes to writers:*

- *revise to provide explicit and specific content detail that is accurate and stage-appropriate*
- *revise to more explicitly incorporate:*
  - *links between knowledge, understanding, skills, values and attitudes*
  - *cross-curriculum content*
  - *suggested science and technology contexts and issues relevant to K–6 students*
  - *content inclusive of students with special education needs*
- *revise KLA Connections to remove the division into Complementary and Supplementary Connections*
- *revise KLA Connections to incorporate a wider range of KLAs, including explicit links to literacy and numeracy Outcomes K–6.*

### 3.8 Continuum of learning in Science and Technology K–10

**i** for your information

**The K–10 continuum of Science and Technology** will provide the scope and continuum of the subject, as relevant, from Early Stage 1 to Stage 5.

 consult

**The proposed description of the continuum of learning in Science and Technology K–10 is:**

#### Continuum of Learning K–10

Outcomes and/or content from the Science Years 7–10 syllabus are identified as ‘SCIENCE’ while Outcomes and/or content from the Technology (Mandatory) Years 7–8 syllabus are identified as ‘TECHNOLOGY’. The study of Technological and Applied Studies in Stage 5 is not a mandatory requirement for the award of a school certificate. To view Outcomes for these elective courses refer to the syllabus documents for Agricultural Technology, Design and Technology, Food Technology, Graphics Technology, Industrial Technology, Information and Software Technology, Marine and Aquaculture Technology CEC and Textiles Technology.

#### *Notes to writers:*

- *revise to describe more clearly the differences between stages*
- *revise to provide a clearer articulation of the progression from Stage 3 to Stage 4.*

Science and Technology K–6 Writing Brief

In Early Stage 1 a student:	In Stage 1 a student:	In Stage 2 a student:	In Stage 3 a student:	In Stage 4 a student:	In Stage 5 a student:
<p><b>IS ES1:</b> Helps explore their immediate surroundings by sharing what they already know, observing, questioning and reporting.</p>	<p><b>IS S1:</b> Helps investigate their environment by comparing what they already know, predicting, collecting and recording data, and suggesting possible explanations.</p>	<p><b>IS S2:</b> Helps investigate their questions, problems and ideas by taking into account scientific information, testing, analysing data, drawing conclusions, communicating findings and reflecting on fairness.</p>	<p><b>IS S3:</b> Identifies testable questions that they can investigate by taking into account scientific explanations, devising fair tests, drawing evidence-based conclusions, reflecting on and communicating procedures and explanations.</p>	<p><b>SCIENCE</b></p> <ul style="list-style-type: none"> <li>• clarifies the purpose of an investigation and, with guidance, produces a plan to investigate a problem</li> <li>• follows a sequence of instructions to undertake a first-hand investigation</li> <li>• uses given criteria to gather first-hand data</li> <li>• accesses information from identified secondary sources</li> <li>• evaluates the relevance of data and information</li> <li>• with guidance, presents information to an audience to achieve a particular purpose</li> <li>• draws conclusions based on information available</li> <li>• uses an identified strategy to solve problems</li> <li>• uses creativity and imagination to suggest plausible solutions to familiar problems</li> <li>• undertakes a variety of individual and team tasks with guidance</li> </ul>	<p><b>SCIENCE</b></p> <ul style="list-style-type: none"> <li>• identifies a problem and independently produces an appropriate investigation plan</li> <li>• undertakes first-hand investigations independently with safety and competence</li> <li>• gathers first-hand data accurately</li> <li>• accesses information from a wide variety of secondary sources</li> <li>• explains trends, patterns and relationships in data and/or information from a variety of sources</li> <li>• selects and uses appropriate forms of communication to present information to an audience</li> <li>• uses critical thinking skills in evaluating information and drawing conclusions</li> <li>• selects and uses appropriate strategies to solve problems</li> <li>• uses creativity and imagination in the analysis of problems and the development of possible solutions</li> <li>• plans, implements and evaluates the effectiveness of a variety of tasks independently and as a team member</li> </ul>

*Science and Technology K–6 Writing Brief*

In Early Stage 1 a student:	In Stage 1 a student:	In Stage 2 a student:	In Stage 3 a student:	In Stage 4 a student:	In Stage 5 a student:
<p><b>DP ES1:</b> Uses imagination, trial and error and play to produce designs with classroom tools, equipment, materials and techniques for an identified purpose.</p>	<p><b>DP S1</b> Responds imaginatively to an exploration of needs and wants to produce solutions using some specialised tools, equipment, materials and techniques.</p>	<p><b>DP S2:</b> Helps establish design criteria addressing needs and wants of the user or audience, to produce and evaluate solutions using specialised tools, equipment, materials and techniques.</p>	<p><b>DP S3:</b> Establishes design criteria addressing responsible consideration of wider social issues to produce and evaluate solutions, selecting and using specialised tools, equipment, materials and techniques.</p>	<p><b>TECHNOLOGY</b></p> <ul style="list-style-type: none"> <li>• applies design processes that respond to needs and opportunities in each design project</li> <li>• generates and communicates creative design ideas and solutions</li> <li>• selects, analyses, presents and applies research and experimentation from variety of sources</li> <li>• applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects</li> <li>• demonstrates responsible and safe use of a range of tools, materials and techniques in each design project</li> <li>• explains the impact of innovation and emerging technologies on society and the environment</li> <li>• applies management processes to successfully complete design projects</li> <li>• produces quality solutions that respond to identified needs and opportunities in each design project</li> </ul>	<p>Refer to Technology Years 7-10 elective courses</p>


*Science and Technology K–6 Writing Brief*

In Early Stage 1 a student:	In Stage 1 a student:	In Stage 2 a student:	In Stage 3 a student:	In Stage 4 a student:	In Stage 5 a student:		
<b>LT ES1:</b> Demonstrates an understanding of the difference between living and non-living things through investigating their characteristics and needs.	<b>LT S1:</b> Demonstrates an understanding of growth, change and diversity in living things through investigating differences and similarities.	<b>LT S2:</b> Demonstrates an understanding of biodiversity through investigating how adaptations allow living things to survive in particular environments	<b>LT S3:</b> Demonstrates an understanding of the importance of interdependence through investigating interactions within a variety of ecosystems.	<b>SCIENCE</b> <ul style="list-style-type: none"> <li>describes features of living things</li> <li>identifies factors affecting survival of organisms in an ecosystem</li> </ul>	<b>SCIENCE</b> <ul style="list-style-type: none"> <li>relates the structure and function of living things to models, theories and laws</li> <li>assesses human impacts on the interaction of biotic and abiotic features of the environment</li> </ul>		
<b>ES ES1:</b> Demonstrates an understanding of familiar changes at the Earth’s surface through investigating conditions that affect them.	<b>ES S1:</b> Demonstrates an understanding of patterns of change at the Earth’s surface through investigating variations observed over time.	<b>ES S2:</b> Demonstrates an understanding of processes and events in the land, water, atmosphere or in space through investigating their predictability.	<b>ES S3:</b> Demonstrates an understanding of causes of change at the Earth’s surface through investigating processes and events in the land, water, atmosphere or in space.			<ul style="list-style-type: none"> <li>describes the dynamic structure of Earth and its relationship to other parts of our solar system and the universe</li> </ul>	<ul style="list-style-type: none"> <li>relates the development of the universe and the dynamic structure of Earth to models, theories and laws and the influence of time</li> </ul>
<b>PP ES1:</b> Demonstrates an understanding of how energy, forces and materials are used through investigating a range of familiar objects, situations and events.	<b>PP S1:</b> Demonstrates an understanding of the effects of energy and forces and the properties of materials through investigating their purposeful use.	<b>PP S2:</b> Demonstrates an understanding of how energy, forces and materials can be manipulated through investigating their purposeful use.	<b>PP S3:</b> Demonstrates an understanding of how forces can act at a distance and of transformation of energy and materials through investigating their practical applications.			<ul style="list-style-type: none"> <li>identifies and describes energy changes and the action of forces in common situations</li> <li>describes observed properties of substances using scientific models and theories</li> </ul>	<ul style="list-style-type: none"> <li>applies models, theories and laws to situations involving energy, force and motion</li> <li>relates properties of elements, compounds and mixtures to scientific models, theories and laws</li> </ul>
<b>BE ES1:</b> Demonstrates an understanding of purpose, layout and conditions in spaces, through designing and modelling familiar or imaginary environments.	<b>BE S1:</b> Demonstrates an understanding of people’s needs, construction methods and the influence of natural conditions through designing and constructing small outdoor spaces.	<b>BE S2:</b> Demonstrates an understanding of structures and building materials, tools and techniques through designing, modelling and/or modifying small buildings or spaces.	<b>BE S3:</b> Demonstrates an understanding of the influence of technological change over time and the development of specialist building materials and techniques through designing, modelling and/or constructing small or temporary spaces.	<b>TECHNOLOGY</b> <ul style="list-style-type: none"> <li>describes factors influencing design in the areas of study of Built Environments, Products, and Information and Communications</li> <li>applies a broad range of contemporary and appropriate tools, materials and techniques with competence in the development of design projects</li> <li>demonstrates responsible and safe use of a range of tools, materials and techniques in each design project</li> </ul>	Refer to Technology Years 7-10 elective courses		
<b>P ES1:</b> Demonstrates an understanding of purpose and some properties of classroom materials through designing and making or modelling useful products.	<b>P S1:</b> Demonstrates an understanding of the source of some common materials and their processing through designing and making useful products.	<b>P S2:</b> Demonstrates an understanding of materials, production techniques and processes, and the influence of technological change through designing and producing useful products.	<b>P S3:</b> Demonstrates an understanding of principles of mass manufacture, production techniques and processes, and the influence of technological change through designing and modelling processes of authentic production.				
<b>IC ES1:</b> Demonstrates an understanding of uses and different features of information and communications products through designing and making their own publications.	<b>IC S1:</b> Demonstrates an understanding of the use of different media, production techniques and publishing software through designing and producing their own publications.	<b>IC S2:</b> Demonstrates an understanding of different media, production techniques and publishing software through designing and producing their own publications.	<b>IC S3:</b> Demonstrates an understanding of systems used to create and manage information and communications, and how information can be manipulated to create meaning and perception through designing and publishing their own products.				

*Science and Technology K–6 Writing Brief*

In Early Stage 1 a student:	In Stage 1 a student:	In Stage 2 a student:	In Stage 3 a student:	In Stage 4 a student:	In Stage 5 a student:
<p><b>STP ES1:</b> Recognises that investigating scientifically and designing and producing can help satisfy their curiosity and needs in exploring the world around them.</p>	<p><b>STP S1:</b> Describes how scientific information and technological know-how is useful in their class work and relates their work to what people do in the community.</p>	<p><b>STP S2:</b> Uses scientific investigation to inform design tasks, uses technologies to enhance scientific investigations and evaluates the possible social, cultural and environmental implications of their work.</p>	<p><b>STP S3:</b> Describes the interaction of Science and Technology in their class work and in society and recognises roles and responsibilities in responding to local and global issues.</p>	<p><b>SCIENCE</b></p> <ul style="list-style-type: none"> <li>• identifies areas of everyday life that have been affected by scientific developments</li> <li>• identifies choices made by people with regard to scientific developments</li> <li>• describes areas of current scientific research</li> <li>• identifies where resources are found, and describes ways in which they are used by humans</li>   <li>• identifies, using examples, common simple devices and explains why they are used</li> </ul> <p><b>TECHNOLOGY</b></p> <ul style="list-style-type: none"> <li>• identifies the roles of designers and their contribution to the improvement of the quality of life</li> <li>• explains the impact of innovation and emerging technologies on society and the environment</li> <li>• identifies and explains ethical, social, environmental and sustainability considerations related to design projects</li> <li>• selects, analyses, presents and applies research and experimentation from a variety of sources</li> </ul>	<p><b>SCIENCE</b></p> <ul style="list-style-type: none"> <li>• evaluates the impact of applications of science on society and the environment</li> <li>• discusses evidence supporting different viewpoints</li>   <li>• analyses how current research might affect people’s lives</li> <li>• analyses the impact of human resource use on the biosphere to evaluate methods of conserving, protecting and maintaining Earth’s resources</li> <li>• relates the interactions involved in using some common technologies to their underlying scientific principles</li> </ul> <p>Refer to Technology Years 7-10 elective courses</p>

### 3.9 Assessment

 for your information

This section contains generic text on **Assessment** in a standards-referenced framework. It also contains some subject-specific advice on choosing appropriate assessment strategies.

 consult

**The proposed assessment advice is:**

#### **General Principles for Planning, Programming, Assessing, Reporting and Evaluating**

Planning, programming, and assessing in Science and Technology involve the consideration of the individual learning needs of all students and the creation of a learning environment that assists students to achieve the Outcomes of the syllabus.

Students' achievement of the syllabus Outcomes is the goal of planning, programming and assessing. The sequence of learning experiences that teachers provide should build on what students already know and should be designed to ensure that they progress through the Stages identified in the learning continuum. As students participate in a range of learning experiences in Science and Technology, teachers make judgements about what students know, what they can do and what they understand.

Evaluating is the process of making judgements about the effectiveness of school/faculty plans, teaching programs, policies and procedures.

#### **Assessment**

##### **Standards**

The Board of Studies K–10 curriculum framework is a standards-referenced framework that describes, through syllabuses and other documents, the expected learning Outcomes for students.

Standards in the framework consist of two interrelated elements:

- Outcomes and content in syllabuses showing what is to be learnt
- descriptions of levels of achievement of that learning.

Exemplar tasks and student work samples help to elaborate standards.

Syllabus Outcomes in Science and Technology contribute to a developmental sequence in which students are challenged to acquire new knowledge, skills and understanding.

The standards are typically written for two years of schooling and set high, but realistic, expectations of the quality of learning to be achieved by most students by the end of Years 2, 4, 6, 8, 10 and 12.

### **Using standards to improve learning**

Teachers will be able to use standards in Science and Technology as a reference point for planning teaching and learning programs, and for assessing and reporting student progress. Standards in Science and Technology will help teachers and students to set targets, monitor achievement, and as a result make changes to programs and strategies to support and improve each student's progress.

### **Assessment for learning**

Assessment for learning in Science and Technology is designed to enhance teaching and improve learning. It is assessment that gives students opportunities to produce the work that leads to development of their knowledge, skills and understanding. Assessment for learning involves teachers in deciding how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment.

Teachers of Science and Technology will provide students with opportunities in the context of everyday classroom activities, as well as planned assessment events, to demonstrate their learning.

In summary, assessment for learning:

- is an essential and integrated part of teaching and learning
- reflects a belief that all students can improve
- involves setting learning goals with students
- helps students know and recognise the standards they are aiming for
- involves students in self-assessment and peer assessment
- provides feedback that helps students understand the next steps in learning and plan how to achieve them
- involves teachers, students and parents reflecting on assessment data.

## Quality Assessment Practices

The following principles provide the criteria for judging the quality of assessment materials and practices.

### Assessment for learning:

- **emphasises the interactions between learning and manageable assessment strategies that promote learning**

In practice, this means:

- teachers reflect on the purposes of assessment and on their assessment strategies
- assessment activities allow for demonstration of learning outcomes
- assessment is embedded in learning activities and informs the planning of future learning activities
- teachers use assessment to identify what a student can already do

- **clearly expresses for the student and teacher the goals of the learning activity**

In practice, this means:

- students understand the learning goals and the criteria that will be applied to judge the quality of their achievement
- students receive feedback that helps them make further progress

- **reflects a view of learning in which assessment helps students learn better, rather than just achieve a better mark**

In practice, this means:

- teachers use tasks that assess, and therefore encourage, deeper learning
- feedback is given in a way that motivates the learner and helps students to understand that mistakes are a part of learning and can lead to improvement
- assessment is an integral component of the teaching-learning process rather than being a separate activity

- **provides ways for students to use feedback from assessment**

In practice, this means:

- feedback is directed to the achievement of standards and away from comparisons with peers
- feedback is clear and constructive about strengths and weaknesses
- feedback is individualised and linked to opportunities for improvement

- **helps students take responsibility for their own learning**

In practice, this means:

- assessment includes strategies for self-assessment and peer assessment emphasising the next steps needed for further learning

- **is inclusive of all learners**

In practice, this means:

- assessment against standards provides opportunities for all learners to achieve their best
- assessment activities are free of bias.

## **Making judgements about student achievement**

*Assessment for Learning in the Science and Technology K–6 Syllabus* is designed to give students opportunities to produce the work that leads to development of their knowledge, skills and understanding. It involves teachers deciding how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment. Teachers of Science and Technology provide students with opportunities in the context of everyday classroom activities, as well as planned assessment events, to demonstrate their learning.

Gathered evidence can also be used for *assessment of learning* that takes place at key points in the learning cycle, such as the end of a Year or Stage, when schools may wish to report differentially on the levels of knowledge, skills and understanding achieved by students.

### **Choosing assessment strategies**

In Science and Technology K–6, assessment of student achievement should incorporate measures of:

- students' skills in working scientifically and technologically, including the selection and use of tools, equipment, materials and techniques
- students' knowledge and understanding about:
  - the processes of investigating scientifically and designing and producing
  - living things, physical phenomena, the Earth and its surroundings
  - built environments, products, information and communications
  - the relationships and significance of science and technology in practice.

Students indicate their level of understanding and skill development in what they do, what they say, and what they write and draw. The most appropriate method or procedure for gathering assessment information is best decided by considering the purpose for which the information will be used, and the kind of performance that will provide the information. Consequently there is a variety of ways to gather assessment information in Science and Technology. Tasks given to students for the purpose of gathering assessment information include projects, investigations, oral reports or explanations, tests, and practical assignments. For example, practical tasks would often be an appropriate strategy for the assessment of achievement of Outcomes for investigating scientifically.

Teachers have the opportunity to observe and record aspects of students' learning in a range of situations. When students are working in groups, teachers are well placed to determine the extent of student interaction and participation. By listening to what students say – including their responses to questions and other input – teachers are able to collect many clues about students' existing understanding and attitudes. Through interviews (which might be only a few minutes in duration), teachers can collect specific information about the ways in which students think in certain situations. The students' responses to questions and comments will often reveal their levels of understanding, interests and attitudes. Records of such observations form valuable additions to information gained using other assessment strategies, and enhance teachers' judgement of their students' achievement.

Consideration of students' journals or their comments on the progress of gaining a solution to a problem can also be very enlightening for teachers and provide valuable insight into the extent of students' thinking in Science and Technology.

Possible sources of information for assessment purposes include the following:

- samples of students' work
- explanation and demonstration to others
- questions posed by students
- practical tasks such as scientific investigations or design tasks
- students' plans for and records of their scientific investigations and design tasks
- students' journals and comments on the process of their scientific investigations and design tasks
- assignments and projects
- students' oral and written reports
- short quizzes
- pen-and-paper tests
- comprehension and interpretation exercises
- teacher/student discussion or interviews
- observation of students during learning activities, including listening to students' use of language
- observation of students' participation in a group activity
- consideration of students' portfolios.

## **Reporting**

Reporting is the process of providing information, both formally and informally, about the progress of student achievement. Reports can be presented in a spoken or written form. The principles below underpin effective reporting.

- Reporting students' achievement has a number of purposes for a variety of audiences such as students, parents/caregivers, teachers, the school and the wider community.
- Reporting should provide a diagnosis of areas of strength and need, including those in which the students might be given additional support.
- Reporting information needs to be clear and appropriate to the audience.

Parents will want to know how their child is progressing in relation to:

- skills and competence in working scientifically and technologically
- knowledge and understanding about science and technology.

When reporting to parents, key features of the report should include:

- information about how the student is progressing
- suggestions of ways the parents can help at home to develop the child's confidence to take risks in working scientifically and technologically.

## **Evaluating**

Evaluation is an ongoing process. Information for use in evaluation may be gathered through: student assessment; teachers' own reflection on their teaching practices; written records such as questionnaires, logs and diaries, submissions or records of meetings; and discussion with general staff members, teaching staff (including any specialist teachers involved), parents and other community members.

Teachers need to gather, organise and interpret information in order to make judgements about the effectiveness and appropriateness of:

- curriculum overviews and plans
- teaching plans
- teaching strategies.

*Note to writers:*

- *consider providing more specific assessment advice to support the requirements of K–6 Science and Technology in NSW.*

**Other overall notes to writers:**

- *address clearly and consistently the interrelationship between science and technology throughout the syllabus*
- *address explicitly and consistently the nature and scope of science and of technology in K–6 for NSW throughout the syllabus*
- *make explicit the scope of the terms ‘working scientifically’ and ‘working technologically’ and their relationship to ‘investigating scientifically’ and ‘designing and producing’ and use consistently throughout the syllabus*
- *link learning explicitly to the world beyond school throughout the syllabus, incorporating key science and technology issues and interests in the lives of K–6 students, their families and societies (including sustainability)*
- *give more emphasis throughout the syllabus to developing student interest and enthusiasm for science and technology*
- *develop the intent of the Rationale consistently through the Aim, Objectives and Outcomes*
- *consider including a glossary of terms used in the syllabus*
- *review and revise to incorporate clear language*
- *review and consider more specific suggestions (see Consultation Report).*

## Appendix

### Broad Directions for Science and Technology K–6 Syllabus Revision

#### **Broad direction 1: building on natural wonder and curiosity to develop lifelong interest in science and technology**

The Rationale will be revised to explicitly emphasise the importance of developing in students the knowledge and understanding, skills, values and attitudes to willingly and actively engage in issues and with ideas related to science and technology as informed, reflective and responsible, scientifically and technologically literate citizens. The syllabus will emphasise the importance of engaging students' natural wonder and curiosity in the world around them to develop lifelong interest in science and technology.

#### **Broad direction 2: manageable, explicit content for deep understanding**

The syllabus will describe staged content incorporating the knowledge, understandings and skills essential to this learning area. The processes currently called *Investigating* and *Designing and Making* are central to this learning area. The content will extend and deepen student learning and be able to be taught within the Board's guidelines for the proportion of time allocated to each key learning area.

#### **Broad direction 3: relationships between science and technology**

The syllabus will explicitly incorporate the nature of science and the nature of technology and will describe the relationships that can exist between science and technology. The syllabus will be consistent with the Board's *K–12 Technology Statement* and will retain consistency with the National Statements of Learning in Science and in ICT.

#### **Broad direction 4: user-friendly structure and organisation**

The structure and organisation of the syllabus will be made more user-friendly. The processes currently called *Investigating* and *Designing and Making* will be central to the organisation of the revised syllabus. The revised structure will give careful consideration to the NSW Primary Curriculum Foundation Statements.

#### **Broad direction 5: clear continuum of learning**

The syllabus will describe the continuum of learning in Science and in Technology from K–10.

#### **Broad direction 6: flexibility**

The syllabus will provide flexibility for schools to select contexts that challenge and deepen students' understanding of the world around them from the perspective of science and technology.

#### **Broad direction 7: use of readily available resources**

Knowledge and skills in the use of materials, tools, equipment and techniques will be embedded within the syllabus. The syllabus will give careful consideration to the necessary resources including materials, equipment and facilities reasonably expected to be available to schools.

#### **Broad direction 8: inclusive curriculum**

The syllabus will be inclusive of all students and their diversity of needs.