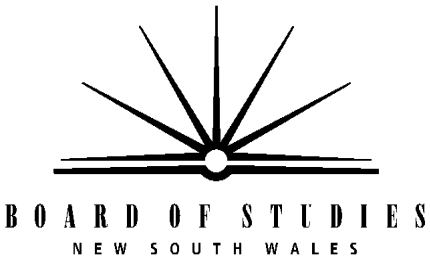

Science
Years K–10 Draft Australian Curriculum

Consultation Report

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GPO Box 5300
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Tel: (02) 9367 8111
Fax: (02) 9367 8484
Internet: www.boardofstudies.nsw.edu.au

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1 Executive Summary

1.1 Introduction

There was overall support in principle for a national curriculum in science and the opportunities it could provide to enhance the teaching and learning of science for all students across K–10. However, there were significant concerns raised in relation to the structure and quality of the draft Australian science curriculum. The level of detail of K–6 content was identified as a strength compared to the current NSW *K–6 Science and Technology Syllabus* (1991) but without referring to the content elaborations, the depth and scope required was unclear. A significant concern expressed by stakeholders was the amount of science content in K–6 in relation to the time available and the implications this has for addressing NSW K–6 Technology education requirements.

1.2 Key matters

- The rationale is inconsistent with the intent of the aims. The intent of the rationale and aims is not reflected in the curriculum.
- The term 'scientific literacy' is not defined and there is no clear link to how the term is related to the aims.
- The organisational framework does not provide a coherent conceptual development of science understanding. It does not integrate the three strands or show clearly how science inquiry is embedded in the strands.
- The content descriptions are not of sufficient specificity to support teaching. There are significant inconsistencies in the sequencing of content across K–10. Overall there is too much content in each year. There are concerns relating to the differences in the level of difficulty between Years 6 and 7 and in the content density and cognitive demand of the Science Understanding content in Years 9 and 10.
- The achievement standards do not provide a clear picture of the depth of understanding, extent of knowledge and sophistication of skills that is required to make consistent judgements about the quality of learning for assessment and reporting. They are at too high a level and do not align with a C level on the reporting framework.
- The organisation of the Science Understanding content as traditional science topics and by Year reduces the flexibility to cater for the needs of the range of students.
- The scope of the general capabilities and cross-curriculum dimensions is unclear and their development in the curriculum is limited.

1.3 Recommendations to ACARA

- Revise the rationale to clearly establish the nature of science as a discipline and the purpose of science education for all K–10 students. Make this intent consistent with the aims.
- Clarify the term 'scientific literacy' and firmly embed this intent across the K–10 science curriculum.
- Revise the overall organisation of the curriculum to provide a structure that will enable a coherent K–10 development of science understanding and science inquiry.
- Reduce the amount of Science Understanding content to provide flexibility for the content to be made engaging and relevant to the range of students' needs and interests. It is

suggested that the Science Understanding content be developed by two-year phases (stages) consistent with the other two strands.

- Base the content sequencing on a cognitive development framework that takes into account the research base of students' learning in science. The curriculum design should not be driven by alignment to a single resource.
- Revise the sequencing to show a coherent conceptual development of scientific understanding appropriate for the range of students' cognitive development by the end of Year 10.
- Show explicitly the integration of the content in the three strands in each year to reduce overcrowding of the curriculum.
- Revise the specificity of the wording of the content descriptions to clarify the overall scope and intent.
- Revise the achievement standards so that in each year the scope of the content is consistent with the content descriptions and is at a level that is able to be aligned with a C level for reporting. Remove references to content included from the elaborations and examples. Develop a clear continuum for the staged content that is not dependent on subjective qualifying terms and that shows the scope of content in each year.
- Address the overall amount and the cognitive demand of the content to provide a curriculum that balances the provision of a foundation for senior secondary science with science learning that prepares students to use science for active citizenship and to function effectively in society.
- Undertake further work to clarify the scope of the general capabilities and cross-curriculum dimensions so that they can be meaningfully embedded in the science curriculum.

2 Background Information

The Australian Curriculum, Assessment and Reporting Authority (ACARA) released the draft K–10 curriculum for the four Phase 1 learning areas on 1 March 2010. The curriculum for English, mathematics, science and history was released in electronic format on a consultation portal for a period concluding 23 May 2010. The consultation portal allowed for response to an online survey as well as opportunities for specific feedback regarding individual content statements. During the consultation period ACARA conducted a trial of materials with 150 schools (25 in NSW), general forums in each state (including a stakeholder meeting on 25 March at the Wesley Centre), and subject-specific national meetings held in Sydney in April.

ACARA has an established timeline that includes further curriculum refinement to follow the consultation period with the release of the final curriculum in September 2010.

The NSW Minister for Education and Training has asked the Board of Studies to lead consultation in NSW in order to provide advice about the quality and suitability of the curriculum for NSW schools.

Consequently the Board of Studies conducted a coordinated set of consultation activities to engage teachers and stakeholders and to seek their feedback. The consultation program consisted of a curriculum mapping activity, teacher meetings in regional and metropolitan venues, videoconferences, subject area stakeholder meetings, and a series of stakeholder meetings that focused on whole-school issues and the implications for assessment, reporting and certification.

The NSW science consultation consisted of:

- curriculum mapping undertaken by three expert practitioners in the learning area on 2 and 3 March
- full-day stakeholder meeting held at Office of the Board of Studies 15 March 2010
- a video conference targeting teachers on 10 March 2010
- afternoon meetings with teachers at
  - Hay on 8 March
  - Ballina on 16 March
  - North Sydney on 18 March
  - St George on 22 March
- an online survey on the Board of Studies website for the period 8 March to 30 April 2010.

Professional associations and schooling sectors conducted a range of activities during the consultation period to inform feedback to the Board.

3 Summary of Respondents

3.1 Consultation at teacher and stakeholder meetings

6 teacher and stakeholder meetings

Stakeholders	26	Teachers	241

3.2 Online survey respondents

81 online survey responses

Years of schooling:

Kindergarten to year 6	8	Years 7 to 10	73

Sector:

Government	29	Independent	31	Catholic	16
Other	5				

Response from:

Parent	4	Principal	2	School Executive	16
Student	9	Teacher	43	Other	7

Number of people contributing to the response:

1	62	2	6	3	2
4	3	5	2	6 or more	6

4 Summary of Key Matters Raised

Key matters raised for Science arising from consultation
Rationale and Aims • The wording and intent of the rationale and aims are not consistent. • The term 'scientific literacy' and its intent in the curriculum require clarification. • The rationale does not make explicit the purpose of science education in the school curriculum and the reasons students should engage in science learning.
Organisation of the content • The interrelationship of the strands is not explicit. • The organisational framework based on the unifying ideas is not effective as a developmental sequence or in integrating the strands or content into a coherent science curriculum. • Equal importance will not be given to all strands with organisation of the Science Understanding strand by Year but the Science Inquiry Skills and Science as Human Endeavour strands by stages. • It is unclear how science inquiry is central to and embedded in all strands. • The high level of alignment in the curriculum organisation to a single resource is of significant pedagogical concern.
Content descriptions • The clarity, language and level of specificity of the content descriptions are insufficient to support teaching and assessment. • The Science Understanding (SU) content is organised by traditional science topics. With the large amount of SU content, equal emphasis will not be given to the Science Inquiry Skill (SIS) and Science as a Human Endeavour (SHE) strand content. • There is too much content to be covered in the time allocated by schools. The amount of SU content reduces the flexibility to contextualise teaching so that the content is relevant and engaging for students. • The development of the SU content for each year and the lack of clear and explicit integration of the content across the strands in each year have further increased the content overload. • There is no clear overview of science concepts/ideas within a Year or a development of these across Years. • Significant concerns were raised in relation to a range of inconsistencies in the sequencing of content. For example, Year 5 covers microorganisms (S5SU1) and Year 7 covers reproduction (S7SU2), but cells are not covered until Year 8 (S8SU1). Heat energy is not in K–6 but is needed for understanding of changing materials in Year 6 (S6SU4). The Periodic Table is in Year 10 (S10SU8) but properties and grouping of matter are addressed in Year 9 (S9SU9). • The difference in the level of difficulty of the SU content between Year 6 and Year 7 is of concern. • The content density and cognitive demand of the Year 9 and Year 10 is a significant issue.

Key matters raised for Science arising from consultation
Achievement standards • The achievement standards are at too high a level. They do not align with a C level on the reporting framework. • There are inconsistencies between the content descriptors and the achievement standards and some content from the elaborations has been included. For example, Year 4 'protecting animal habitats', Years 7–10 many examples listed such as 'lifestyle issues' (Year 7), 'comparing cells', 'comparing physical and chemical properties' (Year 8), 'environmental monitoring' (Year 9), 'genetic engineering' (Year 10). • The use of subjective qualifying terms and only some skills in each year do not overcome the difficulty of providing a clear continuum for the staged content. • The achievement standards do not provide clearly the depth of understanding, extent of knowledge and sophistication of skills that are required to make consistent judgements about the quality of learning for assessment and reporting.
Full range of students • The content descriptions do not give sufficient guidance to cater for the range of students. • The amount of content overall and the level of difficulty of the Science Understanding content do not provide a curriculum that appropriately balances relevant science learning for all students to use for active citizenship and in the provision of a foundation for senior secondary science. • Provision has not been made for students who study Life Skills courses.
General capabilities and cross-curriculum perspectives • These are limited in scope and require further development within a curriculum framework that can be applied across all learning areas. • The Indigenous dimension is tokenistic in nature. • ICT general capability is lacking and tokenistic and should be mapped for consistency in each Year/stage across the curriculum.

5 Analysis

5.1 Rationale

Overall Comments

Respondents identified that the rationale lists the content of the science curriculum. It does not make explicit the nature of science, the purpose of science in the K–10 curriculum or why all students should engage in science learning. The rationale does not capture what is intended in the curriculum by science inquiry or how it is at the centre of teaching and learning. The relationship between science inquiry and the Science Inquiry Skills strand is unclear.

Summary of feedback	Source/s
• The rationale summarises what is included in the strands.	Stakeholder BCC
• The rationale describes the three strands but does not make explicit their interrelationships • It does not present a coherent view of the nature of science in the K–10 curriculum.	Stakeholder, TF AHISA BCC, USyESW
• The view presented of science as ‘a reliable basis for action’ is narrow and should be complemented by the recognition of the uncertainty and complexity of science knowledge.	Stakeholder
• The rationale statement that refers to scientific literacy is inadequate. The draft Australian curriculum should include a definition or description of what is intended by scientific literacy. This should be explicit in the rationale statements relating to the purpose of science in the curriculum and why students should engage in science learning in K–10. • Scientific literacy as defined by the curriculum should be consistent with the aims and this intent should be firmly embedded throughout the content of the curriculum.	Stakeholder Teacher meeting (1) BCC, DET, IEU, USyESW
• The statements relating to what science education is in the K–10 curriculum, the relationship to science inquiry and the purpose of science in the curriculum require extending and strengthening.	Stakeholder TF
• Chemistry and the chemical world are not represented in the rationale. Earth Science is only mentioned in relation to the Science Understanding strand. • In science the sub-disciplines of cosmology and astronomy deal with space. The use of the term ‘earth and space science’ is questioned.	Stakeholder AHISA IEU

Summary of feedback	Source/s
• The language of the rationale is disjointed and lacks coherence; for example, the second sentence of the second paragraph. The fourth paragraph lists the three strands but provides no information to show how they are linked in the curriculum. • The rationale does not articulate the purpose of an Australian curriculum in science. • The rationale does not show a clear relationship to the aims. • It does not include a sense of the student or the range of students.	Stakeholder TF
• The rationale is not consistent with the content descriptions.	Stakeholder Teacher meeting (1)

5.2 Aims

Overall Comments
Respondents commented that there is no clear link between the rationale and the aims. The terminology used in the aims is inconsistent with that of the rationale. The intent of the aims is not followed through in the curriculum.

Summary of feedback	Source/s
• The aims statements provide the general intent and expectations of a science curriculum.	Stakeholder
• The rationale is not consistent with the intent of the aims.	Stakeholder
• The basis for the distinction between experiment and investigation is unclear and requires clarification.	Stakeholder BCC
• The absence of a clear reference to values in the aims is a concern.	Stakeholder
• The inclusion of the statement 'respecting alternative viewpoints and beliefs' needs to be removed as it has no place in a science curriculum. It is inconsistent with the intent of the aim statement in which it is included.	Stakeholder
• The relationship between culture and the developments in science needs to be explicit.	Stakeholder USyESW
• A solid foundation in knowledge and understanding of chemical science is not included. Clarification of the use of the term 'space science' is required.	Stakeholder AHISA
• The aims and the rationale do not mention sustainability. 'Commitment to sustainable living' is one of the three cross-curriculum dimensions to which science would be central in contributing understanding.	Stakeholder IEU

5.3 Organisation of Content

Overall Comments

Teachers and stakeholders commented strongly on the difficulty of the organisation of the curriculum into three strands and the lack of clarity on the relationship between the strands. They indicated that it is unclear how science inquiry is central to all strands and how the general capabilities and cross-curriculum dimensions are embedded in the curriculum. Concerns were raised in relation to the Science Understanding strand being developed by Year while the other two strands are developed by two-Year phases (stages). The unifying ideas were not seen as effective organisers for a developmental sequence or in drawing the strands or content together into a coherent science curriculum.

Summary of feedback	Source/s
• The potential for the development of a genuine K–10 continuum would enhance learning in science and greater dialogue between primary and secondary teachers.	Stakeholders
• Organisation into three strands is problematic. • The organisation section does not make clear how the unifying ideas integrate the strands. They appear to represent another layer in the curriculum.	Stakeholder Teacher meeting (1) BCC, CEC, DET, AHISA, IEU, TF USyESW, IISME
• The authenticity of unifying ideas in Years 7–10 was questioned. They differ in their nature from those in K–6 and appear to be an artificial construct. The suggested development sequence provided by the unifying ideas is not evident in the K–10 curriculum design and is not explicit in the content.	Stakeholder IEU, IISME
• The unifying ideas in K–6 are identical to those that are provided in the scope and sequence for the *Primary Connections* units produced by the Academy of Science. This strong alignment to a single resource was raised philosophically as a concern as a curriculum development approach. • Alignment of the sequencing and content of part or all of the curriculum to specific resources was identified as a major backward step in science pedagogy.	Stakeholder Teacher meetings (2) BCC, USyESW
• There is no overview statement of what is intended in the Australian curriculum by each of the general capabilities and cross-curriculum dimensions. Without this background the links to the content have limited meaning.	Stakeholder USyESW TF
• It is not explicit how science inquiry is intended to be encompassed by all the strands. The relationship between science inquiry as the learning approach and the Science Inquiry Skills strand needs to be clarified.	Stakeholder Teacher meeting (1) CEC, AHISA, USyESW, TF

Summary of feedback	Source/s
• The organisation of the SU content by Year reduces the flexibility for delivery of the curriculum in vertical groupings, and in small schools	Stakeholders Teacher meeting (5), IEU, DET, USyESW, TF
• How the SHE strand content is to be addressed over a stage is unclear (eg all content in every Year or once across the stage).	DET
• The lack of clarity in the wording of the content strand descriptors was raised. Examples from each of the strands include: *Science Inquiry Skills (SIS)* – The use of the word 'critique' in relation to science investigations: specifically and generally its appropriateness in relation to science. – The aims suggest a distinction between 'experiments' and 'investigations': this is not included in the descriptors. *Science as a Human Endeavour (SHE)* – The view of science in relation to the uncertainty of scientific knowledge is limited. – There is a mismatch between the strand descriptor and the aims. The descriptor recognises the impact of society on science but this is not in the aims. – Content from other cultures that is not related to science understanding should not be included in a science curriculum. – The apparent absence of an explicit statement relating to values was identified as a concern. The use of the terms 'moral, ethical and social implications' as implying values was questioned. *Science Understanding (SU)* – The wording 'facts and concepts' is confusing, as these should be integrated. The scientific meaning of 'theory' is not explicit. – This strand should make explicit the nature of science and the uncertainty of scientific knowledge, and should relate explicitly to any description in the aims.	Stakeholder Teacher meeting (1) DET, AHISA, USyESW, IISME , TF

5.4 Content Descriptions

Overall Comments

Respondents supported the view that the content descriptions could generally be considered to represent essential learning for science. However, this was qualified by comments that the Science Understanding (SU) content consisted of traditional science topics that do not emphasis the essential concepts. This structure does not provide flexibility to contextualise teaching so that the content is relevant, engaging and extends students' learning. Without clarification of depth in the content descriptions and explicit integration of the strand content there would not be equal emphasis given to the content of the Science Inquiry Skill (SIS) and Science as a Human Endeavour (SHE) strands. The lack of clear and explicit integration of the content across the strands further increases the content overload. There is no clear overview of science concepts/ideas within a Year or a development of these across Years. Significant concerns were raised in relation to a range of inconsistencies in the sequencing of content. The level of difficulty of the SU content, particularly in Year 7 and Year 10, was a significant issue. Respondents indicated that there was not appropriate specificity in the content descriptions to support teaching and assessment.

Summary of feedback	Source/s
• The content is similar to that already covered across K–10. The K–6 content provides support and direction and the language is user-friendly for K–6 teachers.	Stakeholder Teacher meeting (2)
• The curriculum is overcrowded. • There is too much content. It cannot be addressed in the current time allocated by schools.	Stakeholder Teacher meeting (5) BCC, AHISA, IEU, DET, IISME, TF USyESW, STANSW
• There is a lack of any clear integration of the content between the strands across a year.	Stakeholder Teacher meeting (5) CEC, DET, IEU, IISME, USyESW, STANSW, TF
• Science Understanding content would provide greater flexibility if it were in stages like the SIS and SHE content.	Teacher meeting (5) BCC, DET, USyESW, TF
• The amount of content will mean that the emphasis on inquiry-based learning (including practical investigations) will be lost. • The Science Inquiry Skill (SIS) content: – will not receive the same emphasis as SU – is at a low level compared to SU content – lacks a clear K–10 continuum – has inconsistencies in sequencing and numbering.	Stakeholder Teacher meeting (1) AHISA, TF Teacher meeting (4) BCC, DET, IEU. STANSW

Summary of feedback	Source/s
• There is no clear overview of science understanding in a year. • There is no coherent progression/development of science concepts/ideas across the curriculum.	Stakeholder Teacher meeting (2), DET, TF IISME, USyESW, STANSW
• The Science Understanding content is organised by traditional science topics. It is not what excites and engages students. It is a list of topics covering scientific facts that is often repetitive (eg content including properties and uses of materials is covered in Years 4, 7 and 8; causes of day, night and a year is covered in Years 3, 5 and 7), with little opportunity for students to engage in meaningful and/or current inquiry, eg simple machines (S8SU7). • The lack of clarity of the language/wording results in ambiguity in the level of demand of the concept intended by the content descriptions. It also increases the appearance of repetition. • The purpose of examples and 'such as' in some content descriptions requires clarification. • The Science Understanding content is not science for living/citizens.	Stakeholder Teacher meeting (2) BCC, CEC, DET, AHISA, IEU USyESW , TF
• The Science as a Human Endeavour (SHE) strand content will not receive the same emphasis as SU. • Contemporary issues change with time and the curriculum should be flexible enough to be able to incorporate current science. • There is a lack of a clear K–10 continuum, and there are inconsistencies in sequencing and numbering. • The scope and sequencing of this strand were raised as concerns. Examples included: – the history of science is missing/needs to be strengthened across K–10 – the nature of the discipline of science is not clear – the emphasis on science and engineering careers is too high and not relevant to non-academic users of science.	Stakeholder Teacher meeting (4) BCC, DET, AHISA IEU, USyESW, TF
• The level of difficulty of the content should be appropriate for the cognitive development of the typical student and give time for the range of students to develop depth of understanding (eg light (S3SU5); the symbolic equations found in physics and chemistry (S10SU6 and 9) currently sit in Year 11 and 12 courses).	Stakeholder Teacher meeting (2) DET, AHISA, TF USyESW, STANSW
• No consideration has been given in the curriculum design to meeting the needs of students who study Life Skills courses.	Stakeholder IEU

Summary of feedback	Source/s
• The language and clarity of the content descriptions are not specific enough to provide a clear indication of the required scope and/or depth (eg light (S3SU5), 'simple report' (S3/4SIS7), 'different cultural groups have different perspectives on science' (S7/8SHE5), matter and energy (S10SU7). • There are content descriptions where the wording and/or intent are unclear (eg Matter and Energy (S10SU7)) or incorrect (eg 'energy is wasted' (S7SU6)). • Some key concepts are not articulated, eg kinetic theory and field theory.	Stakeholders Teacher meeting (4) DET, AHISA IEU, IISME, USyESW, STANSW
• There are significant inconsistencies and repetition in the sequencing of the content across K–10. • There is variation in the wording and clarity of the content descriptions within and across strands and Years which will result in variations in interpretation. • The sequencing in places does not match students' cognitive development. Examples include: Year 1 students are required to make inferences (S1SIS1), yet have little or no background knowledge. Year 3/4 students are required to identify patterns and trends (S3/4SIS6) but are not required to use graphs or tables until Year 7/8 to assist. Year 5 cover transfer and transformations of energy without being introduced to the concept of energy, its types and uses; Years 7 and 8 students have difficulty with this. • The content in Year 7 has a flow-on effect for the amount and level of difficulty of content in Years 8–10. • The content descriptions relating to chemical science and the sequencing of this content were identified as needing major review and revision.	Stakeholders, TF Teacher meeting (4) BCC, DET, IEU, USyESW, STANSW
• The level of difficulty in Year 7 does not show a progression from that in Years 5/6, eg Years 7/8 are not required to plan investigations (S7/8SIS2), yet Years 5/6 are (S5/6SIS2). Years 5/6 students evaluate evidence (S5/6SIS9), but Years 7/8 students only reflect on methods to identify alternatives (S7/8SIS9). • The sequencing of content relating to the human body, cells and reproduction is inappropriate.	Teacher meeting (3) IEU, IISME, USyESW
• The amount of content and level of cognitive demand means that only the top students will continue with science in the senior years. • The cognitive demand of the Years 9 and 10 Science Understanding (SU) content is too high. • The Year 10 SU includes some content that is currently taught in Senior Years where it is appropriate for the students' level	Stakeholder Teacher meeting (2) Stakeholder Teacher meeting (3) BCC, AHISA, TF IEU, USyESW

Summary of feedback	Source/s
of cognitive development (eg genetics, symbolic equations, describing force, motion and conservation of energy quantitatively). • The theoretical nature and cognitive demand of the Year 10 SU content raised concerns relating to: – how it can be integrated with the content of the other strands – the limited emphasis that will be given to the SIS and SHE content.	
• The amount of Earth Science content appears very high. • The wording and lack of focus on science concepts in the Earth Science content appears to create a significant overlap with Geography. Examples include KSU2, 7SU4, 8SU3 and 10SU5 relating to environment, ecosystems and Earth Science respectively.	Teacher meeting (1) Teacher meeting (4) BCC, AHISA
• There should be flexibility to extend the better students. • The amount of content and the curriculum structure have implications for contextualising learning, inclusion of electives and school-based courses.	Teacher meeting (1), TF Stakeholder Teacher meeting (2)

Online survey data

- The content descriptions focus on the essential learning for the subject.

Strongly Disagree	Disagree	Agree	Strongly Agree
8	16	27	7
13.8%	27.6%	46.6%	12.0%

- The sequence of content is logical and appropriate to the students' stage of development.

Strongly Disagree	Disagree	Agree	Strongly Agree
14	19	23	2
24.1%	32.8%	39.7%	3.4%

- The descriptions of content are specific enough to support teaching.

Strongly Disagree	Disagree	Agree	Strongly Agree
13	23	18	2
23.2%	41.1%	32.1%	3.6%

5.5 Achievement Standards

Overall Comments

Respondents commented strongly that the achievement standards do not give a clear picture of the depth of understanding, extent of knowledge and sophistication of skills that are required to make consistent judgements about the quality of learning for assessment and reporting. The standards describe a level that would not be achievable by most students. A well-developed continuum in the content descriptions in the SIS and SHE strands, where the content is staged, is required for the achievement standards to describe the quality of learning in each year.

Summary of feedback	Source/s
• With revision, a set of achievement standards would be a useful tool for teachers.	Stakeholder
• The achievement standards do not clearly present an appropriate standard of the depth of knowledge or sophistication of skills. Their intent is not reflected. • The achievement standards are not sufficiently clear for assessment or differentiating the curriculum.	Stakeholder Teacher meeting (2) BCC, IEU, TF
• The level of the achievement standards is set too high. They are not at C level on the reporting framework. • They represent what might be expected of the top performing students, not the typical student.	Teacher meeting (4) BCC, DET, TF STANSW
• There are inconsistencies between content descriptions and achievement standards in a number of Years. (eg Year 10 achievement standards identify 'with guidance', but this is not stated in the content description). • The inclusion of examples as a means of clarifying the content descriptions and relating specific content to the SU and SHE strands was raised as a concern.	Teacher meeting (1) Stakeholder
• The difficulty of achievement standards for each Year when the content in the SIS and SHE strands is staged was raised as needing further work. Examples illustrating concerns include: – the use of subjective qualifying terms (eg 'basic understanding of/understand that', 'begin to', 'routinely record', 'with minimal guidance') as a means of showing a progression within a stage – the SIS content is split between the Years in a stage rather than being included in both Years – The inclusion of examples as a means of relating specific SU content for a year to the staged SHE content.	Stakeholder Teacher (1), DET

Summary of feedback	Source/s
• The achievement standards for a number of Years includes content from the content elaborations, which are examples only and not mandatory.	Stakeholder Teacher meeting (1) DET, IEU
• Concern was raised in relation to student progress to the next Year if the achievement standard is not reached.	BCC
• To be effective for assessing and reporting there would need to be separate achievement standards or band descriptors, eg A–E statements.	Teacher meeting (4) BCC
• Life Skills achievement standards should also be included.	Stakeholder Teacher meeting (1)

Online survey data

- The standards for each year of schooling represent an appropriate level of achievement.

Strongly Disagree	Disagree	Agree	Strongly Agree
11	16	23	3
20.8%	30.2%	43.4%	5.6%

- The standards form a sound basis for guiding assessment and reporting.

Strongly Disagree	Disagree	Agree	Strongly Agree
14	16	21	2
26.4%	30.2%	39.6%	3.8%

5.6 Catering for the full range of students

Overall Comments

Respondents identified that the Science Understanding (SU) content is traditional science and is not that which excites and engages students. The amount and the level of difficulty of the SU content target the top students. The curriculum design has not balanced science learning that will prepare all students for citizenship, with providing a foundation for senior secondary science. The SU content overload reduces the time and flexibility for teachers to contextualise learning and to actively engage students in inquiry-based learning. Life Skills should be part of the curriculum design, not an add-on.

Summary of feedback	Source/s
• The content descriptions do not provide sufficient clarity to determine the depth required and how this can be addressed to meet the needs of the range of students.	Stakeholder Teacher meeting (1) STANSW, TF
• The curriculum is overloaded with SU content. There needs to be a reduction in this content to provide sufficient time and flexibility to include content that is relevant to the range of students.	Stakeholder Teacher meeting (3) IEU, TF
• The amount and level of difficulty of the content mean that by Year 10 fewer/only the top students will continue with science to senior years.	Stakeholder Teacher (1)
• To cater for the needs of the range of students the sequencing of the content should take into account the cognitive load of the science concepts/ideas and students' cognitive development.	Stakeholder IEU
• No consideration has been given in the curriculum design to include the scope to meet the needs of students who study Life Skills courses.	Stakeholder IEU

5.7 General capabilities and cross-curriculum dimensions

Overall Comments

Teachers and stakeholders identified that in their current form the general capabilities and cross-curriculum dimensions are very limited in their scope and level of development. Without an overview statement of the intent in the Australian curriculum for each general capability and cross-curriculum dimension, the relevance of the examples and the basis for their inclusion in the science curriculum is unclear.

Summary of feedback	Source/s
• Well-developed general capabilities would provide the potential for K–6 teachers to genuinely integrate content across KLAs.	Stakeholder
• There is a lack of guidance on cross-curriculum dimensions. • Cross-curriculum emphasis is poorly addressed.	Teacher meeting (1) STANSW, TF
• In a science curriculum it should be explicit that content from other cultures is that which relates to science understanding.	Teacher meeting (1)
• Concerns were raised about the tokenistic nature of the Aboriginal and Torres Strait Islander dimension in the science curriculum. • The descriptors in the Organisation section recognise that Aboriginal and Torres Strait Islanders have contributed knowledge and understanding that is integrated into science. However the content descriptions are not explicit in relation to Indigenous peoples. The scope of content relies on the examples in the content elaborations. • It is noted that the Intercultural general capability, and Indigenous and Asia and Pacific dimensions are related to exactly the same content descriptions.	Stakeholder Teacher meeting (1) DET, USyESW
• Numeracy and literacy demands of the content need to be appropriate for each Year.	Teacher meeting (1) DET, USyESW
• The links and references to ‘using ICT skills where appropriate’ are lacking, tokenistic or difficult to relate to the digital revolution.	Teacher meeting (3)

Summary of feedback	Source/s
• The scope of the description of literacy in the introduction is limited and this impacts on what is identified as literacy in the content descriptions. • The statement lacks clarity. It does not make explicit the connections between science and literacy. The explicit literacy requirements of science are not evident. • The science-specific language required to respond to and compose science texts should be included. • Oral interaction in learning is not evident in Years 9 and 10.	Stakeholder DET
• There does not appear to be a cognitive framework or clear continuum for the development of general capabilities across K–10 science, eg thinking skills, creativity.	Stakeholder STANSW
• A mapping across the four curricula is necessary to show that the literacy, numeracy and ICT standards in each Year/stage are consistent. • A curriculum framework for the general capabilities and cross-curriculum dimensions is required so that these can be appropriately and meaningfully addressed in the teaching within all learning areas.	Stakeholder USyESW BCC

Online survey data

- There is appropriate emphasis given to the general capabilities and cross-curriculum dimensions in the content descriptions.

Strongly Disagree	Disagree	Agree	Strongly Agree
9	21	20	3
17.0%	39.6%	37.7%	5.7%

- The general capabilities and cross-curriculum dimensions are represented in authentic ways.

Strongly Disagree	Disagree	Agree	Strongly Agree
13	15	23	2
24.5%	28.3%	43.4%	3.8%

5.8 Other comments

Teachers' and stakeholders' concerns included the need for a realistic, staged implementation timeline with ongoing quality curriculum and professional learning support. The narrow research base underpinning the science curriculum design was a significant concern for stakeholders.

Summary of feedback	Source/s
• The online format with the content for a Year on a single page was identified as a good model. The concept of a readily accessible interactive site and potential for filtering would be helpful for programming.	Stakeholder USyESW
• Implementation across K–10 needs to be well planned, staged and supported with quality syllabus materials and resources and ongoing professional learning. • The timeline for implementation must be realistic and take into account the competing priorities teachers must address. • The time allocated in K–6 to address the science curriculum and the requirements of Technology education needs to be considered in planning the implementation.	Teacher meeting (5) Stakeholder, TF AHISA IEU USyESW
• Stakeholders raised concerns that the research base for the curriculum appears to be very narrow. The issues raised in relation to the rationale, organisation of the content, the content overload, relating sequencing to students' cognitive development, are all well researched. This research base is not evident in the curriculum design and content development.	Stakeholder
• Concerns were raised that in K–6 *Primary Connections* would become the de facto curriculum. The sequencing of the K–6 topics has been explicitly aligned with the *Primary Connections* units. The curriculum identifies only one teaching/learning model, and it is one that aligns with this resource.	Stakeholders Teacher meeting (1)
• There is an emphasis on teacher- or textbook-driven learning rather than a focus on inquiry-based student-centred learning. • The large amount of, and traditional nature of the Science Understanding (SU) content will focus learning on a transmission model.	Stakeholders, TF Teacher meeting (2)
• The level of understanding described in the Year 10 content description, achievement standards and content elaborations raised concerns about what would be expected in Years 11 and 12.	Stakeholders

Summary of feedback	Source/s
• The implications for School Certificate and national testing of the lack of clarity of the content descriptions and achievement standards.	Teacher meeting (2)
• For the K–10 science continuum to be effective, ongoing professional learning support is needed that includes: – K–10 support for teaching SHE – science content knowledge, teaching through science inquiry and assessment support for K–6 teachers.	Stakeholders Teacher meeting (3) IEU, IISME, STANSW
• In the content elaborations there are inaccuracies (eg Kilogram is described as a derived unit in Year 5 (S5SIS5). In Year 9 the topic Radiation (S9SU6) focuses on EMR, then cites solar radiation). • Many are not age-appropriate and show a level of cognitive demand that is not consistent with the content descriptions (eg Year 4 cover forces acting at a distance (S4SU5) yet Year 7 students rarely understand this. Content covered in Years 9 and 10 such as disease (S9SU2), DNA (S10SU2), genetics (S10SU3), characteristics of the Australian continent (S10SU5) and the symbolic equations found in physics and chemistry (S10SU6 and 9) currently sit in HSC courses because of their complexity).	Stakeholder Teacher meeting (1) DET
Years 10 to 11 transition • In general terms the SU content across Years 7 to 10 includes the underpinning knowledge for all the Year 11 Senior Years science courses. Revision of the sequencing of some content is required to better address the transition into Year 11. • The cognitive demand of the Years 9 and 10 SU content is at a level that is achievable by only the top students and this follows through into the Year 11 content. The cognitive demand is of concern in all courses. • There is overlap with the Year 10 content in the Year 11 units. The Year 11 units assume that content from the elaborations has been addressed in Year 10. • In the Year 11 units there is overall too much content. In all the Year 11 courses the relevance and cognitive demand of the content is not appropriate for the range of students. • The organisers within the SIS and SHE strands in all courses in Year 11 suggest a K–11 continuum. However the amount of content, its complexity and specificity within these strands in the Year 11 units in all courses are of significant concern. There is a lack of clarity in the Year 11 SIS and SHE content in relation to how these build a K–11 continuum.	BCC

6 Respondents

6.1 Responses from individuals and groups

Responses were received from the following groups:

- Association of Heads of Independent Schools of Australia, NSW (AHISA)
- Catholic Education Commission NSW (CEC)
- Department of Education and Training (DET)
- Institute for Innovation in Science and Mathematics Education (IISME)
- NSW/ACT Independent Education Union (IEU)
- NSW Teachers Federation (TF)
- University of Sydney Faculty of Education and Social Work (USyESW)

6.2 Stakeholder meeting at the Board of Studies on 15 March 2010

Name	Organisation
Wendy Abernathy	Independent Primary School Heads Association of Australia
Elizabeth-Anne Banfield	NSW/ACT Independent Education Union
Stephen Bloomfield	NSW Primary Principals' Association
Garry Brown	Association of Heads of Independent Schools of Australia NSW
Rose Cantali	NSW Parents Council
Wayne Chaffey	NSW Secondary Principals' Council
Rick Connor	University of Sydney
Steve Connelly	NSW Primary Principals' Association
David Giblin	Federation of Parents and Citizens' Associations of NSW
Julie Greenhalgh	Association of Heads of Independent Schools of Australia NSW
Terry Lyons	Committee of Chairs of Academic Boards
Meredith Martin	Special Education Committee
Sue Millar	Association of Independent Schools of NSW
Judith Morgan	NSW Vice-Chancellors' Committee
Mike Morgan	NSW Teachers Federation
Karen Morton	NSW Teachers Federation
Samantha Nicol	Professional Teachers' Council
Pauline Ross	Committee of Chairs of Academic Boards

Glen Sawle	NSW Department of Education and Training
Margaret Shepherd	Catholic Education Commission
Damian Sligar	NSW/ACT Independent Education Union
Nicole Sprainger	Catholic Education Commission
Patricia Stockbridge	Professional Teacher's Council; Science Teachers' Association of NSW
Louise Sutherland	University of Sydney
Harris Vassila	NSW Department of Education and Training

6.3 Teacher meetings

Venue	Date	K–6	Years 7–10	Unspecified	Total
War Memorial High School Hay	8 March	3	25		**28**
Ballina Comfort Inn	16 March	11	15		**26**
North Sydney Anzac Memorial Club	18 March	26	72		**98**
St George Leagues Club	22 March	16	63		**79**
K–6 video conference to Drummond Memorial Public School	10 March	10			**10**

Other Reponses	Organisation
Stakeholders (includes comments from 9 Science discipline-specific academics)	UNSW, UTS, USyd, UOW, UWS, Macquarie University
Teacher Meetings (includes comments from individual school submissions)	Cranbrook School The Scots School, Bathurst and Lithgow Shore School