Science

Directions for Syllabus Development

Consultation Report

October 2014

Phone: (02) 9367 8289
Fax: (02) 9279 1482
Email: mila.buraga@bostes.nsw.edu.au

Published by
Board of Studies, Teaching and Educational Standards NSW
GPO Box 5300
Sydney NSW 2001
Australia

www.bostes.nsw.edu.au

20140755

Contents

1 Background information

The Board of Studies, Teaching and Educational Standards NSW (BOSTES) began its syllabus development process for Stage 6 Science following state and territory education ministers' endorsement of the senior secondary Australian curriculum for English, Mathematics, Science and History as the agreed and common base for development of state and territory senior secondary courses. BOSTES has determined that there will be a need to modify, reorder and supplement the Australian curriculum content in order to maintain the breadth and current high standards of NSW curriculum.

In NSW, BOSTES develops syllabuses approved by the Minister for Education for use by all NSW schools. As part of the syllabus development process of BOSTES, broad directions are proposed to inform future development of syllabuses.

BOSTES conducted consultation from 11 August to 21 September 2014 to engage stakeholders and to seek their feedback on the proposed directions for the senior Science syllabuses. The consultation program consisted of:

- a meeting of the Years 11–12 Science Board Curriculum Committee on 1 September 2014
- afternoon teacher meetings at
    - Liverpool Catholic Club on 26 August 2014
    - Wagga Wagga RSL on 28 August 2014
- a targeted teacher meeting to review the Life Skills syllabuses at BOSTES on 8 September 2014
- an online survey on the BOSTES website for the period 11 August to 21 September 2014
- written submissions from
    - Association of Independent Schools of NSW
    - Catholic Education Office, Archdiocese of Sydney
    - Catholic Education Office, Diocese of Wollongong
    - NSW Department of Education and Communities
    - NSW Teachers Federation
    - Science Teachers Association of NSW
    - University of Sydney, Faculty of Education and Social Work
    - University of Technology Sydney, School of Chemistry and Forensic Science
    - Gosford High School, Gosford
    - Holy Spirit College, Bellambi
    - St Benedict's Catholic College, Oran Park
    - St Joseph's Catholic High School, Albion Park
    - St Patrick's College, Campbelltown
    - Mr Wayne Chaffey
    - Ms Geraldine Gray, State Coordinator, Special Learning Needs, CEC NSW
    - Assistant Professor Bree Jimenez, School of Education, University of North Carolina
    - Mr Jon Keeble, Founder and Chief Technical Officer, Wattwatchers
    - Mr Andrew McCredie, Manager, Innovation, Innovation Trade and Investment Branch, Treasury and Economic Development Directorate, ACT Government
    - Mr John Philips, Manager Education Projects, the Warren Centre for Advanced Engineering
    - Mr Michael Saxon, Principal, Liverpool Boys High School
    - Ms Jennifer Solomon, Danebank Anglican School for Girls, Hurstville
    - Mr Jeff Stranger, Head Teacher Science, St George Girls High School

    - Ms Margaret Watts
- a meeting of the BOSTES Student Advisory Group on 28 August 2014. Due to the diverse range of subjects studied by members of this group, the meeting focused more broadly on the Higher School Certificate.

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

2 Executive summary

Introduction
The *Science Directions for Syllabus Development Consultation Report* ('Consultation Report') provides a description of the consultation process and a summary and analysis of feedback received. The Consultation Report includes feedback affirming the proposed directions, key matters raised and proposed actions for syllabus development.

The Consultation Report presents data and findings gathered through 121 survey responses, 23 written submissions, a Board Curriculum Committee meeting and three teacher consultation meetings.

There was general agreement with the need for revision of all Stage 6 Science syllabuses and with consideration of providing experiences that further extend students as well as designing courses accessible to a greater number of students. While well supported, further analysis and clarification was sought in regard to the development of modules and in regard to balancing the breadth and depth of content requirements. The current syllabuses are perceived as requiring updating, having excessive content, being overly prescriptive and not catering well for the full range of students in light of the raised school leaving age.

General support was expressed for a review of all Stage 6 Science courses to incorporate contemporary science and project-based learning/research opportunities in the area of Science, Technology, Engineering and Mathematics (STEM) for students to learn science as it is practised, while maintaining academic rigour.

The development of modules was acknowledged as an enabler for cross-disciplinary study for those students transitioning to the multidisciplinary courses offered by tertiary institutions and the varied employment environments. However, concern was expressed about operationalising these structures in schools, particularly in regard to the effects on staffing and timetabling. Other respondents indicated that such structures were to be avoided as they interrupted continuums of learning and the development of overarching discipline-based concepts. Issues were also raised about new assessment strategies and the need to maintain equity across proposed modules.

There was a view that assessment practices would need to be reviewed in light of the proposed changes. Respondents indicated that current assessment practices did not adequately assess a student's practical skills or their ability to transfer ideas and concepts to new situations and/or problems. Integration of project-based learning, rich research tasks and/or a major research study were recognised as a means of providing opportunities for students to more adequately demonstrate their skills and understanding.

A review of the efficacy of the Science Life Skills course was identified as necessary.

Key matters

The issues to emerge from consultation included:

- revision of the syllabus content in terms of currency, relevance and the promotion of practical opportunities
- the need to provide experiences that further extend students as well as design courses accessible to a greater number of students
- consideration of the development of modules to enable a combined study in Science (particularly Senior Science) with the maintenance of discipline-based concepts and ideas
- review of assessment practices to allow students to demonstrate a holistic understanding of skills and concepts and their application to different situations and problems
- revision of the Stage 6 Science Life Skills course to ensure it meets the needs of students, provides an appropriate progression from Stage 5 and aligns with the regular Stage 6 Science courses where appropriate
- the provision of course structures that enable teachers to integrate STEM, including project-based learning/research.

Proposed directions in response to consultation feedback

The following actions are proposed:

- reduce and amend the content of the Stage 6 Science courses; include contemporary concepts and increase engagement by elevating opportunities to gain science knowledge and concepts through practical activities
- enhance experiences that further extend students as well as design courses accessible to a greater number of students
- consider how Science courses may be structured to enable multidisciplinary study, including the integration of STEM, and provide project-based learning/research opportunities
- review assessment requirements and practices to better cater for the range of students
- the rationale, outcomes and content of the Stage 6 Science Life Skills course will be reviewed to better meet the needs of the students for whom the course is intended, as well as to provide an appropriate progression from Stage 5 Life Skills outcomes and content and alignment with the regular Stage 6 courses where appropriate.

A summary of key matters and proposed actions is contained in section 4 of this report.

3 Summary of respondents

Stakeholder and teacher consultation meetings

One Board Curriculum Committee (BCC) and three teacher meetings

BCC members	13
Teachers	56

Online survey respondents

121 online survey responses

Government sector	61
Catholic sector	17
Independent sector	43
Other	0

Response from:

Principal	3
School Executive	14
Coordinator/Head of Department	43
Teacher	56
Parent	1
Student	4

Individuals identifying as:

an Aboriginal person	1
a Torres Strait Islander person	0
an Aboriginal and Torres Strait Islander person	0

Number of people contributing to the response:

1	103
2	0
3	1
4	4
5	2
6 or more	11

4 Summary of key matters raised and proposed actions

Key matters raised for directions for syllabus development for Science from the consultation process	**Summary of actions**
Revise the syllabus content in terms of currency, relevance and the promotion of practical opportunities.	The syllabus rationales, content and practical requirements including their balance will be revised to allow for a range of practical opportunities including project-based learning/research opportunities where appropriate. The amount of content will be carefully considered and in cases reduced and/or restructured to provide opportunities for Science to be learnt as it is practised.
Provide experiences that further extend students as well as designing courses accessible to a greater number of students.	The course structures will be examined to provide further opportunities for teachers to make adjustments to what is taught and how it is taught to cater for the full range of students. Consideration will be given to providing learning opportunities that extend students within the disciplines, and to support teachers to provide for the full range of students.
Consider the development of modules to enable a combined study in Science with the maintenance of discipline-based concepts and ideas.	The structure of Science courses will be reviewed with consideration given to enabling multidisciplinary study and the development of modules aligned with technician, technologist and applied science employment opportunities.
Provide course structures to enable the integration of Science, Technology, Engineering and Mathematics (STEM) including project-based learning/research.	Content will be reviewed and where appropriate opportunities provided for the explicit teaching of relevant technology, engineering and mathematics principles as they apply to science.
Review assessment practices to demonstrate students' holistic understanding of skills and concepts and their application to different situations and problems.	Assessment and examination specifications will be reviewed throughout the syllabus development process.
The Science Life Skills course should be revised and aligned more closely with the content and structure of the regular science courses.	The rationale, outcomes and content of the Stage 6 Science Life Skills course will be reviewed to better meet the needs of the students for whom the course is intended, as well as provide an appropriate progression from Stage 5 Life Skills outcomes and content and alignment with the regular Stage 6 courses where appropriate.

5 Analysis

5.1 Stage 6 Science Courses

5.1.1 Proposed directions for syllabus content

Summary
Respondents generally agreed that the current Stage 6 Science courses required a review of their rationales and a review of the content to allow teachers to develop strategies to better meet the needs of the diversity of students. Sources indicated that currency and relevance are crucial for twenty-first century Science courses, to respond to contemporary issues including current demands to develop STEM knowledge and skills.

The development of modules to deliver the content was supported. This was seen as enabling the combined study of concepts across the Science disciplines to promote engagement by personalising learning and responding to developments in the evolving employment and multidisciplinary tertiary Science sectors. Concurrently, concern was raised about the impact on schools and school structures that a module approach may have, as well as concerns about the maintenance of the integrity of the disciplines. A model that provided for both would be supported.

There was a widely held view for a need to develop and implement project-based learning/research tasks within STEM opportunities to allow students to authentically engage with the scientific method whilst addressing content demands. There was a significant call to reduce the amount of content to be covered in each course to promote learning by doing.

Respondents indicated their support for the maintenance of the Senior Science course and revision of its content. It was suggested that literacy-based citizen science opportunities be provided to enhance a continued study of science.

Revision of the Science Life Skills course was supported to better align with the *Science K–10 Syllabus* and the revised senior secondary science courses, with recognition of their needs in relation to literacy, numeracy and personal and social capability.

Feedback affirming the proposed directions for syllabus content

Feedback (all Science subjects)	Source/s
Content, including breadth, currency and options should be reviewed in line with current developments and contemporary science knowledge and issues.	BCC, CEO Sydney, CEO Wollongong, DEC, STANSW, TF, Submission 2, Submission 3, Submission 6, Submission 7, Submission 8, Submission 14, Submission 16, Submission 17, Survey x 32
Modularisation provides opportunities for student interest and learning; however, concern was expressed in regards to staffing and timetabling, and the maintenance of discipline-specific knowledge and understanding.	BCC, Liverpool (CM), Wagga (CM), AIS, DEC, STANSW, TF, Submission 1, Submission 2, Submission 8, Submission 17, Survey x 10

Feedback (all Science subjects)	Source/s
A stronger emphasis on skills is required, in particular scientific method, quantitative skills, discipline-specific skills and design.	BCC, Liverpool (CM), AIS, Submission 1, Survey x 40
A focus on practical research and investigations should be provided through a research project and project-based learning.	BCC, CEO Wollongong, TF, Submission 1, Submission 2, Submission 13, Survey x 10
The inclusion of STEM content and literacy is needed for currency and relevance to student citizenry and links to further study.	BCC, TF, Submission 3, Submission 6, Submission 13, Submission 17, Survey x 5
Scientific literacy should be a priority in the new syllabus.	BCC, STANSW, Survey x 4
The current suite of Science subjects does not meet the needs of students with a wide range of abilities, circumstances and expectations. Consideration should be given to how proposed changes support all students.	STANSW, Survey x 5
A dedicated Science Life Skills course to cater for specific students should be maintained and reviewed.	BCC, DEC, STANSW, Submission 17, Survey x 10
Emphasis on analytical and critical thinking should be included.	BCC, DEC, STANSW, Submission 1, Submission 17, Survey x 13
A greater emphasis on professional learning among all science teachers is needed.	BCC, Liverpool (CM), TF, Submission 2, Submission 17, Survey x 10

Matters raised and proposed action

Matters Raised	Source/s	Proposed Action
All Science subjects		
The rationales for subjects should be reviewed for consistency, as well as the incorporation of working scientifically, the history and sociology of science and scientific literacy.	BCC, Submission 3, Submission 17, Survey x 11	Course rationales will be reviewed to ensure they reflect contemporary and significant learning in science.
There should be a focus on the scientific method, including qualitative and quantitative skills.	BCC, Liverpool (CM), CCHT, CEO Sydney, Submission 1, Submission 2, Survey x 13	The emphasis on scientific skills and practical investigations will be reviewed.
The number of hours of practical/first-hand investigations should be maintained in order to reflect an emphasis on the development of practical skills.	Wagga (CM), TF, Submission 17, Survey x 10	
Greater flexibility for teaching and learning is required across the disciplines, including flexibility for rural students, EAL/D students and gifted and talented students.	CCHT, DEC, Submission 8, Survey x 9	Access and flexibility for all learners will be a key focus of the syllabus development process.

Matters Raised	Source/s	Proposed Action
Biology		
Current Biology units focus on content that is dry, superfluous and lacking in student or teacher engagement, especially in the Preliminary course. There is a disconnect between the Preliminary and HSC courses.	Liverpool (CM), Submission 3, Submission 6, Survey x 4	Content will be reviewed for student engagement, relevance and currency, as well as opportunities for quantitative and qualitative knowledge and skills in the development of the Draft Writing Brief.
Content should be revised to incorporate new and relevant topics in Biology eg genetics, current technologies and 'Big Ideas'.	BCC, Liverpool (CM), Submission 6, Survey x 5	
Qualitative and quantitative skills, including statistics, should be emphasised.	Liverpool (CM), Survey x 7	
A greater focus on human biology should be included, with the possibility of creating a separate Human Biology course.	Wagga (CM), Submission 3, Submission 5, Submission 6, Survey x 3	

Matters Raised	Source/s	Proposed Action
Chemistry		
A global context approach should be introduced to the Chemistry syllabus.	Survey x 4	Content will be reviewed in the development of the Draft Writing Brief in relation to breadth and the inclusion of contemporary learning.
There is excessive content in the current syllabus. Outdated content should be removed in favour of current Chemistry topics eg nanoparticles, material sciences.	BCC, Liverpool (CM), Wagga (CM), Submission 2, Submission 3, Submission 6, Survey x 16	
Content should be reviewed for currency, including providing a greater focus on carbon chemistry, stoichiometry and kinetics.	Liverpool (CM), Wagga (CM), Submission 3, Survey x 2	
A full range of science skills, including qualitative and quantitative skills and problem-solving should be emphasised.	Liverpool (CM), STANSW, Survey x 8	Contemporary quantitative and qualitative knowledge and skills will be addressed in the development of the Draft Writing Brief.
There should be a review of practical activities to remove outdated tasks eg titrations, with emphasis on first-hand investigations.	BCC, Submission 11, Survey x 4	
Chemistry is under-resourced if students are expected to undertake research.	Submission 3	Support materials for Chemistry will be provided during the syllabus development process.

Matters Raised	Source/s	Proposed Action
Earth & Environmental Science (EES)		
Content should be reviewed and revised to include contemporary topics and reduce overlap with Stage 5 Science.	Submission 17, Survey x 4	Content will be reviewed in the development of the Draft Writing Brief for relevance and currency, including the emphasis on scientific skills.
A focus on Geology should be considered.	Survey x 2	
Practical research activities should be a focus.	Survey x 2	
It was suggested that ESS be discontinued in light of the number of student enrolments, or more closely aligned with Senior Science.	BCC, Survey x 2	The status of ESS within the suite of Science courses will be further considered by BOSTES.
EES is not commonly taught in schools due to teacher inexperience and lack of professional development.	Survey x 2	
EES is not commonly identified as a subject and is unfamiliar to students.	Survey x 4	

Matters Raised	Source/s	Proposed Action
Physics		
Content should be revised to provide opportunities for learning that are more directly related to post-school pathways, including general relativity, quantum physics and thermodynamics.	BCC, CEO Wollongong, Submission 3, Submission 6, Survey x 10	The scope of content will be considered in the development of the Draft Writing Brief.
Content should be reviewed for currency and overlap with the Stage 5 Science course, including an increased emphasis on mathematics and the removal of content relating to outdated concepts.	BCC, Wagga (CM), TF, Submission 3, Survey x 13	
Topics need to be more systematic and have a coherent sequence.	Survey x 2	
A review of content should ensure rigour is maintained.	STANSW, Submission 17, Survey x 4	
There was concern regarding the place and form of contexts.	Liverpool (CM), Wagga (CM), Submission 12	Syllabus structures will be examined in the development of the Draft Writing Brief.
The option topics in Physics vary widely in terms of their level of difficulty.	Submission 3, Survey x 1	
The current syllabus is limited in regards to conceptual development in experimental skills.	BCC, Submission 3, Submission 11, Survey x 3	Practical opportunities will be enhanced in the development of the Draft Writing Brief.

Matters Raised	Source/s	Proposed Action
Senior Science (SS)		
The rationale does not include references to a career, compared with Biology, Chemistry and Physics.	BCC	All syllabus rationales will be reviewed in the development of the Draft Writing Brief.
There should be a review of the content to include relevance to knowledge, skills and STEM topics.	BCC, Submission 5, Submission 17, Survey x 5	The scope of the content of Senior Science will be reviewed and considered in the development of the Draft Writing Brief.
The rigour of SS should be maintained or elevated, particularly as it contributes to the calculation of a student's Australian Tertiary Admission Rank (ATAR).	BCC, Liverpool (CM), Wagga (CM), CEO Sydney, CEO Wollongong, DEC, STANSW, Submission 1, Submission 4, Submission 6, Submission 17 Survey x 20	
There should be an incorporation of Biology, Chemistry, EES and Physics within the content, with an emphasis on skills.	BCC Survey x 1	
There is a need to increase practical activities to develop students' understanding of scientific processes.	BCC Survey x 4	
Topics in SS should be replaced with project-based learning.	BCC, Liverpool (CM), Submission 6, Survey x 3	
Senior Science should be internally assessed for non-ATAR students.	BCC, Survey x 3	Assessment and examination specifications will be reviewed in the development of the Draft Writing Brief.
ATAR scaling of SS compared to core Science subjects should be reviewed.	CCHT	The scaling of Science courses is a matter for the University Admissions Centre.
SS is not commonly identified by students as a valid Stage 6 Science subject.	BCC, Survey x 1	
An orientation to competencies is supported, as is done in VET courses.	BCC, Submission 2, Survey x 1	Broader Science syllabus structures, emphasis and combinations of study will be further considered throughout the syllabus development process.
SS should not be seen as a preliminary course for HSC Biology, Chemistry, EES and Physics.	AIS, Submission 1, Survey x 1	

Matters Raised	Source/s	Proposed Action
Science Life Skills		
There is no specific reference to subject-related skills and knowledge.	AIS	The scope and structure of the content and skills requirements for Science Life Skills will be reviewed in the development of the Draft Writing Brief.
There should be a greater emphasis and focus on science-specific skills, including an increase in working scientifically and knowledge aligned to syllabuses.	Liverpool (CM), Wagga (CM), AIS, Submission 15 Survey x 3	
Review outcomes and content to progress from the *K–10 Science Syllabus*.	AIS, TF, Submission 1, Submission 9, Submission 15, Survey x 1	
The content is too restrictive and requires flexibility.	Submission 15, Survey x 2	
Provide alternative measure of achievement through the development of broad, flexible Life Skills outcomes that can provide access points to regular content.	AIS, Submission 9, Submission 10	
There is a need to provide both outcomes and key competencies in the final Profile of Student Achievement.	Submission 15, Survey x 1	Key competencies have been replaced by Employability Skills. Additional reporting information will be considered in any future review of the HSC credential.
More support materials are required.	Liverpool (CM), CEO Sydney, STANSW, Submission 9, Submission 15	Syllabus support materials will be developed to support teachers in the implementation and assessment of Science Life Skills.

5.1.2 Proposed directions for assessment and examination specifications

Summary

Respondents identified the positive aspects of assessment and agreed that the proposed revisions of the assessment and examination specifications for the Science disciplines were appropriate. However, concern was expressed with regard to how assessments, including examinations, were to be implemented in schools if modules were adopted. Respondents also expressed concerns over outdated examination lengths and assessment strategies and the need to use rich, quality tasks and twenty-first century technologies for students to demonstrate understanding and skills.

Respondents were interested in introducing a research-based project or research investigation in the Stage 6 syllabuses to engage students in Science subjects and STEM opportunities. Concern was raised over demands on teachers such as extra marking and time constraints. Feedback proposed external marking of student work/projects.

Feedback affirming the proposed directions for assessment and examination specifications

Feedback	Source/s
A research-based project or major work would be favourable for students in terms of extending learning, skills and real-world relevance.	BCC, CCHT Submission 8, Submission 14, Survey x 16
Ongoing formative tasks were favoured by some respondents, including the introduction of accessing content online.	CCHT, Submission 8, Survey x 2
Quality assessments and a mixture of assessment methods that assess students' application of knowledge were supported.	DEC, STANSW, TF, Survey x 6

Matters raised and proposed actions

Matters Raised	Source/s	Proposed Action
There should be an emphasis on demonstration and application of scientific literacy over recall and rote learning.	STANSW, Survey x 7	Literacy, and in particular scientific literacy, will be a central focus in the development of the new senior science syllabuses.
There needs to be an emphasis on scientific literacy and critical thinking in assessment.	DEC, STANSW	

The following matters raised in relation to assessment and examination specifications will be further considered throughout the syllabus development process.

Matters Raised	Source/s
Further information is required about how current assessment practices can further promote deep discussion and analysis of issues in Science.	BCC, DEC, STANSW, Submission 4, Submission 17
Clarification is required as to how modules will be examined across Science disciplines.	CEO Wollongong, TF, Survey x 2
Further specificity is required regarding proposed changes to the HSC examinations and the proposal for project and research-based learning to be assessed internally.	AIS
Time constraints, increased marking and school resources were a concern with the proposed introduction of projects or research investigations.	BCC, Survey x 5
Experimental work should be examined in the HSC in a meaningful manner.	BCC, STANSW, Submission 14, Survey x 1
There should be a focus on summative assessments for Science courses.	TF
High stakes examinations are too long and currently reflect students' ability to regurgitate information. There is need for examinations that support the synthesis and application of knowledge.	BCC, CCHT, Submission 14, Survey x 2
Final high stakes examinations mirror the syllabus instead of providing original tasks for students to extend/apply understanding.	Submission 14, Survey x 1
The HSC should be accessed by students over two years with multiple attempts at examinations if required.	SAG
Preliminary assessment marks should count towards the HSC.	SAG, Survey x 5
The HSC should be accessible online with mastery tests.	CCHT, Submission 3, Survey x 2

5.2 Additional comments for Science

Summary
Overall, several issues were raised during the consultation process, including the currency and relevance of syllabuses and the need to include the study of contemporary Big Ideas by 'doing' science.

There was support for opportunities across the suite of science courses to extend and to make senior secondary science syllabuses accessible to a greater number of students.

During face-to-face meetings, discussion often centred on the rationale for each discipline, the nature of Science and the speed of scientific knowledge developments within each field. The need to remain contemporary is evident.

Respondents supported the introduction of STEM opportunities in the senior courses to extend student experiences and opportunities for post-school pathways.

Modular structures, while well supported, raised many issues about their implementation in schools. Further exploration and discussion around this structure is anticipated.

Respondents noted that the revision of the senior secondary science courses is timely and warranted.

Matters raised and proposed actions

Matters Raised	Source/s	Proposed Action
Technology Publish syllabuses in an online format to enable syllabus revisions to be responsive to contemporary issues in education.	Liverpool (CM), BCC, Submission 2, Submission 14, Survey x 2	BOSTES intends to publish the senior secondary syllabuses in an interactive online format.
Create online learning environments for students to access content and learning opportunities.	Liverpool (CM), Submission 14	
There should be consideration and equity for students who cannot access the internet and decent bandwidth.	Wagga (CM), Survey x 1	
Course content Science topics should focus on Big Ideas, real world career prospects and STEM industries.	Liverpool (CM), Wagga (CM), BCC, Submission 13, Survey x 3	The contexts and content of the Science syllabuses, including practical opportunities and the development of ICT skills, will be considered in the development of the Draft Writing Briefs.
Practical activities and first-hand investigations are important to science courses and hours should be maintained or increased.	Submission 17, Survey x 1	
There should be more focus on integrity, probity and rigour in the scientific method.	BCC	
There should be a greater link between Preliminary and HSC Science topics.	Liverpool (CM), TF, Survey x 4	
There should be an introduction topic for all Preliminary Science courses.	BCC, Submission 2, Survey x 2	
There should be a greater integration of Information and Communication Technology (ICT) activities.	BCC, Submission 11, Submission 14, Survey x 1	
The progression of learning from Stage 5 to Stage 6 Science should be strengthened.	AIS	

Matters Raised	Source/s	Proposed Action
Course requirements The current hours of study for Science disciplines should be maintained.	CEO Wollongong	The range and calibration of Science courses and Stage 6 pattern of study requirements will be further considered throughout the syllabus development process.
There should be an increase in flexibility in Stage 6, with students able to retake units and resit examinations.	SAG, Submission 14, Survey x 2	
A multi-strand Science course is favoured as a study pathway. A multidisciplinary study is not suited to EES.	Wagga (CM), TF, Survey x 2	
Science should be a compulsory 2-unit subject in Stage 6, similar to English.	Submission 3, Survey x 2	
An extension Science subject or other strategies should be introduced to cater for high-achieving students.	Liverpool (CM), BCC, CCHT, DEC, STANSW, TF, Submission 2, Submission 3, Submission 14, Survey x 10	
There is a need for a non-ATAR Science Studies course or non-examination option to be introduced.	Wagga (CM), BCC, AIS, DEC, STANSW, Submission 1, Submission 9, Submission 17, Survey x 19	
Clarity More information is required to clarify project-based learning in relation to Science courses.	AIS, Submission 1 Survey x 3	The directions for syllabus development, including the nature of project-based learning, will be reviewed in the development of the Draft Writing Briefs.
Further specificity is required in relation to the directions for syllabus development, including the assessment and examination specifications.	AIS, CEO Sydney, STANSW, Submission 1, Submission 17 Survey x 16	
Further clarity in relation to how the Australian curriculum content will be incorporated into the NSW syllabus content is required.	AIS	
Access for the diversity of learners Stage 6 Science courses should provide flexibility to cater for the full range of students.	AIS, Submission 8, Submission 17, Survey x 8	Course requirements will be considered in the development of Draft Writing Briefs to provide greater flexibility for teachers to meet the full range of learners.
Some students are inappropriately placed in Science Life Skills	AIS	
Clear and direct reference to the requirement for teachers to provide adjustments to learning experiences and assessment practices for students with special education needs should be made in all Senior Science courses.	AIS, Submission 9	
A provision for students not wishing to obtain an ATAR but still undertake the study of Science in Stage 6 was also considered.		

6 Quantitative analysis of survey responses

(*Note: due to rounding, some percentages may not total 100%)*

Survey Item	Number of Responses	Strongly agree		Agree		Disagree		Strongly Disagree		Non response	
		n	%	n	%	n	%	n	%	n	%
The proposed Stage 6 Science courses provide flexibility to meet the needs of the diversity of learners.	121	10	8.3	59	48.9	29	24.0	11	9.1	12	9.9
The development of modules to enable a combined study across Biology, Chemistry, Earth and Environmental Science and Physics is supported.	121	17	14.0	60	49.6	24	19.8	7	5.8	13	10.7
Other proposed revisions of the Biology, Chemistry, Earth and Environmental Science and Physics syllabus content are appropriate.	121	16	13.2	67	55.4	19	15.7	5	4.1	14	11.6
The proposed revisions of the assessment and examination specifications for Biology, Chemistry, Earth and Environmental Science and Physics are appropriate.	121	12	9.9	72	59.5	18	14.9	3	2.5	16	13.2
The Senior Science course should be retained as a course option.	121	76	62.8	31	25.6	3	2.5	1	0.8	10	8.3
If retained, the proposed revisions of the Senior Science syllabus content are appropriate.	121	19	15.7	63	52.1	12	9.9	6	5.0	21	17.4
If retained, the proposed revisions of the assessment and examination specifications for Senior Science are appropriate.	121	13	10.7	59	48.8	17	14.0	5	4.1	27	22.3
The proposed revisions of the Science Life Skills syllabus content are appropriate.	121	9	7.4	55	45.5	8	6.6	1	0.8	48	39.7

7 Respondents

7.1 Consultation meetings

Teacher meetings
(code: CM)

Venue	Date	Number of participants
Liverpool Catholic Club	26 August 2012	30
Wagga Wagga RSL	28 August 2014	19

Board Curriculum Committee (BCC) meeting at BOSTES on 1 September 2014
(code: BCC)

Name	Organisation
Dr Timothy Wright	Chair of the Committee
Mr Robert Farr	Association of Independent Schools NSW
Ms Regina Menz	Catholic Education Commission NSW
Ms Catherine Garrett-Jones	Council of Catholic School Parents, NSW and ACT
Mr John Cairns	NSW Chapter of the Australian Association of Special Education
Mr Andrew Hadjichari	NSW Department of Education and Communities
Mr Martin Lauricella	NSW Department of Education and Communities
Mr Paul Reilly	NSW Department of Education and Communities – TAFE
Mr Philip Argy	NSW Parents' Council
Mr Mike Morgan	NSW Teachers Federation
Professor Anthony Baker	NSW/Territories Committee of Chairs of Academic Board/Senates
Dr Louise Southerland	NSW/Territories Committee of Chairs of Academic Board/Senates
Ms Shirley Casper	Professional Teachers Council NSW

Targeted teacher meeting: Life Skills
(code: LSM)

Venue	Date	Number of participants
BOSTES	8 September 2014	7

Feedback on the Science proposed directions for syllabus development was also gathered at the following meetings:

Venue	Date	Number of participants
Student Advisory Group (code: SAG)	28 August 2014	6
Central Coast Head Teachers Group (Code: CCHT)	4 September 2014	6
UTS Inspiring Science Teaching Group (code: UTS)	7 October 2014	17

7.2 Written submissions

Organisations, groups and individuals	Code
Association of Independent Schools of NSW	AIS
Catholic Education Office, Archdiocese of Sydney	CEO Sydney
Catholic Education Office, Diocese of Wollongong	CEO Wollongong
NSW Department of Education and Communities	DEC
NSW Teachers Federation	TF
Science Teachers Association of NSW	STANSW
University of Sydney, Faculty of Education and Social Work	Submission 1
University of Technology Sydney, School of Chemistry and Forensic Science	Submission 2
Gosford High School, Gosford	Submission 3
Holy Spirit College, Bellambi	Submission 4
St Benedict's Catholic College, Oran Park	Submission 5
St Joseph's Catholic High School, Albion Park	Submission 6
St Patrick's College, Campbelltown	Submission 7
Mr Wayne Chaffey	Submission 8
Ms Geraldine Gray, State Coordinator, Special Learning Needs, CEC NSW	Submission 9
Assistant Professor Bree Jimenez, School of Education, University of North Carolina	Submission 10
Mr Jon Keeble, Founder and Chief Technical Officer, Wattwatchers	Submission 11
Mr Andrew McCredie, Manager, Innovation, Innovation Trade & Investment Branch, Treasury and Economic Development Directorate. ACT Government	Submission 12
Mr John Philips, Manager Education Projects, The Warren Centre for Advanced Engineering	Submission 13
Mr Michael Saxon, Principal, Liverpool Boys High School	Submission 14

Organisations, groups and submissions	**Code**
Ms Jennifer Solomon, Danebank Anglican School for Girls, Hurstville	Submission 15
Mr Jeff Stranger, Head Teacher Science, St George Girls High School	Submission 16
Ms Margaret Watts	Submission 17