Review of Achievement Standards Level 1, Phase 1

Feedback Report Chemistry and Biology

Feedback provided on draft Phase 1 subject content 28 April 2021

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## Purpose

This report outlines the feedback received by the Ministry of Education (the Ministry) on the Phase 1 development of Level 1 subject content for Chemistry and Biology. It aims to identify common themes and trends across the feedback. This report will be used to inform any necessary changes to the subject content developed so far as well as the further development of Phase 2 content by the Subject Expert Groups (SEGs) as part of the Review of Achievement Standards (RAS).

## Background

1. The Ministry received 155 responses to the Ministry’s online survey about the subject content developed for Chemistry and Biology. These included both multiple choice answer questions and long form, written response questions.
2. The Ministry also conducted Focus Group meetings with members of the education sector who provided feedback on the draft subject content.
3. Feedback was also provided by the four NCEA panels. Each panel did not review every subject – for Chemistry and Biology, feedback was received from the Māori, Pacific, and Pathways Panels.
4. This report is divided into the following:
   1. General Overview and Themes
   2. Analysis of Feedback by source
      1. Online
      2. Focus Group
      3. NCEA Panels
      4. Mātauranga Māori Expert Review
   3. Next steps
5. Please note that the content in this report does not reflect the opinions of the authors. The report aims to thoroughly and accurately reflect the views presented by those who fed back on the draft subject content.

## General Overview and Themes

1. ***Wording of the Achievement Standard titles***

In both the feedback data and the Focus Group, concern was expressed regarding the use of the term ‘Western Science’ in the draft Achievement Standard titles. In particular, many respondents commented that the use of this term is inappropriate as it excludes the contribution of non-Western Scientists to a global Science endeavour.

It was also noted that the use of the term “mātauranga Māori and Western Science understandings…” in the draft Achievement Standard titles creates barriers between these knowledge systems, instead of breaking them down. There was a concern that this could lead to mātauranga Māori being taught as ‘pseudoscience’, as a comparison to Western Science.

In addition, parallels were drawn to draft Achievement Standard titles in other subjects, particularly Physics Earth and Space Science. It was generally thought that the Chemistry and Biology titles are too cumbersome, and there needs to be greater coherence between Achievement Standard titles across subjects.

1. ***Progression from Level 1 to Levels 2 and 3***

Many respondents expressed concern that there is a lack of direction regarding progression to Chemistry and Biology at Levels 2 and 3 NCEA in the draft subject content. There was a theme that progression needs to be explained in greater detail, to allow for appraisal of the draft subject content and the design of Level 1 courses with consideration of student pathways. It was suggested that Levels 1 to 3 should be developed concurrently.

Others observed that the content covered in the Learning Matrix is not sufficiently rigorous to prepare students for Levels 2 and 3 NCEA. There was a concern that breadth and depth of the proposed subject content is inadequate and will result in gaps in student knowledge that will hamper their progression in chemistry and biology. Most of these comments were directed towards the chemistry content. Rates of reactions was mentioned by one respondent as important content that is missing.

Opinions were mixed on whether the draft Standards would be useful for students who were not pursuing studies in chemistry or biology at Level 2 and 3 NCEA.

1. ***Clarification of Subject Content***

It was noted by many respondents that the content to be taught and assessed is too vague. Concerns were raised in particular about the potential for inconsistency in teaching and assessment across New Zealand. Some respondents commented that they can not confidently plan a teaching unit using the provided subject content.

Many respondents asked for more specific detail in the subject content to clarify what chemistry and biology content needs to be taught, the depth it needs to be taught at, and what content will be assessed.

1. ***Clarification of Assessment***

Much of the feedback pointed to a desire to see the form of assessment clarified. It was suggested that the Assessment Schedules and Activities should have been developed simultaneously with the published subject content. Respondents mentioned that the absence of these created anxiety and frustration, as they could not see how the assessments would be implemented. This meant that they felt less capable of commenting on the utility of the draft content. There was also a common remark that the form of assessment would inform the teaching of the current Year 9 cohort, which will be the first to sit the new standards in 2023. Respondents commented that they currently feel unable to adequately prepare that cohort for the shift in learning and assessment.

There was also a concern that the draft subject content currently indicates that assessment will be research heavy. Concerns were raised that this requires a high literacy capability and would result in heavy device use in the classroom, as well as a potential reduction in opportunities for experiments and practical work, which are seen as a “point of difference” in science learning. There were specific speculatory comments around whether external assessment would be examination based, with mixed views on the appropriateness of examinations.

1. ***Inclusion of te ao Māori***

Generally, respondents received the inclusion of mātauranga Māori and te ao Māori in the subject content very positively. However, many were concerned that a lack of knowledge and confidence around mātauranga Māori in the teaching community would prevent these concepts from being implemented appropriately and consistently. To address this barrier, it was suggested that the draft content could be further developed to give more explicit guidance on how mātauranga Māori concepts could be integrated into teaching and learning. In particular, it was suggested to give a more detailed unpacking of mātauranga Māori kupu in the Teaching Learning and Assessment Guide (TLAG), and more examples of mātauranga Māori contexts in the Course Outlines. In addition, there was an overwhelming call for significant professional development and further resourcing in this area.

Some respondents thought the specific mātauranga Māori concepts referred to in the subject content were a good fit with biology and chemistry. Others thought they seemed ‘forced’ or ‘tokenistic’, often with reference to kaitiakitanga and chemistry. It was suggested that alternative mātauranga Māori concepts may be a better fit.

A further common comment questioned the compatibility of mātauranga Māori with science. Some commented that the introduction of mātauranga Māori could result in the teaching of pseudoscience, myths, and legends alongside or as a comparison to science knowledge. They believed the reference to mātauranga Māori within the content is disproportionate and queried whether this is consistent with other subjects.

1. ***Restrictive biology contexts***

Respondents commented that the focus of Achievement Standards 1.1 and 1.3 on microorganisms and genetics respectively are familiar and straightforward. However, there was a theme that they may be overly restrictive. Respondents noted that the study of biology also includes topics such as human biology, ecology, cell biology, plant and animal biology, and life processes. They did not think the Standards in their current form are broad enough to address this breadth of biology. Human biology was noted as being particularly relevant to students with interest in health career pathways.

Many suggested that specific reference to microorganisms in Achievement Standard 1.1 could be removed, to allow a broader ecological approach to this standard. Some noted that this would allow for a stronger connection to environmental guardianship and kaitiakitanga.

1. ***Curriculum level of chemistry content***

Concerns were raised that the chemistry content in the draft material, particularly the Course Outlines, does not always connect to Level 6 of the New Zealand Curriculum. It was noted that some concepts seem to sit at Level 4 and 5 of the Curriculum and are therefore taught in Years 9 and 10. The content around properties of matter was often given as an example.

In addition, it was noted that explanations of some of the chemistry ideas would require knowledge at Level 7 of the Curriculum, which would make it difficult for students to demonstrate higher understanding without blurring the Curriculum levels.

1. ***Focus on ‘environmental guardianship’***

Environmental guardianship was seen by many as an excellent and powerful learning context. However, the specific inclusion of environmental guardianship in three of the four Achievement Standards was seen by many as overly restrictive and forced. Concerns were raised that this focus was disproportionate, would not be engaging for students, and would lead to gaps in other foundational science knowledge. There were suggestions that environmental guardianship would be better included as an optional learning context, instead of an explicit requirement of the Achievement Standards.

More specifically, many thought environmental guardianship weaves naturally into learning in biology, but less naturally into learning in chemistry. In particular, a few respondents noted that the link between ‘chemical reactions’ in Achievement Standard 1.2 and environmental guardianship is unclear and limited. Some were also concerned that a focus on environmental guardianship would result in students being underprepared for Levels 2 and 3 Chemistry.

It was also noted that the concept of environmental guardianship needs further unpacking in the draft subject content, particularly in the course outlines.

1. ***Professional development***

There were many comments from respondents who found the proposed draft subject content overwhelming, and who were concerned about a high demand on teacher workload to successfully implement the content. This was seen as potentially creating inequities in the education system, with more pressure placed on those teaching at remote, smaller schools. There was a huge call for resourcing, professional development, and time in schools to action the changes.

Some respondents were also concerned about the “tight” timeline for implementation of the new NCEA Level 1, 2 and 3 Standards, and suggested that an additional year between changes would give teachers time to reflect on the delivery of the new Standards and manage workload issues.

1. ***Coherence of a Chemistry and Biology course***

There was an element of confusion regarding the coherence of the Chemistry and Biology subject. Some respondents noted that their schools would like to “mix and match” Achievement Standards from Science, Chemistry and Biology and Physics Earth and Space Science. There were multiple suggestions that Course Outlines that “mixed” Standards from these subjects would be useful to teachers – although a wide range of useful “mixes” were suggested, including Chemistry and Earth and Space Science, Physics and Chemistry, Biology and Earth and Space Science, and courses that incorporated a Standard from each subject.

Others felt that the Standards were too discrete and noted that there was a missed opportunity to weave both chemistry and biology into each of the Achievement Standards (for example as biological chemistry) or create Standards that “support” each other. Some felt that the course outlines wove chemistry and biology together successfully but that this was not reflected in the Standards.

1. ***Utility of course outlines***

In general, the Course Outlines were seen as useful, workable, and interesting. Some respondents raised concerns around the practicality of some activities in the course outlines – specifically field trips and experiments that require expensive equipment or a connection with a university.

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## Sources of Feedback

#### Online

Below are the quantitative data questions summarised in graphs.

#### Focus Group

The Focus Group consisted of 7 participants, external of MOE officials. The participants were all kaiako and represented a range of schooling environments from across New Zealand.

The Focus Group was able to be more targeted in its feedback, due to the specific nature of the questions asked in that forum. In general, the feedback was more forensic in its recommendations, and added much needed detail to the general concerns outlined in the Feedback Survey data. Generally, the issues raised in the focus group were similar to those raised in the Feedback Survey data.

The Focus Group raised the same concern regarding the term “Western Science” that was identified in the Feedback Survey, namely that science is a global endeavour and this term is exclusive. “Global Science including mātauranga Māori” was suggested as a possible alternative.

Clarity around mātauranga Māori concepts, particularly kaitiakitanga, was requested to ensure that teachers have a shared understanding of these concepts. Regional differences in mātauranga Māori were identified as being potential impediments to consistency, and there was concern about how this might affect assessment, especially external assessment. It was thought that the draft subject content could do more to make these concepts explicit, unpack them and exemplify their integration into science teaching. It was also identified that additional professional development is required to minimise barriers that may prevent teachers from accessing mātauranga Māori. Furthermore, it was noted that it would be easier for some schools to upskill in mātauranga Māori than others, due to connections with local Iwi, Universities or Crown Research Institutes.

It was also noted that while kaitiakitanga was identifiable in the subject content, its use sometimes seemed arbitrary and other mātauranga Māori concepts were missed out. Whakapapa, mauri and whakawhanaungatanga were identified in particular. Care should be taken when using mātauranga Māori concepts as they have deep meanings.

It was identified that there is no explicit Pacific knowledge in the subject content. This was noted as a significant gap.

Some Focus Group members said that the TLAG allowed them to clearly see the “big picture” and appreciated the freedom within the TLAG for designing teaching units. Others requested more precision regarding content. Like the Feedback Survey, it was suggested that a greater focus on biological chemistry would be interesting for students, and especially relevant for students considering health pathways. For example, rongoā Māori could be linked to microorganisms.

The Course Outlines were received positively and identified as being particularly valuable for seeing how the ideas in the Learning Matrix and Achievement Standards could be implemented in practice. The Focus Group saw the utility of the Course Outlines as being primarily inspiration and did not think that they would “pick up and run with” them. There were criticisms of the emphasis on field trips, and it was noted that some activities require expensive equipment, such as identifying phosphates or nitrates in waterways.

#### NCEA Panels

The NCEA Panels have raised some important issues which complement some of the themes which were forming in both the Feedback Survey and Focus Group data.

The Māori Panel noted that while the subject aligns to Māori ideologies and knowledge constructions, there is no reference to te ao Māori. They suggested that reference to environmental guardianship needs to be changed to kaitiakitanga, and that this needs to be reflected in the big ideas or be a standalone big idea. They advised that the current distinction between “mātauranga Māori and Western Science” in the Achievement Standard titles may build barriers or create an expectation that these knowledge systems should be compared and contrasted.

The Pacific Panel offered implementable suggestions for inclusion of Pacific concepts across the subject content. They noted that Pacific knowledges and contexts need to be explicitly embedded in the subject content.

The Pathways Panel commented very positively about the explicit inclusion of pathway education in the subject content, particularly in Course Outline 1. They suggested that this could be supported by a summary of how Chemistry and Biology supports student pathways in the TLAG. A lack of human biology content was noted, which would be relevant for students who wish to enter the healthcare industry.

**Mātauranga Māori Expert Review**

The Mātauranga Māori Expert Review team undertook a careful analysis of the subject content. They identified a lack of explicit mātauranga Māori concepts in the Big Ideas, leaving the inclusion of mātauranga Māori in teaching and learning to chance. They saw opportunities within the Learning Matrix to refer to mātauranga Māori concepts such as whakapapa and kaitiakitanga, but again noted that these need to be made explicit. It was suggested that kaitiakitanga was overused and other mātauranga Māori lenses may fit better for the subject content.

Course Outline 2 was identified as demonstrating successfully how mātauranga Māori can be aligned to learning in chemistry and biology.

## Next Steps

**Ministry Actions**

There are several recommendations which will be undertaken prior to reengaging the SEG. Some are too specific to detail in this report, but the overall themes are:

* Ministry to clarify position on addressing PLD concerns in relation to:
  + being able to adequately reflect and competently deliver Mātauranga Māori in classroom settings, especially understanding kupu and concepts Māori
  + preparing sample or exemplar materials to support the delivery of the new teaching, learning, and assessment subject content. These will be included in the Pilot content.
* Ministry to clarify timing of development process and develop sector responses. This may be what the public should be expecting and when; and confirming what is being asked of the public at engagement points.
* Ministry to clarify communication with sector regarding the Change Package, including:
  + mandate for mana ōrite mō te mātauranga Māori
  + rationale on a number of standards
  + coherence of subjects within the Science Learning Area.
* Ministry to clarify, alongside NZQA, the ways in which both internal and external assessment are carried out. This would also include concerns about specifics of assessment (methods, deadlines in year etc).
* Ministry to continue to work on messaging about the concurrent curriculum refresh and how that work is aligned with the Review of Achievement Standards.

**SEG actions**

* SEG to discuss how the subject content can be best used to support users understanding of mātauranga Māori concepts and how they relate to teaching and learning in Science.
* SEG to discuss the framing and appropriateness of mātauranga Māori concepts in the subject content. External expertise will be sought to ensure this is done accurately and authentically.
* SEG to revisit use of ‘environmental guardianship’ in three of the Achievement Standards and consider alternative contexts for teaching in chemistry and biology.
* SEG to review the wording of the Achievement Standard titles.
* SEG to work through Māori and Pacific Panel feedback, prioritised by the SEG Facilitator and Technical Writer, and make appropriate additions to the Learning Matrix so that the subject content more explicitly reflects all ākonga.
* SEG to revisit Learning Matrix and TLAG to see where more explicit guidance as to content can be included without restricting the freedom of schools to develop individualised local curricula.
* Course Outlines to be reviewed during Phase 2 and amended to reflect New Zealand Curriculum Level 6 as well as any changes made by the SEG to the TLAG. They will be republished alongside Phase 2 subject content.
* As part of Phase 2 development further content and detail will be created for the Achievement Standards and their supporting subject content. While working on this development, the SEG will consider all relevant feedback as highlighted by the SEG Facilitator contained in this report.