Review of Achievement Standards Level 1, Phase 1

Feedback Report Mathematics and Statistics

Feedback provided on draft Phase 1 products 20 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 materials for Mathematics and Statistics. It aims to identify common themes and trends across the feedback. This report will be used to inform any necessary changes to the products developed so far as well as the further development of Phase 2 materials by the Subject Expert Groups (SEGs) as part of the Review of Achievement Standards (RAS).

## Background

1. The Ministry received 139 responses to the Ministry’s English-medium online survey about the materials developed for Mathematics and Statistics. There was one response to the Māori-medium online survey. 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 products.
3. Feedback was also provided by the four NCEA panels. Each panel did not review every subject – for Mathematics and Statistics, feedback was received from the Māori, Pacific, Pathways NCEA Panels.
4. There was also feedback from various individual contributors, and other organisations such as the New Zealand Statistical Association which will be summarised below.
5. 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. Other individual contributors and organisations outside of the online survey process
   3. Next steps
6. 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 products.

## General Overview and Themes

1. ***General clarification of subject content***

In the feedback data, it was noted that it is important to have a much more in-depth understanding of the products before being able to adequately feed back on it. The wider issue is that currently many respondents think that there is too little information given in the Phase 1 subject content to give adequate feedback to it. It is frequently mentioned that without Step Ups or details of Assessment Activities, those delivering the new subject content may struggle. It is hard to see at this stage how the subject content might be implemented in classrooms.

Specific examples of how to clarify content are improving messaging around which products are expected at each stage of the development process; editing the Unpacking the Big Ideas section to clarify how Significant Learning will link to assessment; more links to how these materials can be linked to the wider community.

In addition to this, there appears to be some clarification required that the Course Outlines are not compulsory teaching and learning programmes and should be used as a guide for how new products *might* be used.

1. ***Interaction with te reo Māori and inclusion of te ao Māori***

Many respondents said they were unfamiliar with the te reo used across the subject content and felt that this may be a barrier to implementing the materials in the classroom. This is particularly the case when mixing Te reo and English terminology, which was perceived by some to be confusing. To help with this, many respondents suggested a large expansion of the glossary. Few examples of how to do this were offered, however, one comment suggested that using “te hononga, tairinga korero and wananga” was trivial. A further concern related to teacher capability and how many kaiako Māori are able to deliver PLD to the sector. Also, a concern was raised about the impact that the changes would have on teachers that are new to Aotearoa and whether they would be appropriately supported with targeted PLD.

There are also concerns that without more concrete detail, the mātauranga Māori in the subject content is too vague to provide meaningful comment on. This has been interpreted in two ways – some see the possibility for cultural innovation and that this allows a move towards better and more authentic interaction with te ao Māori, others worry that the approach will be limiting and superficial in Phase 2 development.

Some note that the survey questions should be more directly targeted at Māori, as they feel underqualified to discuss these issues. Generally, respondents are supportive of the changes, but they do note that significant PLD is required: “However willing I am to embrace te ao Maori, I'm not skilled/trained/resourced enough to do this.”

There were mixed reactions to the Course Outlines, with some respondents suggesting that there is not enough mātauranga Māori in them. There were several comments referring to how it would be better to see less tokenism in the Te reo used, and that they would like to see new products differ from what they currently see as repackaged ‘eurocentric’ ideas. A further contribution notes that it would be interesting to “ask mokopuna if they see themselves in this learning”.

Conversely, a further set of feedback queried how appropriate it is to incorporate mātauranga Māori into the subject content. “The context of Algebra is numbers, the context of Geometry is shapes. The idea that these contexts need to be dressed up is some superficial Maaori context for our Maaori students to be able to relate to them is condescending.” These respondents believe that Mathematics is universal and it is contexts, and not concepts, which change.

In terms of marking rubrics, one comment questioned whether Māori ways of calculating are acceptable, given that the rubrics would therefore have to be expanded to include approximation and intuition.

1. ***Mathematics and Statistics too large as one subject***

An issue relating to Mathematics and Statistics is that some respondents suggest that more subject areas are possible at Level 1, such as General Maths, Statistics, Calculus, and Algebra, following the example of Science. Respondents recommend this because it would provide greater coverage and more specialised subject knowledge at Level 1. Separate suggestions recommend more alignment with the curriculum strands of numbers and algebra, geometry and measurement, and statistics and probability.

This issue leads to comments made in the feedback survey that there is an issue with Mathematics and Statistics as a single subject. As a result, there are some respondents who would like more standards, in order to fully cover the content expected at Level 1. There is no consensus on what this might look like, but some suggest four standards each for both mathematics and statistics, others would prefer six standards giving specific coverage to each Big Idea. This is partly in response to the reduction of the current standards but is also related to managing teacher workload.

A recurring theme focussed on ākonga wellbeing and how fewer, larger standards may lead to more high-stakes assessment. Being able to access more standards, respondents suggest, reduces pressure on ākonga and kaiako. It was suggested that with fewer instances of assessment, learners would not feel as if they were making progress (achieving credits) throughout the year. However, there was agreement that if a ‘four standard’ model must be used, an equal five credit split was the most reasonable approach.

In order to help with these pressures, several respondents suggested the need to draft all three levels concurrently, so that the full picture could be given. This would enable respondents to give a more rounded view at this stage of the review.

1. ***Curriculum-wide coverage***

There was significant concern that as the Significant Learning covers all the Curriculum Level 6 Achievement Objectives, and the Achievement Standards sample all of that learning, teachers and students would be overstretched.These views are summarised well in this submission: “Currently most students would experience between 50 - 75% of the curriculum level 6 achievement objectives, I am extremely concerned that [in the proposed subject content] there is too much significant learning to be covered … These changes limit teacher freedom.” The view that there was not enough time to cover the content prescribed was pervasive. “The end result is that students have to know more but get less credits.”

Respondents were also confused as to their choices regarding assessment. Several wanted to know if sitting all four standards was mandated. They felt that this was unrealistic and that courses would begin to only offer three standards in a year in order to allow learners to cope. A small number of respondents were also unsure as to the purpose of Significant Learning, and questioned whether it all needed to be covered in a year.

A substantial contingent of responding teachers drew the conclusion that one, some, or all of the Achievement Standards would be assessed by portfolio. This seems to be due to wording in Course Outlines stating that a task or activity would inform later assessment (with the SEG intention being knowledge built, not work collected).

Achievement Standards 1.2 and 1.3 involve working across strands and with both mathematics and statistics. One respondent raised the issue that it would be difficult to ensure that learners using different mathematical or statistical skills to achieve the standards were assessed comparably and fairly. Another comment asked how employers and whānau would know what particular skills or knowledge a learner had used to achieve a standard.

A few submissions mentioned that with the breadth of content being covered, students who switched schools would be unlikely to cover all the content, and would subsequently be at a significant disadvantage.

Several comments requested clarification on the impact the curriculum refresh would have on these products and the subject.

1. ***Achievement Standards generally***

Manysubmissionsnoted that a considerable amount of ‘extra work’ will be needed to be done before 2023 if curriculum-spanning Achievement Standards were to be instituted. Some of the mentioned areas needing support were ‘textbooks’, ‘workbooks’ and ‘professional learning development’. Respondents commenting on this seemed unsure as to the Ministry’s intent and planning in this area. Specific concern was shown for current Year 9’s who will be the first students (outside of pilot) to use these products and Achievement Standards.

The most frequent comment on the Phase One products was that there was “too much statistics”. This was due to three of the four Achievement Standards having opportunities to apply statistics skills to assessment. This indicates that the intention to provide open standards which use different mathematical skills was not effectively communicated in the products.  
  
A significant number of respondents felt that the Achievement Standards needed to be more weighted towards abstract mathematics, algebra and calculus. This was seen as necessary to enable pathways into STEM fields and allow specialisation at Levels 2 and 3. When raised as an issue there were strong feelings on this point, however this was not widely seen as an issue by the majority of respondents.

There were some comments relating to the Achievement Standards which came up five or less times. A small number of respondents were confused that the ‘Unpacking the Standards’ section represented the actual Achievement Standards. Others wanted to know whether the same work could be applied to two different standards. Some concern was expressed that current practice varied greatly from school to school resulting in unfairly inflated or deflated student achievement; it was felt that the Phase 1 products did nothing to redress or mitigate this issue.

1. ***Achievement Standard 1.1 – statistics standard***

Regarding Standard 1.1, there was a significant amount of feedback suggesting that the scope of the proposed standard was too much work for five credits, and that there would not be enough teaching time to adequately cover the required material. There were also concerns that three investigations are too many to cover in a standard at this level.

A further common suggestion was to include non-primary evidence within the investigations, as primary evidence is specified at Levels 2 and 3. This would allow more scope for students at Level 1, giving more opportunities for assessment.

In addition to this feedback, there was a series of specific suggestions to clarify the standard. Due to the specificity and volume of these suggestions, they will be passed directly to the development teams for consideration during the next phase of development.

1. ***Course Outlines***

Overall concerns with the Course Outlines related to how much content was specified within the suggested timeframes. There was a resulting concern that because of the amount and breadth of the content, the Course Outlines are not specific enough to give a good idea of what a teaching programme may look like, and that they look much different to current programmes. In addition, they do not show enough information to understand the differences that the Change Package brings.

After having reviewed the Course Outlines, some respondents suggested PLD or guidance would be required in order to teach the new materials to mixed-ability cohorts.

Further suggestions include Course Outlines being broken down lesson-by-lesson, and a suggestion that Ministry endorsement could give Course Outlines more credibility.

1. ***The Learning Matrix***

The cross-strand emphasis of both the Learning Matrix and TLAG received a mixed response in the feedback. The majority of responses which mentioned the approach were in favour. However, many of the respondents who agreed with the approach in principle were unconvinced that the sector was well-placed to deliver this sort of teaching and assessment model. There was a perception that because cross-strand teaching and learning was not done at earlier curriculum levels, learners would struggle to adapt at curriculum Level 6. There was also some concern that applying skills from different strands across a single problem was too high level for most learners. “I think that in NZ a lot of teaching flies in the face of research such as the cognitive load theory. A good knowledge base makes thinking and learning easier and to try to teach (and assess) in an integrated and interwoven approach is a real challenge and possibly unrealistic if the external assessment content is too broad.”

There was some confusion around the layout of the Learning Matrix, and a small section of respondents were confused about how the Significant Learning related to the Big Ideas and Achievement Standards.

In addition to this feedback, there was a series of specific suggestions on how to improve the Learning Matrix. Due to the specificity and volume of these suggestions, they will be passed directly to the development teams for consideration during the next phase of development.

1. ***Learner ability level***

Concerns were expressed that ākonga coming into NCEA Level 1 have considerably varied ability levels. Many teachers explained that they typically take a considerable amount of time in the first months of the year to bring their learners’ understanding up to where it should be. Flexibility in standard choice was seen as helpful in addressing this. Similarly, several commentors observed that “Middle to lower ability students could struggle to achieve with project-based learning.”

There was a trend of respondents requesting clarification on how the NCEA Level 1 Achievement Standards would tie in with the numeracy standards**.** “The Learning Matrix also seems to assume that all students will gain their 10 Numeracy credits before they reach Year 11/NCEA Level 1 - what happens to those who don't? Can we offer a course that combines the Numeracy standards with 1 or 2 of the four Level 1 standards?”

1. ***TLAG***

Responses on the TLAG content were mixed. Many respondents see the new materials as aspirational and appreciated the explanations of the Big Ideas and Significant Learning. However, others suggested that this may be difficult to implement, so whilst the aspirational nature of the materials is a positive move, more PLD will be required to transition to them. Some respondents consider the change of direction as too much to manage in one transition period.

A further set of respondents would like to see more consideration of the wide variety of contexts in which ākonga learn. Whilst it was broadly seen as a good idea to allow variance for local learning contexts, some requested examples or support to show how this would be realistically managed. In addition, some respondents suggested that applying problems to contexts might be too high level for most students at NCEA Level 1.

1. ***Further explanation of external assessment***

There were concerns that there was not enough information about external assessment. Respondents wanted to know the specifics of assessment methods: would the externals be exams, portfolios, or common assessment activities?

1. ***Feedback on Change Programme***

Whilst much of the feedback given related to specific phase 1 products, some respondents focused on the Change Package itself. Respondents particularly focused on the time given to development, seeing it as too little time to reflect upon the subject content developed.

There were also several suggestions that it would have been better to develop from NCEA Level 3 and work back to Level 1. These responses were also linked to a concern that Level 2 was being developed too late to be effectively used in 2023.

A couple of respondents reported issues with accessing the materials for feedback. Others noted that the survey developed was not a robust tool for collecting feedback. These contributors suggested a ‘real time’ question and answer session.

There were a small number of comments in which respondents said they are likely to leave the teaching profession, or that their schools would drop NCEA Level 1 or move to Cambridge.

## Sources of Feedback

#### Online

Below are the quantitative data questions summarised in graphs.

The quantitative data reflects some of the concern that is shown across the general themes above. Overall, for Mathematics and Statistics there is more positivity for the Learning Matrix than the rest of the products, and this is evident in parts of the online survey and in individual Subject Association responses. Overall, the quantitative data suggests that there is widespread concern for how products may be implemented in the classroom, a theme consistent in the feedback survey data. This may be due to a number of reasons including kaiako capability; the ability to cover enough content in Level 1 Mathematic and Statistics; and general disquiet at having a consolidated subject at Level 1.

#### NCEA Panels

NCEA Pacific Panel

Overall, the Pacific Panel reported that the products have significant room for improvement. The Pacific Panel noted that some of the Mathematics and Statistics products lacked explicit links to Pacific knowledge and concepts, although it was similarly noted that the subject content is not exclusive of Pacific peoples. The Panel would also like to see better use of the Glossary for additional Pacific terms and concepts.

Specific feedback was that the materials lack links to Pacific students’ reality, their backgrounds, and everyday lives. This may include adding units on fa’alavelave or similar Pacific contexts. However, they were very supportive of ‘weaving strands’ through the products and would like to see more of it generally.

Overall, there is potential for more of the Pacific Quality Criteria to be reflected, but the Panel understood that quality teaching and learning was the single major driver in successful implementation. References to community across products and the inclusion of “Aotearoa and Pacific” in Standard 1.2 was warmly received by the Panel. The Panel also have specific recommendations for the Big Ideas, which will be considered by the development team. These revolve around specific word changes and the inclusion of indigenous ways of knowing and acquiring knowledge.

NCEA Pathways Panel

The Panel noted that there are good links to progression and future aspirations and recommend that the subject content show more of this where possible. However, it had a number of concerns relating to accessibility of language within the subject content, suggesting that the writing is too wordy and the level of literacy required to access it would be too high. There are concerns that the materials are not responsive to their audience and are therefore less user-friendly than they might be.

The Panel also reported that the products lack guidance for teachers to contextualise the subject and how it could be applied in the real world. It was noted that the products are quite traditional in outlook and require more ways of delivering learning in a contextual way.

NCEA Māori Panel

The NCEA Māori Panel gave a mixed response, pointing to the ease of understanding the subject content – “mihi to team who put this together and embedding mātauranga Māori in here”. However, there were several criteria which the Panel suggested had not been met. These all related to the appropriate use and grounding of subject content in mātauranga Māori.

The Panel would like to see some quick fixes, such as consistency in the use of ākonga/student and mathematics/pāngarau, and further explanation of concepts Māori, such as ‘Honora’. In particular they cautioned against using terms such as pāngarau unless the SEG were sure that they were using it correctly.

Overall, the Panel would like to understand the lens through which the subject content was being developed – although Big Idea 2 was warmly received in principle, there is consequent language which defaults to more Eurocentric ideas of “proof”. Clarification of how these ideas are viewed through a te ao Māori lens will be important in phase 2. Other examples of this are that ‘global’ perceptions of Mathematics ‘through multiple views’ may only tell one story of the subject and may be exclusionary.

#### Other Sources of Feedback

New Zealand Statistical Association

The New Zealand Statistical Association has offered a submission as an organisation. For the purposes of this report, NZSA refers to the 11 member group who submitted the response, on behalf of the organisation. In the response, they raise a series of concerns related to the new materials, but also accept that, in lieu of a separate subject, the division of the four standards in principle is an acceptable compromise. As these are comprehensive documents, the full documents will be made available to development groups to discuss as they see appropriate. These are summarised below.

In relation to the Learning Matrix, many of the recommendations relate to retaining the existing Achievement Objectives and contain numerous suggestions to strengthen statistical content within the Big Ideas and Significant Learning. Examples of this include limiting the scope of RAS to the existing curriculum to allow kaiako a smoother transition to the new materials; the addition of ‘probability’ to the knowledge Big Ideas, with an emphasis on communication; and a clear separation of some Big Ideas to show the distinction between Mathematical and Statistical content. In addition, there is a view that Mathematics and Statistics are used inconsistently, with Mathematics more commonly being used in isolation of Statistics. In a separate document, tracked changes have been used to support development of the TLAG.

In summary, of the four draft Achievement Standards, there are some areas of agreement, but also a clear sense is given that delineation between statistical content and mathematical content is essential. In principle, the balance of the standards to encompass both elements is welcomed, with recommendations below.

In terms of Standard 1.1, the intent of the standard is agreed upon, with clarifications required in the details of the standard, such as how many investigations are necessary, and whether it is necessary to be primary data. For Standard 1.4, the recommendation is for there to be clarification that this is a Mathematics standard, with suggested wording ‘*Demonstrate mathematical reasoning’*. This reflects the fact that there should be no statistical knowledge necessary in this standard.

Standards 1.2 and 1.3 are more complicated in nature. NZSA suggest that some changes in Standard 1.2 will clarify the intent. “Solve problems that relate to life in Aotearoa and the Pacific using relevant mathematics and statistics.” NZSA also ask for clarification on whether both mathematical *and* statistical problems would have to be solved in order to meet the standard. Their suggestion is no. There are also questions whether the content is at curriculum Level 6 and note that assessment will have to ensure this.

Standard 1.3 shows another area which NZSA identifies as requiring delineation between mathematical and statistical content, noting that mathematical and statistical literacy are commonly understood, distinct concepts. The suggested wording adds ‘critique’ to make the suggested title “Evaluate and critique information using mathematical and statistical literacy skills”.

New Zealand Mathematics Society

The New Zealand Mathematics Society also contributed to the Phase 1 feedback process. In general, NZMS is positive about the draft changes, but note some areas for consideration and clarification.

Some of the changes relating to the TLAG are around messaging to the sector about whether the new materials are compulsory, to what extent the new standards might be studied at different points in a student’s NCEA journey, and how more information can be communicated about what skills students will gain from Mathematics and Statistics which they can take through life.

Regarding the Achievement Standard 1.1, there is agreement with NZSA that primary data does not need to be used. Also, in agreement with NZSA, NZMS suggest the SEG reconsider whether three investigations are necessary, or whether it could be just one or two.

For Standard 1.2 and 1.4, there are wording suggestions:

* 1.2 Reword: Solve problems that relate to life in Aotearoa and the Pacific using mathematics or statistics.
* 1.4 Reword: ‘mathematical theories’ replace with ‘mathematical concepts’ or ‘mathematical content’ [reasoning: “theories” is a Science word and is not really used in Mathematics]

One suggested addition to the Learning Matrix is to include ‘measurement error’ as a topic. In Course Outlines they note note that “Understanding that a solution to a problem is with certainty” in Course Outline 2 is problematic because assumptions are made in order to solve problems and there is uncertainty in this process.

Sector Initiated Survey

A survey was created and shared among members of the Mathematics and Statistics teaching community through the NZ Mathematics Teachers and the Stats Teachers NZ Facebook groups. The survey garnered 116 responses, including demographic information not included here.

Themes from general comments:

The strongest theme in the general comments sections was that people felt under-informed and as such unable to provide the depth of feedback they wanted to. The limited detail around the Achievement Standards comprises most comments around this theme, though some commenters felt that lack of clarity about Levels 2 and 3 made comment difficult. Some responses indicated that the weighting towards statistics is too high (though not clear whether the weighting is in the Learning Matrix or the Assessment Matrix). Several responses made reference to statistics being at the expense of ‘pure maths’.

Some of those surveyed suggest that the amount of Learning Matrix content to be covered was too much for a single year. There was some support for the Big Ideas.

A number of comments were generally critical of the RAS processes for development and feedback – though some of these appear to be based on misunderstandings of process or product. There was some general anxiety about pace of change and about the level of support available to implement changes.

There were very few comments on Achievement Standards, though two responses suggested 1.4 may be too large in scope. One comment suggested that 1.1 was burdensome, requiring three investigations that include the collection of primary data.

## Next Steps

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 Actions**

* Ministry to clarify position on addressing PLD concerns 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 materials
  + preparing adequate work book, textbook and learning activities to support teaching of new subject content in 2023.
* 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, alongside NZQA, the ways in which both internal and external assessment are carried out, including confirmation on written assessment plans. 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 complementing the Review of Achievement Standards.
* Ministry to clarify the purpose of the incoming Numeracy standards as ‘corequisite’ standards which may be attempted before, alongside, or after Level 1 standards.

**SEG actions**

* Addressing concerns about how Unpacking the Standards links to the Learning Matrix – better explaining the relationship between Significant Learning and assessment.
* SEG to work through the Mātauranga Māori, Pacific and Pathways Panel recommendations, prioritised by the SEG Facilitator and Technical Writer, and make appropriate additions to the products so they more appropriately and explicitly reflect ākonga perspectives.
* SEG to work through survey feedback related to mātauranga Māori and make appropriate additions to the subject content so that it more appropriately and explicitly reflects ākonga perspectives.
* SEG to consider ways that teacher and student workload might be managed by refinement of phase 1 products.
* SEG to clarify in SEG response statement that none of the Achievement Standards are confirmed to be assessed as portfolios, and that the significant sector response against portfolios will be considered when deciding on assessment type.
* SEG to discuss the overwhelming support across feedback channels for lowering the requirements of Achievement Standard 1.1.
* SEG to consider options for enabling Achievement Standards 1.2 and 1.3 to sample learning across a range of strands, while not requiring knowledge of the entire curriculum or creating consistency problems/undermining the standard.
* SEG to discuss the strong feedback saying there is ‘too much statistics’, and also the requests for more algebra and abstract mathematics.
* SEG to consider how subject content can be adapted to better cater to lower-ability students, students who have recently moved, and mixed-ability classes.
* SEG to consider all other relevant feedback as highlighted by the SEG Facilitator contained in this report.