The future of NCEA - Detailed Submission
NZ Mathematics Society

What are your experiences of NCEA?

What could be working well, but is either usually not implemented or needs support to be implemented well:

- Various skills and talents are recognised and valued.
- The mixture of internal and external assessment allows for assessments that value different competencies. Internal standards give opportunities for creativity and increased autonomy for schools.
- For some students the endorsement system motivates and engages them.
- The flexibility of NCEA:
    - Schools can piece together courses with any mix of standards they see suitable for their students. (This can also be a negative.)
    - Multiple standards can be achieved through one piece of work (within and between subjects). (Though the standards need to be written with this in mind, for this to really work.)
    - Students can do an assessment when they are ready.
    - On some assessments, students can be given an opportunity to reassess if they are not successful the first time.
    - Schools can develop programmes that give students and teachers time to explore and have better learning experiences.
    - Schools can develop programmes that have lots of internal assessment that reduces pressure on end of the year exams.

What's not working well?

1. Bias – mostly probably unconscious and institutional – allows schools to push marginalised students such as Māori, Pasifika, and females into tracks where they are "more likely to be successful" but also where they have worse future outcome. Instead of pushing ALL students to high standards of success, the system seems to encourage discriminatory consequences, in the name of 'success for all'. For example, some Māori and girl students are discouraged from taking the most academic science track because they are thought to be less likely to be successful. There are some towns where the boys' school will have 4 or 5 times as many students taking the Level 3 Calculus course as the girls' school.

2. Subjects can be delivered in a fragmented way, where inter-related topics are assessed separately. Many of the connections between concepts are lost not only for the students but also for the teachers. This has led to a lack of coherence.

3. There is a design and resourcing issue in the internal assessments, causing a lot of interpretation to be left to teachers, departments, and moderators. The current standards (on the whole) are neither well designed nor well resourced. Constraints around formatting and allowable information in the design of the standards reduced their helpfulness (made them less clear). The standards were written separately from the exemplar assessments, which had external constraints such as constructs around how assessments are to be written and formatted (e.g. an assessment should be one task without numbered parts). This led to the moderators needing to enforce rules that they often develop separately from either the standards or the exemplars. Teachers, departments, and teachers associations are left to make guidelines from this information. All of this is opaque and can be very frustrating and time consuming for teachers, and leads to more inconsistency across schools. Based on moderator feedback, over time teachers learn to interpret the standards and gather resources, but this is a slow, inconsistent process that does not necessarily match with the intended purposes.

4. Courses are designed around assessment rather than learning and this can lead to over-assessment. Teachers can feel pressured to put shortcuts into the learning to fit in more assessment. For example, for a standard that is designated to cover 40 hours of learning, a school or teacher may teach and assess a narrow portion of the standard, so that a student can get 4 credits for 10 hours of learning.

5. The internal assessments reward short term learning and generally do not assess for students knowing and understanding concepts over the long term and rarely do they provide students with multiple experiences with the same topic.

6. Changes in NCEA external assessments need to be communicated clearly to all teachers. The recent issues with Algebra at Level 1 stands out as an example where the style of the assessment changed and while some teachers and their students were informed about this (i.e. through the Auckland Maths Teacher Association), other teachers and their students were uninformed or did not understand the communication.

7. NCEA external assessments can be overly long. The assessment should be written so that all questions can be done by an expert in less than 30 minutes to give students time to show the extended abstract thinking needed to reach excellence. Reaching

excellence should not be about speed or to be done at the expense of other assessments.

How can NCEA be improved?

1. All students should experience mathematics and statistics teaching and learning that leads to the development of problem solving, reasoning, conceptual understanding, and fluency. This should be underpinned by confidence and competence in the subject skills, including using data and transferring the skills to other contexts. Teachers and schools need to be given the systematic support and tools to enable this.

2. NCEA can only be improved by having high-quality teachers. The government needs to prioritise training, recruiting, and retaining excellent teachers with subject area knowledge. Otherwise, any adjustment in the assessment system will not make the needed improvements in the outcomes.

3. A main concern about mathematics and statistics education is that the subject is often delivered in a fragmented way, where inter-related topics are taught and assessed separately.
   Possible solutions or ways to address this:
   a. Develop standards that assess students abilities to make connections: e.g. a standard on 'modeling' or 'mathematical processes'.
   b. Continue to have internals which are broken up but have an exam that is a mix of standards.
   c. Streamline (reduce) the content of the mathematics and statistics curriculum into something more coherent, allowing teachers time and space to step back and take a bigger picture or a more connected approach.
   d. An essential list of mathematics and statistics that all students should know at each of level 1 and 2 should be developed. So that any course that is developed at that level will have a common core.
   e. Encourage and provide resources for Junior school to use more engaging rich tasks and alternate forms of assessment.

4. Mathematics and statistics are more than a list of topics or procedures that students need to learn and to apply. Mathematics and statistics are also ways of knowing and understanding the world and are creative mediums. Students need to be exposed to these other ways of viewing mathematics and statistics. This could be done through a cross-curricular research standard where they research uses of mathematics and statistics that affect their lives or future careers, e.g. flight, medicine, art, running a

restaurant, or it could be done through support provided for teachers to help incorporate these into the curriculum.

5. Redesign of the curriculum and standards must be supported with well-designed guidelines, good tasks, classroom resources, assessments, and PLD. They should take into account the concerns listed above in points 1-4, especially 3. The standards need to be written with a view towards uses, such as:
    a. assessing multiple standards through one piece of work (which is currently hard to achieve),
    b. integrated courses and assessments,
    c. cross curricular assessments,
    d. adaptive testing,
    e. non-routine problems that use critical thinking and analysis,
    f. creative ways of implementing assessment, including incorporating appropriate technology.

What is your reaction to each of the proposed six big opportunities?

NCEA Review Reaction to big opportunity 1:
Creating space at NCEA Level 1 for powerful learning (Rebuild Level 1 as a 40 credit qualification – 20 for literacy and numeracy, and 20 for a project.)

We are neither fully supportive, nor against this big opportunity. Could the project be done for a portfolio but not for credits so there would not be concern around equivalence?

If it was adopted, there would need to be a lot of support and guidance provided for schools/teachers around what a project is or how it could be assessed. It makes teaching and planning what to teach for all subjects seem much less straightforward. Past changes with NCEA have not left teachers confident that this magnitude of change would be well supported.

Some positives, it allows for

- cross-strand learning: a project can incorporate a large range of possibilities and opens the student up to learning about their chosen topic over a range of subjects
- collaborative learning: people can share ideas, or could even create a single themed project with interlinking smaller projects within their group
- personalization: assuming students choose their project based on what they are interested in

- greater equity: as each student can produce not only their final product, but can show their prototypes and failures.

Problems that could arise:

- cross-strand learning: when assessing for the credits, each cross-strand project will need input from assessors with different specialities
- collaborative learning: there will likely be some people pulling others back or carrying the load
- personalization: motivation and guidance will require more staff time.

What does the literacy and numeracy look like? There is concern that maths teachers will be left doing assessment-driven teaching at Year 11 with the associated workload. Or would there be support and guidance for schools to have school-wide numeracy?

More comments on numeracy under big opportunity 2.

Reaction to big opportunity 2:
Strengthening literacy and numeracy. (Benchmark literacy and numeracy at the level needed for success in further learning and employment.)

What is meant by numeracy? Many people see mathematics and statistics as no more than a useful toolbox, a list of topics or procedures. This perspective on mathematics and statistics is far too narrow for today's world. It overlooks key features of mathematics and statistics that are growing in importance. The digitisation of many aspects of life, the ubiquity of data for making personal and societal decisions involving topics from health and investments to climate change and the spread of pandemic diseases, have reshaped what it means to be mathematically and statistically competent. These critical issues as well as others that are facing individuals and societies throughout the world all have quantitative components to them. Understanding them, as well as addressing them, requires thinking mathematically and statistically. Such thinking in more and more complex contexts is not driven by the reproduction of basic computational procedures, but rather by reasoning. The important role of reasoning demands a reconsideration of what it means for students to be competent in mathematics and statistics. Numeracy needs to go beyond using procedures and problem solving, to mathematical, statistical, and computational reasoning and thinking, which provides the intellectual acumen behind problem solving in the 21st century.

When looking for NZ and international definitions of numeracy, the following definitions are useful and it should be made clear what definition NZ is using. All three of these definitions use mathematics to mean mathematics and statistics.

Adult Competencies (PIAAC) definition: the ability to access, use, interpret, and communicate mathematical information and ideas, in order to engage in and manage the mathematical demands of a range of situations in adult life.

PISA's current definition: an individual's capacity to identify and understand the role that mathematics play in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.

PISA's 2021 definition: an individual's capacity to reason mathematically and to formulate, employ, and interpret mathematics to solve problems in a variety of real-world contexts. It includes concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to know the role that mathematics plays in the world and to make the well-founded judgments and decisions needed by constructive, engaged and reflective 21st century citizens.
It is important that the construct of numeracy not be perceived as synonymous with minimal, or low-level, knowledge and skills. Rather, numeracy should be mathematical, statistical, and computational reasoning and thinking, regarded as a thought process entailed in formulating problems and designing their solutions in a form that can be executed by a computer, a human, or a combination of both.

Questions that still remain:

- Will NCEA signify different levels of numeracy?
    - There are definitely different levels of mathematical and statistical preparation required depending on a students' post school destination.
    - The current requirements are not clear to students to let them know what they need for their future, e.g. the UE numeracy requirement is not adequate for anyone pursuing a degree in Science.
- How do digital and financial literacy fit in to this need to strengthen?

Reaction to big opportunity 3:
Ensuring NCEA Levels 2 and 3 support good connections beyond schooling. (Introduce pathways opportunities to NCEA Levels 2 and 3, giving every young person access to learning relevant to their pathway.)

No strong opinion.

Reaction to big opportunity 4:
Making it easier for teachers, schools and kura to refocus on learning. (Shift culture from achieving as many credits as possible to encouraging quality teaching and learning.)

Absolutely! This is strongly supported. However, if is not clear how to do this. Do we create recognition for students for improvement and hard work?

Reaction to big opportunity 5:
Ensuring the Record of Achievement tells us about learners' capabilities. (Enhance the Record of Achievement with better summary information and space for learners to detail achievements outside of NCEA.)

The RoA should possibly be enhanced with information about students' soft skills and overall approach to learning. These could be advantaged by connecting them to online portfolios where students could show clear examples of what the RoA means.

Reaction to big opportunity 6:
Dismantling barriers to NCEA. (Make NCEA more equitable, starting with making it easier for learners to access Special Assessment Conditions, and remove fees to enrol in NCEA.)

Clearly the answer here should be yes. Students should not need often costly specialist or parents who understand the system in order to get needed Special Assessment Conditions. Students whose family finds the fees a hardship should not be required to pay them. (There is an economics argument about whether the fees should be entirely removed, but there should be a low barrier to having them removed.)

The future of NCEA
Is there anything else you'd like to say?

It is clear from our consultation with industry training representatives, teachers, and across disciplines in the tertiary sector, that the current level of numeracy (level 1 numeracy) for school leavers is too low. We need a clear definition of numeracy and we need to raise the level. To benefit students we may even want to develop a second level of numeracy as well. We strongly emphasise the need to develop students' capacity to use mathematics in context, and it is important that they have rich experiences in their mathematics classrooms to accomplish this.

We reiterate that mathematics and statistics should be seen as more than a list of topics or procedures. Critical issues that are facing individuals and societies throughout the world have quantitative components to them. Understanding them, as well as addressing them, requires

thinking mathematically and statistically. Numeracy needs to go beyond using procedures and problem solving, to mathematical, statistical, and computational reasoning and thinking.

By NZ Maths Society (NZMS), the representative body of professional mathematicians in New Zealand, and other mathematicians and teachers we have consulted with.

The Education Committee of the NZ Statistical Association has read this submission, and and supports and endorses it.

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