National Curriculum Board

Framing Paper Consultation Report: Mathematics

May 2009

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1. Introduction

The National Curriculum Board has been charged with developing a single, world-class national curriculum for all Australian students from Kindergarten to Year 12, starting with the key learning areas of English, mathematics, the sciences and history.

On 20 November 2008, the National Curriculum Board released for public consultation the set of curriculum framing papers for English, mathematics, the sciences and history. The consultation period officially closed on 28 February 2008. The purpose of the consultation was to obtain feedback from stakeholders that would inform the rewriting of the framing papers to the point where they would be foundational documents for writing the national curriculum.

The framing papers were developed from advice obtained through an extensive consultation process involving national forums, guidance from individual experts and focus groups, input from teachers and academics, and direct feedback through the Board's website.

This report provides a brief description of the consultation process, the process of data analysis, and a summary of the analysis of all feedback received. The summary analysis outlines affirmations for the directions in the framing papers, and matters requiring further examination.

The feedback analysis is representative of more than 1100 responses, 226 of which were in relation to the mathematics Framing Paper. Feedback was received in two forms – via completion of surveys (most through online lodgement) responding to questions asked by the Board, and via formal submissions lodged either electronically or by mail. It represents the contributions of education authorities, professional education associations, individual educators, business and industry, community groups and individuals. The report also provides tabulated data indicating the spread of responses across the many stakeholder groups.

The Board acknowledges with appreciation the contributions of all respondents to the consultation. Many written submissions were extraordinarily detailed, while others provided briefer more indicative input, clearly waiting to contribute further as the curriculum writing process gets under way.

2. Consultation

Process

The National Curriculum Board has committed to an open curriculum development process with substantial consultation with the profession and the public. Stakeholder groups include government, education authorities (national, state and territory, government, Catholic and Independent, and local school authorities where such bodies exist), parent bodies, professional educational associations, academics, business and industry groups, wider community groups and interested individuals from the wider community.

The Board's primary consultation instrument was a survey seeking stakeholder responses to questions posed by the Board in relation to each framing paper. The survey instrument was placed on the Board's website to permit online completion and lodgement. Respondents for whom this was not suitable chose to either mail, email to the Board's feedback box (feedback@ncb.org.au) or fax the survey responses in to the Board.

Many stakeholders chose to respond by preparing formal submissions. These were received by the Board through mail, email or fax.

All online survey responses and submissions through the Board's electronic feedback mailbox triggered an immediate electronic message of acknowledgment and appreciation for the contribution. All other submissions were responded to individually by staff of the Office of the Board.

Section 5 of this report contains a summary of framing paper survey responses and submissions by respondent group.

The consultation period officially closed on 28 February 2009. At this point in time, the online survey environment was closed. However, significant numbers of responses continued to flow in after that date, and were being entered into the data base as late as the end of March. During March, a gap analysis of major stakeholders was prepared, and direct contact was made with those stakeholders, to ensure that submissions were still forthcoming and would be taken into account in the data analysis process.

In addition to this formal consultation process, a range of consultation forums were held to ensure that specific concerns also within the Board's curriculum development responsibilities are met. These include:

- equity and diversity
- futures-orientation
- stages of schooling
- continua for literacy, numeracy and ICT
- needs of Indigenous children and incorporation of Indigenous perspectives
- Asia-literacy and
- sustainability.

Data Analysis

Upon receipt, every submission and survey response was formally recorded. Those not received through the online process were either scanned (in the case of submissions) or entered manually into the database. A single record of the details of all responses was updated as they were received and weekly summary reports prepared.

Every submission was read by relevant Board staff, and a summary of significant points in each submission was noted for consideration in the collation and analysis of the data. At the same time, the full text of all submissions was recorded for analysis.

The outcomes of the data analysis have been documented in two main forms – feedback that affirms the directions (broad and specific) of the individual framing papers, and feedback that indicates matters that require further examination. In the latter case, additional processes have been put in place to conduct that further examination.

From the data analysis, major affirmations and major areas for examination have been identified in the report. These have been identified both by the strength and frequency of their presence in the responses. Minority insights from individuals or groups of respondents were respectfully taken into account but may not necessarily appear in the report. This does not indicate a rejection of their value as contributions, but recognition of the major directions and concerns emanating from the larger body of data.

3. Feedback affirming the directions in the Mathematics Framing Paper

The quantitative data, provided in the table below, indicates a strong level of support for the Mathematics Framing Paper as a whole.

	Strongly Disagree	Disagree	Agree	Strongly Agree
To what extent do you agree with the aims of the mathematics curriculum?	5%	8%	47%	39%
To what extent do you agree with the definitions and applications of terms used in the paper?	7%	16%	46%	31%
The proposed structure identifies the curriculum focus for Stage 1 of schooling. To what extent do you agree with the focus in this stage?	9%	9%	53%	28%
The proposed structure identifies the curriculum focus for Stage 2 of schooling. To what extent do you agree with the focus in this stage?	7%	10%	56%	27%
The proposed structure identifies the curriculum focus for Stage 3 of schooling. To what extent do you agree with the focus in this stage?	8%	21%	42%	29%

Particular areas of support have been noted below about each aspect of the framing paper. The level of support ranges from general support for some areas which indicates that a majority of respondents were generally supportive with additional comments or suggestions, to strong endorsement where there was significant majority support.

Introduction
- The introduction to the paper has been generally supported

Aims
- The proposed aims of the mathematics curriculum have been strongly endorsed

Terms used in this paper
- The number and nature of the content strands have been strongly endorsed
- The number and nature of the proficiency strands have received general support

Considerations
- The proposition for a clear and succinct curriculum has been strongly endorsed
- The notion of depth over breadth of content has been generally supported

Structure of the curriculum
- The curriculum foci for Stage 1, 2 and 3 of schooling have been strongly endorsed
- The notion of four senior secondary courses has been generally supported

4. Feedback requiring further examination

The following matters have been identified as areas requiring further examination:

1.0 Nature of the organisation of content

1.1 Respondents were supportive of the number and nature of the content strands, however this did not assure a less crowded curriculum.

1.2 Respondents were generally supportive of the proficiency strands, however concerns were expressed about: the separation of problem solving and reasoning; the use of the term "fluency" and the artificial separation from understanding; and how the 'understanding' proficiency was different from content learning.

1.3 Respondents also commented that the notion of and term "working mathematically" should not be lost and that it would be beneficial to clearly define the term for teachers eg. problem posing and problem solving, mathematical modelling, developing proofs, conjecturing, making and conducting investigations are essential elements of working mathematically

1.4 Many respondents directly or indirectly identified the need to clarify the relationship between, and the application of, the content and proficiency strands.

1.5 Many respondents commented that the national curriculum should make strong connections across learning areas and allow for curriculum integration.

1.6 While some respondents commented that they felt the terms 'space', 'chance' and 'data' would be appropriate, particularly K-10, the majority of respondents welcomed the return to the traditional mathematical terms as they were seen to better describe the nature of the mathematics being taught and learnt.

2.0 Specification of content

2.1 Some respondents reported a desire to see further detail in what is described by the content and proficiency strands and in the content at each stage of schooling including the sequence and emphases of particular topics.

2.2 Despite general support for less topics, the comment was made that working in more depth on fewer topics requires teachers with strong content knowledge and understanding. Further, that creating brief statements relating to the intended curriculum will not necessarily thin out the implemented curriculum.

2.3 Some specific advice on mathematical content was provided about such matters as the application of statistics and algebra.

2.4 Some respondents commented on the perceived absence of the affective domain, requesting that elements of the content be used to enhance a positive disposition toward mathematics.

2.5 Many respondents put forward the view that there was a need to engage more students and this could be done by specifying content that enabled connection and relevance to their life, using everyday problems and situations.

2.6 Some respondents recommended that the national mathematics curriculum should clearly articulate the content through the identification of a core of mathematics that students should learn and teachers should teach.

3.0 Addressing the needs of all learners

3.1 Respondents often valued depth over content acceleration as an opportunity to extend students. Many were keen to see challenging mathematics to engage students at the higher end of the achievement scale. Some felt it was important to extend students vertically by challenging them with more rigorous work.

3.2 Depth of study with fewer topics was seen generally as an appropriate and supported method to thin an overcrowded curriculum.

3.3 A number of respondents also emphasised the necessity of a good grounding in basic mathematics as an integral foundation upon which to build understanding of more complex concepts and content.

3.4 Ability streaming was mentioned by several respondents as a potential solution to issues raised. For example, the opportunity for Year 9 and 10 students intending to take higher level mathematics in the senior years having a curriculum pathway to that end.

3.5 Many respondents endorsed the need to preserve options for every student for as long as possible. Content should be accessible to every student including those from low SES background, language backgrounds other than English or special education needs (eg intellectual disabilities, learning difficulties). The nature of the content should also reflect the diversity of Australian students and communities in which they live.

4.0 Stages of schooling

4.1 Many respondents explicitly stated or recommended that content be written for every year of schooling.

4.2 In relation to the stage one descriptions, respondents variously commented on:

- the need to build on the national Early Years Learning Framework and to refer to other research evidence including Count Me In Too (NSW), Early Numeracy Research Project (NSW), First Steps (WA) and Numeracy Development Project (NZ);
- using 'patterns' to denote pre-algebraic thinking from the beginning; pattern making is a natural exploratory activity of young children; by giving children the chance to create patterns from an early age, they develop their capacity to generalise about number patterns and relationships and this ability is at the heart of algebraic thinking.

4.3 In relation to the stage two descriptions, some respondents commented on the need to include:

- subitising and partitioning, using deep understanding of whole numbers to build understandings of fractions and decimals and development of conceptual understanding of place value; proportional reasoning including fractions, decimals, percentages; and developing number sense and fluency and flexibility with number through mental computation skills.

4.4 In relation to the stage three descriptions, some respondents identified the need to:

- encourage concrete materials and investigative thinking; develop deep understanding of algebra with adequate time to use algebraic modelling and applications; develop critical statistical literacy skills; and build on primary school knowledge and skills.

5.0 Number and nature of senior secondary courses

5.1 A large majority of respondents preferred four senior secondary courses. Most of those commented that the fourth course should be for those students in a strong vocational program.

5.2 The nature of the courses described in the framing paper was supported by most respondents, however many suggested that the Barrington terms should not be used to name the courses.

5.3 Advice was given that the described "intermediate" and "advanced" courses should, at a minimum, be calculus-based courses. There was no clear advice about the importance of including calculus in the "elementary" course.

5.4 Some respondents stated that the number of courses was less critical than the provision of multiple entry and exit levels to enable all students to engage or re-engage with mathematics.

5.5 A few respondents stated that the current rigour of Year 11 and 12 courses in their particular states needed to be maintained.

6.0 Concept of numeracy and its relationship to the national mathematics curriculum

6.1 Many respondents commented favourably on the inclusion and focus of numeracy outlined in the Framing Paper but also expressed the view that there was a lack of clarity about how the relationship between mathematics and numeracy was described.

6.2 Many respondents saw numeracy not being the specific domain of mathematics alone and that it should also be taught through other subjects or learning areas. Suggestions were made to ensure that the nature of cross-curricular numeracy was not lost from the other learning areas and that the numeracy requirements should be embedded.

6.3 In connecting numeracy to other learning areas there is a need for common understanding of language, symbolism and representation; and to introduce concepts at an appropriate developmental level and synchronise timing of these concepts across disciplines.

6.4 Building numeracy into the curriculum is important and desirable but not all teachers are confident in their own mathematical ability or disposed to engage with mathematics.

6.5 Some respondents suggested that numeracy requirements form part of the assessment requirements at the conclusion of each stage. Some responded that numeracy should not be separated from content and proficiency strands.

7.0 Application of technology and incorporation into the curriculum

7.1 Respondents were generally in favour of the position on technology in the framing paper. Whether in support or opposition, many commented that digital technologies should be used purposefully and be seen as a tool to support the learning in mathematics not to replace knowledge of the basics.

7.2 The interaction between technology and curriculum is dynamic. New and emerging technologies provide not just new tools for doing mathematics but new possibilities for pedagogical approaches.

7.3 The issue of equity of access, teacher training and resource funding was raised by a number or respondents concerned with a mandated level of technology and the expense for schools, students and parents, especially in low socio-economic areas.

7.4 Respondents commented that it would be important for teachers to outline to students the appropriate use of the technology that they can access. Further, respondents felt that teacher training would be required if the proposal in the Framing Paper was adopted.

7.5 A number of the issues identified by respondents may be influenced by their uncertainty around the assertion in the paper that the curriculum needs to "embed digital technologies so that they are not optional extras". A number of respondents perceived the framing paper proposal to imply a mandate for CAS calculators. Many commented that the use of a particular technology instrument should not be mandated and that the use of technology should be incorporated as appropriate with examples.

8.0 Clarity of language and structure

8.1 Many respondents expressed a desire for a consistent application of the mathematics terms used in the paper.

8.2 There has been general feedback that there needs to be a degree of consistency across the learning areas in the general curriculum terms used.

8.3 Respondents provided advice variably about improvements to the structure and content of the introduction and aims sections and refinements to the language throughout the document.

9.0 Other considerations

9.1 The following considerations related to curriculum development were raised in the feedback:

- It will be important to consult with teachers and provide opportunities for them to review and provide feedback at critical stages in the curriculum development process.
- Learning area writers and committees must liaise with each other and writing teams to include mathematicians, teachers and mathematics educators.
- There must be continuing consultation with and involvement of primary school educators, secondary educators and university mathematicians and mathematics educators across the states and territories.

9.2 The following considerations have been identified related to implementation. These are outside the remit of the Board but are included for noting.

- Pedagogy – many respondents commented on the importance of providing relevant, purposeful and engaging teaching strategies and the implications for teaching practice in some classrooms where drill and rote learning is prevalent.
- Teacher training – availability of qualified teachers of mathematics, teachers' understanding of mathematical concepts (especially for primary mathematics teachers), ongoing professional development, support for teachers teaching outside their area of expertise, knowledge of appropriate use of technology, pedagogical tools to cope with the paradigm shift.
- Available resources – textbooks to represent the changed thinking about the organisation of mathematics, development of commercial teaching resources, clear and comprehensive diagnostic tools; other suggestions included a national database of electronic teaching resources and on-line experts and mentors and promotion of developmental frameworks like First Steps.
- Parental involvement – support for students.

- Student support – assistance to achieve the basics before moving beyond, instilling a sense of enjoyment from mathematics, streaming of classes by ability, differentiation, sufficient to support extension of students.

- Structural – considered important by some to arrive at settlements around issues like common starting age and the placement of Year 7 in secondary school.

5. Addressing feedback requiring further examination

The table that follows identifies the actions that have or will take place in response to the key issues that have emerged from the consultation feedback. In addition, information will be included identifying the source of the feedback.

No	Item	Source	Action for consideration
1	**Nature of the organisation of content**	Academics Business & industry stakeholders Community members Education authorities Education authority – individual No profile Parents Principals Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Undergraduate teacher Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Structure of the curriculum' (1.1/1.2/1.4) • the interaction between the content and proficiency strands (1.2/1.4) • the curriculum focus through 'K-12 years of schooling' (1.2/1.4) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 3.1 & 3.2: clarification in definitions used to describe the content and proficiency strands (1.1/1.2/1.4) • Section 5.5: advice about the relationship between content and proficiency strands (1.4) • Section 5.6: strengthened advice about the curriculum foci for the 'Years of schooling K-12' (1.2/1.4) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • ensure that the nature of the proposed strands does not lead to overcrowding in the curriculum content written (1.1) • ensure relevant links to other curriculum areas are made explicit (1.5) **For noting:** • notion of working mathematically is reflected in the proficiency strands but there was agreement to retain structure of the proficiency strands because it provides a more explicit way of representing thinking and working mathematically (1.3) • retain in the shape paper, the mathematics terms used for the content strands (1.6)

No	Item	Source	Action for consideration
2	**Specification of content**	Academics Business & industry stakeholders Education authorities Education authority – individual Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Structure of the curriculum' (2.1) • the interaction between the content and proficiency strands (2.1) • the curriculum emphasis by strand at each year level (2.3/2.4/2.5) • the curriculum focus through 'K-12 years of schooling' (2.1/2.3/2.5) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 3.1 & 3.2: clarification in definitions used to describe the content and proficiency strands (2.1) • Section 5.5: advice about the relationship between content and proficiency strands (2.1) • Section 5.6: strengthened advice about the curriculum foci for the 'Years of schooling K-12' (2.3/2.4/2.5) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • content elaborations to contain further support for teachers requiring additional content knowledge (2.2) • analyse the consultation feedback provided about specific mathematical content (2.3) • ensure connections and relevance to the lives of students from a range of diverse backgrounds are evident within the curriculum (2.5) • ensure the mathematics content expresses clearly and succinctly what students should learn and teachers should teach (2.6)

No	Item	Source	Action for consideration
3	**Addressing the needs of all learners**	Academics Business & industry stakeholders Community member Education authorities Education authority – individual No profiles Parents Principals Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Undergraduate teacher Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Structure of the curriculum' (3.3/3.4) • the curriculum emphasis by strand at each year level (3.3/3.4/3.5) • the curriculum focus through 'K-12 years of schooling' (3.3/3.4/3.5) • the nature of curriculum differentiation and potential curriculum pathways at Year 9 and 10 (3.4) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 4.4: strengthened advice with revised text about the 'Breadth and depth of study' (3.1) • Section 5.6: strengthened advice with revised text about the curriculum foci for the 'Years of schooling K-12' (3.4) • Section 5.6.3: strengthened advice with revised text about the pathways available in the mathematics curriculum and their connection with the senior secondary courses (3.4) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • ensure the nature and structure of the curriculum challenges students to explore content in further depth (3.1/3.2) • consideration be given to writing a curriculum for all students up to Year 10 but with opportunities for extended or accelerated learning (3.4) • ensure the curriculum content reflects the diversity of the student population (3.5)

No	Item	Source	Action for consideration
4	**Stages of schooling**	Academics Business & industry stakeholders Community members Education authorities Education authority – individual No profiles Parents Principals Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Undergraduate teacher Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Structure of the curriculum' (4.2/4.3/4.4) • the curriculum emphasis by strand at each year level (4.1/4.2/4.3/4.4) • the curriculum focus through 'K-12 years of schooling' (4.2/4.3/4.4) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 5.6: strengthened advice about the curriculum foci for the 'Years of schooling K-12' (4.2/4.3/4.4) • removal of specific references to "stages of schooling" **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • ensure the curriculum supports the nature of the learner for which it is intended (4.1/4.2/4.3/4.4) • refer to available research on the nature of the learner K-12 and the implications for teaching and learning of mathematics (4.2/4.3/4.4)

No	Item	Source	Action for consideration
5	**Number and nature of senior secondary courses**	Academics Business & industry stakeholders Community member Education authorities Education authority – individual No profiles Parents Principals Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Structure of the curriculum' (5.2) • the nature and structure of the senior secondary curriculum and the four courses (5.1/5.2/5.3) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 5.6.4: strengthened advice with revised text about the broad foci of the four proposed senior secondary courses (5.1/5.2) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • analyse feedback provided about specific mathematical content of the four courses (5.3) • ensure there is consideration about potential pathways to support the provision of multiple entry and exit levels (5.4) • ensure senior secondary courses maintain the rigour of the corresponding existing courses from states and territories (5.5) • refer to current senior secondary courses across states and territories (5.1/5.3/5.5)

No	Item	Source	Action for consideration
6	**Concept of numeracy and its relationship to the national mathematics curriculum**	Academics Business & industry stakeholders Education authorities Education authority – individual Parent Principal Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Union	**Action 1:** Advice was sought from an expert numeracy consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Terms used in this paper to define numeracy' (6.1/6.2/6.3) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 3.4: revised definition of numeracy (6.1/6.2/6.3) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • ensure the relationship between numeracy and mathematics is made explicit (6.1) • provide advice about the potential opportunities to develop numeracy in the other learning areas (6.2) • ensure the advice and ideas about numeracy support the nature of the learner for which it is intended (6.3) • content elaborations contain further support about the development of numeracy (6.4) **For noting:** • the developmental work on the numeracy continuum will further inform curriculum development with particular reference to achievement standards (6.5)

No	Item	Source	Action for consideration
7	**Application of technology and incorporation into the curriculum**	Academics Business & industry stakeholders Education authorities Education authority – individual No profile Parents Principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • a position on the inclusion of technology in the mathematics curriculum (7.1/7.2/7.4/7.5) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 4.5.2: strengthened advice to reiterate the position that the curriculum will describe embedded and appropriate use of technology (7.1/7.2/7.5) **For noting:** • consideration and monitoring by advisory panel and jurisdictions of potential implementation issues related to equity of access, teacher training and resource funding (7.3/7.4)

No	Item	Source	Action for consideration
8	**Clarity of language and structure**	Academics Business & industry stakeholders Education authorities Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Union	**Action 1:** Advice was sought from an expert mathematics consultation group on key issues raised through the consultation feedback. Specific advice and direction was provided about: • revisions to the text in the section 'Terms used in this paper to define topics' (8.1/8.2/8.3) **Action 2:** Specific revisions have been made to the Shape of the Australian Curriculum: Mathematics as follows: • Section 3.5: inclusion of definition of 'topics' (8.1/8.3) • text has been moved/rearranged to better align with the structure of the paper (8.3) • some text has been deleted or revised to ensure internal consistency and minimise overlap (8.3) • additional text has been included to address identified gaps and points of clarification raised in the feedback (8.3) **Action 3:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • ensure consistency and succinctness of language across the entire national curriculum (8.2)

No	Item	Source	Action for consideration
9	**Other considerations**	Academics Business & industry stakeholders Community members Education authorities Education authority – individual No profile Parent Principals Professional associations – principals Professional associations – teachers (state) Professional associations – teachers (national) Teachers Union	**Action 1:** Specific instructions will be provided to the learning area advisory panel and to the curriculum writers on the following matters: • continuing consultation with primary school educators, secondary educators and university mathematicians and mathematics educators across the states and territories (9.1) **For noting:** • continued consultation with primary school educators, secondary educators and university mathematicians and mathematics educators across the states and territories is encouraged (9.1) • issues for implementation to be considered: pedagogy, teacher training, resourcing, parental involvement, student support, curriculum structure (9.2)

6. Summary of framing paper feedback

The National Mathematics Curriculum: Framing Paper

Consultation period: October 2008 – February 2009

Data as at 27 March 2009

Submissions	
English	87
Mathematics	67
Science	78
History	82
	314
Surveys	
English	246
Mathematics	159
Science	192
History	220
	817
Total of all feedback	
English	333
Mathematics	226
Science	270
History	302
	1131

7. Appendix: What the community said in response to NCB survey questions

Introduction

Question 1: Please comment on the Introduction.

The introduction to the paper was generally supported by respondents. There was much discussion about the proposition of advancing students with the majority of respondents preferring the position of the paper (*"advanced students can be extended appropriately using challenging problems within current topics"*).

- *The general principles are sound. The key objectives are concisely written, centred around contemporary teaching and learning of mathematics. The emphasis on reducing the topic extent should allow in-depth coverage of topics and be accessible to all students. The curriculum is based on discussion papers including National Numeracy Review Report and the National Mathematics Advisory Panel (2008).* (Academic)

- *I particularly support the dot point relating to advanced students. It is important that the extension of these students is via challenging problems within current topics rather than acceleration through topics at a more superficial level.* (Education professional – Teacher)

- *There is an apparent emphasis by NCB for achieving numeracy for all students, and this is commendable, however not at the expense of extending the most capable students.... dot point 15 talks about extending appropriately... but this is not possible given the NCB's intention to thin out the curriculum thus reducing opportunities for students to discover the numerous connections that exist across all of mathematics.... as a result, i.e. many of the links between algebra, geometry and measurement will be unavailable, and so the more capable students will be disadvantaged. Had there been a representative from NSW on the NCB advisory group, this argument would have been considered at the earliest stages of planning. At present, the highest levels of mathematics can be found in the NSW syllabus [extension 2] which offers the most extensive and the most challenging courses.... equivalent to honours. When this top level is no longer offered, because the ncb has reduced curriculum content and our nation will educate our most capable students to a lesser degree and I argue that this is counter to the need for our nation to increase the number of highly competent mathematicians, some of whom we need to become teachers of mathematics , at the highest levels. In other words I would have written the dot point in a way to ensure full opportunities at both ends of the learning spectrum.*
  (Education professional – Curriculum director)

- *Clear and precise, but lacks content. No real frame for implementation. Would require a more specific time frame for schools to be ready for a national curriculum. Expressed clearly and succinctly. It effectively communicates the thinking behind the new curriculum and sets the context for the following pages. The mention of advanced students being extended propriately using challenging problems is not addressing the methods, processes etc. This curriculum is said to be useable and useful for experienced and less experienced teachers. At what level of experience or knowledge will teachers or personnel be allowed to teach this curriculum?*
  (Education professional – Departmental / sector representative)

Aims

Question 2: To what extent do you agree with the aims of the mathematics curriculum?

Strongly Disagree	Disagree	Agree	Strongly Agree
5%	8%	47%	39%

Question 3: Please comment.

The proposed aims of the mathematics curriculum were strongly endorsed by respondents. There was concern expressed by some respondents as to the capacity for the actualisation of these aims in the curriculum. Some suggestions were provided for further inclusions.

- *As with the introduction, we are in total agreement with all of the aims, especially the need for the importance of mathematics in the curriculum to be reflected in the time and resources allocated.* (Education professional – Teacher)

- *Whilst there is nothing specific here with which to disagree, the aims are not expressed as aims. They are unnecessarily verbose and again say nothing original or creative; neither can they explicitly inform the direction of our new curriculum as they are written.*
  (Education professional – Departmental / sector representative)

- *You have stated many aims – how are you going to do it? How will you:*
  - *promote the value and study of maths?*
  - *create maths professionals and workforce people in a way that differs from what we already do?*
  - *make maths elegant and beautiful?*

  How do your aims differ to what are already established aims in our current syllabus? (Academic)

- *These items are general discussion not aims. For example you could aim that all students wil complete a part of the curriculum before they sit a national test (unlike the current debarcle that is naplan testing), or you could aim that all teachers complete a module of study on each strand on the first five years.* (Education professional – Teacher)

- *Mathematics is certainly a language of beauty and sophistication. It is pleasing to see that the national curriculum aims to provide students with the opportunity to appreciate the 'elegance and power of mathematical thinking, experience mathematics as enjoyable and encounter teachers who communicate this enjoyment' (p. 2, para. 18). This statement begs the question, how will this be translated into content in a national curriculum?*

  Many of the aims for a national mathematics curriculum will be achieved through improved initial mathematics teacher training, at both primary and secondary level, as well as continued professional development of teachers to improve content knowledge and pedagogical content knowledge. Areas that need further training and development will be further explored through other reflections made through this response.

  As the aims of the curriculum are to develop a great enjoyment and appreciation for mathematics, the result should be more students choosing to study mathematics at a tertiary level. It is accepted that effective teachers of mathematics need to have a strong knowledge of the content they are teaching (Clarke 2004, p. 16). Not only do we need more top level mathematicians in the wider Australian workforce and operating at an international level (p. 2, para. 19) we need to encourage more capable mathematicians back to the classroom to teach our students. (Educational authority)

Terms used in this paper

Question 4: To what extent do you agree with the definitions and applications of terms used in the paper?

Strongly Disagree	Disagree	Agree	Strongly Agree
7%	16%	46%	31%

Question 5: Please comment on the content and proficiency strands as organisers for the curriculum.

The content strands were strongly endorsed by respondents as a welcomed return to the traditional names of the mathematics being learnt and taught. The proficiency strands were generally supported with respondents commenting on the use of some terms and their meaning.

- *There are a lot of students who at the higher secondary levels are taught maths without being given the reason for learning the topics and how they would ever need those areas of maths eg. calculus ever again in their lives as they may all not end up as engineers and mathematicians. They need to see how the maths they have learned can be applied to different situations that can affect them.*

  Also, my children were able to learn and understand the different topics in maths, but had trouble combining it all together in analysis problems which called on them using everything they had learnt to solve them. (Community member)

- *I agree with them. The challenge will be to ensure all aspects of the proficiency strand are included so maths becomes more orientated to the life events, not just drill and practice (see fluency).*
  (Education professional – Teacher)

- *Disagree with Number and Algebra being combined in the same strand. There is no connection between Number and Algebra that is not as strong as with the other strands. Eg. statistics and probability. Cutting the strands does not streamline the curriculum if you combine two strands into one with the same content in the combined one.*

  Networks, not normally taught in the middle school is mentioned as a possibility for its introduction but no topic is suggested for deletion. This will not thin out a crowded curriculum.

  Students coming in to high school do not know their times tables or number skills.

  Numeracy does not include, by definition, the esoteric mathematics of the professions.
  (Education professional – Teacher)

- *Why is algebra emphasised? For weaker students near the end of compulsory years to emphasise algebra would be detrimental.* (Education professional – Teacher)

- *We believe that the content strands create clear interconnectedness. They are fitting and the combination of two areas of study within each strand will help to deepen students' understanding as links between mathematical ideas are established. Research has shown that 'we understand something if we see how it is related or connected to other things we know' (Hiebert et al. 1997). Discussions based on the mathematics framing paper have raised some concern about the use of the term 'algebra' as part of a content strand, particularly by primary teachers. This concern is mostly based upon a belief that algebra refers solely to the mathematics that is typically done in secondary. What this demonstrates is not a need to change the term used, but rather greater teacher education in how algebraic thinking is taught and the impact of this on the early primary classroom practice. As a sector we do not see the use of this term as unhelpful, rather the opposite. It is appropriate and highlights an area of teachers' content knowledge that needs to be further addressed through professional development.*
  (Educational authority)

Considerations

Question 6: Comment on the considerations that need to be taken into account when developing a national mathematics curriculum. Are there other considerations not canvassed in the paper?

In the main, respondents reacted positively to the considerations proposed by the paper. Some suggestions were provided for further inclusions.

- *Of the considerations outlined, the thinning of the curriculum stands out as the most progressive and worthwhile aims of any new curriculum. Importantly, and this is also an issue of equity, students should not be underestimated in their ability to master mathematical concepts especially at an early secondary age. I have experienced students in years 8 and 9 who were not only able to apply content from the NSW Stage 6 syllabus, but who were able to discover it independently! Of course this is not to say all students can achieve this, but given the opportunity and with sufficiently high expectations I believe students are capable of grasping content at an earlier age than they are presently required to do so. In fact, it is my belief that this is largely to blame for why students become disinterested in mathematics at the early secondary stage – they are bored with it. Opportunities are wasted in year 7 and 8 because secondary schools insist on evaluating students abilities as they come from primary schools. Far greater fluency is required as students move from primary to secondary schools, especially in the methods of instruction used. It is unreasonable to expect students who have typically studied mathematics through concrete exploration during primary school to be able to immediately adapt to the text-book driven mathematics classroom so often seen in secondary schools. It is no wonder that these years are often when students lose interest and confidence with mathematics.* (Academic)

- *I am pleased to see recognition of the need to develop problem solvers not just students who can reproduce routine calculation techniques. Deep understanding is a vital goal. The statement about digital technologies is to be commended. It is essential that all Australian students are familiar with using the same technologies. The lack of sophisticated technology in NSW HSC mathematics examinations severely limits the performance of students who have moved from other states or countries. It is essential that the National Curriculum mandates an Australia wide policy on examination technology. The policy could be at any level from all students use CAS capable technology to no technology at all. Whatever the decision it MUST bind all states and territories.*
  (Education professional – Professional organisation representative)

- *Disengagement occurs also when: the teacher slows down to help lower ability groups, students are distracted by those who don't want to be there, some people see maths as fun and not always practical at first glance.*
  - *technology is only a tool. It costs, and some areas cannot keep supplying/replacing it.*
  - *again, not everyone is equal.*
  - *perhaps it should be a role of government and education departments to teach parents their role in developing their children instead of blaming schools and teachers.*

  (Education professional – Teacher)

- *There is no argument about the need to address equity, but there is a need to consider which equity groups. The paper rightly considers socioeconomic groups who are not well treated at present. I would also consider a group comprising mathematically talented students who are currently bored by a system that provides no challenge and excitement. This group is treated badly by attitudes such as any teacher can teach mathematics". They need explicit support in a curriculum. I strongly agree with the need to emphasise algebra and geometry. Other areas such as statistics are nice, but should not be covered to the exclusion of the core. (I am a statistician.) Digital technologies are a mixed blessing, both removing the druggery and hiding the ideas. No curriculum should make them too central."*
  (Business or industry professional)

Structure of the curriculum

Question 7: The proposed structure identifies the curriculum focus for Stage 1 of schooling. To what extent do you agree with the focus in this stage?

Strongly Disagree	Disagree	Agree	Strongly Agree
9%	9%	53%	28%

Question 8: Please comment.

The proposed curriculum focus for stage 1 has been strongly endorsed. An emphasis on building the basics was evident. Respondents commented that current curriculum documents overemphasise the role of number to the detriment of other strands and implored that the framing paper should outline the importance of all aspects of mathematics. Respondents suggested research evidence that the writers should be aware of when commencing writing for this stage.

- *Great to see a hands on approach is planned to support traditional Early Childhood Philosophy and pedagogy. Relevance and the creation of meaning are vital to the lives of children in this age bracket.* (Education professional – Teacher)

- *If the focus is on a maths language-rich environment full of real" problems which are relevant to the children, and developmentally appropriate, then YES!* (No profile stated)

- *Whilst it is very important that teachers build on what students know and can do, when they enter school, key conceptual mathematical ideas need to be made explicit. For example the principles of counting should be clearly articulated for teachers. In addition, the importance of subitising and counting in learning about quantities should be made clear.*
  (Education professional – Curriculum director)

- *Bit hard to determine what the curriculum focus is here – very vague description. I do agree that ideas need to be based on physical models and allow students the opportunity to explore ideas using these physical models – however, a clear connection MUST be made between the physical models and the symbolic representations.* (No profile stated)

- *It is assumed that the reduction of the 'crowded curriculum' (paragraphs 46-49) will exclude content that no longer serves any purpose in a futures-oriented curriculum. This would allow time for students to develop conceptual and relational learning as opposed to instrumental learning. Digital technologies can enhance conceptual and relational learning by removing the drudgery of routine calculations and procedures. The Council agrees that the new technology also allows learners to investigate more easily mathematical patterns, make and test conjectures and generalise and prove mathematical relationships. (paragraph 50) Such activities require the student to apply concepts and relationships to unfamiliar problem-solving situations, choose and use mathematical models with adaptations, compare solutions and present conclusions. These are all higher-order processes that lead to better understanding of the mathematics.* (Educational authority)

Question 9: The proposed structure identifies the curriculum focus for Stage 2 of schooling. To what extent do you agree with the focus in this stage?

Strongly Disagree	Disagree	Agree	Strongly Agree
7%	10%	56%	27%

Question 10: Please comment.

The proposed curriculum focus for stage 2 has been strongly endorsed. Respondents commented on the curriculum areas that should be emphasised within the curriculum of this stage.

- *Maths needs to be meaningful and relevant. It will be vital to keep students engaged. Structure should allow for different level of ability – support children who require it and challenge advanced children.* (Parent)

- *There was broad agreement with the focus amongst primary teachers and curriculum officers consulted. The move to abstract concepts needs to be supported by appropriate language activities and visual texts/models to help students understand the challenging content in this stage.* (Academic)

- *What happens to students who at age 12 have not achieved these outcomes? By this age there is a growing gap between what students know and can apply. What process is in pace to cater for students learning at very different paces and levels?* (Education professional – Curriculum manager)

- *The idea that all students in a given age range should have the same general curriculum focus needs to be justified. For example, there are many students between 8 and 12 years of age (i.e. stage 2) who are not ready to lay the foundations for future studies, particularly algebra or for the introduction of fractions and decimals. They might be ready during what the document is calling stage 3, but by then the expectations have moved on. Teachers are generally not trained in how to detect and cope with this range, but at primary level it is easier than at secondary.* (Business or industry professional)

- *Number and Algebra – Number content should also consider Australasian research that looks at how children learn mathematics in the early years such as Count Me In Too (NSW), Early Numeracy Research Project (VIC), First Steps in Mathematics (WA) and the Numeracy Development Project (NZ). It is of vital importance that these early years students are exposed to algebraic thinking (Warren 2002). This is not addressed in this stage within the framing paper, however, mention is made in Stage 2 being the stage to lay the foundations of algebra, which is in conflict with current and accepted research. Development of fractional concepts is also absent from this area of the curriculum. The everyday application of the content needs to be introduced in the early years.* (Educational authority)

Question 11: The proposed structure identifies the curriculum focus for Stage 3 of schooling. To what extent do you agree with the focus in this stage?

Strongly Disagree	Disagree	Agree	Strongly Agree
8%	21%	42%	29%

Question 12: Please comment.

The proposed curriculum focus for stage 3 has been strongly endorsed. Respondents emphasised the importance of building upon the foundations from previous stages to assist students in building their understanding in areas that should be emphasised by the curriculum at this stage.

- *I agree that the current curriculum is very crowded. The idea of covering less topics but at a greater depth is great. More advanced students should be able to be catered for through the use of challenges and problem solving opportunities.*

  The idea of ensuring that students have options available to them in their future studies is important. Many students are not mature enough to make informed decisions about their futures at this age. More time to develop key concepts will benefit students who would currently become disengaged due to the pace of the course and their consequently disappointing results. (Education professional – Teacher)

- *Whilst not knowing the 'actual' curriculum, we agree with the general comments made, provided the curriculum does not again become too crowded. Also, it will be vital that the content and proficiency strands are very clearly defined at all stages so as to reduce confusion and increase consistency.* (Education professional – Teacher)

- *Sounds good in theory – but this will be a very difficult balancing act – especially given the algebraic and geometrical concepts become so much more abstract at this level, and will take up a lot of teaching time. How will the curriculum attempt to establish the meaningfulness and relevance to students' lives?* (no profile stated)

- *Extension of more mathematically able students using more challenging problems is OK up to a point. I really think that if students are more proficient, they really do want to learn more advanced maths as this satisfies their curiosity and eagerness to learn more in the field. Merely giving them more challenging problems within the same topic limits their learning and consequently would make them lose interest. Why can't proficient students learn at their own level? We need to train teachers sufficiently in maths so that they can cater for this, and I think there aren't enough skillful teachers with sufficient qualifications for this to happen.* (Community member)

- *Again the comments concerning the clarification of the breadth and depth of what is meant by the term 'topics' apply. The concern is that 'topics' as used in the paper may represent too narrow a focus, which in turn will determine how teachers are able to extend the more able students. It is expected that the scope of the syllabus for stage 3 prepares students for senior year mathematics courses. This also predicates sufficient preparation and opportunity to meet the needs of society as outlined in paragraph 19.* (Educational authority)

Question 13: How many mathematics courses for the senior years of schooling should be included in the national mathematics curriculum?

Number of courses	Number of responses
1	0%
2	4%
3	27%
3 or 4	1%
4	56%
4 or 5	2%
5	10%

Qualitative responses:

There was a strong preference for the development of four secondary courses in the senior years. Respondents suggested a variety of purposes and content emphases to define the courses.

- *Certainly the national curriculum should include the courses for senior levels of study since these will be determined based on the content achieved up to the end of year 10. Courses should be designed so that ALL students are able to successfully take a senior course in mathematics. Thus, as well as an elementary course, an intermediate course and 1 or 2 extension courses, there should be a course designed for those students who have failed to master the content of the curriculum up to the end of year 10.* (Academic)

- *Three. Each targeting a different post-school pathway. I'd suggest general strands targeting: engineering / physical science, commerce / social sciences and retail / trade.*
  (Education professional – Department / sector representative)

- *The proposal to offer four different courses of study in Stage 4 would be appropriate, and would involve a relatively smooth transition from the current suite of senior subjects in Queensland. However, it is imperative that students in all schools, ranging from large metropolitan through to small regional, have access to the same opportunities in Stage 4 courses.*
  (Education professional – Professional organisation representative)

- *Four – one basic calculus; one advanced calculus; one applied and high level; one applied and low level eg. numeracy skills.* (Academic)

- *Rather than determining the number of courses for Stage 4, greater clarity needs to be provided concerning the proposed structure of the courses. Stage 4 courses in NSW are currently of two years duration with an identifiable Preliminary component and an HSC component. The Initial Advice paper (p. 11) indicated that one-year courses may have been envisioned as it stated "… that once there is agreement on the Year 12 offerings, Year 11 subjects could be designed subsequently'. Any comments on the number of courses need to be tempered by the nature of the courses, whether one-year or two-year courses.* (Educational authority)

Question 14: Are there any other comments that you would like to make regarding the paper?

Respondents produced a variety of comments in regard to the paper. The responses included ideas for inclusion in the paper, reactions to the pedagogy and assessment section of the paper, affirmations of the intent of the paper, comments that are outside the scope of the national mathematics curriculum at this stage and ideas for the development phase of the national mathematics curriculum.

- *It looks like you have come to grips with the problems of school maths. I hope you can manage to change it & make it more relevant. Changing textbooks is crucial.* (Education professional – Teacher)

- *Pedagogy and assessment will need greater emphasis as many teachers at levels 1-3 are not specifically trained in mathematics. This is why I have placed strong emphasis on text book writing which is more critical in the subject than any other. Perhaps the committee could reexamine some present day textbooks and discuss this with the teachers to cement the relevance of the comments.*
  (Education professional – Curriculum director)

- *I'm not sufficiently close to the teaching profession to assess the student learning rationale at a deeper level, however I find I'm in close agreement with the above proposals.* (Academic)

- *Problem Solving and modeling pose assessment problems and are difficult to administer and quanitfy the outcomes. The need to be compared to other countries amy drive the assessment rather than to concpets and pdeogiallicaly theories outline in this paper.*
  (Education professional – Professional organisation representative)

- *I read the paper as a professional statistician/mathematician who for almost 25 years has recruited university graduates in the mathematical sciences. I see the decline in the numbers and quality, and in some cases the quality issue can be tracked back to students who did not have the opportunity to do a higher level of mathematics in secondary school. This is sufficiently important that when assessing applicants (even those with honours degrees) I check on how much school maths they did. With regard to the fact that the document will create a need for adjustments to some aspects of professional learning for mathematics teachers", this is critical. As a mathematician, I find it paradoxical (almost insulting) that to teach mathematics even in senior school, a teaching qualification is required but not a mathematical qualification. I cannot teach mathematics in a school but a teacher who knows little/no mathematics can. The answer to this is beyond the curriculum alone, but the curriculum must not be brought down to a low level to accommodate less than ideal teachers. Finally, I find it disappointing that the document does not really address where these students will be going and the Advisory Committee includes no-one who employs mathematicians."* (Business or industry professional)

- *The ideas and big picture teaching is deperately needed. Good teachers already implement the strategies and ideas discussed. It will require a large amount and in-depth inservicing, but for the better!*
  (Education professional – Curriculum manager)

- *At this point it is not so much about Content and Proficiency strands as it is about opportunities for students to access relevant and meaningful courses that allow engagement at various levels. Added to this is the need for adequate resources and training. Note: See the broader comments made at the front of this appendix under the heading: Overview.* (Educational Authority)