National Curriculum Board

Shape of the Australian Curriculum: Mathematics

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1. PURPOSE

1.1 The *Shape of the Australian Curriculum: Mathematics* will guide the writing of the Australian mathematics curriculum K–12.

1.2 This paper has been prepared following analysis of extensive consultation feedback to the National Mathematics Curriculum Framing Paper and decisions taken by the National Curriculum Board.

1.3 The paper should be read in conjunction with *The Shape of the Australian Curriculum*.

2. INTRODUCTION

2.1 The national mathematics curriculum will be the basis of planning, teaching, and assessment of school mathematics, and be useful for and useable by experienced and less experienced teachers of K–12 mathematics.

2.2 There have been two important recent reports relevant to the development of this paper: the *Australian National Numeracy Review Report* (NNR, 2008); and Foundations for Success: The final report of the *National Mathematics Advisory Panel* (NMAP, 2008) from the United States. Although both had some emphasis on what research says about learning, teaching and teacher education, they each contribute to current considerations of the mathematics curriculum, particularly in describing the goals and intended emphases. In addition, the National Numeracy Review Report (2008) provides a summary of current research and practice in Australian schools.

2.3 The obvious imperative to create a futures-oriented curriculum provides a major opportunity to lead improved teaching and learning. This futures orientation includes the consideration that society will be complex, with workers competing in a global market, needing to know how to learn, adapt, create, communicate, interpret and use information critically.

2.4 If Australia's future citizens are to be sufficiently well educated mathematically for the development of society and to ensure international competitiveness, there needs to be adequate numbers of mathematics specialists operating at best international levels, capable of generating the next level of knowledge and invention, but also of mathematically expert professionals such as teachers, engineers, economists, scientists, social scientists and planners.

2.5 Successful mathematics learning lays the foundations for study in many disciplines at tertiary level and in the applications of those disciplines. Mathematics and numeracy provide a way of interpreting everyday and practical situations, and provide the basis for many informed personal decisions.

2.6 Successful mathematics learning also provides a workforce that is appropriately educated in mathematics to contribute productively in an ever-changing global economy, with both rapid revolutions in technology and global and local social challenges. An economy competing globally requires substantial numbers of proficient workers able to learn, adapt, create, interpret and analyse mathematical information.

2.7 This critical importance of mathematics will be assumed by the mathematics curriculum but it also needs to be reflected in: the time and emphasis allocated to mathematics learning in schools; the study of mathematics teaching in teacher education programs; the resources allocated to the support of the implementation of the curriculum; and the promotion of the value of the study of mathematics.

3. AIMS OF THE MATHEMATICS CURRICULUM

3.1 Building on the draft *National Declaration on Educational Goals for Young Australians*, a fundamental aim of the mathematics curriculum is to educate students to be active, thinking citizens, interpreting the world mathematically, and using mathematics to help form their predictions and decisions about personal and financial priorities. Mathematics also enables and enriches study and practice in many other disciplines.

3.2 In a democratic society, there are many substantial social and scientific issues raised or influenced by public opinion, so it is important that citizens can critically examine those issues by using and interpreting mathematical perspectives.

3.3 In addition, mathematics has its own value and beauty and it is intended that students will appreciate the elegance and power of mathematical thinking, experience mathematics as enjoyable, and encounter teachers who communicate this enjoyment — in this way, positive attitudes towards mathematics and mathematics learning are encouraged.

4. KEY TERMS

4.1 This paper uses four terms that together describe the mathematics curriculum: content strands, proficiency strands, numeracy and topics. The cornerstone of mathematics is its interconnectedness, and while these distinctions are somewhat artificial, they facilitate the organisation of the curriculum in a form that will enable the achievement of the aims described in this paper.

4.2 Content strands

The content strands are the collected concepts and terms that form the basis of the curriculum. To maximise interconnections, coherence and clarity, the concepts and terms are grouped into developmental sequences that are termed strands. For mathematical and pedagogical reasons, it is proposed that the national mathematics curriculum includes three content strands: Number and algebra, Measurement and geometry, and Statistics and probability.

4.3 Proficiency strands

In many jurisdictions the term working mathematically is used to describe applications or actions of mathematics. This term does not encompass the full range of desired actions nor does it allow for the specification of the standards and expectations for those actions. It is proposed that the national mathematics curriculum use the four proficiency strands of Understanding, Fluency, Problem solving, and Reasoning, adapted from the recommendations in *Adding it Up* (Kilpatrick, Swafford & Findell 2001), to elaborate expectations for these actions. These proficiency strands define the range and nature of expected actions in relation to the content described for each of the content strands.

4.4 Numeracy

Numeracy is the capacity, confidence and disposition to use mathematics to meet the demands of learning, school, home, work, community and civic life. This perspective on numeracy emphasises the key role of applications and utility in learning the discipline of mathematics, and illustrates the way that mathematics contributes to the study of other disciplines.

4.5 Topics

Content areas within mathematics are commonly identified as topics to facilitate planning and teaching. The topics form the knowledge and skill building blocks of the strands. Examples of topics include fractions, area and measures of central tendency. It is not intended that these topics be considered separately during the teaching and learning of mathematics; and connections between topics should be emphasised.

5. STRUCTURE OF THE MATHEMATICS CURRICULUM

5.1 The mathematics curriculum will be organised around the interaction of content and proficiency strands.

5.2 Content strands

The three content strands in the national mathematics curriculum will be:

Number and algebra: In this content strand the concentration in the early years will be on number, and near the end of the compulsory years there will be emphasis on algebra. Recent research has emphasised the connections between these. An algebraic perspective can enrich the teaching of number in the middle and later primary years, and the integration of number and algebra, especially representations of relationships, can give more meaning to the study of algebra in the secondary years. This combination incorporates pattern and/or structure and includes functions, sets and logic.

Measurement and geometry: While there are some aspects of geometry that have limited connection to measurement, and vice versa, there are also topics in both for which there is substantial overlap, including newer topics such as networks. In many curricula the term space is used to cover mathematical concepts of shape and location. Yet many aspects of location, for example maps, scales and bearings, are aligned with measurement, and the term geometry is more descriptive for the study of properties of shapes, and also gives prominence to logical definitions and justification.

Statistics and probability: Although teachers are familiar with the terms data and chance, statistics and probability more adequately describe the nature of the learning goals and types of student activity. For example, it is not enough to construct or summarise data — it is important to represent, interpret and analyse it. Likewise, probability communicates that this study is more than the chance that something will happen. The terms provide for the continuity of content to the end of the secondary years and acknowledge the increasing importance and emphasis of these areas at all levels of study.

The names of these content strands refer to substantial mathematics sub-disciplines and so reflect more accurately the purpose of their study. The reduction to three content strands will allow greater coherence within strands, will facilitate the building of connections between related topics within and across strands, and will support a clear and succinct description of the curriculum.

5.3 Proficiency strands

The four proficiency strands in the national mathematics curriculum will be:

Understanding, which includes building robust knowledge of adaptable and transferable mathematical concepts, the making of connections between related concepts, the confidence to use the familiar to develop new ideas, and the 'why' as well as the 'how' of mathematics.

Fluency, which includes skill in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily.

Problem solving, which includes the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively.

Reasoning, which includes the capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying, and generalising.

Expectations for these four proficiency strands will be elaborated to inform teaching and assessment. There are specific topics for which understanding is critical (e.g. decimal place value, 2D–3D relationships) and others for which standards for fluency will be specified (e.g. mental calculation, using Pythagoras's theorem). Expectations for proficiency in problem solving (e.g. representing situations diagrammatically) and reasoning (e.g. justifying solutions) will also be specified, noting that these are central to ensuring a futures orientation to the curriculum.

5.4 The relationship between content and proficiency strands

The content strands describe the 'what' that is to be taught and learnt while the proficiency strands describe the 'how' of the way content is explored or developed i.e. the thinking and doing of mathematics. Each of the 'content descriptions' in the mathematics curriculum will include terms related to understanding, fluency, problem solving or reasoning.

In this way, proficiency strands describe how students interact with the content i.e. they describe how the mathematical content strands are enacted via mathematical behaviours. They provide the language to build in the developmental aspects of the learning of mathematics.

5.5 Mathematics across K–12

Although the curriculum will be developed year by year, this document provides a guideline across four year-groupings:

Years K–2:	typically students from 5 to 8 years of age
Years 3–6:	typically students from 8 to 12 years of age
Years 7*–10:	typically students from 12 to 15 years of age
Years 11–12:	typically students from 15 to 18 years of age

*Specific advice will be provided to writers on the development of the Year 7 curriculum.

What follows for each year grouping is a description of the major content emphases either as points of exposure, introduction, consolidation or extension; some of the underlying principles (and rationale) that apply in these considerations; key models or representations; and possible connections across strands and year levels.

5.5.1 Years K–2 (typically from 5 to 8 years of age)

The early years (5–8 years of age) lay the foundation for learning mathematics. Children at this level can access powerful mathematical ideas that are relevant to their current lives, and that it is the relevance to them of this learning that prepares them for the following years. Learning the language of mathematics is vital in these early years.

Children in the early years have the opportunity to access mathematical ideas by developing, for example: a sense of number, order, sequence and pattern; understandings of quantities and their representations, and attributes of objects and collections, and position, movement and direction; and an awareness of the collection, presentation and variation of data and a capacity to make predictions about chance events.

Developing these understandings and the experiences in the early years provides a foundation for algebraic, statistical and multiplicative thinking that will develop in later years. These aspects of early mathematics build the foundations with which children can pose basic mathematical questions about their world, identify simple strategies to investigate solutions, and strengthen their reasoning to solve personally meaningful problems.

5.5.2 Years 3–6 (typically from 8 to 12 years of age)

The AAMT (2005) vision for quality mathematics in these years notes the importance of students studying coherent, meaningful and purposeful mathematics that is relevant to their lives. Students still require active experiences that allow them to construct key mathematical ideas, but there is a trend to move to using models, pictures and symbols to represent these ideas.

The curriculum will develop key understandings by, for example: extending the number, measurement, geometric and statistical learning from the early years; building foundations for future studies by emphasising patterns that lead to generalisations and describing relationships from data collected and represented, to make predictions; and introducing topics that represent a key challenge in these years such as fractions and decimals.

Particularly in these years of schooling, it is important for students to develop deep understanding of whole numbers to build reasoning in fractions and decimals and develop their conceptual understanding of place value. With these understandings, students are able to develop proportional reasoning and flexibility with number through mental computation skills. These understandings extend students' number sense and statistical fluency.

5.5.3 Years 7–10 (typically from 12 to 15 years of age)

Traditionally, during these years of schooling (12–15 years of age), the nature of the mathematics needs to include a greater focus on the development of more abstract ideas through, for example, explorations that enable students to recognise patterns and why these patterns apply in these situations. From such activities abstract thoughts can develop, and the types of thinking associated with developing such abstract ideas can be highlighted.

The foundations that have been built in the years prior, provide a solid basis for preparing for this change. The mathematical ideas built previously can be drawn upon in unfamiliar sequences and combinations to solve non-routine problems and develop more complex mathematical ideas. However, to motivate them during these years, students need an understanding of the connections between the mathematics concepts and their application in their world in contexts that are directly related to topics of relevance and interest to them.

During these years students need to be able to, for example: represent numbers in a variety of ways; develop an understanding of the benefits of algebra, through building algebraic models and applications, and the various applications of geometry; estimate and select appropriate units of measure; explore ways of working with data to allow a variety of representations; and make predictions about events based on their observations.

The intention is that the curriculum will list fewer detailed topics and encourage the development of important ideas in more depth, and the interconnectedness of the mathematical concepts. An obvious concern is the preparation of students who are intending to continue studying mathematics in the senior secondary years. It is argued that it is possible to extend the more mathematically able students appropriately using challenges and extensions within available topics and the expectations for proficiency can reflect this. This can lead to deeper understandings of the mathematics in the curriculum and hence a greater potential to use this mathematics to solve non-routine problems they encounter at this level and at later stages in their mathematics education.

The national mathematics curriculum will be compulsory to the end of Year 10 for all students. It is important to acknowledge that from Year 10 the curriculum should enable pathway options that will need to be created and available for all students. This will enable all students to access one or more of the senior years' mathematics courses.

5.5.4 Years 11–12 (typically from 15 to 18 years of age)

Given the commonality in approach that currently exists across the jurisdictions there will be four types of courses which provide a useful starting point for development of senior secondary courses.

The first type of course is an applied study of mathematics with a focus on the analysis of everyday work and life problems to enable students to view these problems mathematically and develop greater confidence in deriving solutions through the application of mathematical strategies.

The second type of course is a study of mathematics which provides a suitable pathway to tertiary studies with a moderate demand in mathematics. This second type of course could include content such as business or financial mathematics, probability, statistics, applied geometry and measurement and, in some places, possibly include topics like navigation, applied geometry and networks.

The third type of course could enable a substantial development of mathematical knowledge suitable for many students, including those intending to study mathematics at university, and include graphs and relationships, calculus, and statistics focusing on distributions.

The fourth type of course could contain content intended for students with a strong interest in mathematics, including those expecting to study mathematics and engineering at university. It could include complex numbers, vectors with related trigonometry and kinematics, mechanics, and build on the calculus and statistics from the earlier course. This course would typically be taken in conjunction with the third course type.

There will be further advice for writers about the nature of the curriculum in the senior secondary years and key considerations in the development of the curriculum.

6. CONSIDERATIONS

The following key considerations have informed the development of this paper and will continue to inform the development of the Australian mathematics curriculum.

6.1 Equity and opportunity

An unintended effect of current classroom practice has been to exclude some students from future mathematics study. The goal of equity of outcome is central to the construction of the mathematics curriculum. This includes consideration of the need to engage more students, the way particular groups have been excluded, and the challenge posed by creating opportunity.

6.1.1 The need to engage more students

The personal and community advantages of successful mathematics learning can only be realised through successful participation and engagement. Although there are challenges at all years of schooling, participation is most at threat in Years 6–9. Student disengagement at these years could be attributed to the nature of the curriculum, missed opportunities in earlier years, inappropriate learning and teaching processes, and perhaps the students' stages of physical development.

At the same time, students' experience of mathematics is alienating and limited. For example, the *Third International Mathematics and Science Study (TIMSS) Video Study (Hollingsworth, Lokan, & McCrae 2003)* reported that in the Year 8 lessons in Australian classrooms more than three-quarters of the problems used by teachers were low in complexity (requiring four or fewer steps to solve), most problems involved emphasis on procedural fluency and only one quarter of problems used any real-life connections.

The disengagement in these years has flow-on effects. One effect is that, while the overall proportion of students studying mathematics at Year 12 is steady, there is a decline in participation of students in specialised mathematics studies in most jurisdictions. The *Australian National Numeracy Review Report* (2008) reported two linked issues: the first is a decline in students undertaking major sequences in tertiary mathematics study; and the second is the shortage of qualified secondary mathematics teachers and the resultant numbers of non-specialist mathematics teachers. High-quality teachers can support students in meaningful and productive mathematics learning and more students will retain aspirations for further mathematics study.

6.1.2 Ensuring inclusion of all groups

A fundamental educational principle is that schooling should create opportunities for every student. There are two aspects to this. One is the need to ensure that options for every student are preserved as long as possible, given the obvious critical importance of mathematics achievement in providing access to further study and employment and in developing numerate citizens. The second aspect is the differential achievement among particular groups of students. For example, the following figures are extracted from the report on the PISA 2006 results relating to numeracy (their term was mathematical literacy) of Australian 15-year-olds, comparing the responses of the commonly discussed equity groups. Table 1 compares the achievement of students based on their socioeconomic background.

Table 1: Percentage of Australian students from particular socioeconomic backgrounds (SES) in highest and lowest levels of PISA numeracy achievement

	Percent at the highest level	Percent at level 1 or below
Low SES quartile	6	22
High SES quartile	29	5

Similar differences are evident when comparing non-Indigenous and Indigenous achievement, and there are also differences in achievement levels between metropolitan, regional and remote students and, to a lesser extent, between boys and girls.

Numeracy (and other academic) achievement seems very much related to SES background (and cultural and geographic factors in other data), which is contrary to a fundamental ethos of Australian education, that of creating opportunities for all students.

The differences between the achievements of students at opposite ends of the SES scale are substantial. Those achieving only PISA level 1 are responding at a very low level for 15-year-olds, would have great difficulty coping with the demands of school without specific support, and would have a restricted set of work choices available to them once they leave school. Yet those achieving at the highest level are progressing at the best international standards. It is tempting to cater for the spread of achievement by differentiating opportunities, but it is essential that all students have the opportunity to make progress before and/or during the senior secondary years.

6.1.3 The challenge of creating opportunity

The development of the national mathematics curriculum offers a wonderful opportunity to revitalise the experience of all mathematics learners in a way that respects equity considerations. A key first step is to affirm a commitment to ensuring that all students experience the full mathematics curriculum until the end of Year 10, and with schools developing relevant options preserving for all students the possibility of further mathematics study. This signals to systems and schools the requirement to ensure structures are inclusive and that support is available for students who need it.

One aspect of making the mathematics curriculum accessible is to emphasise the relevance of the content to students. Any mathematics concepts or skills can be introduced by drawing on practical situations and so the purpose of the study is more obvious, and the mathematics is made more meaningful.

The curriculum must also provide access to future mathematics study. It is essential, for example, that all students have the opportunity to study algebra and geometry. The National Mathematics Advisory Panel (2008) argues that participation in algebra, for example, is connected to finishing high school; failing to graduate from high school is associated with under-participation in the workforce and high dependence on welfare. The study of algebra clearly lays the foundations not only for specialised mathematics study but also for vocational aspects of numeracy. Yet the study of algebra represents a challenge for many students during the compulsory years, and serves to exclude some students from further options.

There is now an opportunity to rethink the curriculum in the early secondary years. The intention is to increase student access to relevant and important mathematics, with a particular focus on ensuring that algebra and geometry are developed in meaningful and interesting ways. There are specific implications in this for the upper primary curriculum.

6.2 Connections to other learning areas

6.2.1 The learning acquired by students in mathematics contributes to learning in other areas. The curriculum for each area will identify where there are links or opportunities to build cross curriculum learning.

6.2.2 The *Australian National Numeracy Review Report* (2008) identified numeracy as requiring an across-the-school commitment, including mathematical, strategic and contextual aspects. This across-the-school commitment can be managed by including specific reference to other curriculum areas in the mathematics curriculum, and identification of key numeracy capacities in the descriptions of other curriculum areas being developed. For example, the following are indications of some of the numeracy perspectives that could be relevant to history, English, and science.

History: Learning in history includes interpreting and representing large numbers and a range of data such as those associated with population statistics and growth, financial data, figures for exports and imports, immigration statistics, mortality rates, war enlistments and casualty figures, chance events, correlation and causation; imagining timelines and timeframes to reconcile relativities of related events; and the perception and spatial visualisation required for geopolitical considerations, such as changes in borders of states and in ecology.

English: One aspect of the link with English and literacy is that, along with other elements of study, numeracy can be understood and acquired only within the context of the social, cultural, political, economic and historical practices to which it is integral. Students need to be able to draw on quantitative and spatial information to derive meaning from certain types of texts encountered in the subject of English.

Science: Practical work and problem solving across all the sciences require the capacity to: organise and represent data in a range of forms; plot, interpret and extrapolate graphs; estimate and solve ratio problems; use formulas flexibly in a range of situations; perform unit conversions; and use and interpret rates including concentrations, sampling, scientific notation, and significant figures.

6.2.3 It is proposed that such references be evident in both the mathematics curriculum document and in the documents of the other relevant disciplines. All these curriculum documents should ensure alignment of cross-curriculum aspects of numeracy along with literacy and ICT.

6.3 Clarity of the curriculum

6.3.1 The form of presentation of the curriculum will be critical to its successful implementation. Some of the experience of users of current curriculum documents has been that some documents are long, complex, written in convoluted language, and with ambiguous category descriptors in which it is difficult to identify key ideas.

6.3.2 The current diversity in terminology adds to complexity and means that many of the high-quality resources produced in various jurisdictions are difficult to transfer to other contexts. National curriculum documents will be written so that they are accessible to teachers and will help define a language for communication about the curriculum.

6.3.3 Documents should communicate succinctly the important ideas of the curriculum. Hattie and Timperley (2007) reviewed a wide range of studies and found that teacher feedback to students is a key determinant of effective learning and that good feedback involves making explicit to students what they should be doing, how they are performing, and what is the next phase in their learning. Teachers do this while they are interacting with students, and so need to know the purpose of the current student activity, the expected standards for performance, and subsequent learning goals. A clearly, succinctly written curriculum will assist in this.

6.4 Breadth and depth of study

6.4.1 Many mathematics teachers report that the scope of the curriculum creates pressures to move on to new topics before students have mastered the current one. The *National Mathematics Advisory Panel* (2008) argued that 'the mathematics curriculum in Grades Pre-K to 8 should be streamlined and should emphasise a well-defined set of the most critical topics in the early grades' (p. 11). When everything is presented as equally important, this does not help teachers to appreciate short and long-term goals, and to identify the key ideas. It is possible to reduce some of the crowding by dealing with complementary topics and concepts together, but there may still be a need for the identification of other mechanisms that can allow teachers to feel less hurried.

6.4.2 The curriculum should enable teachers to extend students in more depth in key topics, and one of the challenges will be to identify which are those more important topics. Fractions and decimals are examples of those more important topics, as are the principles of measurement. Long division is an example of a topic which could be given less emphasis. As an example of how advanced students might be extended in a basic topic, like perimeter and area of regular and irregular shapes, such students could be posed a question like: 'Can you describe some shapes that have the same number of perimeter units as area units?' This creates opportunities for examination of a range of shapes, for use of algebraic methods, and even the historical dimension of this problem.

6.4.3 For the purposes of curriculum documentation, learning for most topics can be considered to occur along a continuum, although not necessarily with development at a regular rate. It is essential that this continuum be developed from early to later years, rather than the reverse.

6.5 The role of digital technologies

6.5.1 An important consideration in the structuring of the curriculum is to embed digital technologies so that they are not seen as optional tools. Digital technologies allow new approaches to explaining and presenting mathematics, as well as assisting in connecting representations and thus deepening understanding. The continuing evolution of digital technologies has progressively changed the work of mathematicians and school mathematics (consider the use of logarithm tables and the slide rule), and the curriculum must continue to adapt.

6.5.2 Digital technologies are now more powerful, accessible and pervasive. For example, modern mathematical technologies (hand-held devices or computer software) support numerical, statistical, graphical, symbolic, geometric and text functionalities. These may be used separately or in combination. Thus, a student could readily explore various aspects of the behaviour of a function or relation numerically, graphically, geometrically and algebraically using such technologies. These approaches allow greater attention to meaning, transfer, connections and applications. Digital technologies can make previously inaccessible mathematics accessible, and enhance the potential for teachers to make mathematics interesting to more students, including the use of realistic data and examples.

6.5.3 The curriculum and associated assessment will allow teachers to use appropriate technologies in the classroom that support learning and teaching mathematics. The curriculum will advise on standards and expectations for parts of mathematics which are better done mentally, and the need for students to make appropriate choices about when to use technology. To give just one instance, it is reasonable to expect that school leavers will choose mental calculation to multiply or divide by 10 or 100, or to calculate a 10 percent tip, and that nearly all will be able to accurately estimate 15 percent of a quantity. In the senior secondary years, current courses allow appropriate use of computer algebra systems and dynamic geometry, and an option for this will be preserved in the new national mathematics curriculum.

6.6 The nature of the learner (K–12)

In developing the curriculum (both content and achievement standards) consideration must be given to the unique characteristics of learners across the years of schooling. These characteristics influence curriculum decisions about how and when particular content is best introduced and consolidated.

6.7 General capabilities

Skills and understanding related to numeracy, literacy and ICT need to be further developed and used in all learning areas, as do thinking skills and creativity. In addition, there are other general capabilities like self management, team work, intercultural understandings, ethical awareness, and social competence which will be represented in each learning area in ways appropriate to that area.

6.8 Cross-curriculum perspectives

There are other cross-curriculum matters related to Indigenous education, sustainability and Australia’s links with Asia that can be thought of as perspectives rather than capabilities. Each of these perspectives will be represented in learning areas in ways appropriate to that area. The curriculum documents will be explicit on how the perspectives are dealt with in each learning area and how links can be made between learning areas.

7 PEDAGOGY AND ASSESSMENT: SOME BROAD ASSUMPTIONS

7.1 The preceding discussion on the content and organisation of a national mathematics curriculum is based on some pedagogical assumptions, which include that:

- it is preferable for students to study fewer aspects in more depth rather than studying more aspects superficially
- challenging problems can be posed using basic content, and content acceleration may not be the best way to extend the best students
- effective sets of ideas with goals for key phases specified are preferable to disconnected experiences, even though they may be rich ones
- teachers can make informed classroom decisions interactively if they are aware of the development of key ideas, and a clear succinct description will assist in this
- effective use of digital technologies can enhance the relevance of the content and processes for learning
- teachers can make mathematics inclusive by using engaging experiences that can be differentiated both for students experiencing difficulty and those who can complete the tasks easily.

7.2 It is assumed that teachers will use a variety of mathematical task types including those that give students choice of approach and those for which there is an optimal strategy; those for which there are various possible solutions and those which have a single correct answer; those that prompt the development and use of mathematical models; those that incorporate ideas across content strands; and those that require thinking in more than one discipline.

7.3 Another underlying assumption is that specifying expectations in the four proficiency strands can help in focusing teaching. Teachers should base their teaching on what the students already know, should make explicit the subsequent key ideas, should ensure tasks are posed at an appropriate level of challenge, and should offer feedback on activities, standards and directions as often as possible.

7.4 Reporting to parents or to systems should be based on these expectations for proficiency. Indeed, it is essential that the content strands, proficiency strands, pedagogy, assessment and reporting requirements are connected coherently.

8 CONCLUSION

A national mathematics curriculum that promotes enjoyment and confidence in mathematics and that emphasises in-depth knowledge of content, enables Australia's future citizens to be sufficiently well educated mathematically. This paper has outlined directions for a mathematics curriculum that aspires to re-engage the community with mathematics. The perception that mathematics is 'not for everyone' only serves as an excuse for students not to try and continues the sentiment that mathematics is an elitist academic pursuit. This paper acknowledges the challenges of creating opportunity for all students and outlines a starting point from which to develop a curriculum that caters for all students.