AAMT Response to the Draft K-10 *Australian Curriculum: Mathematics*

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Presented by

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Executive Summary

The Council and Executive of the Australian Association of Mathematics Teachers Inc. (AAMT) has observed a growing level of enthusiasm for the notion of a 'national curriculum' in Affiliated Associations and the association's wider membership. This explains the care with which many people have analysed the Draft K-10 *Australian Curriculum: Mathematics*, and the detail of the comments they have made.

The AAMT has engaged with and drawn on the feedback from a wide range of members and others involved in school mathematics in the preparation of this feedback. The full paper contains analysis and recommendations on many aspects of the Draft K-10 curriculum. Of these the following are perhaps the most important in the eyes of teachers of mathematics are:

- The Draft does not provide for greater depth vs breadth and this is at odds with the emphasis in the Shape Paper.
- The Draft presents a structure that results in a lack of potential for differentiation at Years 8/9-10 for the range of students at these year levels.
- The Draft does not provide a coherent picture of the development of content and the 'big ideas' in mathematics.
- The Elaborations need to be made much more purposeful and coherent.
- The Proficiencies and the General Capabilities need to be much more prominent.
- The Achievement Standards need to be revised to be in line with reasonable expectations for the year level, and to have a greater focus on the proficiencies.
- The time for teaching mathematics should be nationally set at 5 hours primary and 4 hours secondary in order to make the expectations of the K-10 *Australian Curriculum: Mathematics* feasible in practice.

The AAMT hopes that these comments are useful as ACARA works to finalise the K-10 *Australian Curriculum: Mathematics* in the coming weeks and months. We look forward to continuing to work constructively with officers of ACARA in the interests of mathematics in Australia's schools.

Background

The Australian Association of Mathematics Teachers Inc. (AAMT) welcomes the opportunity to provide comments on the Draft K-10 *Australian Curriculum: Mathematics* (Draft). This response is informed by input from teachers of mathematics and other mathematics educators around the country. A number of associations in the states and territories have provided copies of their views on the Draft.

The overwhelming sense from this material, and from many interactions within the mathematics education community, is one of optimism – teachers of mathematics are ready for a 'national' mathematics curriculum. Indeed, the AAMT released a Position Paper that endorses the development and implementation of what is now the *Australian Curriculum: Mathematics*[1].

The Shape Paper will come to be seen as something of a landmark document in Australian mathematics education. Most of the principles and directions in the Shape Paper have received strong endorsement in the input received by the AAMT. Subsequent sections of this paper will outline ways in which the current Draft is seen to fall short of realising the aspirations of the Shape Paper. These comments and suggestions are designed to bring greater alignment between the Shape Paper and the resulting K-10 *Australian Curriculum: Mathematics*.

Previous experience is the 'lens' through which an educator views a new curriculum document. The mathematics curriculums that are currently in place around the country are different in many ways including arrangement, layout, level of detail, and responses to key issues in the teaching and learning of mathematics. Placement and emphases in the content does vary from jurisdiction to jurisdiction. These local factors play heavily on teachers' assessments of the Draft. State and territory perspectives are at times contradictory, given that they are based on the heritage and background of the respondent.

This makes the construction of national feedback from the AAMT a challenging task. This paper takes the detail of the responses of teachers and our state and territory associations as read – responses have been forwarded directly to ACARA and we urge those involved to carefully address the matters raised. We do not try to weigh these views to come to an "AAMT stance" on matters of detail. Rather, our focus is on highlighting and discussing the common concerns that underlie the detailed responses from state and territory perspectives, and, where practical, recommending ways to improve the Draft.

[1] See Appendix 1 for a copy of the paper – as will be seen the endorsement was subject to some 'principles'. See Appendix 2 for an analysis of the extent to which the current processes and Draft meet the expectations of those principles.

Mismatches between Shape Paper and current Draft

Big ideas

A persistent comment from the field has been that the promise to focus on the 'big ideas' is not apparent. An observation is that whilst the term 'big ideas' has great currency in discussions about school mathematics, there would seem to be no clear agreement on what these 'big ideas' actually are. The Shape Paper does not describe or list them, nor does it refer to the literature. As an example of the diversity of what people might call the 'big ideas', we observed that in one response 'numeration for whole numbers' and 'exact vs approximate' are cited as both being 'big ideas'. They may well be, but on the surface they are quite different kinds of ideas.

The AAMT recommends that an outline of 'big ideas' of mathematics as they relate to the curriculum be included in the preamble section of the *Australian Curriculum: Mathematics*; noting that this may be contested, we further recommend that work be undertaken on the 'big ideas' for inclusion at some later stage.

Less content; more depth

The promise of less crowding of the mathematics curriculum has been welcomed by all our respondents[2]. They have expressed a general view that this has not been achieved in practice in the Draft, however. This is particularly the case for Years 5-10; less so for the earlier years. It is worth noting the point made earlier about the lens through which teachers are looking at this Draft.

It may be that people are interpreting the Content Descriptions as though they are being read in their current curriculum and 'reading into' these content complexity that is in fact not intended – greater clarity and specification would address this.

In some cases the response of 'too much' is related to respondents using the number of Elaborations as an indicator of what needs to be taught – see below for more discussion of the Elaborations; a uniform number of Elaborations would address this.

Some discussions have suggested that there are too many actual Content Descriptions (again, especially from Year 6 or so onwards) – merging related Content Descriptions could be a strategy.

Whilst each of these three can be addressed, there does remain, however, a persistent sense that the expectations at Year 10, in particular, are beyond what can be expected of 'average' Year 10 students, certainly without resorting to teaching practices that focus on procedures.

The AAMT recommends that in revising the Draft that this concern be noted and addressed, with the expectations for Year 10 matched to what is challenging and feasible for 'average' year 10 students, not what is seen to be needed for Senior years mathematics.

Connections

Teachers and others want a curriculum that makes clear the connections within mathematics, and between mathematics and other subjects at school and the world at large. By and large our respondents do not believe these connections are well made in the current Draft.

In the case of the connections within mathematics, attention to the headings and sequencing of content as discussed below will help make these clearer. Connections with the world at large are really about the practical uses of the mathematics being taught and learnt. These practical uses can be further highlighted within the written curriculum, but this needs to be balanced so that the intent of the curriculum is not unreasonably skewed towards the practical – the beauty and structure of mathematics needs also to be apparent in the written curriculum.

The issue of the connections with other subjects is difficult to discern in the absence of the ACARA numeracy continuum. This is seen as an integral part of the picture for mathematics curriculum.

The AAMT recommends that these sorts of connections be emphasised in refocussing and recasting the Elaborations (see below).

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2 There is, however, an inherent contradiction between taking this view, while at the same time having the expectation that students will, by the end of Year 10, have covered approximately what they currently cover (and in some jurisdictions more than what is included in the Year 10 curriculum).

In the document

The preamble

This is the term we are using for the preliminary material included at the front of the document, before the Content Descriptions. This sort of material is often given cursory attention by teachers. We infer that the current material is brief to try to encourage more teachers to read it carefully. This material does need to cover everything that is relevant to the curriculum. Hence it does need to be comprehensive. Above we have recommended the inclusion of material about the big ideas of mathematics; later we identify other matters that need to be covered in this preamble. These include the purpose and structure of the Elaborations and the role, level and use of the Achievement Standards.

The rationale for having everything that is relevant in this section is to support those with roles in implementation. For their purposes it will be important to have all the relevant information in one place, and the preamble to the document is the appropriate location. We acknowledge that this will make the section longer, and therefore arguably less read by teachers, but believe that the full picture needs to be presented and easily accessible.

The AAMT recommends that the preamble be expanded to provide information about other important aspects of the Australian Curriculum: Mathematics.

Year level statements

The decision by ACARA that the curriculum will be written in year levels is at odds with the approaches in most jurisdictions. Hence it is not surprising that this aspect of the Draft has generated significant comment. In broad terms, the year level arrangement is seen by many as too restrictive, and not in tune with the notion from the Shape Paper and otherwise that the teaching should where practical 'start from where the student is at'. The issue takes on a particular importance in relation to Years 9 and 10 where many of our respondents believe that the curriculum needs to allow for more systematic and early differentiation to better meet the needs of all students (see below). Changing the name from "Year" to "Level" may help teachers and schools to work more flexibly with the document, as "level" suggests a more developmental sense. We note that this may have implications for assessment and reporting that will need to be addressed.

The AAMT recommends that the term Level be used instead of Year as the organiser for the curriculum.

Further, the AAMT will monitor the extent to which teachers feel constrained by the structure and how that can be dealt with in classrooms and schools.

Language and clarity

Many of our respondents were critical of some aspects of the English expression in the Draft. ACARA has these detailed comments.

The AAMT recommends that ACARA undertakes careful copy editing and other quality assurance processes – including careful checking of the mathematics – to ensure that the final K-10 *Australian Curriculum: Mathematics* meets the standard of English expression expected of professional documents of this kind.

Headings; sense of development; scope and sequence

These matters are all related. In essence, most – perhaps all – of our respondents found the headings for the Content Descriptions and associated Elaborations inconsistent and unhelpful in providing a sense of continuity in the development of the content. Many of the curriculums in the states and territories provide effective models of how this can be achieved.

The AAMT recommends that the headings:

- be rewritten to maximise consistency from year to year (perhaps the concept of 'sub-strands will be useful; the writers may wish to consider headings that make a statement about the 'big ideas', noting of course the caveat on this outlined above); and
- include the one or more Content Descriptor that relates to the heading (that is, all for more than one Content Descriptor per heading).

Having established the structure, the writers should then make sure that the Content Descriptions clearly convey the development of the content under the headings.

Proficiencies

The skills and understandings encapsulated in the Proficiency Strands are essential for a balanced mathematics curriculum. This was emphasised in the feedback we received from members and others.

The preamble of the Draft indicates that the 'proficiencies...have been incorporated into the Content Descriptions'. Our respondents found that this 'incorporation' is uneven across the proficiencies (with 'fluency' seeming to be the most thoroughly teated), and from year to year. They expressed a real fear that the curriculum would be seen as simply describing the content strands, without any real hope that the proficiencies will play an important role in construction and implementation of teaching and learning programs in mathematics.

Further emphasis on the Proficiencies can be achieved by highlighting within the document how, for each Year level, these 'play out' in the students' learning and doing of mathematics. This will be a major task to do well, but would be effective in further highlighting the commitment to the importance of the Proficiencies expressed in by our respondents.

Given the importance of the proficiencies in the learning and doing of mathematics, the AAMT recommends

- that every effort be made to highlight all the proficiencies in the revised Content Descriptions, Elaborations and Achievement Standards;
- that a statement be included at the top of each Year's content to describe the nature and scope of the Proficiencies for that year level.

Supporting an appropriate focus on the Proficiencies in classrooms will require more than the action indicated above. Support materials and processes will also need to provide guidance and assist teachers and schools.

The level set in the curriculum

Many respondents expressed concern about the placement of particular content; in general their examples suggest that the level set is rather too ambitious. This judgement is, of course, based on their experience with their current curriculums and students, and in the context of current arrangements for the teaching of mathematics. Their judgement may also be the result of interpreting the content in the way it is in the curriculum with which they are familiar, rather than as it is written and intended in the Draft.

The AAMT recommends that the detailed comments about inappropriately high levels being set in the Content Descriptions be carefully analysed and acted upon where appropriate; particular attention needs to be given to ensuring the content in Year 7 is feasible for teachers who work in primary schools[3].

Elaborations

There was also a great deal of negative commentary on the Elaborations in the current Draft. Again, most respondents commented that they found the Elaborations, on the whole, to be confusing. There is no consistency in terms of their number for a particular Content Descriptor; nor do the Elaborations have a consistent form or focus.

The AAMT recommends that the Elaborations be refocussed on their prime purpose – to elaborate the content; classroom examples should not be included; there should be a consistent number of Elaborations for each Content Descriptor.

Achievement Standards

The Achievement Standards also received much critical comment. As the bridge between the statement of content to be taught and learnt and the assessment of that learning, the Achievement Standards need to be extremely carefully constructed to achieve their purpose. The AAMT understands that ACARA has decided that there will be a single Achievement Standard that

[3] This recommendation needs to be seen in conjunction with the earlier recommendation that Year 10 be challenging and feasible for 'average' students. A logical consequence of shifting content to later years will be a need to have flexibility to make Year 10 less demanding that it is at present. This, in turn, will have implications in relation to preparation for Senior years courses.

describes a 'C' level of achievement at each year level. A number of respondents argue that more Achievement Standards (say one for each of the A to E grades) would lead to much more precise and consistent assessment. This may not be a matter that can be addressed within the final document itself; the AAMT would like to signal that, given ACARA has an 'A' for Assessment in its name, the association intends to raise a number of matters related to assessment – including this one – with the ACARA Board.

The Achievement Standards in the current Draft seem to be a restatement of some of the content from the year level. There may be a logic for what is included and excluded, but this has not been apparent as many of our respondents have grappled with the text of the current Achievement Standards. The Achievement Standards are not currently achieving their purpose. Further, respondents have taken the view that the Achievement Standards set too high a standard for the 'average' student, with some suggesting that the level set is around one year too high.

Further, in recasting the Achievement Standards, steps should be taken to highlight the proficiencies.

The AAMT recommends that:

- the Achievement Standards be very carefully revised to address issues of clarity and difficulty, and to give greater emphasis to the Proficiencies;
- the preamble of the final document should be be more expansive and precise about the purposes and construction of the Achievement Standards.

General capabilities – in general

The General Capabilities are also an area which many of our respondents agree are extremely important to incorporate in the mathematics curriculum. Indeed, a number would look for the document to go further by explicitly dealing with the five General Capabilities that the preamble suggests are only in the province of 'teaching practice' in mathematics[4].

That said, respondents did not find the General Capabilities to be well represented in the Content Descriptions and Elaborations, and would look for a greater attention to them in the final document.

The AAMT recommends that all the General Capabilities be given more prominence in the revised document as appropriate. This will most likely be feasible in the Elaborations, and could be one of the parameters for the refocussing of the Elaborations discussed above.

We note also that further support materials, including but not only the Work Samples, will also be very useful in enhancing the presence of the General Capabilities in the teaching and learning of mathematics.

Three key General Competencies

Three of the General Capabilities have received particular attention from our respondents.

Numeracy. A numeracy continuum is being developed alongside the Draft and is not yet available. This has been a frustration for many respondents, given that it is seen in the preamble to be 'fundamentally the responsibility of mathematics'.

The AAMT recommends that the numeracy continuum be made available for consultation and as a frame for reviewing the whole of the Australian Curriculum (i.e. not just mathematics).

Literacy. The statement in the preamble does not mention speaking and listening to mathematical 'texts'; nor does it identify that communication is a critical dimension of literacy within mathematics. Communication was noted by a number of people and groups to not be sufficiently emphasised in the Content DescriptionsDescriptions and Elaborations.

The AAMT recommends that the statement on literacy in the preamble be revised along the lines indicated above; that 'communication' of mathematics be emphasised more in the curriculum.

ICT. The AAMT received somewhat contradictory advice about ICTs in and for mathematics. In some cases the mention was seen to stray into the area of providing pedagogical advice; in others opportunities to highlight the use of ICT were seen as central to learning the content in the

[4] These are self-management, teamwork, intercultural understandings, ethical behaviour and social competence.

contemporary context (for example in geometry in the later years). The inclusion of ICT as a General Capability is intended to ensure young people develop appropriate skills and attitudes with technologies; crucial for this in mathematics is the provision of effective support materials, and this needs to be a priority as the *Australian Curriculum: Mathematics* is implemented.

Pedagogy in the document

The Shape Paper clearly states that recommending pedagogy is not the role of the Australian Curriculum, and not part of what the curriculum documents will be trying to convey. Whilst this is a clear departure from the approach taken in some states and territories, it is a clear position that has been adopted – it remains to be seen, and the AAMT will take a keen interest in, whether the teaching approaches used by teachers implementing this curriculum are informed and guided by research on how children learn, and contemporary notions of 'good practice' generally.

However, the position that the curriculum will not provide pedagogical advice needs to be consistently applied. Respondents have noted instances where particular teaching approaches are suggested, particularly in the current Elaborations.

The AAMT recommends that care be taken to ensure that the revised Elaborations do not carry directions or messages about pedagogy. The AAMT expects that support materials, including but not only the Work Samples, will give teachers strong guidance on pedagogies appropriate for teaching with the *Australian Curriculum: Mathematics*.

Consumer and Financial Literacy

Through a project commissioned by the Australian Securities and Investment Commission (ASIC), a group of members of the AAMT has undertaken a detailed review of the Draft in relation to Consumer and Financial Literacy and provided advice to ASIC to inform their submission on the Draft. It is not appropriate to recount those findings here. Suffice it to say that those respondents who independently commented on this matter were in accord with the advice to ASIC that the treatment of Consumer and Financial Literacy is uneven and inconsistent in the Draft.

The AAMT recommends that the mathematics underpinning Financial Literacy be located in the Number and Algebra strand through an explicit presence that at least matches that of the MCEECDYA National Framework on Consumer and Financial Literacy (2009) in which there are expectations at years 3, 5, 7 and 9.

The Glossary

Given some differences between usages between the jurisdictions, and the need to provide support for new and less well qualified teachers, the notion of the Glossary was generally supported by our respondents. A number of matters are raised in detailed feedback that will need to be addressed to ensure that the Glossary meets its purpose.

Interface with Senior Secondary

The Draft Senior Years *Australian Curriculum: Mathematics* has only recently been released for analysis and comment. Hence most respondents have not addressed the issues related to this interface.

The K-10 Draft identifies some extra content at Year 10 that can be used to provide further extension of higher achieving students (10A). A number of the topics in the Draft Course D (Specialist Mathematics) indicate that some of this material from 10A is 'assumed knowledge'. Hence the status of the 10A material is in question. Further, it would seem that smaller schools will not be in a position to provide a course that includes the 10A content, thus potentially excluding their students from being appropriately prepared for and taking the Senior years Course D. This is unacceptable in principle, and in particular in the context of the lack of students taking these higher level senior years mathematics courses.

Another observation is that the Draft Course A (Essential Mathematics) repeats a great deal of the content from the K-10 curriculum. In fact, it would be instructive to analyse this course to identify the 'assumed knowledge' as has been done for Course D. For many of the topics this would seem to be much less than the Year 10 level. The conclusion could be that there is actually some 'core' background that is essential for progress into mathematics in the Senior years (Course A) that is substantially less than the stated curriculum for Year 10.

The AAMT recommends that the revision of the K-10 *Australian Curriculum: Mathematics* makes clear the intended optional role of the content in 10A, and that as a consequence the need to address the issues of assumed knowledge in the analysis of the Draft Senior Years Curriculum is noted as a task in that work.

Beyond the document

The matters raised in this section may be seen to be associated with the 'implementation' of the *Australian Curriculum: Mathematics* and not with its development. Each, however, has some connection to the document itself; in any case, each is an extremely important matter for mathematics in schools in the current context.

Time for teaching mathematics in schools

One of the frames of reference for respondents in considering the level set by the Draft has been the amount of time in the curriculum for mathematics that students typically have allocated to the subject. It could be that at least some of the concerns about the level of mathematics expected at a given year level would be lessened if students were allocated 5 hours in primary and 4 hours in secondary in mathematics. These allocations are those of the National Numeracy Review (2008); these were also the notional time allocations given to writers of the Draft.

Greater levels of national consistency is one of the driving forces behind the commitment at all levels to the development and adoption of the Australian Curriculum. The AAMT believes that the time allocated for the teaching and learning of mathematics should be made consistent around the country.

The AAMT recommends that ACARA indicates that the K-10 Australian Curriculum: Mathematics is feasible for teachers to teach, and for students to learn if mathematics is allocated at least 5 hours per week in the primary years, and 4 hours per week in the secondary years, over a full school year of at least 40 weeks.

Differentiation

The Shape Paper takes the view that the principle of 'equity' is best met by providing for a common curriculum until the end of Year 9, with the possibility of content that is additional to the Year 10 curriculum (i.e. 10A) for the higher achieving students in Year 10. The intention is that all students will have covered all the content that enables them to take any of the courses in the Senior years[5].

Many respondents see an issue of equity for average and lower achieving students. They want to see the *Australian Curriculum: Mathematics* provide for 'differentiation' of students in at least Years 9 and 10 (some say Year 8 as well), according to achievement in mathematics. This is essentially an extension of the very common practice in junior secondary mathematics of 'ability grouping' across classes at the year level. In some states this has been provided for and directly encouraged within the curriculum (syllabus); in other jurisdictions where the curriculum is a 'framework', teachers tailor their programs to the students' backgrounds, needs and aspirations. The result is the same in either case – class-wise differentiation of the curriculum according to students' previous achievement.

Ability grouping in mathematics has been disputed territory in research and policy for many years[6]. It is not, however, problematic at all for most teachers of mathematics. It is – and has been – part of their practice for a very long time. The current Draft reflects the position of the Shape Paper. It is directly at odds with the wishes of virtually all of our respondents. It is possibly the issue on which they argue most passionately.

The AAMT recommends that the matter of differentiation in Years 7/8 to 10 be revisited; however the matter is resolved it should become a matter that is attended to carefully in plans for implementation, including teacher professional development programs.

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5 The anomaly of 10A content being assumed knowledge for aspects of Course D has been discussed above.

6 The National Numeracy Review (2008) analysed available evidence and recommended that the practice 'be discouraged'.

Teacher skills

Amongst the most concerning comments about the Draft setting too high a standard were those from people in states where Year 7 is in the primary school. Their concerns related to aspects of mathematics that are completely unknown, in a teaching sense, to primary teachers (indices at year 7 is an example). Whilst the matter of building teachers' skills to enable them to teach this curriculum can be seen as relating to 'implementation', the location of year 7 in primary schools is a substantial structural issue that will result in a huge demand on teachers in the upper primary years. They will need to learn and become proficient in teaching new content; during the transition, and if they find it difficult to teach this new content due to their often limited formal mathematical background, there will be a significant 'knock on' effect in the junior secondary years. Whole cohorts of students will be significantly disadvantaged.These negative impacts will occur because of the level of content in the curriculum itself – the risk of whole cohorts being poorly taught some key aspects of mathematics in some states is too great.

This is not the only area in which respondents have highlighted key areas of mathematics content for which teachers lack a suitable background and will, therefore, need professional learning to build their knowledge and skills. For many teacher, focussing on the Proficiencies and General Capabilities in ways that reflect the intentions of the *Australian Curriculum: Mathematics* will also require substantial development of teaching skills.

The AAMT recommends that governments and other stakeholders develop and implement a sustained and well-designed program to develop teachers' skills to match their needs in relation to the *Australian Curriculum: Mathematics*.

Support materials and processes

The K-10 *Australian Curriculum: Mathematics* will require substantial, targetted and ongoing support for teachers and teaching, both through teaching resources and professional development. The AAMT is conducting the *Ways Forward – Teacher support and the Australian Curriculum: Mathematics* conference in Melbourne on 31 May and 1 June. The outcome from the conference will be well-grounded advice for all stakeholders in the form of a short and direct conference communiqué; the AAMT will forward the communiqué to the Board and Secretariat of ACARA for their information as part of a concerted effort to influence the support provided for teachers of mathematics in the context of the implementation of the *Australian Curriculum: Mathematics*.

Implementation

The development and use of support materials and processes (above) will need to be undertaken in the light of the overall implementation plans and processes that are put in place in the jurisdictions. Our respondents highlighted a number of issues that need to be considered in developing these plans. The resolution of issues and setting clear directions – and clear statements about these – need to be high priorities in the jurisdictions.

Appendix 1 – AAMT Position on National Curriculum in Mathematics

Preamble

High quality teaching and learning of mathematics in our schools is a matter of urgent national need. A high quality mathematics curriculum document as the 'intended curriculum' can contribute to this, but there are many pressing needs to ensure that the 'enacted curriculum' — what happens in schools and classrooms — is of consistently high quality across the country. In order to achieve internationally recognised standards of excellence in teaching practice and student outcomes, Australia must make a concerted and sustained effort and commitment of resources to:

- attract and retain well-prepared teachers;
- provide for the ongoing professional learning for all teachers of mathematics in the face of profound changes in the discipline and substantial development in our knowledge of how mathematics is learnt;
- actively and significantly reduce the differential performance of students that is based on factors other than their interest and potential in mathematics (eg city/country, Indigenous/non-Indigenous, high/low socio-economic status);
- develop and provide access to high quality teaching and learning resources and technologies; and
- ensure there is adequate time in the school week for students to learn the mathematics necessary for them as involved and productive people in the 21st century.

The work to develop a national curriculum in mathematics needs to be done in the context of a strong commitment to address these issues at the same time.

The AAMT Position

The AAMT supports a national curriculum for mathematics in Australian schools, provided the work (ie process and product) incorporates the following principles in relation to the:

- ***mathematics curriculum itself***
- ***purposes and audience of the national curriculum***
- ***process for developing a national curriculum***

Principles regarding the nature of the national mathematics curriculum

Schooling should prepare students for their lives as global citizens. Their experiences with mathematics should provide the knowledge, disposition and confidence to use mathematics in their lives. To achieve this, a national mathematics curriculum should:

- acknowledge that all students can and should learn mathematics;
- focus on deep learning of the *Big ideas* and key *Mathematical Concepts* and *Actions*;
- encourage teachers to set high, achievable goals for their students;
- provide pathways to enable all students to maximise their mathematical learning;
- be flexible to assist teachers to elaborate on the curriculum to suit the needs of their students;
- be realistic in terms of expectations on teachers;
- provide a sense of scope and sequence; and
- be concise, explicit and written in clear and easily understood language.

Principles regarding the purpose and audience for national curriculum

A national mathematics curriculum should help teachers to teach well, and help students to learn well. To achieve this the curriculum should:

- be written for teachers (pre-school to post-compulsory);
- be separately elaborated in a document that communicates its values, purposes and approaches to parents and the wider community; and

- ensure that high quality resources and effective teaching practices developed anywhere in Australia can be used and adapted across the nation; and
- be the basis for subsequent national assessment that provides teachers with diagnostic information.

Principles regarding the processes for developing and renewing a national curriculum

To be successful a national mathematics curriculum should be ***universally supported***. In order to achieve this:

- the process for development should be open and transparent;
- people with expertise and interest should be actively and purposefully engaged in the development of the mathematics curriculum, including:
    - mathematics teachers
    - mathematicians
    - mathematics education researchers and educators
    - mathematics curriculum writers
    - industry and professions
    - parents
    - community
- the process for development, and the curriculum statement itself, should allow for transition from the current setting where there are local differences in curriculum, teachers' content knowledge and teaching practices to national consistency;
- the process for development should specify an ongoing process for quality assurance, review and renewal over time that incorporates meaningful consultation with people from the groups (above) at the state, territory and national level

To be successful a national curriculum should be ***properly funded***. This means that:

- the total current funding across the nation on curriculum development and implementation should not be reduced; and
- funds released through adopting a singular, national curriculum should be used for on-going quality support of teachers and schools to implement the national curriculum and ,in particular, to elaborate on the curriculum for the needs of their students.

To be successful the national curriculum should be ***internationally respected and well regarded***. This means that the writers of the national mathematics curriculum should:

- be experts in mathematics education and experienced writers of mathematics curriculum for teachers;
- be able to draw on high quality research on mathematics teaching and learning; and
- have a thorough[7] understanding of mathematics, its structure, history and emerging directions as well as its place in, and relevance to, our culture.

[7] Knowledge that is profound in the sense meant by Liping Ma, Deborah Ball and others when discussing teachers' knowledge of mathematics

Appendix 2 – Analysis of Australian Curriculum: Mathematics against principles of position paper[8]

In mid-2008, AAMT released a position statement making clear that the Association supported a national curriculum for mathematics in Australian schools, provided that the work (both the process and the product) was in concert with a collection of principles in relation to the mathematics curriculum itself, its purpose and audience, and the process for its development.

The full position statement is available on the AAMT website:

http://www.aamt.edu.au/Documentation/Statements/National-Curriculum

Now (in May 2010), the process of developing the Australian Curriculum: Mathematics has progressed to the stage that we have

- the *Shape of the Australian Curriculum: Mathematics* document (ACARA, 2009);
- draft K-10 Curriculum (with consultation closing on 30 May)
- draft Senior Years Curriculum (released on 14 May, with consultation due to close on 30 July) – AAMT members are invited to are invited to share their views and provide input to the AAMT response to this draft via the AAMT website
- http://www.aamt.edu.au/AAMT-in-action/Representing-teachers/Curriculum

So, on National Mathematics Day 2010, teachers and others have a chance to consider how the work is progressing; and potentially have your say.

In the AAMT Position Paper the following principles for the curriculum document itself were identified. The AAMT believes that a national mathematics curriculum should:

1. acknowledge that all students can and should learn mathematics;
2. focus on deep learning of the *Big ideas* and key *Mathematical Concepts* and *Actions*;
3. encourage teachers to set high, achievable goals for their students;
4. provide pathways to enable all students to maximise their mathematical learning;
5. be flexible to assist teachers to elaborate on the curriculum to suit the needs of their students;
6. be realistic in terms of expectations on teachers;
7. provide a sense of scope and sequence; and
8. be concise, explicit and written in clear and easily understood language.

You and your colleagues might like to consider the discussion and questions below regarding the extent to which the draft documents are in alignment with these principles. (Note that quotes below have been taken from and refer to the draft K-10 documents; you may also wish to consider the same set of principles in relation to the more recently released senior years curriculum content).

1. *acknowledge that all students can and should learn mathematics*

The **rationale** states that the "curriculum is written with the expectation that schools will ensure that all students benefit from access to the power of mathematical reasoning and be able to apply their mathematical understanding creatively and efficiently". The **aim** begins with the goal of ensuring that "students are confident, creative users and communicators of mathematics". These statements go some way towards acknowledging that all students can and should learn mathematics.

The **Considerations** listed in the *Shape of the Australian Curriculum: Mathematics* (ACARA, 2009) provided clearer statements about access and equity with a commitment that "the goal of equity of outcome is central to the construction of the mathematics curriculum" (p. 9). The Shape paper goes on to describe the importance of engaging students in more meaningful learning experiences with clear implications for pedagogical practices in the teaching of mathematics in schools. Advice about pedagogy is not to be included in the Australian

[8] This paper was originally developed and published for AAMT's National Mathematics Day on 21 May 2010. Some Discussion Questions have been omitted from that version.

curriculum. However, the way the curriculum is constructed and represented can be taken to give an indication of the importance of particular aspects of mathematics and hence how it might be taught.

2. *focus on deep learning of the Big ideas and key Mathematical Concepts and Actions*

   Content Descriptions for each of the three content strands provide an indication of the mathematical concepts to be taught and learnt at each year level. Because they are written as brief statements, the overall 'big ideas' are not evident in this document. Academics, researchers and other leaders in mathematics education have been encouraging a focus on 'big ideas' for a number of years. As a result many teachers would like to know what the 'big ideas' are, how they are incorporated into the curriculum document, as well as how they link within and across strands. The current draft can be improved in this regard.

   For each of the content descriptions, headings have been used, presumably to assist teacher interpretation but this is not consistent and therefore not helpful. Indeed, the headings do not assist with the identification of 'big ideas', this is particularly the case in the content descriptions related to the number aspects of the Number and Algebra stand. A better approach would be to group content descriptions under the 'big ideas' such as numeration, operations/calculation, and pattern and structure (communication from Siemon, April, 2010).

   The mathematical actions – what it means to "do" mathematics – are most evident in the Proficiency Strand descriptions presented in the Organisation of the learning area section on the Australian Curriculum Consultation Portal. Understanding, Fluency, Problem Solving, and Reasoning provide opportunities for students to "build robust knowledge", "make connections", "make choices", "investigate problem situations", and "develop increasingly sophisticated capacity for logical thought and actions". While some attempt has been made in the draft document to embed these actions into the content descriptions, it is inconsistent and therefore does not make it clear that all of these proficiency strands should be embedded in ongoing learning experiences for students. Without reading the introductory descriptions of these proficiency strands, teachers would not necessarily realise the importance of these actions – they provide the purpose for learning the content.

3. *encourage teachers to set high, achievable goals for their students;*

   Feedback from many teachers suggests the expectations from the draft curriculum document are low for the early years but high from Year 3 onwards. There are mixed views as to whether the higher goals, particularly in the middle years, are achievable. From Year 5, children experience many new and more abstract mathematical concepts. If students are to achieve "deep knowledge, understanding, skills and values" in all years of learning, more time may need to be available for mathematics learning in the overall school timetable. The writers were given indicative hours per week to assist their writing of the curriculum. For Kindergarten to Year 6 this was 5 hours per week, and for Years 7 to 10, this was 4 hours per week. There appears to be considerable variation from these hours in schools across Australia. For many secondary teachers, having 4 hours per week for mathematics in the junior secondary years (Year 7/8 to Year 10) would provide necessary and desirable additional time to meet the goals described in the draft curriculum.

   The **Achievement Standards** for each year are intended to provide an expectation of the quality of learning that students should reach including the depth and extent of knowledge and the sophistication of skills. As written, the standards appear to be a summary of the content descriptions although not all content is included. There is little evidence of the Proficiency Strands being embedded in the Standards.

   Communication from ACARA representatives during consultation meetings indicated the achievement standards were written to represent a 'C' grade on a scale of A to E. For many teachers the standards were considered to be too high and not achievable for most students.

4. *provide pathways to enable all students to maximise their mathematical learning;* ***AND***

5. *be flexible to assist teachers to elaborate on the curriculum to suit the needs of their students;*

The equity principle has been applied in the development of the draft mathematics curriculum with the expectation that all students will experience the full curriculum to the end of Year 10. Additional content descriptions have been provided for Year 10A, which suggests some students could be extended through additional content at this level.

Two concerns have been raised. How will the curriculum accommodate students with learning difficulties, particularly if they require special education provisions? How will the learning needs of gifted and talented students be supported in this curriculum? One could argue that strategies could be developed at the school level to meet the needs of each of these groups of students. However, one could also argue that further flexibility and pathways need to be proposed or acknowledged in the mathematics curriculum documents.

Given the level of expectation of students in Year 9, talented mathematics students could be provided with further opportunities to delve more deeply into further mathematical ideas without compromising the learning of others. One proposed suggestion is to combine the content in Years 9, 10 and 10A to provide a developmental continuum of learning suitable for the full range of students and which encourages teachers to provide opportunities to take students' learning as far as possible in each of the content strands while at the same time building in the proficiency strands at every opportunity.

The draft curriculum is presented in year levels – for many teachers this is helpful and sets clear standards. However, presenting content in year levels may also provide the impression that this content should be the focus of learning even when students may not have achieved the standards for the previous year. The curriculum needs to be represented in a way which more clearly communicates the need for teachers to use appropriate assessment to determine students' prior knowledge and understanding and to plan and program to meet their needs rather than just focus on content written for a particular year level.

Content Elaborations have been provided for support as well as to illustrate and exemplify content. The *Curriculum Development Process* document (ACARA, 2009) makes it clear that the content elaborations do not constitute the whole of the content or include student tasks, nor do they describe pedagogical approaches. However, teachers may see the list of elaborations as mandatory for all students. The purpose of the elaborations will need to be made clearer. For less experienced teachers, this support is essential to aid planning and programming. However for more experienced teachers, there is flexibility in the ways that teachers could develop programs to support students' needs.

The elaborations need to be clear and accessible to teachers, as well as be more consistent across strands and year levels. In the draft document, the elaborations range from very specific suggestions about content (eg, using words like bigger or smaller or covers more to compare areas in Year 3) to broad statements (eg, understanding that some data representations are more appropriate than others for particular data sets).

6. *be realistic in terms of expectations of teachers;*

There are several ways we could consider whether the draft curriculum is 'realistic' in terms of expectations for teachers – time available to teach mathematics within the whole curriculum of the school, programming and planning, amount of content, implementation, and the level of knowledge, skills and understanding of the teachers, particularly in relation to the inclusion of Year 7 in primary schools in some states and in secondary schools in others. I have already commented on the time available for mathematics.

Since the content descriptions are the mandatory component of the curriculum, there is much work to be done by teachers to develop programs using the descriptions. ACARA will be providing additional support on the Australian Curriculum Portal but at this stage, it is not clear what support will be provided.

Another aspect of considering whether the document is 'realistic' is the amount of content to be addressed. While the *Shape of the Australian Curriculum: Mathematics* (ACARA, 2009) document indicated there should be more depth and less breadth in the curriculum, this has been questioned for many years in the draft document, particularly from Years 5 to 8, a critical time in students' learning of mathematics.

Decisions about implementation are yet to be made in most jurisdictions so it is difficult to say whether they will be realistic. For some states, the new Australian Curriculum for Mathematics K to 10 may require few changes while for others, the extent of the change could be considerable. Feedback from some states suggest much content will need to be taught a year earlier (particularly in the middle years) which will have significant implications for professional development and support for teachers. This leads to the final consideration about whether this 'realistic' for teachers.

In Queensland, South Australia and Western Australia, Year 7 is located in primary schools whereas for the remaining states and territories, Year 7 is in secondary schools, often – but by no means always – with specialist mathematics teachers. We need to be able to ensure that the content for Year 7 is not only accessible for all students but that teachers are supported, particularly if they are required to teach new content.

7. *provide a sense of scope and sequence;*

The *Shape* paper indicated that to "maximise interconnections, coherence and clarity, the concepts and terms" of the content strands would be "grouped into developmental sequences" (p. 5). The draft curriculum does not provide clear developmental sequences that would provide the basis of a sound and useful scope and sequence of learning from Kindergarten to Year 10. Several teachers have mapped the content descriptions across the years to try to identify a developmental continuum of mathematical learning. This mapping has revealed many inconsistencies both within content strands as well as between content strands. It has also revealed gaps and discontinuities. In the rewriting of the *Australian Curriculum for Mathematics K-10*, a first exercise must be to map the content to refine the developmental continuum. This will help to ensure there are clear links between strands as well as within.

8. *be concise, explicit and written in clear and easily understood language.*

The draft curriculum document is certainly concise if one considers the content descriptions alone. However they are open to interpretation without the elaborations, work samples and other support materials. While this may be appropriate for experienced teachers of mathematics, it is not helpful for new or less experienced teachers or for teachers teaching outside of their subject area of specialisation.