Australian Curriculum Review

Feedback provided by AUSPELD on the proposed Australian Curriculum: Mathematics (F - 6)

Enquiries regarding this submission can be directed to:

Mandy Nayton (President)
AUSPELD
T: (08) 9217 2500
E: admin@auspeld.org.au

Introduction

This submission has been prepared by AUSPELD, the Australian Federation of SPELD Associations, to provide feedback on the proposed revisions to the Australian Curriculum: Math (F-6). AUSPELD represents tens of thousands of teachers, allied health professionals and families; all of whom are strongly committed to the introduction of a more evidence-informed curriculum that has at its heart – increased access, higher aspirations, and improved outcomes for all students – including those at greatest risk.

The stated aims of the Review are to improve the Australian Curriculum by 'refining, realigning and decluttering the content', and offering teachers greater clarity on what they should be teaching and when. Ensuring students are given access to the essential knowledge and skills they need to both achieve at a higher level and to engage meaningfully in their schooling is central to this goal. We are of the view that the Review achieves some, but not all the specified goals; missing a valuable opportunity to: increase the evidence base of the curriculum; provide descriptors that are written in clear and unambiguous language; and ensure that all students are provided with effective instruction and the content knowledge needed to maximise their chances of success.

The document fails to provide teachers with the detail they will need to ensure that students are taught knowledge and skill across the year levels cumulatively, building on content that has been previously taught, and ensuring that students acquire a depth of knowledge that will serve them well across subject areas. It is essential that teachers and schools can identify a clear scope and sequence from the curriculum.

Background

Children commence school with a range of different skills and learning capacities. Many students enter the classroom with knowledge of, and experience using, counting words. They have (or may have) an understanding that counting words are used to represent sets of objects and have an emerging awareness of the early principles of counting. However, this pre-existing knowledge and experience is often limited and unreliable. Students have a basic level of understanding but have not yet developed these skills to the level necessary for strong mathematical performance (relative to age).

Although there is evidence to suggest that early number skills, such as number sense, develop prior to the commencement of formal schooling, research has consistently shown that variations in mathematical achievement in older students are directly linked to variations in the foundational number skills acquired in the early years. In addition, research strongly suggests that explicit and targeted instruction in the foundation skills of numeracy (number sense, building a firm understanding of counting, number names and sequences, quantities and magnitude comparison, symbolic representations, sequencing, and basic arithmetic) is necessary in the early years if success is to occur in upper primary and secondary school. If we do not get it right in the first few years of schooling, students will almost certainly struggle mathematically, lose confidence in their maths abilities, and go on to have cross-curricular difficulties in the multiple areas in which maths plays an important role. Consequently, the importance of high-quality, evidence informed, intentional teaching of mathematics and number skills in the early years, cannot be overstated.

Our approach throughout this document has been to systematically address specific aspects of the 'Mathematics Consultation Curriculum: Scope and Sequence F-6', with the focus of our feedback and review being primarily centred on the first three years of formal schooling, F-2, as this is seen as one of the most crucial developmental periods for mathematical learning and achievement. Several overriding issues of concern will be discussed, and a small number of suggested changes provided (by way of example). These include:

- Ambiguity in the content structure and key ideas
- Poor language choices for the descriptors and elaborations
- Insufficient focus on the explicit teaching of foundation numeracy skills
- The continued inclusion of ineffective numeracy teaching strategies

Ambiguity in the content structure and key ideas

The proposed content structure of the draft curriculum, particularly the introduction of core concepts and the separation into twice the number of strands, appears to be, at least in part, responsible for it remaining cluttered and unclear. The current structure of the three double strands (Number and Algebra, Measurement and Geometry, Statistics and Probability) has been expanded into six content strands in the draft curriculum – number, algebra, measurement, space, statistics and probability.

In addition, thirteen 'core concepts' arranged into three 'concept organisers' (mathematical structures, mathematical approaches, and mathematising) underpin the six content strands, with the core concepts aimed at integrating the four proficiencies in the current curriculum (understanding, fluency, reasoning and problem solving) into the draft curriculum content itself.

This change in structure has resulted in: significant overlap across the core concepts; ambiguity in relation to the key mathematical ideas and concepts to be taught; and, a weakening of the critical mathematical connections, such as the link between number and algebra. Furthermore, the core concepts, and the overarching core concept organisers, remain poorly defined. As a result, they provide little clarity and direction in terms of the essential content students need to learn, and the skills they should attain, in order to develop a deep understanding of mathematics across their schooling.

As a consequence, the framework will not result in teachers gaining a better understanding of the content and skills that need to be taught, and nor will it offer practical value for lesson planning and classroom teaching.

Poor language choice for the descriptors and elaborations

It unfortunately remains the case that many of the content descriptors and elaborations included in the draft curriculum are poorly worded, ambiguous and unstructured. This has, in the past, led to misinterpretation and confusion in terms of what teachers should be teaching and the instructional approach that should be taken. As a consequence, vastly different content is often taught in different classrooms and different schools.

In addition, the wording of many of the content descriptors provide little or no indication of the desired outcome, making it difficult for teachers to determine whether progress is being made.

To minimise confusion around what is required to be taught and what students are expected to learn, the content descriptors and elaborations should be simplified to reflect observable and actionable mathematics behaviours. Elaborations should be used to provide teachers with clear guidance on how to structure a lesson or create a learning opportunity directly tied to a specific aspect of the curriculum.

It is not suggested that these should be prescriptive, nor should they be a list of essential activities that teachers can choose from, but it is important that these elaborations should provide examples of classroom-based activities that teachers can use to assist with instructional design. To achieve this, elaborations should: use more specific and targeted language; provide clear guidance on how to teach the focus skills; and, ensure that teachers are explicitly teaching these skills and concepts.

Additionally, explicit expectations would support targeted teaching at both the whole-class (Tier 1) and small-group (Tier 2) level as well as, in some cases, Tier 3 interventions. A number of examples of descriptors and elaborations in which the language choices should be addressed have been provided in the table below; however, this does not reflect the multiple instances of poor language choices made in the draft curriculum.

Table 1: Examples of poor language choices in descriptors and elaborations

Year	Strand	Code number and descriptor	Elaboration	AUSPELD feedback
Foundation	Number	AC9MFN03 Establish understanding of the language and processes of counting to quantify, compare, order and make correspondences between collections, initially to 20, and explain reasoning.	Understanding that each object must be counted only once, that the arrangement of objects does not affect how many there are, and that the last number counted answers the '*how many*' question (AC9MFN03_E6)	The elaboration gives guidance on what the learning outcome should be, however, it does not provide teachers with information on how to teach and develop this skill.
	Measurement	AC9MFM02 Connect days of the week and times of the day (morning, lunchtime, afternoon, evening) to familiar events and actions	Choosing events and actions that make connections with students' everyday family routines (AC9MFM02_E1) Creating classroom rosters, for example, a roster for watering the classroom garden (AC9MFM02_E3)	There is limited information on how to teach these skills and what the intentional teaching process should be. Teachers are left wondering what to do once they have 'chosen' these events or 'created' a roster.
Year 1	Number	ACM9M1N04 Model situations (including money transactions) and solve problems involving one-digit and two-digit addition and subtraction using physical or virtual materials, diagrams and a range of strategies.	Modelling a variety of different additive situations using effective strategies, for example, keeping track of the number of people on a bus as it stops to pick up and drop off passengers or role-playing financial transactions at a play store (AC9M1N04_E5)	The elaboration asks teachers to model effective strategies however, it does not offer guidance on what strategies would be considered effective for a year 1 student. In addition, there is no information on how this then translates to the student learning these strategies or the explicit teaching of these strategies.
Year 2	Number	AC9M2N02 Group, partition, rearrange and rename numbers up to 1000 according to their place value and into other number groupings. Explain the role of a zero digit in place notation	Comparing the digits with a written number with materials grouped into hundreds, tens and ones, and explaining the meaning of each of the digits in the materials (AC9M2N02_E1)	There is a lack of clarity in this elaboration regarding the link, and comparison, between the physical representation of a digit and the written number itself. Students need to see and understand the increasing magnitude of each group of materials and how the size or number of materials is dependent on its position in the number. Direct instruction in place value is needed.
	Algebra	AC9M2A01 Recognise, identify, describe, and continue additive patterns that increase and decrease by fixed amounts and identify missing elements in the pattern	Creating a shape pattern using digital drawing software and using numbers to describe the pattern for someone else to replicate (AC9M2A01_E2)	This elaboration offers a more general recommendation regarding a possible activity without providing information on the direct teaching of the necessary vocabulary needed to describe the pattern for replication and the need to use number 'words' to indicate how many shapes.

Insufficient focus on the explicit teaching of key numeracy skills

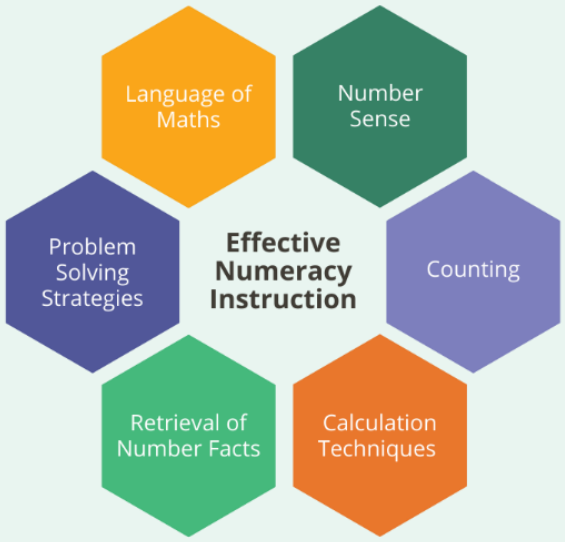
In the review of the draft curriculum, attempts have been made to replicate the curriculum and approaches used by high performing countries, such as Singapore. That said, there is concern that simply attempting to replicate the success of other countries, such as the focus on problem solving in the Singapore math curriculum, without understanding or replicating other factors which have led to their success is concerning. This is particularly the case when considering the importance of explicit teaching of foundation skills in the early years including number sense, counting, symbolic representations and basic arithmetic, among others.

Research into what constitutes effective instruction in the initial teaching of numeracy around the world has consistently found that the most effective teaching programs not only focus on the necessary component skills but do so with a high degree of explicitness and direct instruction.

The aim of this high-quality initial teaching is to maximise the learning experiences for all students to ensure they have the best opportunity to develop their numeracy skills with ease.

While the draft curriculum appears to favour some of these foundation numeracy competencies, the teaching and learning approaches suggested are not intentional or targeted and do not go far enough in establishing and identifying in clear, cumulative, unambiguous steps the teaching that should be provided, the knowledge students need to acquire, and the necessary skills required to build a strong mathematical foundation.

Similar to the principles of high-quality literacy teaching, the initial teaching of numeracy should be carefully sequenced, highly structured, and explicit. When approaching the effective teaching of maths, a strong numeracy program should include:



- direct instruction in the language of mathematics,
- explicit and systematic instruction in building number sense,
- guided and repeated practice of effective counting strategies,
- direct and systematic instruction in calculation techniques (procedural knowledge),
- cumulative instruction in developing number facts with brief and purposeful practice.

A well-rounded numeracy program explicitly teaches these foundation skills and regularly rehearses and reviews these component skills when tackling higher order mathematical tasks.

The continued inclusion of ineffective numeracy teaching strategies

In the review of the draft curriculum, references to ineffective numeracy teaching strategies were either not removed or added. For example, several of the content descriptors make reference to 'investigating', 'exploring', 'solving problems' and 'modelling', and include routine exercises/activities in real world contexts that place heavy emphasis on inquiry-based teaching practices in the early years.

While equipping students with effective problem-solving skills is an important goal of math education, there is strong evidence to indicate that the use of teaching approaches that promote inquiry or discovery-based learning in the early years are far less effective than explicit instructional methods, particularly for young students grappling with new concepts or skills.

For novice learners, these open-ended approaches ignore the understanding we now have from the cognitive sciences, particularly the need to control and limit the amount of new material presented to students at any one time, and to ensure this information is presented systematically and cumulatively.

Problem-solving without sufficient knowledge will almost certainly result in cognitive overload, errors, and the development of misconceptions. This is why providing explicit, step-by-step modelling of each component skill with clear and concise explanations and feedback is necessary, and why giving novices open-ended problems with arbitrary details is ineffective.

Once students have mastered basic concepts and have developed a degree of automaticity in age-appropriate skills, they can apply this knowledge to solve more open-ended problems. Unfortunately, the inclusion of inquiry methods in the content descriptors provides little opportunity to address the key ideas and basic skills that need to be explicitly taught and learned. As a result, their use as determiners of actual teaching and learning content is very limited. Some examples of these descriptors, and accompanying elaborations, are provided below, as well as other instances where references to ineffective numeracy teaching strategies have prevailed in the draft curriculum.

Table 2: Examples of descriptors and elaborations that make use of ineffective teaching strategies

Year	Strand	Code number and descriptor	Elaboration	AUSPELD feedback
Foundation	Number	AC9MFN03 Establish understanding of the language and processes of counting to quantify, compare, order and make correspondences between collections, initially to 20, and explain reasoning	Using counting songs and rhymes to establish the forwards counting sequences of numbers up to 10, then to 20 (AC9MFN03_E2)	The use of counting songs and rhymes, as outlined in the elaboration serve to improve students' knowledge of the number words but will not support their development of the fundamental counting principles. For this to be an effective instructional strategy, the songs/rhymes need to be paired with active counting activities.
		ACMFN04 Model practical situations and solve problems involving addition and subtraction with physical and virtual materials, using counting or subitising strategies to determine the total or the number of objects remaining	Modelling change problems, using role play and materials to show the action in a story [...]; drawing a picture to show what they did with the materials; recording the result of the action with a number and explaining the result (AC9MFN04_E1)	The descriptor is imprecise and would be difficult to implement in a consistent manner across classrooms and schools. Furthermore, the terms 'model' and 'solve problems', as well as the activity choices, emphasise an exploratory and play-based approach, rather than explicit, intentional teaching. There is also no accountability as to whether students have taken away any understandings.
	Probability	AC9MFP01 Discuss and explore the outcomes of games and familiar events involving chance	Exploring familiar games that involve chance and discussing the outcomes, for example, playing games that involve making decisions about where to stand '*corners*' or what to do '*captains coming*', then discussing their choices and sharing what happened during the game (AC9MFP01_E1)	Not only is there very limited information on how to teach these skills and what the teaching process should be, but the suggested activities and general use of the term 'explore' emphasises an open-ended inquiry-based approach, rather than explicit, guided and intentional teaching.
Year 1	Number	AC9M1N04 Model situations (including money transactions) and solve problems involving one-digit and two-digit addition and subtraction using physical or virtual materials, diagrams and a range of strategies	Using play-money to role play addition and subtraction problems, for example, setting up a shop and role-playing buying and selling goods with play money representing whole dollar amounts (AC9M1N04_E4) Modelling a variety of different additive situations using effective strategies, for example, keeping track of the number of people on a bus as it stops to pick up and drop off passengers or role-playing financial transactions at a play store (AC9M1N04_E5)	As in the example, the descriptor is imprecise and would be difficult to implement in a consistent manner across classrooms and schools. The use of terms such as 'model' and 'solve problems', as well as the activity choices, emphasise the use of real world and play-based contexts, rather than explicit, intentional teaching. The potential for assessing student progress or acquisition of knowledge is again, very limited.