Chapter 9
The Australian Curriculum: Mathematics as an Opportunity to Support Teachers and Improve Student Learning

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The creation of a national, as distinct from state and territory based, mathematics curriculum creates important opportunities for improving learning, but whether those opportunities are taken up will depend on the ways that teachers are supported, including by teacher educators, coaches, school leaders and readers of this monograph. The debates that continue on aspects of content are irrelevant to whether the national curriculum provides a prompt to improvement. In fact, such debates are a by-product of the negotiations that are an obvious artefact of the ceding of responsibilities by local jurisdictions to a national authority. The real opportunities for improving mathematics learning are in the principles that underpin the structure of the curriculum and the use of these principles to inform teacher learning.

Introduction

This Chapter describes the potential of aspects of the Australian Curriculum: Mathematics (AC:M) to prompt reconsideration of current approaches to teaching and learning mathematics. In particular, three principles on which the curriculum is based are that:

- the four proficiencies (understanding, fluency, problem solving and reasoning) provide a clearer framework for mathematical processes than "working mathematically" and are more likely to encourage teachers and others who assess student learning to move beyond a focus on fluency, however, there will need to be support for teachers if they are to incorporate them into the curriculum;
- the curriculum has been written to emphasise teacher decision making, therefore, curriculum support for teachers should be in a form that enhances their decision making, rather than reduces it; and
- the challenge of equity can be addressed by focusing on depth of learning rather than breadth, by specifically supporting the learning of those students who need it and by extending more advanced students within the content for that level rather than isolating such students into different classes.

This chapter elaborates the rationale for each of these three principles, illustrates how these are represented in the curriculum, and proposes particular emphases for

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associated teacher learning. The chapter uses an extract of the content related to the teaching of fractions and an illustrative teaching activity to elaborate the discussions of each of these issues.

The Presentation of the Content Descriptions

The following extract from the AC:M is used to illustrate the way the curriculum is presented and to facilitate later discussion of the above principles. The descriptions presented are those related to the teaching of fractions in the middle years. There are other descriptions related to decimals, percentages and ratios that are obviously closely related although these are not presented here.

Year 5

Compare and order common unit fractions and locate and represent them on a number line

Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator

Year 6

Compare fractions with related denominators and locate and represent them on a number line

Solve problems involving addition and subtraction of fractions with the same or related denominators

Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies

Year 7

Compare fractions using equivalence

Locate and represent fractions and mixed numerals on a number line

Solve problems involving addition and subtraction of fractions, including those with unrelated denominators

Multiply and divide fractions and decimals using efficient written strategies and digital technologies

Recognise and solve problems involving simple ratios

Some obvious features are that, in comparison to most other Australian jurisdictional curricula, the descriptions are clear, concisely worded, and few in number. The sequential development is obvious as is the scope of what it is expected that students will learn. As is described below, this is a desirable and potentially productive aspect of the curriculum.

A further aspect of the content descriptions is the way that they are presented. Being set in a flexible web format (Australian Curriculum Assessment and Reporting Authority, ACARA, 2011), teachers can have the content descriptions displayed by year level, by substrand across year levels, or even in comparison with other subjects. This means that, however teachers like to use curriculum documents as part of their planning, the web format can support this. There is no need for the development of school based cut-and-paste versions or extracts of the curriculum, and so teachers can focus on the real issues of planning their teaching and assessment. The effective use of the potential of the web based format can be an important element of teacher professional development.

Identifying the Nature of the Mathematics and Numeracy we want Australian Children to Learn

Any discussion of curriculum is contingent on a view of what mathematics the curriculum is seeking to present. The AC:M takes an explicit stance that the mathematics and numeracy that should be experienced by school students is much more than the emphasis on procedures and computational processes that seems to constitute much current teaching of mathematics in Australia (see Hollingsworth, Lokan, & McCrae, 2003; Stacey, 2010). In various places in this chapter a particular task is used to elaborate the arguments presented, and is also used to represent a particular perspective on mathematics. The task is:

> Ano can paint a house in 3 days. Elizabeth can paint a house in 4 days. How long would it take Ano and Elizabeth to paint a house if they worked together?

Depending of the approach used, this task addresses particular aspects of the content descriptions described above. Indeed the task is useful for teaching junior secondary mathematics precisely because there is a range of possible approaches and so not only allows consideration of various approaches but also can be used to illustrate the connections between them. Some of the possible approaches are described in the following. One mathematically correct approach is as follows:

> Ano can paint $\frac{1}{3}$ of a house in one day, and Elizabeth can paint $\frac{1}{4}$ of a house in a day. So in one day they could paint $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of the house. So they could paint the whole house in $\frac{12}{7}$ or $1\frac{5}{7}$ days.

This approach addresses some of the content descriptions associated with Year 7 including problem solving, addition of fractions and division of fractions. There would be substantial challenge for the students to explain why the fraction is inverted to convert from time per house to house per day but otherwise the explanation of the process is straightforward. Another approach which produces the precise answer, this time involving the use of ratios is as follows:

> Ano could paint 4 houses in 12 days. Elizabeth could paint 3 houses in 12 days. So together they could paint 7 houses in 12 days. Which means they could take $\frac{12}{7}$ days to paint one house.

This approach requires some insight to develop but is easier to understand and possibly more generalisable to other related situations. It allows the teacher to make the connection between fractions and ratios. Another approach might be:

> Ano can paint half a house in one and one half days, and Elizabeth can paint half a house in 2 days. So the total time needed is more than one and one half days but less than two days. Assuming that once Ano finished her half she helped Elizabeth, it is reasonable to suggest that they will take around $1\frac{3}{4}$ days.

This is not the precise answer but is quite close and represents both clear and appropriate thinking about fractions and their applications and also illustrates the type of approximations that are made in realistic situations. There can even be discussion of how to evaluate the limitations of the approximations. Another approach requiring approximations could be as follows:

> Ano can paint $\frac{1}{3}$ of a house in one day, and Elizabeth can paint $\frac{1}{4}$ of a house in a day. So in one day they could paint $\frac{1}{3} + \frac{1}{4} = \frac{7}{12}$ of the house. After two days they could paint $\frac{14}{12}$ of the house which is more than is needed by $\frac{2}{12}$ or $\frac{1}{6}$. So Ano and Elizabeth can paint the house together in $1\frac{5}{6}$ days.

This approach also illustrates some clear thinking about fractions, intelligent reasoning, and produces an approximation of the precise answer. Of course, the inaccuracy arises because it is $\frac{1}{6}$ of a house too much, not $\frac{1}{6}$ of a day but even this allows teachers to explore such misconceptions.

This type of task represents a different sort of mathematics from the common approach in which fractions are taught using rules and procedures and where examples are presented without any context. Of course, it can be argued that this task is unrealistic but the task allows the consideration of a model of fraction manipulation that the students at this level can relate to. There are practical examples that do require this type of thinking but they mainly relate to continuous quantities that increase the complexity of the situation beyond what is appropriate for an introductory exercise. Solutions to the task require some assumptions to be made. For example, most of the above suggestions assume that all houses take the same time to paint. This leads to further opportunities in challenging those assumptions.

Assuming that the teacher draws on the various strategies used by the students, the experience will communicate to students that there are many ways to approach mathematical tasks, that they can choose their own approach (which is motivational – see Middleton, 1995), that some approaches are more efficient than others, that sometimes there is a mathematical and a practical answer, that mathematics and fractions can have practical meanings, and that sometimes it is necessary to consider different aspects of a task simultaneously. There is also potential that such tasks can expose student misconceptions which can then be addressed by the teacher in the context of the task that was posed.

In other words, the task and the associated pedagogies allow students to see that mathematics, and in this case fractions, is more than following rules and procedures but can be about creating connections, developing strategies, effective communication, and so on. While this view is not obvious in the content descriptions presented above, it is part of the opportunity for those supporting teachers to communicate such views. The view is, though, communicated through the proficiencies that underpin the curriculum as is described in the next section.

The Four Proficiencies are Better for Presenting Mathematical Actions than "Working Mathematically"

ACARA (2010) proposed that the *content* be arranged in three strands that can be thought of as nouns, and four *proficiency* strands that can be thought of as verbs. The content strands, *Number and Algebra*; *Measurement and Geometry*; and *Statistics and Probability*, represent a conventional statement of the "nouns" that are the focus of the curriculum. The content descriptions presented above and the painting task are from the Number and Algebra strand.

More interesting, and a break from the common ways of describing the mathematical actions in which we hope that students will engage, are the four proficiency or process strands which were adapted from the recommendations in *Adding it up* (Kilpatrick, Swafford, & Findell, 2001). The first of these is "Understanding" (the Kilpatrick et al. term was *conceptual understanding*) and is described in the AC:M as follows:

> Students build a robust knowledge of adaptable and transferable mathematical concepts, they make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the 'why' and the 'how' of mathematics. Students build understanding when they connect related ideas, when they represent concepts in different ways, when they identify commonalities and differences between aspects of content, when they describe their thinking mathematically and when they interpret mathematical information.

Understanding has long been a goal and teachers are familiar with its importance. Skemp (1976), for example, explained that it is not enough for students

to understand how to perform various mathematical tasks; they must also appreciate why each of the ideas and relationships work the way that they do.

In the painting task, students can build their understanding by making connections between related concepts, by seeing fractions and ratios as interchangeable, and by representing and seeing representations of the same information in different ways. Representing and recording their thinking using language and symbols also connects to understanding. When solving the task, students can use the symbols, words, and relationships associated with the particular concepts, connect these different representations to each other and use them later in building new ideas.

In the content descriptions above, the verbs such compare, order, locate, and represent, are associated with understanding.

The second of the proficiencies is fluency (the Kilpatrick et al. term was *procedural fluency*) includes:

> ... choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly used facts, and when they can manipulate expressions and equations to find solutions.

Watson and Sullivan (2008) used term *mathematical fluency* to include skill in carrying out procedures flexibly, accurately, efficiently, and appropriately, and, in addition to these procedures, having factual knowledge and concepts that come to mind readily. While this is the aspect of mathematics learning that is most commonly emphasised in much mathematics teaching and assessment, there is a clear rationale for fostering appropriate levels of fluency for students. This in part relates to cognitive load theory (see Sweller, 1994; Bransford, Brown, & Cocking, 1999). Pegg (2010) explained that initial processing of information happens in working memory, which is of limited capacity and therefore being able to recall relevant information from long term memory assists people's capacity to process and use information. In the case of the painting task, fluency refers to the efficient manipulation of the numbers, such as addition of the fractions or manipulating the ratios (e.g., one house in 3 days, is $\frac{1}{3}$ of a house in one day), choosing efficient strategies, and awareness of ways of dealing with fractions.

Examples of the actions suggested in the above content descriptions that prompt consideration of fluency are locate, represent, multiply and divide using efficient written strategies.

The third of these mathematical actions is problem solving (*strategic competence*) which was described as:

> ...the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify their answers are reasonable.

Problem solving has been a focus of research, curriculum and teaching for some time, and so teachers are familiar with its meaning and resources that can be used to support students learning to solve problems. In the case of problem solving, there are opportunities in the painting task for students to use more or less all of the actions included in this problem solving statement either in formulating their own solution or in listening to the solutions of others.

As an aside, the problem solving proficiency also creates opportunities to connect the mathematics that students are learning to their lives. Even though there are many interesting problems that have the status of puzzles, there are also many opportunities to use mathematics in interesting ways to understand practical situations that are not only those connected to the world of work or future study but also those that create more informed citizens.

The phrase "solve problems" is mentioned four times in just the few content descriptions above indicating that even with the learning of introductory fractions the intent is that students solve problems as a pathway to that learning.

The fourth proficiency, reasoning (*adaptive reasoning*) includes:

> ...analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false and when they compare and contrast related ideas and explain their choices.

As with problem solving, students have the opportunity to experience more or less all of the actions described as reasoning either in their own thinking about the painting task or in listening to the explanations or arguments of other students and the teacher. As Stacey (2010) argued that there are few opportunities for student initiated reasoning in most current Australian texts, and it is suspected that this is the proficiency that is least familiar to Australian teachers.

As it happens, and perhaps unfortunately, reasoning is explicitly prompted only by the term *investigate* in the content descriptions above, although the intent of the overall proficiencies and the achievement standards is that reasoning be emphasised in the teaching of mathematics.

It is suspected that teachers will need support on how student reasoning applies to experiences with the foundational and other ideas of the curriculum. It is possible, for example, for students to explore and formulate hypotheses about partitioning numbers, perimeter and area relationships, effective definitions of shapes, comparing graphical representations, and then to explain their thinking, justify their argument, convince others, listen and interpret the arguments of others, and so on. Fostering reasoning through the mainstream content requires a teaching stance where problems with possibilities of student decision making and choice are posed for the students to explore, the lessons and the classrooms are structured to facilitate communication both while students are working on the task and then during whole class discussion reviewing the task, with an expectation that errors are learning opportunities and diversity of approaches are valued.

At least part of the reason for adopting the proficiencies rather than "working mathematically" as the prompt or context for encouraging teachers to plan their teaching in such a way as to foster these actions by students is that the ways that "working mathematically" was presented to teachers by many jurisdictions created the impression that it was an additional content strand. It was common for teachers to plan their teaching by addressing the topic of Number for a few weeks, then Space for a few weeks, then Working Mathematically at the end of term. The intention in the AC:M is that the proficiencies apply to all aspects of mathematics. The metaphor of verbs acting on nouns describes the explicit intention to ensure that the emphasis is on the full range of mathematical actions and not just fluency. The challenge for teachers is to find ways to incorporate a balance of these different verbs in their teaching.

The integration of the content descriptions and the proficiencies is represented by an icon that shows the three content strands in one direction and the four proficiencies in the other. Interestingly similar icons are presented for each of the four curriculum subjects (English, science and history as well) indicating that the need to integrate content and action dimensions of curriculum applies more broadly than just to mathematics.

The use of four proficiencies also emphasises to teachers that doing mathematics is more than procedural fluency.

The Kilpatrick et al. terms have been slightly simplified for ease of communication, and the proposed words are in common usage among teachers in Australia. Those familiar with the Kilpatrick et al. report will notice that "productive disposition" is not included in this list. One reason is that disposition was taken to refer to pedagogical approaches which were not proposed to be included in the curriculum statements. Another reason is that the proficiencies are intended to inform assessment and particularly the articulation of standards, and it is neither meaningful not appropriate to set standards for disposition. The omission of disposition is not intended to infer that disposition is less important than other proficiencies. Given that the curriculum was intended to define content and student actions, and that teachers would assess students' enaction of that content and the associated actions, it is clear that disposition is quite different. Nevertheless student disposition is a key consideration for mathematics teachers and its meaning and actions to foster productive disposition can be addressed in teacher learning.

It is noted that, while the first two proficiencies may be able to be pursued by teachers using clear explanations and examples drawn from texts, problem solving and reasoning require the selection of appropriately structured tasks that allow students opportunities to make decisions, to choose their own approaches, and to connect ideas together. Indeed part of the focus of teacher learning associated with these proficiencies should be on ways of identifying tasks that can facilitate student engagement with all four of these proficiencies. It is also noted that the proficiencies act together and so should not necessarily be fostered separately. For example, teachers might pose tasks that require students to solve a practical problem. Students can then be invited to explain the reasoning behind their solution. In this way the teacher can facilitate the building of students' understanding.

Teacher Decision Making

> One of the principles argued in ACARA (2010) is that the curriculum should be described clearly and succinctly. Based on the nature of support that they publish, some Australian jurisdictions seem to believe that teachers are best supported by providing minute by minute guidelines on how teachers should teach. In contrast, the AC:M has taken the stance that the curriculum should be described parsimoniously and presented flexibly via a dynamic web based environment and that this will assist teachers by emphasising the need for them to make active decisions.

It goes without saying, regardless of the educational context, teachers are better able to support students when they know what they hope the students will learn. Hattie and Timperley (2007), for example, reviewed a large range of studies on the characteristics of effective classrooms. They found that feedback was one of the main influences on student achievement. The key elements identified were that students should receive information on "where am I going?", "how am I going?", and "where am I going to next?" To advise the students interactively, it is important for teachers to know their goals.

In the context of the task presented above, whether the teacher started their planning from the content descriptions or the task itself, it is essential that the teacher make active decisions on the goals of learning, the actions in which they want students to engage and how they will assess them. In particular the teachers should know:

- the mathematical point of that task
- the pedagogical point of that task
- whether and how they might make these points explicit to students.

Assuming that the teacher reads the content descriptions at some stage in their planning and that the teacher has a resource of problems on which to draw, an early decision is to choose which tasks are most suited to the relevant content. The next decision is how best to introduce the task to students and how to support them in their learning. For example, in the painting task, the teacher might decide to focus on the problem solving and reasoning proficiencies and so might allow students opportunities to explore pathways to solutions for themselves, and will create time in the lesson for students to explain and justify their strategies, to compare their strategies with others, and to generalise the fractional ideas to other situations.

One of the disadvantages of having the content determined by a text is that teachers are less required to think about their own purposes. The same is true for some curriculums in which the teachers are recommended which tasks to teach without having to appreciate the goals, both content and proficiencies, associated with the tasks. One of the critical foci for teacher learning is to enhance their capacity to make their own decisions using the curriculum documents and the other resources to which they have access.

The Challenge of Equity

> A third key element of the AC:M, and which can be a priority in future teacher learning is ways to address the challenge of equity. In various reports on international assessments (e.g., Thomson, De Bortoli, Nicholas, Hillman, & Buckley, 2010) and in other analyses (e.g., Sullivan, 2011) the diversity of achievement of Australian students is noted. In particular, it seems that low SES students, as a group, perform substantially below other students. This is connected to the curriculum in various ways.

ACARA (2010) argued that all students should experience the full range of mathematics in the compulsory years. Mathematics learning creates employment and study opportunities and all students should have access to these opportunities. This is both an equity and a national productivity issue. The curriculum makes the explicit claim that all students should have access to all of the mathematics in the compulsory years.

> 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. (ACARA, 2010)

Many systems and schools are structured to offer some students a restricted subset of the mathematics curriculum. This is counter-productive. Chris Matthews, the first Indigenous Australian with a doctorate in applied mathematics, in his presentation at the 2011 *Australian Association of Mathematics Teachers* conference reported that the first time he engaged with mathematics was when he started on algebra. Indeed there are many topics, including graphing, indices, and introductory algebra that are more accessible than complex fractions and ratios. In other words, schools and teachers should not restrict the curriculum offerings to students based on any preconceptions of their potential. Many schools seem to group students they identify as lower achieving together and teach them these fractions and ratios over and over again, whereas those students would find introductory aspects of other topics more accessible.

One of the unfortunate aspects of mathematics teaching in the middle school is the way that students are streamed and so stereotyped into different levels of achievement. This hardly seems the point of schooling.

In the case of the painting task, the task is already accessible to a range of students since they can choose their own approach to the task and the complexity of the results. Nevertheless there may be some students who will experience difficulty in starting. One approach to supporting such students was described by Sullivan, Mousley, and Zevenbergen (2004) as posing enabling prompts. For example the painting task can be further adapted for students who have difficulty in starting by posing tasks such as the following:

> Ano can paint a house in 5 days. Elizabeth can paint a house in 10 days. How long would it take Ano and Elizabeth to paint a house if they worked together?
>
> Ano can paint a house in 5 days. How much of a house might Ano paint in one day?

The other side of this argument is the importance of extending the more advanced students. Part of the rationale for the practice of streaming off the best students is to preserve their capacity to proceed later to specialist mathematics study. Yet while such practices may be advantageous for some of these students, there are potentially negative effects on others. Hattie (2009), after reviewing large numbers of studies on streaming concluded that "the results show that tracking has minimal effect on learning outcomes and profound negative equity effects" (p. 90). Zevenbergen (2003) also argued that the most commonly observed effect of streaming is reduced opportunities for students in the lower groups.

Rather than streaming students by achievement, the important needs of the higher achieving students can be addressed by focusing on depth of learning rather than breadth and by extending the more advanced students within the content for that level rather than isolating such students into different classes

Sullivan et al. (2004) proposed that teachers pose "extending prompts" to such students. Examples of extending prompts for the painting task might be as follows:

> Ano can paint a house in 3 days. Elizabeth can paint a house in 4 days. Sally can paint a house in 5 days. How long would it take Ano, Elizabeth and Sally to paint a house if they worked together?
>
> Ano can paint 4 houses in 7 days. Elizabeth can paint 3 houses in 5 days. How long would it take Ano and Elizabeth to paint a house if they worked together?

The process for addressing the diversity of achievement in classes and for building equitable outcomes are important foci for teacher learning.

Implications for Teacher Learning

The argument in this chapter is that there are a number of important issues that should be the focus of teacher support and professional learning.

One of the key foci can be on ways of reading the content descriptions, processes for seeking advice or information if anything is unclear, and how the descriptions can be used to support planning and teaching. It seems that we know quite little about the various ways that teachers plan their teaching and assessment and so structured professional learning on the planning options would be helpful. Connected to this is support on ways of using the flexible web format effectively to support and enhance planning.

As argued above, the proficiencies represent an important shift in emphases on mathematical actions. While teachers are familiar with processes for developing fluency and building understanding, they may need support on the development of problem solving and the integration of problem solving processes into the core of the curriculum. This is especially true for reasoning, which will also have some pedagogical implications in that creating opportunities for student reasoning may require a different lesson format from what most teachers are used to.

Teachers will also need support on ways to teach mathematics to heterogeneous groups, including differentiating the experience to optimise the learning of all students within the context of whole class as a community. Of course, this is a major challenge whatever the curriculum, but this new curriculum makes the intention to include all students explicit and so provides an opportunity to engage teachers in professional learning on such issues.

While it has not been mentioned above, there are some substantial changes to the curriculum expectations especially related to statistics and many teachers will need support to understand the rationale for greater emphasis on statistics and statistical literacy, and on the meaning and implications of many of the content descriptions. For example, the content descriptions for data representation and interpretation in year 5 are:

- Pose questions and collect categorical or numerical data by observation or survey
- Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies
- Describe and interpret different data sets in context

The equivalent descriptions for year 7 are:

- Identify and investigate issues involving continuous or large count data collected from primary and secondary sources
- Construct and compare a range of data displays including stem-and-leaf plots and dot plots
- Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data
- Describe and interpret data displays and the relationship between the median and mean

These, and the descriptions for the other levels, may require some interpretation for many teachers. There is a related issue that is associated with the sufficient level of pedagogical knowledge for teachers and particularly that they know how to learn new content, or even how to use old content in new ways.

A Post Script: The Need for Informed and Timely Debate

Even though the focus of this Chapter has been on the content descriptions, it should be recognised that the curriculum generally is a complex set of interwoven documents all of which contribute to the way the first version of the curriculum is presented.

Whether it was part of the thinking of the various governments that proposed and endorsed the development of the national curriculum, the fundamental argument for its creation is to allow for the development of the best quality resources to support the teaching and learning of mathematics. Clearly Australians working together will be able to progressively develop better curriculum and associated teacher support and resources than if they are working in eight separate jurisdictions. The national specification of the cross curriculum capabilities and general capabilities further contribute to the overall quality of the curriculum.

There is little point at this time in debating the placement of topics in the AC:M. For example, there may be some who feel that the fractions content descriptions presented above go too far, and some who argue that students can learn at a faster rate. There will be important debates to be held after this format has been implemented by teachers, but rather than debating minutiae of the curriculum, the focus of debate should be on the best ways to support teachers.

It is also important to recognise that the current version of the curriculum was developed collaboratively after extensive, indeed exhaustive, consultation. The

"Shape Paper" (ACARA, 2010), which established the underlying principles, was developed by a writing team and sought online and face to face feedback nationally. Subsequently, writers who were predominantly classroom teachers were employed, and an advisory committee formed. There were extensive consultations around the successive drafts, piloting in schools across the nation, mapping of the drafts against the various state curricula, and many other steps beside. The advantage of this process is that a curriculum could be developed which is as familiar as possible to as many teachers, and which can ultimately form the basis for subsequent development. The disadvantage is that the writing was informed by many contributions. In other words, there is a tension between seeking consensus and maximising coherence that should be acknowledged. Indeed this publication is further testimony to the extent to which consultation and collaboration have been part of the process.

The content descriptions above clearly address the key ideas of fractions including equivalence, operations, the different forms of fractions (e.g., as a rational number, as a point on a number line, as an operator), and actions using those fractions. There are obviously many ways of describing these ideas, many different sequences are possible, and their alignment with the year levels is also contestable. Nevertheless it is arguable there is no state-based curriculum that is better at representing these key fractional ideas, that these descriptions do address all of the relevant key fraction ideas, and that the key challenge is to find ways to support teachers in using this curriculum as a prompt to better teaching. Continuing to argue about the detail is unhelpful and the challenge is how to use the AC:M and an opportunity for improvement in the teaching of mathematics.

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