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The Maths Guarantee

How to boost students' learning in primary school

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Overview

Australia has a maths problem. One in three of our school students fail to achieve proficiency in maths. This report shows how governments can turn this around.

Students from disadvantaged backgrounds struggle the most with maths. But one in five students from well-off families struggle too. Other countries show what's possible. On a 2023 international maths test, only 13 per cent of our Year 4 students excelled, compared to 22 per cent and 49 per cent respectively in England and Singapore.

When we teach maths well, children and the nation benefit. But taught poorly, students are robbed of a core life skill. Adults with weaker maths skills have worse job prospects and are more likely to struggle with routine tasks like budgeting and understanding health guidance.

Governments have made rhetorical commitments to excellence and equity in schooling but the reality is that maths has been deprioritised for decades. Governments have also been too slow to rule out faddish but unproven maths teaching methods. To turn rhetoric into reality, governments need to take seriously the evidence base on how humans, including children, learn maths most effectively.

The opportunity to lift maths achievement starts in primary schools. Maths is highly cumulative, so it is imperative that primary schools teach maths well and lay down strong foundations for future success. But this isn't as straightforward as it seems.

Most primary teachers are expected to teach maths, but not all have the maths knowledge, confidence, and training to teach it well. This isn't fair for students. And it's not fair for teachers either.

There are proven strategies to turn this around. Some schools have already put these in place. By implementing explicit and systematic maths teaching, effective catch-up support, and high-quality professional learning, students at these schools are making fast progress and teachers feel successful.

All primary students and teachers deserve to experience that success. To get there, governments, along with the Catholic and independent school sectors, should commit to a 10-year Maths Guarantee strategy.

First, they should significantly raise expectations and commit to a long-term aspiration of 90 percent of students achieving proficiency in numeracy, as measured by NAPLAN. Boosting proficiency is the right place to start, but governments should seek to drive up excellence too.

Second, they should ensure schools have clear guidance on how to teach maths well. Department staff should also align on this guidance.

Third, governments should arm schools with quality-assured and rigorously evaluated curriculum materials and assessments.

Fourth, they should invest in improving the quality of primary maths teaching based on a rigorous assessment of what works. This should include new primary maths microcredentials, Primary Maths Master Teacher roles, support for specialist maths teachers in primary schools, and the creation of 'Maths Hubs' to enable the best primary schools to work directly with other schools that need help.

Fifth, they should improve monitoring and oversight through stronger school reviews and the introduction of a mandatory, research-validated early years numeracy screening tool.

This strategy will require ambition and commitment. But the costs of reforms are modest – about $152 million per year across the nation, less than 0.4 per cent of spending on primary schools – and affordable within existing budgets by giving maths the priority it deserves.

Recommendations

Governments, Catholic education leaders, and independent sector leaders should take the following steps to boost primary school maths achievement.

Recommendations that the federal government should lead on or contribute to are marked with an asterisk.

1. Raise expectations

- Commit to a long-term aspiration of 90 per cent proficiency in NAPLAN numeracy, with an interim target of a 15 percentage point increase over 10 years.

2. Provide better guidance

- Commission detailed, national guidance on what effective maths teaching entails.*
- Review existing guidance – including written guidance, advice provided by departmental or Catholic education staff, and professional learning content – to ensure it is coherent and aligns to the evidence base.

3. Arm schools with high-quality curriculum materials, catch-up interventions, and assessments

- Establish an independent quality assurer to review the quality of externally-created, comprehensive curriculum materials used by schools – including those created by governments or funded by non-government systems – to ensure schools can confidently select evidence-informed resources that will support effective teaching and learning.*
- Commission rigorous research to evaluate the impact on learning of maths catch up intervention programs and digital maths applications to help schools invest in resources that demonstrably lift maths learning.*
- Commission rigorous research to determine the validity and reliability of maths assessments so schools can accurately track student progress and identify who needs additional support.*

4. Improve teaching quality

- Monitor the fidelity with which agreed reforms to initial teacher education are implemented, and update course core content as new guidance on effective maths is published.*
- Develop quality-assured micro-credentials on how best to teach primary maths and lead maths improvement.
- Establish Maths Hubs based in outstanding schools, funding them to work shoulder to shoulder with local schools to lift practice.
- Create an expert career path for specialist Primary Maths Master Teachers.
- Encourage primary schools to employ dedicated maths teachers where appropriate.

5. Tighten monitoring and oversight

- Mandate a national early years screening tool to identify students at risk of falling behind in maths.
- Strengthen school reviews to include a more rigorous examination of instructional quality in mathematics.

Summary of where we are and where we should be

From: The situation today	To: The Maths Guarantee
Too many Australian students underperform in maths • One in three students are below proficient • Maths underperformance is pervasive and persistent • Only about one in eight students excel in maths • Two in three disadvantaged students are below proficient	**Nearly all students are proficient in maths and many excel** • Proportion of proficient students increases by at least 15 percentage points over 10 years, and reaches 90 per cent in the longer term • Many more Australian students excel in maths • All groups of students achieve high rates of proficiency in maths
Primary maths receives limited attention • Time spent on maths varies a lot: it is often the 'poor cousin' of literacy	**Improving primary maths is a clear political and school priority** • Maths time is protected: there is an 'every minute matters' mindset
There are huge differences in how maths is taught • Games and maths-lite activities are too often the driving focus of a lesson without explicit teaching of new concepts and skills	**All students are taught with the most effective approaches** • Students are taught new concepts in small chunks, with clear explanations, step-by-step models, and many opportunities to practise
Some teachers lack the knowledge and skills to teach maths well • Inadequate training on the best way to teach maths • Some teachers feel nervous teaching maths	**Teachers are well prepared to teach maths effectively** • Teachers get high-quality training on maths teaching • Some schools use a specialist model to play to teachers' strengths
Schools are inadequately supported to teach maths well • Principals have varied confidence in leading maths improvement • Inconsistent teaching practices between classrooms undermine how students progress in maths as they move through school • Lack of quality-assured and research-backed maths assessments and curriculum materials limits teaching quality and intervention success	**Schools have the resources they need to teach maths well** • Maths Hubs give principals a mental model of effective practice and implementation support • Schools take a whole-school approach to maths teaching • Schools know which maths materials and assessments are best, and can readily access them to improve teaching and intervention
There is little alignment on – or accountability for – good practice • Governments provide inconsistent guidance on maths teaching • Maths professional learning is poor quality and gives mixed messages • Lack of accountability for early years maths outcomes and teaching quality	**A highly reliable system that gives every student the best chance** • Evidence-based guidance sets clear expectations for maths teaching • Teachers can access the training they need to teach maths effectively • There is an early years numeracy check • School reviews thoroughly examine the quality of maths teaching

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1 Too many Australian students are underperforming in maths

Australia has a maths problem.[1] Too many Australian students are not proficient, too few are excelling, and disadvantaged students are well behind. Despite governments of different stripes promising to lift achievement, the situation shows few signs of improving. This has long-term impacts on young people as well as Australia's prosperity.

The problem begins in primary school. Maths learning gaps emerge early and compound over time. Without solid foundations in place, many students flounder in secondary school, fuelling a cycle of underachievement and disengagement from learning.

1.1 Australian students are underachieving in maths

A fundamental expectation of our school system is that almost all students will leave school proficient in maths (see Box 1 and Box 2 for definitions of maths and proficiency).[2] This is a worthy goal. With a smarter approach, Australia could get much closer to achieving it. Yet across the country, too many students are falling short of expectations.

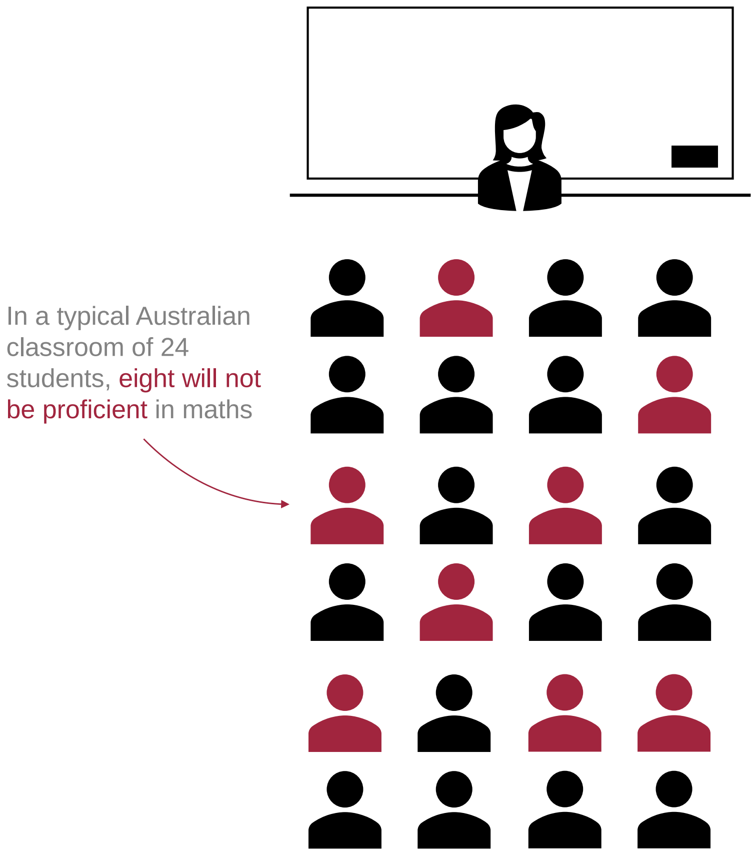
1.1.1 Too many students are falling behind

Assessment results show that Australian school systems are failing the lowest achieving students, no matter the measure used. In 2024, around one third of students in Years 3, 5, 7, and 9 were not proficient in numeracy on the annual National Assessment Program – Literacy and Numeracy (NAPLAN) tests (see Figure 1.1). Applying that across all school students, that's about 1.3 million students across the country

1. Australia also has a reading problem. We set out a strategy to overcome that problem in our report *The Reading Guarantee: How to give every child the best chance of success*. See Hunter et al (2024).
2. This expectation is collectively described by national policy documents outlining Australian education goals. See Education Council (2019) and COAG (2018).

Figure 1.1: One in three students are not proficient

Proportion of students who were not proficient in numeracy in 2024 NAPLAN



Notes: Proportion is a weighted average across Years 3, 5, 7, and 9 based on percentages from ACARA. ACARA includes students exempt from NAPLAN as part of the total from which percentages are calculated.

Source: Grattan analysis of ACARA (2024a).

at risk of leaving school without the skills they need to thrive and contribute to society.[3]

International tests tell a similar story. In the 2023 Trends in International Mathematics and Science Study (TIMSS), 28 per cent of Year 4 students and 36 per cent of Year 8 students fell short of Australia's national proficiency benchmark.[4] And in the 2022 Program for International Student Assessment (PISA), a shocking 49 per cent of Australian 15 year-olds failed to reach Australia's PISA proficiency benchmark.[5]

Box 1: The difference between maths and numeracy

This report is about the school subject maths.

Maths is a domain of knowledge, which includes topics such as measurement, statistics, and probability. Maths knowledge supports students to become numerate.

Numeracy is the application of maths to everyday situations.[a]

For simplicity, throughout this report we refer to 'maths', even when referring to standardised tests of numeracy.

a. See Victorian Department of Education (2020), ACARA (2024b), and Education Services Australia (2024).

Box 2: How Australia measures proficiency

The Australian Curriculum, Assessment, and Reporting Authority (ACARA) describes proficiency as 'a challenging but reasonable' standard that, if met, means students are 'where they should be at this stage of their schooling'.[a]

In NAPLAN, students are proficient if they are in the 'strong' or 'exceeding' categories. Students in the 'developing' or 'needs additional support' categories are not proficient. The benchmark is based mainly on what students should have learnt in previous years. For example, Year 5 students who are proficient can generally identify equivalent fractions and represent hundredths as decimals[b] – skills taught in Year 4 that provide a foundation for future success. Students who fall short of the proficiency benchmarks may have critical gaps in their knowledge and skills, making it harder for them to keep up. The benchmark should be achievable for the large majority of students: a Year 9 student would achieve it even if their performance was on par with the average Year 7 student.[c]

Australia also sets national proficiency benchmarks in PISA and TIMSS, two large-scale, international assessments. The PISA benchmark is band 3 or above.[d] The TIMSS mark is the 'Intermediate international benchmark'.[e]

a. ACARA (2023a, p. 3).
b. ACARA (2023b).
c. Grattan analysis of ACARA (2024a) and ACARA (2024c) using the methodology for determining 'equivalent year levels' from ACARA (2022a).
d. 482 points or above on the PISA scale. See Thomson et al (2023, p. 18).
e. 475 points or above on the TIMSS scale. See Wernert et al (2024b, p. 15).

3. Grattan analysis of ACARA (2024a).
4. Wernert et al (2024a, pp. 10–11).
5. De Bortoli et al (2023).

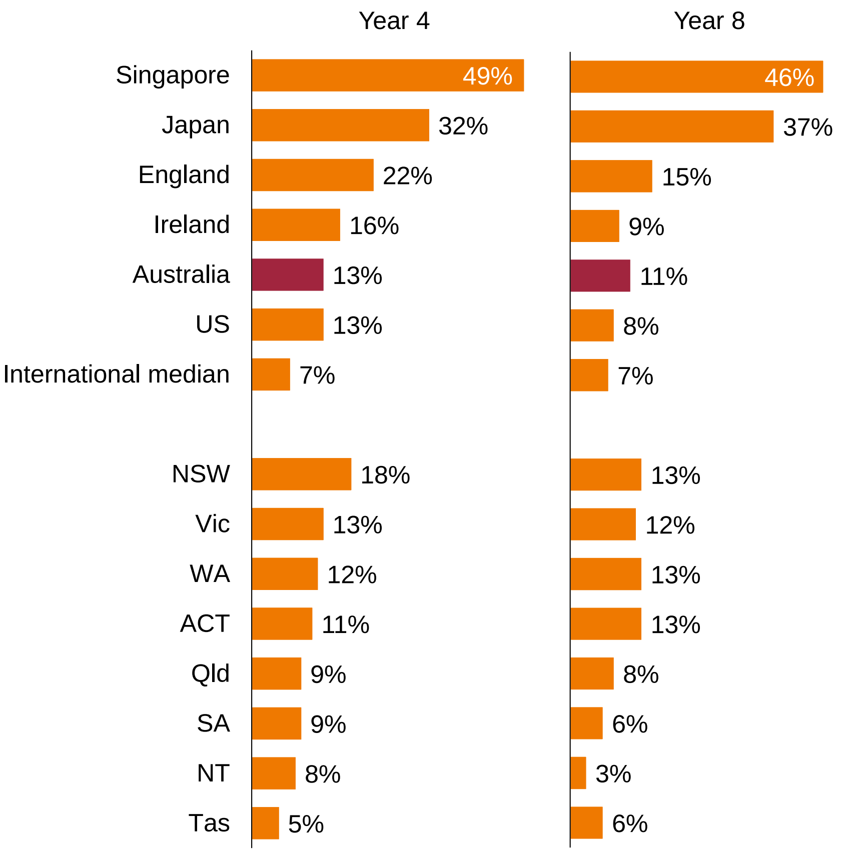
1.1.2 Too few students excel in maths

Excellence remains elusive too. Comparatively few Australian students have strong maths skills, and few students undertake advanced maths in high school.

In the 2023 TIMSS, just 13 per cent of Year 4 students and 11 per cent of Year 8 students excelled. In Singapore, by comparison, 49 per cent of Year 4s excelled, along with 32 per cent in Japan, and 22 percent in England (see Figure 1.2). These countries surpass even the Australian states with the largest share of high-performers: NSW (18 per cent of students excelled) and Victoria (13 per cent excelled).[6] Their girls were also more likely to achieve excellence than ours (see Box 3 on the next page).

Fewer Australian Year 12 students are now enrolling in advanced maths subjects over time. Enrolments in higher-level maths subjects dropped from 11 per cent in 2010 to 9 per cent in 2022, while enrolments in intermediate-level maths decreased from 22 per cent to 18 per cent.[7] That equates to about 12,000 fewer students per year leaving school having studied higher-level or intermediate maths, weakening the potential pipeline of skilled mathematicians entering the workforce.[8]

Figure 1.2: At most, 13 per cent of Australian students are excelling
Proportions of Year 4 and Year 8 students at the advanced benchmark, 2023 Trends in International Mathematics and Science Study (TIMMS)



Notes: Selected peer countries. In 2023 Australia, ranked equal 14th out of 58 economies participating in Year 4 TIMSS, and equal 8th of 42 economies in Year 8 TIMSS.

Source: Wernert et al (2024b, pp. 21, 29, 51, and 59).

6. See Wernert et al (2024b, pp. 21, 29, 51). The international median for Year 4 students was 7 per cent.
7. Marchant and Kennedy (2024, p. 3).
8. Grattan analysis of Marchant and Kennedy (ibid). 2010 participation rates for higher-level and intermediate maths were applied to the 2022 student graduation levels for comparability.

1.1.3 Australia's maths performance has been largely stagnant for a decade

NAPLAN assessments suggest that there has been neglible improvement in maths over the last decade. While some gains were made between 2012 and 2019 – equivalent to around 3 months' learning in Years 3 and 5, and around 6 months' learning in Years 7 and 9 – these were mostly reversed during the pandemic. In 2022, scores for students in Years 3, 5 and 9 returned to 2012 levels.[9]

International assessments paint a more complex picture. PISA shows an alarming decline in the maths skills of 15-year-olds. The achievement of the average Year 10 student in 2022 was about 10 months behind the average in 2012, and about 20 months behind the average in 2003.[10] In TIMSS, Year 4 results were flat between 2011 and 2019, but rose somewhat in 2023.[11] Year 8 results were around the same level in 2023 and 2011.[12]

9. Grattan analysis of ACARA (2023c). Year 7 students in 2022 remained about 4 months of learning ahead of Year 7s in 2012. Since the NAPLAN time series reset in 2023, there is insufficient data to establish more recent trends.
10. Grattan analysis of ACER (2024). PISA tests 15-year-olds, regardless of their year level. We only analysed Year 10 results to account for changes to the year level composition of the Australian sample over time. See Ainley et al (2020). Equivalent months of learning assume 20 PISA points are equivalent to about one year of learning: see De Bortoli et al (2023, p. xxxvii).
11. Grattan analysis of Wernert et al (2024b, p. 23). The improvement in 2023 Year 4 results may largely reflect improvement in NSW, particularly from high-performers. Other than the NT, all other states had no statistically significant improvement overall. See Wernert et al (ibid, pp. 29–33). Between 1995 and 2023 (the first and most recent TIMSS cycles), Australia's Year 4 performance increased from 495 to 525 points. In the same time, England overtook Australia, lifting scores from 484 to 552, while Singapore remained well ahead, lifting scores from 590 to 615. Wernert et al (ibid, p. 23). Note that Australia's 1995 sample did not satisfy the TIMSS sampling guidelines of at least a 75 per cent participation rate (it was 66 per cent).
12. Grattan analysis of Wernert et al (ibid, p. 53). The 2023 Year 8 results were also the same level as in 1995.

Box 3: The maths gender gap

Australian girls perform below boys in maths. In NAPLAN, girls are 5 percentage points less likely to be proficient or high-achieving. In Year 3, girls are four months behind boys. This gap grows to about half a year by Year 9.[a]

International assessments show similar trends. On the 2022 PISA test, 15-year-old girls trailed boys by about half a year of learning. And girls were 5 percentage points less likely to reach proficiency.[b] On the 2023 TIMSS test, Australia had the equal largest gap of 52 economies by how much our Year 4 girls lagged boys.[c] Research provides no compelling reason for the extent of the gap between Australian girls and boys in maths. Differences are likely to be mainly due to social or cultural factors.[d]

While it is concerning that our girls trail our boys by several *months* of learning, it is even more worrying that they lag girls in the top-performing countries by several *years*. Compared to Singaporean girls, Australian girls are nearly four and a half years behind in maths on the PISA tests. Half of Australia's girls fall short of the national proficiency benchmark, whereas only one in five Singaporean girls do. And only one in ten Australian girls excel on the PISA maths test, compared to roughly one in three Singaporean girls.[e]

a. Grattan analysis of ACARA (2024a).
b. De Bortoli et al (2023, p. 47).
c. Wernert et al (2024a, pp. 36, 65). Rankings omits the five economies where boys lagged girls.
d. See Tang and Zhao (2024), Pope and Sydnor (2010), Nollenberger et al (2016), and Lippmann and Senik (2018).
e. De Bortoli and Underwood (2024) Tables 3.5 and 3.6. OECD (2024) Table I.B1.4.28. Students who excel achieve PISA proficiency levels 5 and 6.

1.1.4 Disadvantaged students struggle more with maths, but many advantaged students are also falling behind

Disadvantaged students are more likely to start school behind and make slower learning progress.[13] They are also less likely to get a private tutor to help them catch up.[14]

There is a five-year achievement gap in PISA between 15-year-old students from the lowest and highest socio-economic quartiles.[15] Just 30 per cent of students in the lowest socio-economic quartile reached the national proficient standard in maths, compared to 72 per cent of those in the highest quartile.[16]

NAPLAN reveals similar equity gaps. Students whose parents did not complete high school and Indigenous students are twice as likely as the average Australian student to fall short of the NAPLAN proficiency benchmarks for maths. In schools outside Australia's major cities, about two in five students are below the benchmark (see Figure 1.3 on the following page).[17]

While students from wealthier backgrounds generally achieve better maths results, many advantaged students are also behind. In 2024, about one in five students whose parents hold a bachelors degree were not proficient in NAPLAN numeracy.

Very few disadvantaged students are high-achieving in maths. Only 2 per cent of Australian Year 8 students whose parents did not complete high school achieved excellence in the 2023 TIMSS. This compares with 19 per cent of students whose parents obtained a university degree.[18] Despite efforts by all Australian governments, these large learning gaps for disadvantaged students have hardly budged in the past decade.[19]

But one group of students that is often assumed to be disadvantaged is actually high performing on average. Students from non-English speaking backgrounds are 5 per cent more likely to be proficient than students from English-speaking households.[20]

1.1.5 Mediocre maths performance is a problem in all states and territories

Even in the ACT and Victoria, Australia's most socio-economically advantaged jurisdictions, nearly 30 per cent of students are not proficient in NAPLAN numeracy.[21]

Australia's highest-performing jurisdictions also lag well behind several international peers in the 2023 TIMSS (see Figure 1.2 on page 9). For example, only 13 per cent of Victorian Year 4s and 12 per cent of Year 8s met the excellence benchmark, with similar results achieved in WA and the ACT. This compares with Singapore's excellence rates of 49 per cent for Year 4s and 46 per cent for Year 8s.[22]

13. Garon-Carrier et al (2018), and Jordan and Levine (2009).
14. Using Household Expenditure Survey data, Watson (2008) shows that wealthier households spend double the amount on private tutoring as the average household. ABS (2017) reflects broadly comparable results in 2015-16, with the wealthiest quintile spending double the average household on private education tuition fees.
15. De Bortoli et al (2024, p. 79).
16. Ibid (p. 80).
17. Grattan analysis of ACARA (2024a).
18. Wernert et al (2024b, p. 70).
19. Grattan analysis of ACARA (2023c) based on methodology in Goss et al (2018).
20. They also generally did better in reading. Grattan analysis of ACARA (2024a). TIMSS shows a similar patters. In 2023, a greater share of Australian language background other than English students met the TIMSS 'advanced' benchmark than students from English-speaking backgrounds (19 per cent compared to 12 per cent at Year 4, and 19 per cent compared to 10 per cent at Year 8). See Wernert et al (2024b, pp. 41, 74).
21. Grattan analysis of ACARA (2024a).
22. Australia also trails England, where 22 per cent of Year 4s also achieved excellence, along with 15 per cent of Year 8s. Only NSW came close to this level,

1.2 Poor maths performance limits individuals' opportunities and national prosperity

Maths is essential for daily life, whether running a business, paying taxes, comparing supermarket prices, or managing a family budget. Adults constantly make mathematical judgements (see Box 4). Yet about one in five Australian adults lacked the maths skills needed for everyday tasks such as reading a petrol gauge.[23]

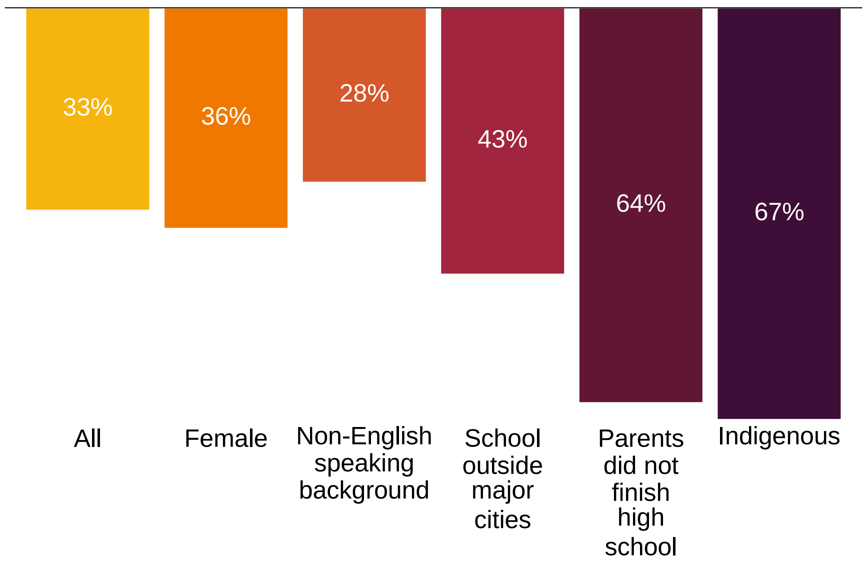
Adults with weak maths skills are more likely to struggle to understand health guidance, have poor health – including worse mental health – and suffer homelessness.[24]

Poor maths skills also cause perennial issues for employers. In one survey, 74 per cent of Australian businesses said inadequate maths and literacy skills affected them, with 17 per cent reporting that they were highly affected.[25] Common consequences of weak maths skills included poor completion of workplace documents and reports (52 per cent of businesses) and financial miscalculations (10 per cent).

Individuals and the nation stand to benefit if we boost students' maths skills. People who do better in maths are more likely to pursue post-school education, gain secure employment, and earn higher incomes.[26] Higher maths achievement would also help the Australian economy. Deloitte Access Economics estimated that boosting average

Figure 1.3: Proficiency rates vary a lot between different groups of students

Proportion of students who were not proficient in numeracy in 2024 NAPLAN



Notes: Not proficient means the student's result placed them in either the 'Needs additional support' or 'Developing' proficiency level. Proportions are a weighted average across Year 3, Year 5, Year 7, and Year 9 using percentages from ACARA. ACARA includes students exempt from NAPLAN as part of the total from which percentages are calculated.

Source: Grattan analysis of ACARA (2024a).

with 18 per cent of Year 4s and 13 per cent of Year 8s achieving excellence. See Wernert et al (2024b, pp. 21, 51, 29, 59).

23. OECD (2017, p. 46).
24. See Bynner and Parsons (2001) and Litster (2013).
25. AIG (2022, pp. 24–25). The 2022 survey attracted responses from 342 Australian companies, employing a total of 213,890 FTE employees.
26. See Deloitte Access Economics (2016), OECD (2019), and Productivity Commission (2014).

maths achievement in PISA by 5 per cent would increase annual GDP by about 0.7 per cent – about $19 billion if it happened today.[27]

1.3 The maths challenge starts in primary school

Solving Australia's maths problem means focusing first on the primary years. This is because students' difficulties with maths begin in the early years of school and compound with age.

Maths is a highly cumulative discipline, with topics generally building on one another.[28] What students are expected to learn in primary school is foundational for future success.[29] This means that knowledge gaps accumulated in the early years can create big problems down the track – students who fall behind tend to stay behind.[30]

Far too many students enter high school without mastering the foundations. Students sit NAPLAN in March, approximately halfway through Term 1. This means Year 7 NAPLAN results largely evaluate primary school learning. The Year 7 results show that 1 in 3 students lack the proficiency expected by the end of primary school, with 1 in 4 achieving below the level of the average Year 5 student just as the pace of maths learning begins to accelerate.[31] These students might struggle to round numbers, apply the order of operations, and calculate perimeter and area.[32] They may still be counting on their fingers, while students who are proficient sprint ahead with new skills like algebra.

27. See Deloitte Access Economics (2016, Table ii, p. xiv). Deloitte presented their estimates based on Australia's GDP in 2016. We have applied their assumptions to GDP in 2024 using ABS (2025a, Table 2, Series A2302459A).
28. See Crato (2022) and Stokke (2015). While maths is highly hierarchical, it is not strictly hierarchical. See Newcombe et al (2015) and Nguyen et al (2016).
29. Newell (2021).
30. Williams et al (2023) found that only about one in five students who fell below the old NAPLAN maths minimum standard in Year 3 caught up and kept up by Year 9.
31. Grattan analysis of ACARA (2024d) and ACARA (2024a).
32. Item-level analysis is not available for the 2024 NAPLAN tests. The skills listed here are those students who achieve proficiency at Year 7 can generally

Box 4: Why maths still matters

Calculating, estimating, and measuring are essential skills used by adults in everyday life. Among other things, these skills allow adults to manage budgets, shop, pay bills, plan holidays, cook, and do home maintenance.[a]

Many everyday tasks require an understanding of maths concepts. Managing a mortgage and retirement planning both require an understanding of compound interest. Probability and statistics are needed to assess vaccination benefits and risks. Interpreting charts and statistics helps voters critically evaluate claims in the news and on social media.[b]

Adults also constantly use maths in the workplace. In 2013, one in two Australians reported using fractions or percentages at work every week, with one in four using simple algebra and formulae.[c] Nurses, for example, are often required to accurately calculate proportions when administering drugs.[d]

Despite claims that we can outsource maths to smart phones' calculators, the reality is that adults often make mathematical judgements on-the-fly.[e] When a rapid answer or estimate is needed, it is often less efficient – and more embarrassing – to pull out a phone for a calculation. In any case, relying on a phone assumes you know what calculation to input and are able to 'sense-check' the result.

a. Duchhardt et al (2017).
b. Iddo et al (2020), and Royal Society Te Apārangi (2021).
c. See OECD (2016, p. 40), drawing on the OECD's Survey of Adult Skills.
d. Hoyles et al (2001).
e. See Marshall and Northcote (2016) for how often Australian adults make maths calculations without a calculator.

Consequently, Year 7 teachers are forced to grapple with wide spreads in students' maths ability. In the typical class, there is a five to seven year gap in achievement.[33] This poses a daunting challenge for teachers wanting to keep up with grade-level curriculum expectations, without leaving these students flailing behind.

Failing to master foundational maths skills in primary school can also create knock-on effects for students' social and emotional wellbeing and self-esteem. Students' disposition towards maths – whether positive or negative – is largely established in the primary school years.[34] Higher achievement is linked to better academic wellbeing, motivation and confidence.[35] By contrast, struggling with maths is linked to disengagement from learning, poor behaviour, lower perceptions of schooling, motivation, and aspirations, and increased absence from school.[36]

The vicious cycle created by early underachievement in maths underlines the urgency of establishing a strong maths foundation in primary school, before challenges intensify later on.

Rather than leaving these challenges for secondary school teachers to try solve, a greater focus on primary school maths is likely to reap benefits for at least two reasons.

First, students are more engaged in their learning and tend to have much better rates of school attendance in primary school, meaning learning progress is easier to achieve.[37]

Second, there are a range of straightforward opportunities to improve the quality of maths teaching in the primary years. Primary school maths has historically received less attention than secondary school maths or primary school reading. It has also suffered from the misconception that it is 'easy' and therefore does not require significant expertise and forward planning to teach well. Adjusting the level of prioritisation and dispelling these misconceptions will likely pay significant dividends relatively quickly.

1.4 How to read this report

This report explains how to turn around Australia's persistent maths problem, starting in primary school.

Chapter 2 summarises the research on effective primary maths teaching, and the implications of this research for teachers and schools.

Chapter 3 presents novel analysis of longitudinal data on teachers' maths background and a new Grattan Institute survey to reveal that some primary teachers lack skills and confidence in maths, and many schools are struggling to implement coordinated teaching approaches in maths.

Chapter 4 describes how schools can buck the trend, drawing on examples from seven schools that have put the evidence into practice and are reaping the benefits.

Chapter 5 explains what governments can do to help more schools implement effective approaches to teaching primary maths.

demonstrate. Some students who are below proficient may have demonstrated these skills. See ACARA (2023b).

33. Siemon et al (2019).
34. Mata et al (2022), and Pinxten et al (2014).
35. Rodríguez et al (2020).
36. Thomson (2016), Norton (2017a), and Kaplan et al (2002).
37. Katsantonis (2024), and ACARA (2024e).

1.5 What this report is not about

This report focuses on the in-school factors directly related to the quality of maths teaching, such as school curriculum (what is taught), pedagogy (how it is taught), and assessment practices (how we know it has been learnt). Research suggests the quality of teaching is the biggest in-school factor affecting learning, accounting for up to 30 per cent of the variation in student achievement.[38]

Other school factors also influence maths achievement, such as establishing orderly classroom behaviour, and building students' reading proficiency to better comprehend worded maths problems. This report touches on these factors, but they are not its primary focus.[39]

Factors outside schools' direct control include community attitudes towards maths, participation in private tutoring, and the background characteristics of students (such as the educational background of a student's family, whether a student attends school regularly, and any underlying health or developmental challenges they may face).[40] While these are important, they are outside the scope of this report.

38. Estimates vary substantially: see ACARA (2020a), Deloitte Access Economics (2016), and Productivity Commission (2023, p. 73), and Appendix B of Goss et al (2018).
39. For a thorough review of what schools and systems can do to improve students' reading proficiency, see Hunter et al (2024).
40. See, for example, Hancock et al (2017) and Jorgensen (2012).

2 Teaching primary maths isn't as straightforward as it seems

Developments in cognitive science in the past 30 years have taught us a lot about how humans learn maths. Now, more than ever, we understand the teaching approaches that help students succeed (see Table 2.1 at the chapter's end for a summary). This chapter provides a synthesis of that evidence, and its implications for schools.[41]

2.1 Mastering primary school maths takes a lot of hard work

Maths, like reading, is not an innate skill.[42] Mastery – meaning students are proficient in a skill to the point of applying it fluently and flexibly – requires careful instruction, effortful learning, and lots of practice.

Adults, who have decades of immersion in maths, tend to take for granted many aspects of primary school maths, such as counting, basic sums, and telling the time.[43] But for most primary-aged children, mastering these basic tasks is not straightforward. This quickly becomes apparent when young children attempt maths many adults find easy, such as figuring out how old they will be in 2030, calculating the time elapsed between 7:15am and 8:30am, or counting backwards by four from 30.

As primary school students move up through the year levels, they encounter topics that extend beyond everyday mathematical knowledge. In Year 6, for example, students learn about prime, composite, and square numbers – essential knowledge for factorisation and Pythagoras' theorem in Year 8, quadratic equations in Year 9, and exponential relationships and calculus later in high school.[44]

Primary school students are also required to think abstractly. For example, they need to understand why 0.201 is smaller than 0.25. Without this knowledge, it becomes difficult to judge the winner in a photo finish in a PE class, accurately measure small quantities in a chemistry lesson, or gauge the reasonableness of interest calculations in a Year 12 accounting exam.

This knowledge does not come naturally to humans.[45] It took humanity millennia to develop formal understandings of many of the mathematical concepts taught in primary school.[46]

A challenge for all schools is that teaching time is in short supply. Primary schools typically devote about 1,400 hours of class time to maths between the day bright-eyed four- and five-year olds first walk through the school gate and their last day in Year 6.[47] During this time, teachers are expected to induct young children into the specialised knowledge of maths, progressing from learning how to count to confidently adding fractions.

This is a daunting task, but it is made much easier if schools teach maths with an eye to how the human brain is wired.

41. Our summary draws mainly on research syntheses conducted by others. In particular, this chapter owes a debt to the work of AERO (2024a), Lee (2023), EEF (2022), Fuchs et al (2021), Gersten et al (2009a), Hartman et al (2023), Merlo (2024), Ofsted (2021), S. R. Powell et al (2022), S. R. Powell et al (2024), Rosenshine (2012), and Sweller (2016).
42. Hartman et al (2023) and Sweller (2024). Some basic maths skills do develop naturally, such as recognising which of two concrete quantities is greater. See Von Aster and Shalev (2007).
43. The blind spot people who are proficient have when it comes to seemingly simple tasks is sometimes called the 'curse of knowledge'. See Hinds (1999, p. 206).
44. Year 6 content descriptor: AC9M6N02. See ACARA (2022b). As another example, Year 6 students learn about angles: essential knowledge for studying trigonometry in Year 9 and waves in physics.
45. Hartman et al (2023).
46. Hefendehl-Hebeker (1991), Kilhamn (2011), and Nieder (2016).
47. This assumes primary schools teach one hour of maths per day for a 40-week school year. In reality, events like camps would reduce the time for maths.

2.2 Effective maths teaching accounts for how memory works

Working memory serves as the brain's mental 'workspace' (see Box 5). It has significant limitations:

- It can typically handle only two-to-five pieces of information at once. Children's capacity tends toward the bottom of this range.[48]
- Information in working memory generally lasts for less than 30 seconds without reinforcement.[49]

These constraints on working memory mean that students can quickly become overwhelmed when tackling a maths problem. This makes working memory 'the bottleneck of thinking'.[50]

Long-term memory provides a workaround to the constraints of working memory. Research suggests long-term memory has virtually unlimited capacity.[51] Knowledge stored in it can be readily accessed without needing to take up the limited slots available in working memory.

This means that maths is considerably easier for students who can draw on knowledge stored in long-term memory (see Box 6).

Adopting more efficient ways of building knowledge in long-term memory leaves more time for students to practise applying that knowledge to solve tricky, multi-part maths problems and more open-ended maths investigations. It also means that students have a more secure knowledge base to tackle hard maths concepts in secondary school. And more efficient maths teaching frees up time for other things, such as choir, sport, and field excursions.

48. Some estimates of working memory capacity are higher, putting it in the vicinity of four-to-seven pieces of information. See Lovell and Sherrington (2020).
49. Hartman et al (2023).
50. Lovell and Sherrington (2020, p. 19).
51. Ibid.

Box 5: How learning happens in the brain

Learning can be understood as 'a change in long-term memory'.[a]

In simple terms, the architecture of human memory includes:

1. **The environment** – The external source of information. In a maths class, this includes a student's teacher and peers are saying, and visual stimuli like writing on a whiteboard.
2. **Working memory** – Where the brain processes information. This has limited capacity; it can only hold somewhere between two and five chunks of information at one time.
3. **Long-term memory** – Where a vast network of interconnected information is stored. It has a virtually unlimited capacity.[b]

Attention is the filter, selecting information from the environment to be processed in working memory.[c]

The goal of teaching is to help students take new information into their working memory and then transfer it into their long-term memory.

Information in working memory is more likely to transfer into long-term memory when it is connected to students' existing knowledge; when information in verbal explanations is reinforced by visual materials; and when students are exposed to, and rehearse, the same information multiple times.[d]

a. AERO (2023, p. 8).
b. See Lovell and Sherrington (2020, p. 19).
c. Willingham (2017, Figure 1, p. 171).
d. See AERO (2023), Burns et al (2015), and Clark and Paivio (1991).

Two important pieces of knowledge to prioritise are maths facts (e.g. that $6 + 7 = 13$, and that *milli-* means one thousandth) and maths procedures (such as how to multiply fractions).

When students are learning to master a new fact or procedure, they should also be taught the underlying concepts.[52] Take the maths fact example of $6 + 7$. Students might learn addition strategies, such as counting up from 6, perhaps using their fingers; making 10 (i.e. $6 + 4 + 3 = 10 + 3 = 13$); or using near doubles (i.e. $6 + 6 + 1 = 12 + 1 = 13$). But for key facts such as $6 + 7$, always relying on these strategies is inefficient and uses up precious working memory slots. This creates challenges for more complex, multi-step problems (see Box 6). Teachers therefore must ensure that students progress to a point where the fact is securely stored in – and rapidly retrievable from – long-term memory.

Having maths procedures securely stored in long-term memory also matters.[53] It means students can carry out each procedure more easily, preparing them for more complex problems, and enabling them to expend working memory on things such as checking the reasonableness of their answer.[54]

52. The relationship between students' understanding of a concept and fluency with a procedure is mutually reinforcing. This means that teachers should not hold out for students to demonstrate adequate conceptual understanding before introducing and practising a procedure like column addition. See Rittle-Johnson (2017), Rittle-Johnson and Schneider (2015), and Schneider and Stern (2010).
53. See background discussions in Strauss (2022) and J. D. Stocker et al (2018). For example, students solving $\$9.32 - \$4.57$ will have an easier time if the formal, written method of subtraction is securely stored in their long-term memory. The written method involves lining up the hundredths, tenths, and ones, subtracting from right to left, and regrouping where needed. This method breaks the problem into a sequence of steps that avoids overloading working memory.
54. For example, a primary school student who can carry out long division fluently is better prepared to tackle polynomial division in senior secondary maths.

Box 6: Why automatic recall of maths facts matters

A 'maths fact' is the solution to an easy problem that is stored in long-term memory, such as $8 + 5 = 13$.

Imagine a Year 5 student presented with the following problem:

$$\begin{array}{ccccc} & 6 & 7 & 2 & 5 \\ \times & & & 7 & 8 \\ \hline \end{array}$$

To solve this problem using the column multiplication method a student must complete eight simple multiplications and 11 simple sums – 19 calculations in total.[a] For example, they would start by multiplying 8 by 5 to get 40, then 8 by 2, and so on.

If a student takes two seconds to complete each calculation – by simply recalling each maths fact automatically from long-term memory – the problem takes 38 seconds to solve. But if ten seconds are needed for each calculation, the problem takes more than three minutes.

A student who can recall maths facts automatically can expend their cognitive effort on checking the reasonableness of their answers to help avoid mistakes.

A student who does not have these maths facts stored in their long-term memory instead must complete these calculations using less efficient methods, such as counting on their fingers or typing them into a calculator. They can quickly become overwhelmed. This student also answers far fewer problems in the available time, which means less practice overall, and a higher risk of them falling behind.

a. Example taken from Sheridan (2024).

2.3 The way the brain works has important implications for how to teach maths

The research on how the human brain works has important implications for how schools plan their approach to teaching primary maths.

The concept of the instructional hierarchy sets out the predictable stages of skill development and maps these against the teaching approach that works best for each stage (see Figure 2.1).[55]

The instructional hierarchy suggests a different approach is needed to teach a new concept or skill than to extend students who have already achieved mastery. Teachers need to break new learning down into small chunks that are taught explicitly. This may seem counterintuitive to some. The goal of maths teaching is for students to apply the maths they have learnt in class to novel problems that require them to adapt what they know without teacher assistance (the final stage of the instructional hierarchy). Given this, the temptation can be to start teaching a new concept or skill by first focusing on meaty application tasks.

But starting at this stage is a mistake. Starting with activities that involve students applying a skill with minimal teacher support before they are proficient is a recipe for student disengagement and teacher frustration. Instead, teachers need to first support students to become accurate and fluent. The sections below explain how.

2.3.1 Acquisition: Teaching new maths concepts and skills

High-quality research shows that the most effective way to help students learn new maths material is to break the concepts down into small chunks, explain them clearly with examples, model what students need to know step by step, and provide students with plenty

55. Haring and Eaton (1978) originated the concept. See also Burns et al (2010), Codding et al (2024), and VanDerHeyden and Burns (2005).

Figure 2.1: The instructional hierarchy shows that, for new material, students should be explicitly taught *before* doing application tasks

Students are at this stage if they cannot respond accurately without help.	Students are at this stage if they are accurate, but their responses are laboured.	Students are at this stage if they are fluent and ready to apply learning to novel contexts.
1. Acquisition	**2. Fluency**	**3. Generalisation**
Goal: Students respond accurately without assistance.	**Goal:** Students maintain accuracy and build speed. Aim is that students recall facts and carry out procedures with 'automaticity' (i.e. with little conscious effort).	**Goal:** Students transfer skill to new and unfamiliar conditions.
Explicit and systematic instruction: Teachers model responses, guide practice, and provide immediate corrective feedback.	**Timed practice:** Students race against the clock and try to beat their personal best.	**Interleaved practice:** Questions of different types so students discriminate when to use which skill.
Blocked practice: Questions of the same type targeting the same skill.		**Non-routine problems:** Students tackle novel, often multi-component problems which may have several possible solutions.

MAINTENANCE	**Goal:** Students retain skill, sustaining performance.	**Spaced practice:** Periodically revisiting previously learnt material.

Notes: The original framework from Haring and Eaton (1978) distinguishes between generalisation (when the student figures out when to use the target skill and discriminates between it and similar skills) and adaptation (when the student adapts the target skill to novel situations). These stages are sometimes bundled, as we have done, following the example of VanDerHeyden and Solomon (2023).

Source: Adapted from Poncy (2023).

of opportunities to practise.[56] This form of teaching gives students what they need to succeed. It avoids overloading working memory and helps transfer information into long-term memory. And, because teachers constantly check for understanding and provide immediate feedback, students know whether they are succeeding. As a result, students experience a high rate of success, which can breed confidence and motivation, and help to combat anxiety about maths (see Box 7).[57] This approach benefits all novice learners but is particularly important for students who are behind in maths or have learning difficulties.[58]

Each lesson should have a clear purpose and measurable learning intention against which its success can be judged. That learning intention should be achievable within the lesson, and focus squarely on a particular maths skill or concept. Well-focused learning intentions distinguish this teaching approach from approaches designed around activities (see Box 8 on the following page).

Teacher explanation

To avoid overloading working memory, teachers should break new content into small chunks and ensure explanations are unambiguous and to the point. Ideally, the explanations should be short too, so that the bulk of class time is dedicated to practice.

During explanations, teachers should clearly explain what students need to know, and fully model mathematical procedures. It can be helpful if teachers also show 'non-standard examples' and

56. See, for example, AERO (2024a), Ashman et al (2020), EEF (2022), Evans and Martin (2023), Fuchs et al (2021), Gersten et al (2009a), Merlo (2024), Ofsted (2021), S. R. Powell et al (2022), S. R. Powell et al (2024), and Rosenshine (2012).
57. Gunderson et al (2018), and Ma and Xu (2004).
58. Chodura et al (2015), Fuchs et al (2021), Gersten et al (2009b), Kroesbergen (2004), and Morgan et al (2015).

Box 7: Effective teaching can combat maths anxiety

'Maths anxiety' is the worry and tension that students can feel when doing maths.[a]

By high school, many Australian students appear to experience some discomfort when doing maths. Forty per cent of Australian 15-year olds agreed with the statement 'I get very tense when I have to do maths homework'.[b] Thirty-five per cent said they feel helpless when doing a maths problem.[c]

There is a well-evidenced connection between academic achievement and maths anxiety.[d] Very intense feelings of nervousness may impede working memory, making it hard for students to solve maths problems.[e]

Research suggests this is mostly a learnt fear linked to poor prior maths achievement.[f] Therefore, helping students develop strong mathematical foundations can build confidence in maths. Simply avoiding maths for fear it will cause students anxiety is not a productive response.

a. Buckley (2013).
b. The OECD average was 39 per cent. See De Bortoli et al (2024)
c. The OECD average was 41 per cent. De Bortoli et al (ibid).
d. Barroso et al (2021), Gabriel et al (2020), Ma (1999), and Szczygieł et al (2024).
e. Ashcraft and Kirk (2001).
f. See, for example, Geary et al (2023), Gunderson et al (2018), Ma and Xu (2004), and Wang et al (2020). Note that different studies have produced different results on the nature of the relationship between prior achievement and maths, and the effect of potential moderators (such as students' age and gender). See Barroso et al (2021).

'non-examples' to clarify the boundaries of a maths concept.[59] Teachers should also introduce straightforward worded problems, to show a maths concept or skill in context.[60]

Teachers' explanations may be supported by concrete or pictorial representations of maths concepts, such as base 10 blocks and diagrams.[61] These representations help students visualise and understand abstract maths concepts.[62] It is important that concrete representations are removed as soon as possible but as late as necessary (this is called 'concreteness fading') so that students have ample opportunities to practise working abstractly – a skill that is essential for later success as maths becomes more abstract.[63]

59. For example, students in a Foundation class might learn that a triangle is a three-sided shape. To show the boundaries of what counts as a triangle, the teacher could present non-standard examples, such as triangles rotated 45 degrees, or very skinny triangles. They could also show non-examples such as a pyramid (which is not a triangle because it is three-dimensional), a diagram of a pizza slice (not a triangle because it has one rounded edge), or a paperclip folded into a triangle-like shape (not a triangle because it is not enclosed). These non-examples help refine the students' understanding from 'a triangle is a three-sided shape' to 'a triangle is a closed, two-dimensional shape with three straight sides'. This example is adapted from White Rose Education (2024).
60. A frequent misconception is that worded problems are best used for extension, or only once students are fluent with a skill. But teachers should model and guide practice with simple worded problems sooner, because these 'give meaning to mathematical operations such as subtraction or multiplication': see discussion in Gersten et al (2009b, p. 26).
61. Base 10 blocks – also known as dienes – are three-dimension blocks typically made out of wood or plastic that represent the base-10 place value system. A set normally consists of units (ones place), longs (tens place), flats (hundreds place) and blocks (thousands place). See discussion in Fuson and Briars (1990).
62. Primary maths requires students to understand abstract concepts, such as that the symbol 5 represents five of a thing and that the percentage sign – % – denotes a number expressed as a fraction of 100. See Bouck et al (2018) and Carbonneau et al (2013).
63. Working with maths symbols is faster than using concrete representations (i.e. it is quicker to compute $6 + 7$ mentally than to arrange six counters, add seven more, and then count the total). Additionally, students need to be confident

Box 8: The dangers of activity-based planning

Primary school teachers are often encouraged to structure lessons around games and activities. But if activities become the driving focus, there is real risk that the maths in the lesson is lost.

One suggested Year 3 lesson sequence for Australian teachers invites students to learn about fractions by exploring the optimal fraction to fill a bottle so it lands upright when flipped.[a] This activity requires knowledge of fractions (e.g. $\frac{1}{3}$, $\frac{1}{5}$, etc.), volume (including millilitres), and data analysis.

If this activity is used before students are proficient with these aspects of maths, there is a real risk that students will spend a lot of time flipping bottles without attending to the underlying maths.

The more students think about something, the more they are likely to learn and remember it.[b] Students may spend the lesson competing with friends at bottle flipping, and not thinking about how a $600\,\mathrm{mL}$ bottle filled to $200\,\mathrm{mL}$ is one-third full.

Activities like this can be fun for both students and teachers. While they have their place – such as at the end of term – they take up a lot of time, and are not a substitute for teaching the foundational knowledge and skills students need to master in order to progress with their learning.

A teaching approach based mainly on these activities also risks exacerbating existing inequities. Students who have the requisite knowledge and self-regulation skills find it easier to engage and consolidate their learning, while their peers who don't sit passively (or disrupt the class), take less from the activity, and fall further behind.

a. See reSolve (2018).
b. Willingham (2009).

In comparison to activity-focused teaching approaches (see Box 8 on the previous page), instruction that involves clearly explaining concepts requires teachers to have a higher degree of confidence with maths as they model problems in front of the class. For this reason, primary teachers' knowledge of maths and how to teach it really matters (we discuss this further in Chapter 3).

Guided practice

After a whole-class explanation of a new concept, students benefit from applying the new knowledge through guided practice.

Guided practice in a whole-class setting involves students having the opportunity to work through problems step by step, with the teacher checking and providing immediate corrective feedback throughout. The questions posed during guided practice should have the same underlying structure as questions the teacher modelled during their explanation. During guided practice, teachers provide scaffolds (or supports) and gradually reduce the amount of guidance as students master a concept or skill.[64]

To guide practice effectively, it is critical that teachers check students' work and responses, so they know whether each student has understood their explanation, can follow the steps modelled, and is ready to apply their learning independently. To quickly check for understanding in a whole-class setting, teachers can use methods that elicit responses from all students at once (for instance by having students answer and display questions on mini whiteboards).

without concrete materials as they move into secondary school maths and tackle increasingly abstract topics, such as algebra.

64. One way to do this is through 'faded worked examples', in which students attempt partially solved maths problems. The number of pre-completed steps for each problem steadily decreases as students transition to solving the problems independently. See Renkl and Atkinson (2016) and Retnowati (2017).

Independent practice

After guided practice as a whole class, students still need opportunities to practise new skills and knowledge independently, so that what they have learnt transfers to their long-term memory.

The focus of practice should initially be on accuracy.[65] It helps if students are given questions structured similarly to those modelled during the explanation and completed during guided practice. For example, if a lesson is on calculating perimeter, the questions students attempt during independent practice should also be on calculating perimeter. This is called 'blocked practice'.[66]

It is also best to start with questions that involve simple arithmetic, so students can focus their attention on the relevant maths processes without being overwhelmed by the numbers.[67]

2.3.2 Fluency: Improving the speed and ease with which students respond

Once students are consistently giving accurate responses, but still do so haltingly, teachers should focus on building fluency: the speed with which students can respond accurately.[68] Fluency is vital for maths.[69]

65. Haring and Eaton (1978).
66. H.-B. Hwang (2025).
67. For example, imagine a Year 5 lesson in which students are learning the standard method for adding fractions. This is a three-step process that involves finding the lowest common denominators, adding the numerators, and simplifying (where possible). It would be unwise to set, as the first practice question, $\frac{7}{13} + \frac{8}{9}$ because the lowest common denominator of these fractions is 117 and the answer involves improper fractions. Such questions are best reserved for when students are fluent with the procedure of adding fractions.
68. See Haring and Eaton (1978). See also Burns et al (2010, p. 71) for a discussion of different teaching strategies to build fluency and how these differ from strategies to build accuracy.
69. Kilpatrick et al (2001).

It means students can do more practice questions in a lesson, and a lot of practice is key for maths success. It also means they can tackle more complex problems.

To support students' fluency, teachers should do some timed practice.[70] This is because once students achieve a high degree of accuracy (nearly 100 per cent correct), timed practice gives teachers more information about what students have mastered and stored in their long-term memory.[71]

Achieving fluency requires at least some repetitive practice.[72] Repetitive practice should not be dismissed as pointless 'rote learning' or 'drill and kill' (see Box 9). Mastering most hard things requires practice, as any budding student athlete or musical performer can attest. Maths is no different. To that end, extra practice outside the class can make a difference, but it should not be relied upon as the primary source of practice (see Box 10 on the next page).

Fluency with maths facts is essential

In addition to building students' fluency with other parts of maths, primary schools play a vital role in ensuring students build fluency in maths facts in the early years. The goal should be for students to recall a maths fact with automaticity – without hesitation (within approximately two-to-three seconds) – because this indicates they probably have automatic recall of that knowledge (i.e. it is in their long-term memory

70. Fuchs et al (2021).
71. See VanDerHeyden and Solomon (2023). Timed practice results in rate-based data such as 'digits correct per minute'.
72. One study found that to master small sets of multiplication facts, students needed many practice sessions on average – sometimes as many as eight. In each practice session, students might rehearse a maths fact multiple times. Younger students and students with poorer maths skills tended to need even more repetitions. See Burns et al (2015, Table 1).

Box 9: Myth busting: Fluency practice is not 'drill and kill'

Fluency practice is sometimes seen as being at odds with the goal of students applying maths to real-life scenarios. Some maths academics have gone so far as labelling the memorisation of times tables through repetition as 'unnecessary and damaging'.[a] But as other academics have pointed out, this misunderstands the importance of having automatic recall of maths facts, and underestimates how engaging fluency practice can be.[b]

Interventions that focus on improving lower-performing students' maths fact fluency can have a positive impact on maths test scores, including students' ability to complete worded application questions.[c] Practice focused on procedural fluency can also reinforce underlying conceptual understanding.[d]

For fact fluency, only small doses of practice are needed if done daily.[e]

Fluency practice can also be fun. To develop maths facts, students can race against the clock to complete as many questions as they can, or work in partners with flashcards, celebrating each new personal best.[f] Fluency practice is also a great way for young children to achieve success in maths, which is highly motivating and helps develop positive attitudes towards the subject.

a. Boaler and Confer (2015, p. 1).
b. See, for example, J. D. Stocker et al (2022).
c. Ibid.
d. For example, column addition emphasises place value: when adding the ones column in $17 + 14$ the 11 ones can be regrouped into 1 ten and 1 one. See Fan and Bokhove (2014) for further discussion.
e. Hernandez-Nuhfer et al (2020), and Duhon et al (2022).
f. See, for example, Fontenelle IV et al (2022) and Payne et al (2024). See also Stokke (2024).

and readily retrievable).[73] Students should have automaticity with addition and related subtraction facts up to $10 + 10$ by the end of Year 2 (at the latest) and with multiplication and division facts up to 12×12 by the end of Year 4 (at the latest).[74]

Evidence suggests a minimum of four minutes of practice with maths facts per day, and that small daily doses of practice are best.[75] This might be scheduled as part of the lesson warm-up. Schools should plan practice to help students focus on a manageable number of maths facts that they haven't yet committed to memory.[76] Adaptive technology can be helpful here.[77] It can personalise practice, pinpointing the facts individual students are yet to master. Technology can also gamify fluency practice, making it fun.

2.3.3 Generalisation: Applying learnt material in new contexts

Once students are accurate and fluent with a maths topic, students are properly prepared for, and benefit from, applying this knowledge flexibly.

73. Stickney et al (2012).
74. Year levels based on ACARA (2022b). See English Department for Education (2021, p. 331) for the fact fluency progression recommended in England.
75. Two minutes per day was the minimum dose required to see gains in Duhon et al (2022). We have suggested four minutes based on Stokke (2024), which allows for some set up time. There is evidence that two minutes of practice in the morning and the afternoon is better than four minutes of back-to-back practice in the morning. See Schutte et al (2015). For further research on optimising fluency practice, see Codding et al (2016), Duhon et al (2009), Hernandez-Nuhfer et al (2020), Payne et al (2024), and S. L. Powell et al (2022).
76. One proven method is incremental rehearsal. Rather than trying to memorise all the seven times tables at once, for example, students instead tackle a practice set that introduces just one unknown fact at a time until that fact has been mastered. See Burns (2005) for further details on this method.
77. See, for example, Burns et al (2012), Hassler Hallstedt et al (2018), and Stickney et al (2012). See Ran et al (2021) for a meta-analysis of the benefits of computer technology for students struggling in maths more generally.

Box 10: Homework and primary school maths

Meaningful, focused practice helps students master maths. It follows that students benefit from additional practice at home, provided it is high-quality and purposeful.[a] Homework may particularly benefit students who are behind.[b]

Homework in maths should involve practising things learnt in class.[c] Short, frequent homework may be more effective than longer bouts.[d] There is promising evidence that digital apps can be an effective means of at-home practice for primary school students.[e]

Whether to set homework will depend on students' ages and the extent to which they are mastering grade-level content in class.

But primary schools should not operate on the expectation that practice will happen at home for all students. Some students may not have a quiet place to work.[f] And, in the younger years, students may struggle without an adult to guide them. In such cases, students might need a place to get support at school, such as an after-school homework club.

Because individual circumstances impact students' capacity to practise out of class, homework is out of scope for this report. Our focus is instead on maximising the impact of time in class.

a. EEF (2021a).
b. Bartelet et al (2016).
c. EEF (2021a).
d. EEF (2021a), and McJames et al (2024).
e. Bartelet et al (2016), and Roschelle et al (2016).
f. EEF (2021a).

At this stage of the instructional hierarchy, students benefit from questions and tasks that require them to figure out when it is appropriate to apply the skill they are now accurate and fluent in. Teachers can achieve this by designing sets of questions that involve a mix of question types (this is called 'interleaved practice').[78] This could be through cumulative tests or quizzes, or daily reviews that involve a mix of question types. Questions should be designed to require students to discriminate between problems and choose appropriate strategies. In the example below, students must choose whether to use addition or subtraction:

> Ed ate 5 cookies, and he now has 9. How many did he start with?
>
> Ed ate 5 cookies, and he began with 9. How many does he have?[79]

Interleaved practice should not be introduced when students are still developing accuracy in a skill, as it might confuse them.[80]

During the generalisation phase, students also benefit from applying previously learnt knowledge to non-routine problems, which are problems where the path to the solution is not immediately clear.[81] Non-routine problems might include application tasks with multiple possible solutions (see Box 11), problems that present the maths skill in a different context, and problems that involve multiple components, requiring students to draw together various maths skills they have mastered. Non-routine worded problems can also be effective (see Box 12).

More open-ended tasks should be carefully planned so the focus is on the maths. Tasks which involve a lot of extraneous elements – such as excessive cutting and pasting – may divert students' attention from the mathematical thinking the task is intended to elicit. For example, asking Year 3 students to design animals out of fraction pieces (circles split in halves, quarters, eighths, and so on) risks students spending more cognitive energy thinking about which animal to create, and arranging the fraction pieces to form it, than about the maths involved in the fractions themselves.[82]

Non-routine problems, which require students to use maths flexibly, mark the final stage and desired destination of maths teaching. But starting an instructional sequence at this final stage is a mistake, based on a misunderstanding of how students learn. It risks overloading students' working memory, thwarting their efforts to complete the task or learn the new skill, which can in turn fuel students' feelings of failure and anxiety.[83] Starting at this final stage also creates equity issues: students who are lucky enough to have the required knowledge for the tasks (because, for example, they have been tutored at home) may engage more. And if the activities are designed as group tasks, students who struggle might sit back while more able peers do the work.

2.3.4 Maintenance: Frequently revisiting previously learnt maths concepts

Knowledge doesn't stick in long-term memory without frequent retrieval. Retrieval practice involves students recalling information that they have already learnt. By trying to recall information, students strengthen

78. Taylor and Rohrer (2010), Rohrer et al (2015), and Rohrer et al (2020).
79. Rohrer et al (2017, p. 4).
80. See discussion in Fischer (2023).
81. Ashman et al (2020), Evans and Martin (2023), Foster (2018), and Sweller et al (2024).
82. This idea comes from Lesson 2 in the instructional sequence outlined by Hubbard and Marino (2023). For an alternative fractions task aimed at Year 5-to-7s that foregrounds maths and has multiple possible solutions, see AMSI (2018, p. 3).
83. These application tasks have higher 'element interactivity' – a term which refers to the number of task elements that must be processed in working memory. More complex tasks have a higher base level of element interactivity. But as learners gain expertise, they can retrieve more from long-term memory, decreasing the effective element interactivity of a complex task. See Ashman et al (2020).

their long-term memory and identify gaps in their learning.[84] Retrieval practice also helps students transfer information they know to novel situations: one goal of maths teaching.[85]

Practice questions should be chosen so students periodically revisit learnt maths topics. This matters because information in long-term memory may fade when not frequently retrieved.[86]

Retrieval practice should be designed so that questions are appropriately challenging, so students respond (for example, via mini whiteboards or cumulative quizzes), and misconceptions and wrong answers are readily identified and corrected.[87] Greater effort at recall during such sessions leads to better memory retention, so questions should be designed to require effortful recall.[88]

There are no hard-and-fast rules for the optimal interval of time before revisiting previously learnt topics. What matters most is that teachers space out retrieval practice, rather than concentrating it all in one lesson.[89] Schools might choose to implement retrieval practice through 10-minute lesson warm-ups that also include some fluency practice.

Designing effective retrieval practice requires careful whole-school planning to identify what content to revisit and when to revisit it.

84. Roediger and Butler (2011), AERO (2024a), Breneman-Smith (2024), and Lyle et al (2020).
85. See Pan and Agarwal (2020) for a summary of the research.
86. See discussion in Baker (2018), May (2022), and Radvansky et al (2022). See Murre and Dros (2015) for estimates of retention length.
87. AERO (2022).
88. Agarwal et al (2020).
89. AERO (2022), Agarwal et al (2020), Agarwal et al (2021), and Carpenter and Agarwal (2020).

Box 11: Example of a rich maths application task

The end of Year 6 unit on calculating discounts might include a lesson with the following application task:

- Each student is to plan an action-packed weekend of entertainment.
- Students receive a fictional budget of $100 to spend across the weekend on as many activities as they can afford.
- Activities are listed on a flyer: $22 for bowling, $35 for indoor rockclimbing, $34 for an arcade games pass, and so forth.
- Students also receive a pack of six coupons – such as a 30% discount or 'Only pay $\frac{1}{3}$'. They can apply these to any activity, but can only use each coupon once.
- Students' aim is to pack in as many activities as possible without going over budget.
- Students are to record the activities purchased, their working out to apply discounts, and the final price of each activity.[a]

This task is reserved for when students are confident with calculating discounts using fractions, percentages, and decimals. Before introducing the task, the teacher might recap necessary prior knowledge, and check students have mastered it.

They would then work through an example of applying a coupon to an expense. If students are struggling, they might choose to do more of the task as a whole class.

Students could be extended or supported with different activity prices and coupon discounts that are more or less challenging.

a. Task sourced from Ochre (2024a).

Box 12: Worded problems are an essential part of a healthy maths diet

Worded problems are sometimes conflated with extension, reserved only for high-achievers. But not all extension questions are worded (see Figure 2.2), and vice versa.

Worded problems help students apply the maths they know to real-life contexts – a core goal of learning maths. They require students to decipher a scenario and choose a suitable mathematical method to solve the underlying problem.

Primary school students often struggle to unpack worded problems.[a] Teachers can help by equipping students with 'attack strategies' (often in the form of mnemonics), that give students a series of steps to follow to make sense of worded problems.[b]

Teaching students to distinguish between the underlying types of worded problems is also effective. But teachers need to be careful. A common mistake is to give students key words and associated mathematical operations (e.g. 'In a worded problem, 'altogether' tells you to add'). But this type of 'key word' strategy falls apart when students encounter questions like:

> Ali bought 3 packs of textas, with 4 textas in each pack. How many textas does Ali have altogether?[c]

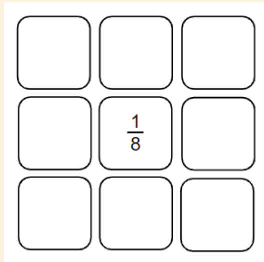
Instead, teachers should help students distinguish between underlying problem types and associated solutions.[d] One example is the 'combine' problem type, which involves putting together two or more separate parts.[e]

Students also benefit from teachers modelling how to use diagrams to visualise worded problems, and to clarify the information they have and the information they need to find out.[f] Bar models are one example.[g]

Worded problems also rely on students having a strong mathematical vocabulary.[h] A whole-school approach to explicitly and systematically teaching mathematical vocabulary is therefore necessary.

Figure 2.2: Not all extension problems involve words

Make your own magic square with $\frac{1}{8}$ in the centre



Note: Magic squares have the same row, column, and diagonal totals.

Source: Adapted from Stewart (2020).

a. Jitendra et al (2007), and Dela Cruz and Lapinid (2014).
b. See, for example, S. R. Powell et al (2024).
c. Example adapted from S. R. Powell and Fuchs (2018).
d. See Fuchs et al (2010). This teaching strategy is termed schema-based instruction, since teachers help students detect the problem type – or 'schema' – of word problems.
e. See S. R. Powell and Fuchs (2018) for a detailed explanation of common schemata.
f. See Kaur (2019), Mahoney (2012), and Morin et al (2017). See Booker et al (2020, pp. 58–59) for a practical example.
g. NCTEM (2020) provides an overview of using the bar model for addition, subtraction, multiplication, division, ratio, and fraction questions. See Kaur (2019) for further examples and a summary of the model's evidence base. Ochre (2024b) has free lesson resources modelling the use of the Bar Model. See Year 3, Unit 2, Lessons 13 and 14.
h. Wanjiru and O'Connor (2015), Riccomini et al (2015), Ufer and Bochnik (2020), Vista (2013), and Carter (2011).

Table 2.1: Practice snapshot: Selected indicators of effective maths teaching

Indicators of more effective practice	Indicators of less effective practice
Each lesson has a clear and measurable learning intention which serves as a tight focus for the lesson – activities and games are used intentionally.	Lessons are primarily focused on different activities, and lack a clear, maths-focused learning intention.
Teachers regularly check that students have understood, using methods such as mini whiteboards to get frequent, whole-class data on students' success against the learning intention.	Students' success rate is not clear at every step, and may only be apparent at the end of the class.
Before students apply learning independently, teachers spend time explaining and modelling concepts and procedures, and guiding whole-class practice (during which students get immediate feedback so they know if they are right).	When students are learning new content, teaching is not explicit and systematic: students independently explore or discover concepts before teacher explanations, and there is little whole-class, guided practice.
Teachers use whole-class participation tactics – such as mini whiteboards and think–pair–share – to maximise engagement.	Participation is uneven: a few students are doing all the work, with many students passive or off-task.
Students develop fluency with one strategy before new strategies are introduced, and are taught which strategy is most useful when.	Students are often expected to invent strategies – or use multiple strategies – to tackle a new problem, without regard to the efficiency of different strategies.
Teachers emphasise both procedural fluency and conceptual understanding, because they see them as mutually reinforcing.	Teachers prioritise only conceptual understanding and spend limited time on procedures, or vice versa.
Students periodically revisit taught concepts, with regular cumulative reviews.	Students do not revisit topics until the subsequent year.
Students all work on the same overarching learning intention, and the range of students' needs is met through different scaffolds (e.g. some students spend longer in guided practice with the teacher while others do independent practice).	To meet a range of abilities, students are split into table groups' and teachers attempt to split their attention by running several concurrent mini lessons on different curriculum content.

Notes: The indicators should be considered holistically, in the context of a whole unit of work. Someone observing a single lesson is unlikely to see all indicators of more effective practice. This table is intended as a conversation starter for professional dialogue about teaching practice.

Sources: Synthesis of the implications of the research cited in this chapter, and, in particular: Fuchs et al (2021), S. R. Powell et al (2024), and Ofsted (2021). Format inspired by Lee (2024).

3 Many schools are struggling

The evidence on how to teach primary maths is clear, but implementing it well requires a high degree of coordination in schools. And while the benefits to students of a coordinated approach are enormous, many Australian schools struggle to work this way.

A new Grattan Institute survey conducted for this report, combined with Grattan analysis of teachers' maths backgrounds, shows that, while many primary teachers enjoy teaching maths, it is unclear how this translates into classroom practice. Some primary teachers struggled with maths before joining the profession, not all teachers feel confident to teach Year 6 maths, and many have concerns about their colleagues' maths teaching ability.

University study, on-the-job training, and better guidance could help fill this gap, but our survey suggests this is not happening. This leaves schools in a difficult position, struggling to implement a whole-school approach. In some schools, the time spent on maths depends on the teacher a student happens to have. And many teachers say there is not an agreed approach to teaching maths at their school, and that curriculum planning is ad hoc.

3.1 Grattan Institute's survey of teachers and school leaders

To better understand maths teaching in Australian primary schools, Grattan Institute did a national survey of teachers and school leaders.

We received 1,745 responses (see Table 3.1 for a breakdown).[90] The survey results provide a unique, detailed – and worrying – insight into the state of primary school maths teaching across the country.

90. Details of the survey questions and responses are provided in the supplement to this report: see Hunter and Parkinson (2025). Unless otherwise specified, all statistics in this chapter are from Grattan's survey.

Table 3.1: Our 2024 survey of primary school teachers and leaders

	Number of people surveyed	Proportion of survey sample	Proportion among all primary teachers
NSW	391	22%	30%
Vic	704	40%	27%
Qld	251	14%	21%
WA	141	8%	10%
SA	83	5%	7%
NT	67	4%	1%
Tas	62	4%	2%
ACT	46	3%	2%
Government	1,085	62%	69%
Catholic	443	25%	17%
Independent	217	12%	13%
Mostly advantaged students*	590	34%	43%
A fairly even mix*	758	43%	33%
Mostly disadvantaged students*	397	23%	24%
<5 years' experience	113	6%	18%
5-9 years	207	12%	14%
10-19 years	490	28%	28%
20+ years' experience	935	54%	39%
Total	1,745	-	-

*Notes: *Respondents self-identified their whether their school had mostly advantaged students, mostly disadvantaged students, or an even mix. Percentages may not add to 100 per cent because of rounding. Survey responses were weighted to population statistics to account for over- and under-sampling. See Hunter and Parkinson (2025).*

Sources: ACARA (2024d), ACARA (2024f), ACARA (2024g), and AITSL (2024a).

3.2 Many teachers enjoy teaching maths

Eighty-three per cent of teachers in our survey said they enjoy teaching maths.[91] About half (52 per cent) said it is their favourite learning area to teach.[92]

That most teachers reported having a passion for maths teaching is positive news, although it may indicate our survey sample was biased in favour of primary teachers with a particular interest in maths.[93] For example, primary teachers who did our survey were more likely than average to have studied upper intermediate or advanced maths in Year 12.[94] It nevertheless shows there is a substantial cohort of primary teachers willing and eager to teach the subject.

3.3 But not all primary teachers have strong backgrounds in maths or feel confident to teach it

While most teachers in our survey self-identified as good at maths and confident to teach it, data gathered for this report (see Box 13) raise concerns that not all primary teachers share that skill or confidence.

The upshot from this analysis is that there are primary maths teachers across the country who are expected – day in and day out – to teach

91. See Hunter and Parkinson (2025, Figure 5.6, p 20)
92. Ibid (Figure 5.6, p 20).
93. The survey used a convenience sampling approach: it was advertised on social media and distributed to teachers through the newsletters of several state education departments, professional associations, and not-for-profits working with schools. This means that respondents may have been particularly engaged in primary maths teaching and Grattan's work. As a result, caution should be taken when generalising the findings. See Hunter and Parkinson (ibid).
94. About 23 per cent of the entrants into undergraduate primary teaching degrees in NSW and Queensland between 2014 and 2023 studied upper intermediate or advanced maths. This compares to 44 per cent in our survey. See Hunter and Parkinson (ibid, Figure 4.7, p. 21). Grattan analysis of datasets prepared for this report by the Queensland Tertiary Admissions Centre and the Universities Admissions Centre.

Box 13: Indicators of primary teachers' confidence and competence in maths teaching

There are few Australian studies of primary teachers' maths skills.[a] Given the importance of maths, this is a surprising and major gap in the research. Similarly, Australian states and territories collect no systematic data on maths teaching practices.[b]

There are risks of relying solely on teachers' self-reports.[c] Teachers tend to overestimate their maths knowledge.[d] As a result, Grattan's analysis had to rely on several proxies:

- Our survey data indicating teachers' assessments of their own maths capability and confidence and that of their colleagues.
- State and territory datasets on teachers' own performance in maths when they were in high school.
- Studies conducted with Australian pre-service teachers.

These are imperfect proxies: for example, it is possible to do poorly in maths at high school and go on to fill those knowledge gaps and be a strong maths teacher.

But, when taken together, the available research and data underscore that a sizeable cohort of primary teachers lack confidence teaching upper primary maths, and some have weak backgrounds in maths.

a. See, for example, Hurrell (2013). For an analysis that bundles literacy and numeracy performance over time and includes primary and secondary teachers see Leigh and C. Ryan (2006). For larger international studies, see Harbison and Hanushek (1992), Hill et al (2005), and Mullens et al (1996).
b. This differs from England: see Ofsted (2023a).
c. See Ernst et al (2023).
d. See, for example, Kadluba and Obersteiner (2025) and Norton (2017b).

maths that they may not feel confident with. These teachers need more support to be and feel effective, and their students deserve it too.

3.3.1 A significant minority of teachers worry about teaching maths

About 1 in 5 teachers we surveyed (21 per cent) worried more about teaching maths than their other subjects.[95] Beginning teachers and female teachers were more likely to report these worries.[96]

Seventy-two per cent of teachers said they would feel confident teaching Year 6 maths topics.[97] But this leaves more than 1 in 4 teachers (28 per cent) who did not feel this way.[98] And fewer than half (48 per cent) felt confident supporting high achievers with topics from the Year 7 and 8 maths curriculum.[99]

These statistics are troubling, given that teachers' maths ability and confidence matter for student learning.[100] To give clear explanations and model worked solutions, teachers must themselves understand – and be able to do – the maths involved quickly and confidently. One study found that, compared to the average teacher, students taught by teachers at the 68th percentile of content knowledge for maths made almost an extra month's learning gain on average between Year 3 and Year 5.[101] Teachers' confidence also affects their performance in the classroom.[102] Teachers who feel insecure about maths may even pass on their negative perceptions of maths to students.[103]

Teachers' nervousness about teaching maths can create challenges for schools, particularly if staff are hesitant to teach upper primary classes, where the maths is more difficult. Ninety-four percent of school leaders said at least some teachers at their school would be hesitant to take Year 5 or Year 6 because of the maths involved (see Figure 3.1 on the following page).

3.3.2 Teachers offer mixed reports on their own versus their colleagues' capability

While most teachers we surveyed perceived themselves as confident and capable maths teachers, they felt less certain about their colleagues' capabilities (see Box 14 on page 33).[104]

Only 25 per cent of teachers said that all students in their school are taught by teachers with strong mathematics subject knowledge (see Figure 3.6 on page 42). In disadvantaged schools, just 16 per cent of teachers said this was the case.[105]

Forty per cent of teachers we surveyed said most or all of their maths-teaching colleagues understood the developmental continuum of maths from Foundation to Year 6 (see Figure 3.2 on page 34).[106] Only 18 per cent of teachers felt that most or all of their colleagues could confidently teach the Year 6 maths curriculum.

95. See Hunter and Parkinson (2025, Figure 5.9, p. 22).
96. See Hunter and Parkinson (ibid, Figure 5.10, p. 22).
97. See Hunter and Parkinson (ibid, Figure 4.6, p. 20).
98. About 18 per cent of teachers disagreed or strongly disagreed. About 10 per cent neither agreed nor disagreed. This question was only asked to teachers who currently teach maths. See Hunter and Parkinson (ibid, Figure 4.6, p. 20).
99. See Hunter and Parkinson (ibid, Figure 4.6, p. 20).
100. See, for example, Baumert et al (2010), Darling-Hammond et al (2001), Ferguson and Ladd (1996), Hill et al (2005), and Ramirez et al (2018).
101. This difference was after controlling for a range of student, teacher, and school factors. See Hill et al (2005). Performance at the 68th percentile represents a one standard deviation increase in maths knowledge.
102. See, for example, Norton (2017b) and Rowland et al (2000).
103. Klinger (2009), and Wilson (2012).
104. This difference could be because of sample bias, and because people overestimate their own competence. See Ernst et al (2023).
105. See Hunter and Parkinson (2025, Figure 4.4, p.19).
106. Teachers in disadvantaged schools were about twelve percentage points less likely to say this than teachers in advantaged schools. See Hunter and Parkinson (ibid, Figure 5.5, p.20).

A comment from a primary teacher in an ACT Catholic school captured this:

> I love maths but I think many teachers don't feel comfortable teaching it or don't know how to teach it.

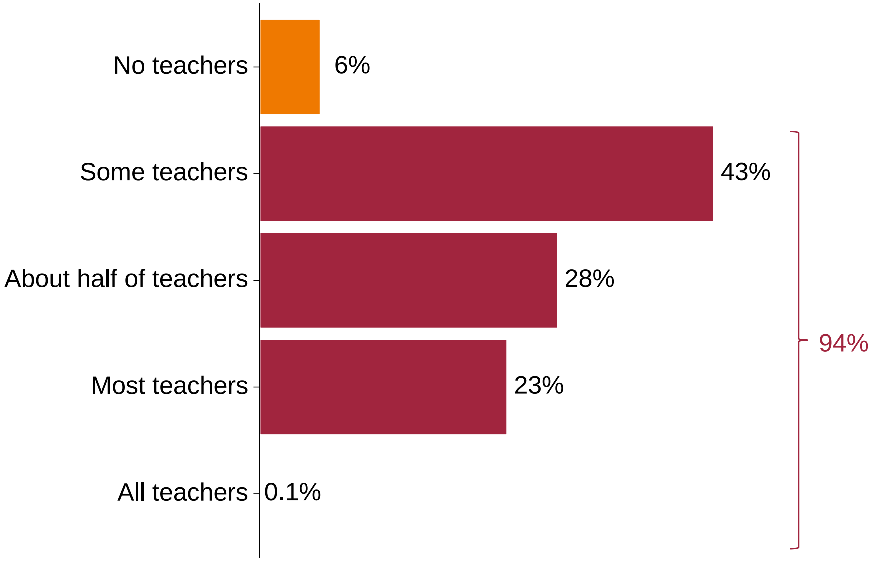
This is concerning. It suggests many teachers may not have a strong grasp of how maths knowledge builds across the primary years, and where it leads to after that. This matters as maths is cumulative. When primary teachers understand the maths 'up and down' the curriculum they can better identify gaps in students' learning and prioritise how to allocate teaching time between different maths topics.[107] It also means that they can more readily extend students who are working ahead, catch up students who are behind, and cover the class of an absent colleague who teaches a different year level.

Forty-three per cent of surveyed teachers said that at most half of their colleagues had good mental arithmetic (see Figure 3.2 on page 34).

Mental arithmetic is crucial for effective teaching. When scanning through students' working out, teachers need to do quick maths to spot errors 'on the fly, because in a classroom, students cannot wait as a teacher puzzles over the mathematics'.[108] Effective teachers do this kind of vital error analysis constantly. All students will misunderstand some things at some stage, and it is a teacher's job to anticipate and

107. See Ball (1993), Ball and Bass (2009), and Guberman and Gorev (2015). Place value, for example, is a gateway concept students need to understand for future success. See Moeller et al (2011). Teachers who understand the mathematical big picture will dedicate as much class time as needed for students to master it. In contrast, tessellation – a topic in the Year 6 curriculum – provides a rich opportunity to explore aspects of geometry, but multi-week projects on tessellation are likely to be a poor use of scarce class time. For this reason, Ball et al (2008, p. 391) suggests that teachers must 'understand why a particular topic is particularly central to a discipline whereas another may be somewhat peripheral'.
108. Ibid (p. 397).

Figure 3.1: Nearly all leaders said at least some maths teachers at their school would be hesitant to teach Year 5 or Year 6 maths
Proportion of school leaders by their estimate of how many maths teachers at their school would feel hesitant to teach upper primary (Year 5 or Year 6) because of the maths involved



Notes: There were 734 total responses. This question was only asked to leaders. Leaders were asked to respond only in relation to teachers currently teaching maths. Proportions do not add to 100 per cent due to rounding.

Source: Grattan Institute's 2024 survey on primary maths.

rectify these misunderstandings. Without good mental arithmetic, it is hard for teachers to 'size up and evaluate the mathematics' of students' incorrect answers 'swiftly, on the spot'.[109]

3.3.3 Most primary teachers were mid-performing in maths at school, but some struggled a lot

Research finds a correlation between the level of maths teachers have previously studied, their test scores, and their later value-add to students' learning in maths.[110]

Worryingly, Grattan's analysis finds that some primary teachers left school without strong maths skills. Grattan analysed how a small sample of Australian primary teachers fared on the PISA maths assessment back when they were 15 years-old. We found that while performance was satisfactory on average, there was a non-trivial share of primary teachers who – as teenagers – had poor maths skills. About 13 per cent of primary teachers' PISA scores put them below the National Proficiency Standard for maths when they were in high school. And primary teachers' average maths achievement in high school was below that of many other professionals (see Figure 3.3 on page 35).

Virtually all primary classroom teachers are maths teachers, with the exception of specialist teachers (of languages, religion, sport, music, or art, for example). Ideally, primary teachers' average maths achievement would be *at least* equal to secondary teachers' average achievement, given that more primary teachers teach maths. Yet primary teachers were less likely to be proficient than secondary teachers. And the proportion of primary teachers who excelled at maths was 16 percentage points smaller than the proportion of secondary teachers who excelled (see Figure 3.3 on page 35).

109. Hill et al (2005, p. 339).
110. See Darling-Hammond et al (2001), Ferguson and Ladd (1996), Monk (1994), and Wayne and Youngs (2003).

Box 14: Some teachers worry about their fellow teachers' maths knowledge

Some teachers who took our survey raised concerns about the content knowledge of their peers:

'Teachers don't necessarily know how to teach maths and may have misconceptions they are passing onto the children.'

– ACT Catholic school teacher

'Teachers lack knowledge of Year 5/6 and beyond... if we haven't used that maths in a while, you lose it so to speak.'

– NT government school teacher

'Teachers have insufficient knowledge of the fundamentals of maths, the connection between these and the most effective strategies to use when teaching maths.'

– NSW Catholic school instructional leader

'There is a lack of teachers' understanding of the incremental steps to build conceptual maths knowledge and how this knowledge builds across the curriculum.'

– NSW independent school instructional leader

'Teachers don't have the curriculum knowledge, the mathematics content knowledge, or the pedagogical content knowledge to teach high quality maths content to our students.'

– Victorian government school instructional leader

Longitudinal data of Year 12 maths participation also show that some Australian primary teacher trainees have a weak background. Of the approximately 22,000 high school graduates accepted into a primary teaching degree in NSW or Queensland between 2014 and 2023, 8 per cent did not complete any Year 12 maths.[111]

Of those who did study Year 12 maths, some struggled. In Queensland and NSW, Year 12 General Mathematics and Mathematics Standard 2 are the most popular and among the least challenging maths courses. About 30 per cent of Queensland entrants into primary teaching degrees between 2021 and 2023 scored a 'C' grade or below in Year 12 General Mathematics.[112] In NSW over the past decade, more than 5,600 entrants into primary teaching degrees took Year 12 Mathematics Standard 2. About 34 per cent were in the bottom three scoring bands (there are six bands).[113] These prospective teachers could only demonstrate some 'basic knowledge and skills' and 'some mathematical reasoning'.[114] About 400 aspiring teachers scored in the bottom two bands, demonstrating 'limited knowledge and skills'.[115]

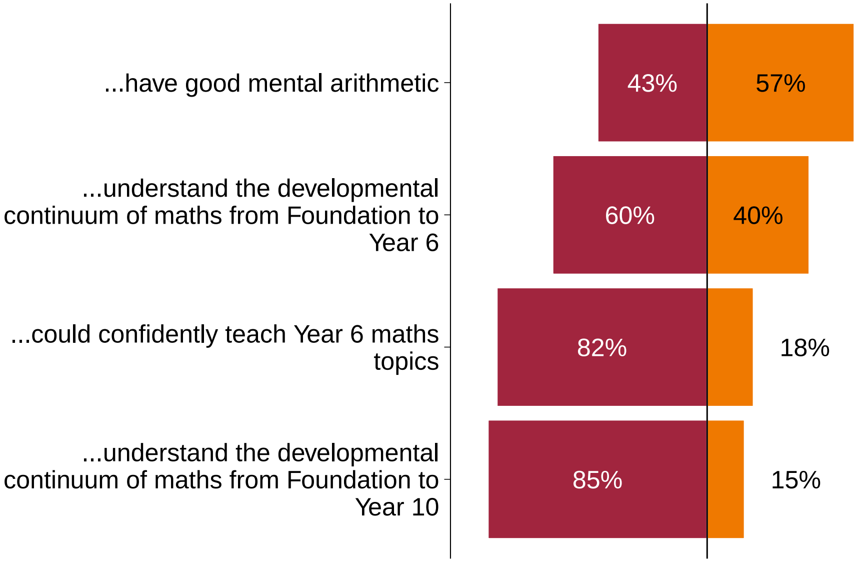
While it may not be essential for primary teachers to have studied intermediate or advanced maths at school themselves, it is important that they are confident to teach the primary maths curriculum.

Our survey found a strong connection between the maths that teachers studied in high school, and their confidence teaching maths in primary

111. Grattan analysis of datasets prepared for this report by the Queensland Tertiary Admissions Centre and the Universities Admissions Centre. Our survey found similar results: about 12 per cent of respondents studied no maths in Year 12. See Hunter and Parkinson (2025, Figure 5.7, p. 21).
112. Grattan analysis of a dataset prepared by the Queensland Tertiary Admissions Centre. Results are reported on an 'A' to 'E' scale, with 'C' in the middle. A 'C' grade is typically about 65 marks or below out of 100. See QCAA (2024).
113. Grattan analysis of a dataset prepared by the Universities Admissions Centre.
114. See NESA (2019).
115. Ibid.

Figure 3.2: Most teachers say that half or fewer of their colleagues could confidently teach Year 6 maths

Proportion of teachers who said that half or fewer or most or all of the teachers at their school...



Notes: Teachers were asked to respond only in relation to their colleagues currently teaching maths (i.e. not a specialist art or languages teacher). Total responses to statements varied by statement between 1,331 and 1,446.

Source: Grattan Institute's 2024 survey on primary maths.

school. For example, teachers we surveyed who studied advanced maths in Year 12 were 31 percentage points more likely to report feeling confident teaching Year 6 maths topics, all else being equal. And they were 48 percentage points more likely to agree that they would feel confident supporting high-achievers with topics from the Year 7 and Year 8 maths curriculum.[116]

3.3.4 Our survey suggests that university education isn't adequately filling maths knowledge gaps

High-quality university education could help build the skills and confidence of aspiring primary teachers who struggled with maths at school or didn't pursue it in Year 12.

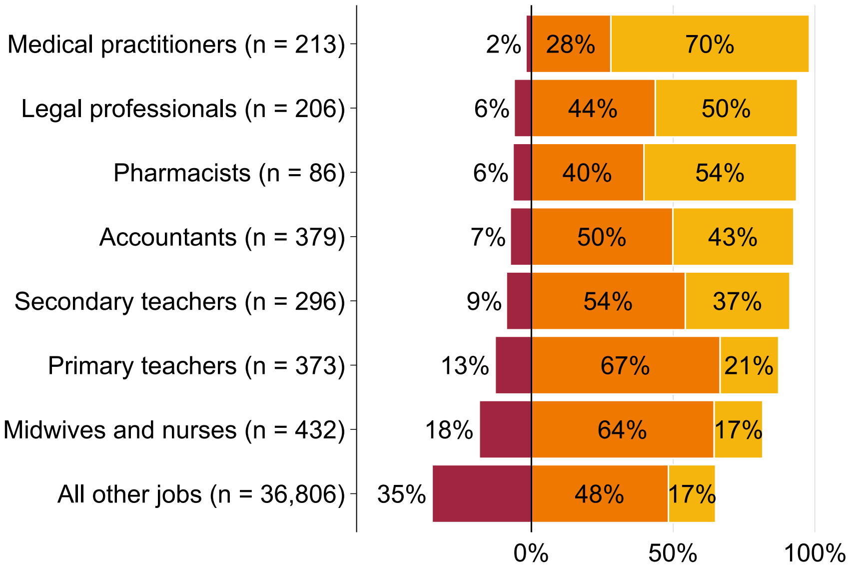
Secondary maths teachers will have studied intermediate or advanced maths in Year 12, and – if they are studying a postgraduate teaching degree – have an undergraduate studies in maths, engineering, or a similar field.[117] But this is a substantially higher bar than for primary maths teachers.

Just 6 per cent of primary teachers we surveyed studied maths or engineering at university.[118] And primary teaching courses typically involve only two or three maths pedagogy subjects.[119] These are often focused on how to teach maths, and may incorrectly assume that trainee primary teachers already know the underlying maths.[120]

Our survey raises significant concerns about the degree to which initial teacher education is upskilling primary teachers in maths.

116. See Hunter and Parkinson (2025, Figure 5.8, p. 21).
117. Entrance requirements to teaching degrees vary across the country, but the subjects listed are typical prerequisites for secondary teachers specialising in maths.
118. This includes a degree or major in pure or applied maths, engineering, or other tertiary maths studies outside of initial teacher education.
119. AITSL (2023a).
120. Norton and J. Allen (2020).

Figure 3.3: Primary teachers were less likely than other professionals to be high-achievers in maths when they were in high school
Proportion of different professionals who were **below proficient**, **middle-performing**, or **high-performing** in PISA maths



Notes: PISA = Program for International Student Assessment. Data is from the Longitudinal Survey of Australian Youth, which surveys students who sit PISA from the age of 15 through to 25. We pooled data from the cohorts of students who sat PISA in 2003, 2006 and 2009. See Leigh and C. Ryan (2006) for analysis of earlier survey cohorts. Respondents were categorised as working in that profession if they nominated it as their main occupation at any time during that period. Below proficient is proficiency bands 1 and 2, middle-performing is bands 3 and 4, and high-performing is bands 5 and 6.

Source: Grattan Institute analysis of National Centre for Vocational Education Research (2024).

Just 16 per cent of leaders surveyed agreed that beginning teachers (i.e. teachers with less than 5 years' experience) have strong maths content knowledge (see Figure 3.4). One NSW teacher said: 'My latest university intern didn't like maths and couldn't do Year 6 maths.'

Other teachers felt similarly:

> There should be a greater focus in university education on teaching mathematics and addressing teachers' mathematics anxiety.
>
> *– SA government school teacher*

> Too many university students studying primary teaching can't do primary level maths and don't like maths.
>
> *– NSW government school teacher*

These comments reflect a wealth of research showing that many primary teacher trainees who are about to graduate hold concerning mathematical misunderstandings (see Box 15 on the following page).

While recent policy changes have sought to address the knowledge gaps of future teachers, we cannot rely on these alone (see Box 16). This means that many primary teachers will need additional support to upskill in maths once they enter the classroom.

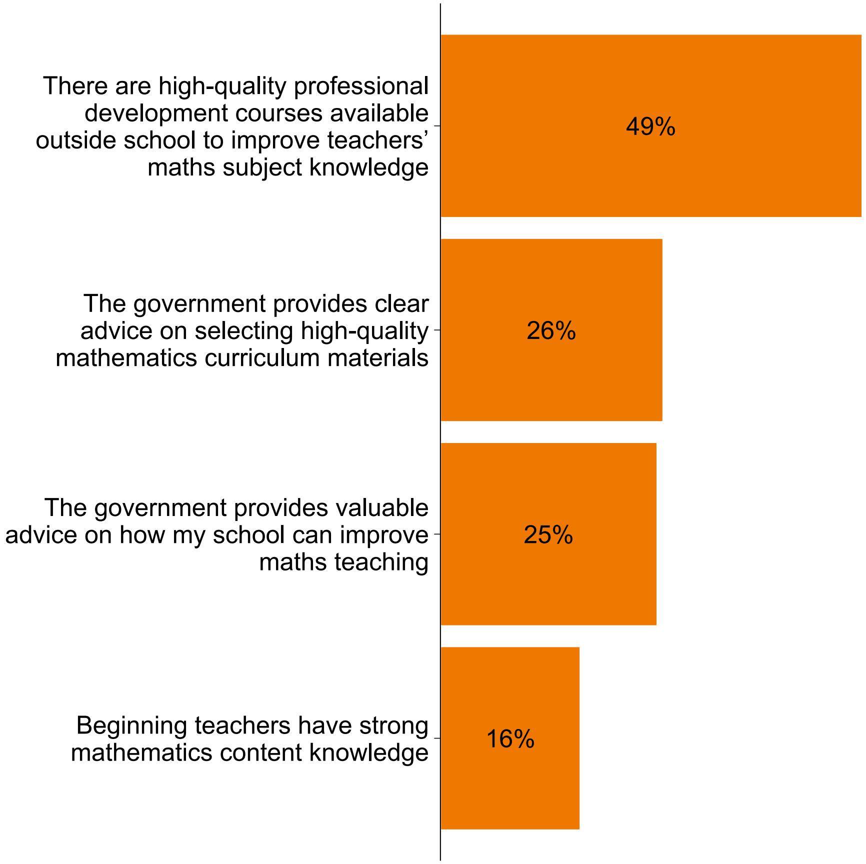
3.4 Teachers can't access the high-quality training and guidance needed to build their knowledge and confidence

With effective on-the-job training and high-quality guidance, graduates who struggled with maths when they were in school or at university could become adept with maths once they begin teaching.

Our survey suggests that, by and large, this is not happening. Most teachers and school leaders find that the guidance and professional learning offered by their school system are inadequate.

Figure 3.4: Leaders feel ill-supported by government to improve maths teaching in their schools

Proportion of leaders who agreed or strongly agreed



Note: Total responses to statements varied by statement between 709 and 727.

Source: Grattan Institute's 2024 survey on primary maths.

Box 15: Prospective primary teachers often struggle with primary maths content

Studies expose substantial gaps in training teachers' knowledge of maths, and several found that pre-service teachers can overestimate their own knowledge.[a]

One study tested 426 Australian pre-service primary teachers. Some held significant misconceptions, including about foundational concepts like place value. For example, about a third of the trainee teachers could not select the correct multiple choice response to $300.62 \div 100$.[b]

In another study, 72 per cent of group of 222 pre-service primary teachers incorrectly believed that whenever you increase the perimeter of a rectangle, the area also increases.[c]

In a separate study of 210 third-year primary teaching students, 65 per cent had low to very low confidence in their ability to do Year 6 maths questions.[d] Only 12 per cent could correctly work out how many 0.05mm pages are in a 2.5cm thick book.

In yet another study, just 20 per cent of 253 Australian trainee teachers tested could write $\frac{3}{8}$ as a decimal and percentage. This compared to 99 per cent of the 116 Chinese trainees tested.[e]

These difficulties translate into anxiety about maths. In one survey with 219 primary school teacher trainees, most had a 'fair' amount of anxiety about maths, and many had high anxiety.[f]

a. Stephenson (2020).
b. J. Ryan and McCrae (2005, p. 78).
c. Livy et al (2012, p. 104).
d. This was despite having already completed two maths curriculum subjects. See Norton (2017b, pp. 53–54).
e. Norton and Zhang (2018, p. 275).
f. Wilson (2012, p. 782).

Box 16: The numeracy test for trainee teachers doesn't solve the problem

The Literacy and Numeracy Test for Initial Teacher Education Students (LANTITE) was introduced in 2016 with the aim of ensuring teachers have a minimum level of literacy and numeracy. The test's numeracy component consists of 65 questions in 2 hours, 52 of which can be completed with a calculator. It has about a 96 per cent pass rate.[a]

Australia cannot rely solely on the LANTITE to address content knowledge concerns. It mainly tests comprehension of data tables, charts, and worded problems. For example:

> The weight of a box of stationery is 3.2 kilograms. What is the weight of 100 such boxes?

Some academics have commented that this makes the numeracy component 'a poor reflection of what teachers are expected to know' for maths teaching.[b]

But even if the LANTITE were effective in ensuring all incoming teachers have the requisite maths skills, this would only address content knowledge concerns for a sliver of all teachers. In 2022, about 8,000 teacher trainees completed a primary or general teaching degree.[c] Even if all these graduates taught in primary schools, they would only make up about 3 per cent of the primary teaching workforce.[d]

We therefore need to address the maths knowledge of the profession as a whole, beyond reforms to graduate requirements.

a. Barnes and Cross (2020).
b. Norton and J. Allen (2020, p. 163).
c. AITSL (2024b).
d. ACARA (2024f).

3.4.1 Many teachers are not getting high-quality professional learning in maths

Fewer than half of leaders we surveyed said there are high-quality professional development courses available to improve teachers' maths knowledge (see Figure 3.4 on page 36). Twenty-two per cent of teachers said that, in the last year, none of the external professional learning they attended was maths-specific.[121] And only about 2 in 5 teachers agreed or strongly agreed that external professional learning improved their understanding of common misconceptions, or built their knowledge of maths topics like fractions.[122]

According to one Victorian government school principal, there is a scarcity of 'teacher professional learning in discipline-based knowledge and effective pedagogy for mathematics learning.' An instructional leader echoed this, writing:

> There is often much well intentioned professional development that is either ill-informed or lacks direction.

When asked what would help improve primary maths teaching in Australia, a Victorian Catholic school teacher responded:

> Professional learning and associated classroom materials which address how children come to understand and become fluent and proficient in maths [would help]. Such resources need to focus on pedagogical decisions beyond broad sweeps and instead focus on questions like what's the most effective way to build understanding of fractions.

While high-quality out-of-school professional learning matters, most professional learning happens in school.[123] There is also strong evidence that 'embedding' professional learning in the school site enhances its impact.[124] Instructional coaching is particularly effective.[125]

Our survey suggests that governments have failed to set sufficiently robust expectations about in-school professional learning, and have not offered schools enough support to implement effective instructional coaching.

More than half (52 per cent) of teachers agreed or strongly agreed that their school supports teachers to develop the subject knowledge needed to teach maths confidently.[126] A worrying 47 per cent of teachers said that, in the past 12 months, they had not received feedback on their maths teaching (see Figure 3.5 on the following page). And 30 per cent said that 10 per cent or less of professional learning time at school was maths-specific.[127] Just 40 per cent of teachers agreed that professional learning at their school left them more confident to teach maths effectively.[128] This held true regardless of whether teachers' considered themselves good at maths.[129]

3.4.2 Schools receive unclear guidance about what effective maths teaching looks like

To compound the challenge, teachers and leaders get mixed messages about what constitutes effective maths teaching (see Box 17 on page 40). This produces confusion at a school level. Fewer than half

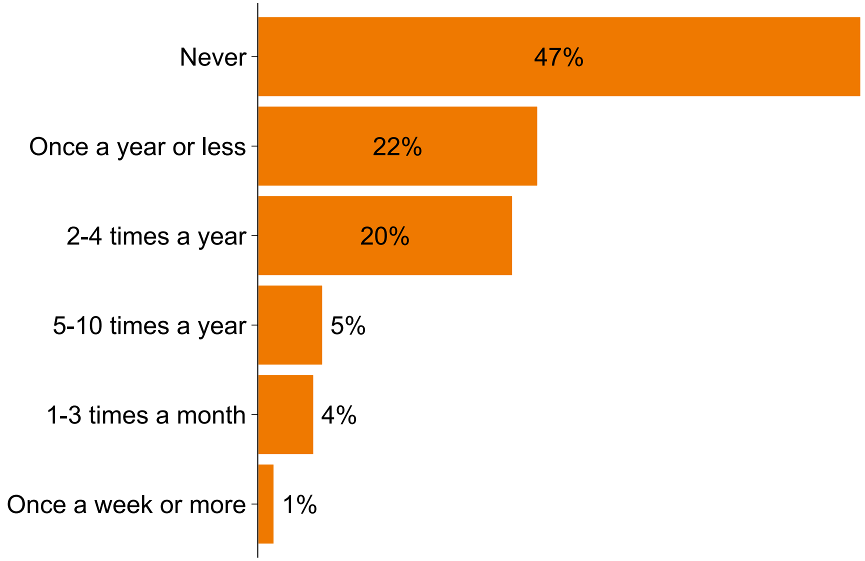
121. See Hunter and Parkinson (2025, Figure 5.11, p. 23).
122. See Hunter and Parkinson (ibid, Figure 5.12, p. 23).
123. There are few large-scale surveys comparing modes of professional learning participation. For a small study, see Mukan et al (2019). For a larger study that does not break down participation by whether the learning was in-school or external, see AITSL (2023b). Grattan has also written on high-quality professional learning: see Goss and Sonnemann (2020).
124. See, for example, Meiers and Ingvarson (2005).
125. See Albornoz et al (2018), Bruns et al (2018), and Cilliers et al (2019).
126. See Hunter and Parkinson (2025, Figure 5.3, p. 19).
127. See Hunter and Parkinson (ibid, Figure 5.11, p. 23).
128. See Hunter and Parkinson (ibid, Figure 5.12, p. 23).
129. In other words, it is unlikely that high initial levels of capability explain why professional learning failed to boost their confidence. See Hunter and Parkinson (ibid, Figure 5.13, p. 24).

(46 per cent) of teachers say that at their school, teachers agree on what effective maths teaching entails (see Figure 3.6 on page 42).[130] In the absence of consensus on what good maths teaching looks like, coordination is challenging, undermining efforts to collaboratively plan, which means that students are likely to experience disjointed maths teaching from year-to-year.

Open-text responses to our survey shed light on the split views on what effective maths instruction entails. One Victorian teacher said 'disagreement about the best pedagogy' was the biggest challenge to improving maths results at her school. Another said 'debate about what best practice in maths looks like' was getting in the way. A third pointed to the 'lack of consensus (across and within schools) on the most effective 'mental model' or evidence-informed approach to teaching maths'. Some teachers shared fears about the teaching approaches described in Chapter 2 of this report. A few expressed the misconception that teaching maths explicitly is 'passive' or all about 'rote learning'.

Governments have an important role to play in allaying concerns and clarifying the uncertainty about how to teach maths effectively, especially in jurisdictions where confusing or inaccurate government advice has muddied the waters. The guidance provided to date does not cut it. Just 25 per cent of school leaders said the government provides valuable advice on how their school can improve maths teaching (see Figure 3.4 on page 36).

Figure 3.5: Teachers rarely receive feedback on their maths teaching
Proportion of teachers by the frequency with which they received feedback on their maths classroom teaching in the last 12 months



Note: Total responses to statements was 1,418. The question asked teachers to consider feedback from a leader or coach (such as a principal or assistant principal; a school instructional leader; a year level team leader; or an external coach employed by the school, such as an educational consultant.)

Source: Grattan Institute's 2024 survey on primary maths.

130. Teachers in advantaged schools were more likely to report consensus on effective teaching at their school (54 per cent agreed).

3.5 This leaves schools struggling to implement effective maths teaching

Without clear guidance from governments or high-quality professional development, it's little surprise that many schools are struggling to implement effective maths teaching.

Effective maths teaching requires schools to set aside time for maths each day, and take a whole-school approach to planning to ensure a well structured sequence of learning across year levels. Our survey suggests this is not happening in far too many schools.

3.5.1 Some schools allocate much less time than others to maths

Australian guidelines typically suggest schools dedicate at least 5 hours per week for maths (or about one hour per day).[131] Giving maths this much time matters because a lot of practice is needed for students to develop proficiency.

Despite this guidance, one third of teachers in our survey reported that maths gets less than an hour per day at their school.[132]

A common theme was that an emphasis on literacy had come at the expense of maths. One Queensland government school teacher said:

> Maths is not seen as a priority compared to literacy. No professional development time is spent on it. All our weekly Learning Teams time

131. NSW suggests 4 hours and 45 minutes, Queensland and Western Australia suggest 5 hours, and Victoria does not give a notional time allocation. No state or territory prescribes a mandatory minimum. See New South Wales Department of Education (2023), Queensland Department of Education (2022), SCSA (2016), and Victorian Department of Education (2024a). See Yeşil Dağlı (2019) for a summary on the evidence on the impact of marginal hours of instructional time in maths.
132. See Hunter and Parkinson (2025, Figure 5.2, p. 18).

Box 17: Teachers get mixed messages about how to teach maths

Teachers we surveyed highlighted the challenge of conflicting guidance on best practices for teaching maths:

> There is a lot of conflicting advice on best practices, [such as the] explicit versus inquiry approach.
>
> *– Government school teacher, VIC*

> A clear indication [is needed] of how best to teach primary students, with good explanations of how to teach and how to differentiate maths in the classroom.
>
> *– Catholic school instructional leader, VIC*

> We need clear messaging on effective math teaching, like good quality phonics instruction in literacy, [and] a focus on conceptual understanding across all areas.
>
> *– Government school teacher, WA*

> The biggest challenge is applying science of learning and explicit instruction to the area of mathematics with no guidance from system.
>
> *– Government school instructional leader, NSW*

> The confusion of an instructional model: we have been taught the 'launch, explore, summarise' model which focuses on experience before explicit instruction, yet evidence indicates explicit instruction yields best results.
>
> *– Victorian government school teacher*

> goes to literacy and at least 90 per cent of planning time goes to literacy.

The principal of a rural Tasmanian Catholic school felt similarly:

> I think the biggest challenge is ensuring maths is given equal weight to English. For some time I think maths has been on the 'back burner' in some schools.

Some teachers we surveyed also felt the broad expectations on schools squeezed the time available for maths.[133] A teacher from the Northern Territory said:

> A challenge is protecting maths time from being infringed on by other demands.

More than half of teachers said that maths is not a timetabled subject at their school.[134] This means there is no guarantee that students will get the maths teaching they need. Indeed, some respondents said that teachers at their school often drop maths when there are interruptions, or cut back the length of a maths lesson if they are teaching a topic outside their comfort zone.

3.5.2 Curriculum planning in maths is often ad hoc

Given that maths is cumulative and takes significant expertise to teach, schools need to have high-quality maths curriculum materials in place.[135] Using high-quality curriculum materials makes a big difference for students and teachers. They can boost student learning by up to two months in a single school year.[136] In schools with comprehensive curriculum materials, teachers spend on average three hours less planning per week, and are more likely to report consistent student learning across classrooms, and higher satisfaction with planning.[137]

Embedding high-quality curriculum materials is no mean feat. Curriculum materials should be comprehensive, including everything a teacher needs to teach every lesson of maths in a year: from planning documents, such as year-level overviews and unit plans, down to student-facing materials such as workbooks and assessments. They should also be rigorous and systematic. Rigorous means they tackle grade-level content with ample challenging questions. And systematic means they ensure maths topics are comprehensively covered and arranged in logical sequence.

Creating such materials the night before a lesson is simply not possible. And because maths is so sequential, even the hardest-working teacher cannot guarantee that students' learning builds across year levels if they are planning in isolation.

Grattan's survey suggests that in too many schools, curriculum planning practices lack coherence, meaning maths learning may be left to chance. About two in three teachers say that their school has mapped out exactly what maths is taught in each term (see Figure 3.6 on the following page). This suggests that one in three teachers may well be trying to pace out the curriculum content for their class without a whole-school roadmap. This risks students experiencing a dizzyingly disjointed curriculum that disregards the sequential nature of maths, thereby making the task of learning maths harder than it needs to be.

Our survey results suggest that even fewer schools have done the next level of detailed planning. Fifty-three per cent of teachers said that their school has lesson plans that cover the primary school curriculum. And

133. For further discussion about the broadening expectations on schools: see Hunter et al (2022c).
134. See Hunter and Parkinson (2025, Figure 5.1, p. 18).
135. Hunter et al (2022a), Tarr et al (2008), and Jaciw et al (2016).
136. See Stokes et al (2018). See also Appendix B in Hunter et al (2022a).
137. See Hunter et al (2022b).

only 42 per cent said they use agreed textbooks or lesson materials as part of a whole-school approach to teaching maths at their school. [138]

Many teachers emphasised the challenge this poses for workloads:

> We need more resources freely available. Way too much time goes in hunting for games and assessment tasks and worksheets. A massive waste of time and duplication of effort goes on year-on-year as teams of teachers start from ground zero to recreate lesson plans.
>
> *– Victorian government school teacher*

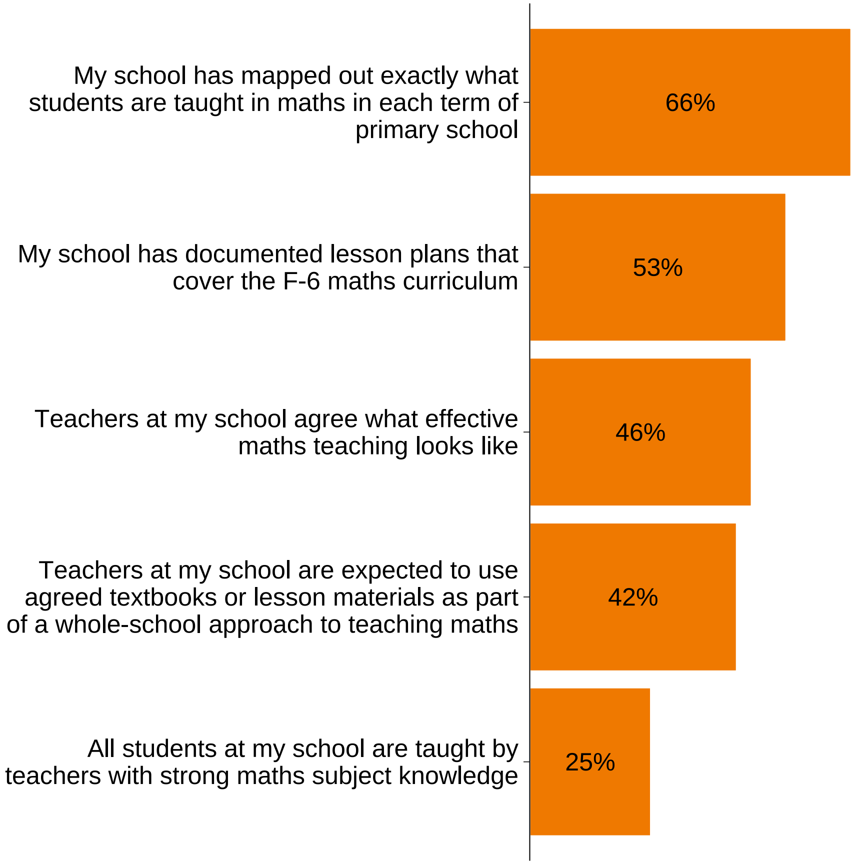
Teachers also emphasised that the lack of high-quality curriculum materials compounds challenges with teachers' maths knowledge. They felt that having such materials would help them teach certain parts of maths:

> The syllabus materials are not specific enough for new and inexperienced staff. They do not clearly explain the cumulative nature of the steps involved in developing maths understandings and skills.
>
> *– WA government school principal*

> We need more freely available resources for structuring units. For example, what are the steps needed to teach fractions to Grade 5 students? We can create activities, but staff need help in knowing exactly what to teach and when.
>
> *– Victorian Catholic school deputy principal*

Figure 3.6: Many schools do not have a systematic approach to maths instruction

Proportion of teachers who agreed or strongly agreed with each statement



Note: Total responses to statements varied by statement between 1,501 and 1,513.

Source: Grattan Institute's 2024 survey on primary maths.

138. See Hunter and Parkinson (2025, Figure 5.4, p. 19) for the results split by schools' socio-economic advantage.

4 Some schools are getting it right

A systematic approach to maths teaching increases the odds that all students receive effective instruction, and get the most out of every instructional minute. Getting this right is hard work. But it is possible.

For this report, Grattan studied seven schools that have adopted a systematic approach that is delivering significant pay-offs for teachers and students.

Transforming how maths is taught required strategic leadership and prioritisation from the schools' principals, and a high degree of organisational coordination.

While these schools show what is possible, the vast majority of schools are not yet at this level.

4.1 Our case study schools show it's possible

To see how schools put into practice the research evidence on effective maths teaching, Grattan visited seven schools across NSW, Victoria, and Western Australia, including three NSW government primary schools that were a part of the Explicit and Systematic Teaching (EAST) network: a network of schools pursuing a common approach to explicitly teaching new content, with a strong focus on maths (see Table 4.1 on the next page). The schools varied across important dimensions, including school size, location, sector, and level of advantage. Some had recently changed how they taught maths; others were more than ten years into implementation.

We selected these schools because they had experience embedding the evidence-informed teaching approaches described in Chapter 2. They were identified through recommendations from a range of experts and sector leaders working directly with schools, analysis of publicly available information, and screening interviews. The purpose of the case studies was to understand how these schools had put into practice the evidence on effective teaching; the challenges they faced, and what had worked to overcome these; and how the implementation process varied across different contexts.

For each case study, the Grattan Institute team conducted multiple interviews with leaders and teachers, reviewed curriculum documents, and spent time on-site to observe maths teaching in practice.[139]

From our analysis of the research on effective maths teaching we distilled nine key lessons which the case studies illustrate. These are set out below to help inform other schools and school sectors seeking to improve primary maths outcomes.

4.2 Schools should prioritise maths

To boost student learning in maths, schools need to prioritise it. Principals must see improving teaching quality as their core responsibility and make sure maths is timetabled each day.

4.2.1 School leaders need to see themselves as responsible for the quality of maths teaching

In all of our case study schools, principals had a strong sense that they were ultimately responsible for the quality of teaching and students' maths achievement. As a result, they were frequently in and out of classes and heavily involved in professional learning.

For example, senior leaders at Budgewoi Public School felt that principals need to have a general understanding of effective maths teaching, because principals need to drive teaching practice from the

139. See Appendix A for further information on our case study methodology.

Table 4.1: Our case study schools have strong approaches to maths teaching

School	Location	Sector	Student count	ICSEA percentile	School journey
Bentleigh West Primary School	Melbourne, Victoria	Government	734	96	Shifted to an evidence-informed teaching approach around 2014 and maintained it through successive principals. Now has some of the strongest NAPLAN results in the state and is a school of preference for students with additional learning needs.
Ballarat Clarendon College	Ballarat, Victoria	Independent	1,876 (P-12)	98	Among the highest-performing schools in Victoria. In a mature stage of implementation, having first shifted to an evidence-informed approach in Year 5 and Year 6 around 2012. This flowed through to other year levels by around 2018. From Year 1, maths is taught by a dedicated maths teacher (i.e. a subject specialist).
St Bernard's Primary School	Bateman's Bay, NSW	Catholic	381	42	Sixty per cent of its students are in the bottom two disadvantage quartiles (10 percentage points more than average). Began its turnaround journey around 2020 and was supported by the Catalyst school improvement program run by Catholic Archdiocese of Canberra and Goulburn Education.
Wattle Grove Primary School	Perth, WA	Government	879	76	Seventy per cent of students have a language background other than English. Has undergone a major transformation, from a school of 104 students in 2002. Shifted to a systematic maths teaching approach in 2010. Now supports other WA schools to improve how they teach literacy.
Explicit and Systematic Teaching (EAST) Network					
Charlestown South Public School	Newcastle, NSW	Government	254	76	Shifted its maths teaching approach in 2015. Now widely recognised for its strong NAPLAN results. Its success, and that of peers in the Hunter Region, was a key catalyst for establishing the EAST Network and EAST maths curriculum materials.
The Entrance Public School	Central Coast, NSW	Government	431	14	Seventy per cent of students are in the bottom quartile of socio-economic advantage, 61 per cent are from single-parent families, and about a quarter of students are Aboriginal and/or Torres Strait Islander. Had a poor reputation in the community and, before shifting its maths-teaching approach in 2019, was ranked 70^{th} out of 73 schools on the central coast for maths performance.
Budgewoi Public School	Central Coast, NSW	Government	570	19	Its community is relatively disadvantaged. Sixteen per cent of its students are Aboriginal and/or Torres Strait Islander. Shifted its maths teaching approach in 2020.

Notes: School demographic data are for 2024. The Index of Community Socio-Educational Advantage (ICSEA) measures the level of educational advantage that students bring to learning. An ICSEA percentile of 40 means that the school's community is more educationally advantaged than 40 per cent of all schools in Australia. See ACARA (2020b) for details.

Source: ACARA (2024h).

top. They warned that without this, principals may struggle to lead change and justify improvement initiatives to staff. The principal of Budgewoi emphasised the importance of clearly prioritising learning, even when there are other stressors on the school or community:

> Every principal is time-poor. There are all these other services that are going to support kids outside our school gates, but we're the only ones who are going to teach them. I think principals need to deeply understand the importance of that. It's teaching and learning that's going to make the biggest difference to the kids' lives.

Principals should also ensure their school's resources are appropriately invested in maths. The principal of Charlestown South Public School explained that he was careful not to compromise on maths, despite financial constraints. He ensured that instructional leaders maintained an equal focus on maths and literacy when coaching teachers. The school also ensured every classroom had a well-stocked supply of maths teaching materials.

4.2.2 Schools should protect time for maths teaching

Our case study schools prioritised maths by ensuring there was protected time to teach it on most, if not all, days. Some teachers told us this differed from their previous schools, where individual teachers were free to determine how to allocate class time, and maths was often squeezed out by other learning areas or activities.

Blocking out time for maths was a key ingredient of success at Bentleigh West Primary School. Early in the school's shift to a systematic teaching approach, leaders identified the need to change student and teacher attitudes to maths. The principal recalled:

> It was always the first thing to drop here, particularly if something came along such as an excursion or swimming. It was never English that was dropped.

To turn this around, leaders decided to timetable maths as the first class on a Monday. A leader explained:

> We wanted to really change the culture around maths, and we made maths first thing on a Monday morning. Usually it's English every morning for the first block. We changed it to Maths Monday.

4.3 Schools need a detailed, high-quality maths curriculum

High-quality, shared curriculum materials underpin a systematic approach to maths instruction and are crucial to alignment between teachers within and across year levels (see Section 3.5.2 on page 41). They also enable schools to pace out maths content, and ensure that, through retrieval practice, students periodically revisit learnt concepts so they are consolidated in long-term memory.

Bentleigh West Primary School, Ballarat Clarendon College, Wattle Grove Primary School, and Charlestown South Public School mainly used shared curriculum materials they had developed themselves.

Schools that shifted their maths teaching approach more recently were able to adopt and adapt quality materials that are now more readily available. St Bernard's Primary School used curriculum materials developed by the not-for-profit Ochre (see Box 18 on the next page).[140] The Entrance Public School and Budgewoi Public School drew – to varying degrees – on curriculum materials developed by the EAST network. With access to these materials, teachers said they could spend more of their individual and shared planning time preparing for *how* to teach their students, rather than trying to work out *what* to teach.

140. Ochre's materials have been supported through philanthropy, some government support, and partnership with education systems and organisations like the Australian Education Resource Organisation, the Melbourne Archdiocese Catholic Schools, the National Catholic Education Commission, and Catholic Archdiocese of Canberra and Goulburn Education.

Shared materials also provided an anchor for professional collaboration. One leader at St Bernard's observed that since adopting shared materials, teachers passing one another in the staffroom now chat about the nitty-gritty aspects of an upcoming lesson.

The impact of shared curriculum materials for teachers and students was substantial. Leaders at Budgewoi Public School felt that a 'main benefit' of the EAST materials was that they 'eliminated a lot of the workload'. At St Bernard's Primary School, one teacher felt that the Ochre materials had cut down the time spent planning his daily reviews by two thirds. Another teacher at the school said the materials meant 'you're not spending hours and hours trying to make them' but instead focusing on the 'small adjustments' to suit the class.

The quality of the curriculum materials is key. Ballarat Clarendon College's shared materials were refined over several years, and now support highly focused and intentional teaching. A teacher who recently joined the school told us that as a result of the shared, high-quality materials, 'I think we teach four to five times more content every hour here than at other schools'.

4.4 Schools should establish effective instructional routines

Schools can build positive classroom cultures for maths with fast-paced lessons, in which teachers elicit students' thinking through participation tactics that engage students and help them experience success.

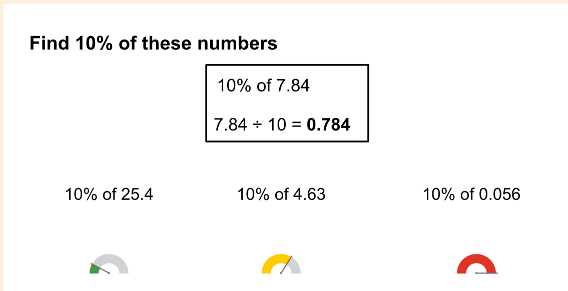
At St Bernard's Primary School teachers employ engaging participation strategies to gain immediate data on student learning. Before 2020, maths lessons involved the use of 'workstations', where students rotated between tables, attempting a different activity at each one while the teacher worked with a small group of students. Students were sometimes given a task, but it often wasn't modelled or explicitly explained. A school leader reflected on the challenges of this approach:

Box 18: How St Bernard's Primary School uses externally developed curriculum materials

In 2024, St Bernard's adopted as its base for planning the comprehensive curriculum resources created by the not-for-profit Ochre, with funding support from Catholic Archdiocese of Canberra and Goulburn Education. Ochre's maths materials are freely available and include a scope and sequence mapped to the Australian Curriculum, slide packs for teaching, daily review materials, student worksheets, in-built assessments, and re-teach lessons to consolidate learning.

Previously, St Bernard's teachers developed their own materials. Now, the workload is more manageable. According to one teacher, 'We've got the structure now; it's just the small adjustments we're making.'

Adopting external materials also lifted the quality of teaching. One instructional leader explained that because the new materials are detailed and thoughtfully ordered, they give teachers a 'step-by-step' guide on how to cover each topic in the best sequence. Teachers also liked how the Ochre resources provided different levels of challenge (see Year 6 example below).



Notes: Green gauge: simplest question. Red gauge: most challenging.

Source: Ochre (2024c).

> Previously you had students in little groups. So, how did you know, really, what they were all doing, and if they were mastering it?

Teachers were working hard, but the results were disappointing.

To turn this around, St Bernard's stopped using workstations and brought in coaches to train teachers in instructional tactics that maximise student participation and make learning visible. Teachers across year levels began to use mini-whiteboards, giving teachers a way to quickly check each student's understanding in real time. If a teacher saw many incorrect answers on students' mini-whiteboards, it told them they may need to re-explain a concept, and step through another worked example. The result, according to the principal, is that now 'teachers are getting more data from their lessons than ever before'.

These consistent classroom routines also helped teachers to manage student behaviour. One primary teacher at the school said:

> The way that we're delivering curriculum is consistent. The kids know what's expected. The pace is very good; they haven't got a chance to disengage too much.

Teachers at St Bernard's emphasised that the consistency particularly mattered for students with a difficult home life who might otherwise struggle to maintain focus. One instructional leader said:

> There are kids coming here who are hungry and who might have had a traumatic situation. But the nature of this teaching really does help with regulation. That's what we've noticed. I remember that the groups and rotations actually added to the busyness in the room. For someone who is struggling with learning, it was a lot to track, and they were required to be more independent.

Now the whole-class teaching approach and consistent participation routines mean that students are focused, engaged and learning. One teacher noted that now, students 'really like doing maths'.

Teachers added their unique flair to the participation routines. While there was enough consistency across classrooms for students to know what to expect, each teacher's personality could also shine through. For example, one St Bernard's teacher celebrated success with her class by calling out, 'Raise the roof', with students responding, 'Whoop, whoop!', raising their hands in the air.

This playfulness was common across our case study schools. An instructional leader at Ballarat Clarendon College was famous for his theatrical poses. An experienced teacher at Bentleigh West Primary School revelled in deliberately showing non-examples (such as pretending to incorrectly line up the digits in a column addition question) and watching her students gleefully correct her – dispelling misconceptions in the process.

4.5 Schools should expect their students to master all maths curriculum content

To reduce the risk that students get left behind, schools should adopt mastery approaches to teaching the curriculum. When schools use a mastery approach, they expect that almost all students will demonstrate achievement of a learning intention before moving on.[141] This increases the chance that students will progress through school without gaps in their learning.

In practice, commitment to a mastery approach meant that our case study schools considered the achievement standards in the Australian Curriculum (or state variants) as a minimum expectation of what students should be able to do. For example, the *Australian Curriculum: Mathematics* expects Year 3 students to 'recall and demonstrate proficiency with multiplication facts for 3, 4, 5 and 10 [and] ... related

141. See EEF (2021b), E4L (2021), and E4L (2021). A small proportion of students may not initially master the learning intention, and need further repetitions to achieve mastery – perhaps through small group tutoring or one-to-one support.

division facts'.[142] Adopting a mastery approach meant our schools insisted that students were not just familiar with these facts, but had automatic recall of them (i.e. could recall them within 2-3 seconds).

To adopt a mastery approach, the case study schools broke down the curriculum into small learning intentions that could be mastered, effectively checked for students' understanding, and ensured that all students got plenty of practice to achieve mastery.[143]

Early on in the Bentleigh West Primary School's maths transformation, a curriculum leader mapped out a single learning intention for each maths lesson in every year level. This helped Year 4 teachers – for example – know that in Week 7 of Term 1, students in their Monday class would learn to add fractions with like denominators (e.g. $\frac{1}{7} + \frac{4}{7}$). The roadmap took the guesswork out of interpreting the state's high-level curriculum. And Bentleigh West's approach to planning, teaching, and retrieval practice (including daily review and re-teach lessons: see Section 4.6) meant that teachers could be pretty sure their students would be ready for that content come Week 7.

The documentation, still in use today, is not static. The order of topics can be moved around if, for example, assessment data points to students needing extra time on a particular topic. But year-on-year adjustment decisions are made at a whole-school level, to manage the flow-on effects of sequencing changes between year levels and to avoid gaps or redundancy in the curriculum.

Bentleigh West has found that students make quick progress thanks to its high expectations that students will master these learning intentions. Students now cover the Foundation and Year 1 curriculum in the first year of school. Reflecting on Bentleigh West's ambitious curriculum, one experienced teacher reflected:

> I have learnt that I can have really high expectations of students. And I assume competence because I know that they can do it.

The results speak for themselves. A teacher who had been teaching for many years said, 'I never felt like I was effective. Now I feel successful every day. I feel like I'm a great teacher.' A leader recalled:

> I remember one of the first years that a group who had [the new systematic approach] from Prep moved through to Year 3. We were almost crying in the office because we got good results. We were literally hugging and jumping around in a circle because we were so excited it had worked.

4.6 Schools need reliable data to monitor student progress

Schools need high-quality assessments to know whether students are mastering the curriculum and to evaluate the quality of teaching. In addition to the in-the-moment assessment teachers do in class (formative assessment), and tests teachers set after teaching a topic (summative assessment), schools also need robust external assessments which are created and validated by assessment experts.

Bentleigh West Primary School collects a range of data to paint a rich picture of student progress that can be used to adjust the curriculum and teaching approaches. Each Friday students sit a short test on that week's content (and some content learnt previously). Results are entered into a colour-coded spreadsheet, enabling teachers to see which topics require greater focus in the daily review at the start of each lesson, and in the re-teach lessons each Friday. The Friday re-teach lesson acts a 'pressure valve' on the whole-class teaching that occurs from Monday to Thursday, giving teachers a chance to go over content that students have not quite grasped, and provide extra help to students who need it.

142. ACARA (2024i, Version 9 content descriptor AC9M3A03).
143. For example, a Year 3 teacher focusing on the content descriptor above might focus on a few multiplication facts from the four times tables in a given lesson, rather than having students skip-count by 4s (i.e. 4, 8, 12, 16, and so on), or having them recite all 10 facts from 4×1 through to 4×10.

In addition, a range of standardised assessments help Bentleigh West teachers monitor student progress and determine who needs additional support or extension. These include:

- Term 1: DIBELS Maths,[144] students sit NAPLAN
- Term 2: DIBELS Maths, Essential Assessment
- Term 3: School receives NAPLAN results
- Term 4: PAT Maths, DIBELS Maths, Essential Assessment.

Teacher-designed topic tests can also be a powerful vehicle for improving teaching quality. This is the case at Ballarat Clarendon College, where common assessment tasks underpin rich professional discussions during teachers' shared planning time (see Box 19).

Schools also need valid and reliable assessments to determine which students require extra support. In making these judgements, Australian schools often use general outcomes measures, which sample questions from across the curriculum and provide a broad indication of how students are tracking against grade-level expectations and national benchmarks. NAPLAN and the Progressive Achievement Test (PAT) maths assessments are examples of these.

General outcome measures alone are insufficient for accurately deciding which students need extra help. So schools need to supplement these with assessments of students' mastery of foundational sub-skills – such as the ability to count, compare quantities, and fluently add and subtract (see Box 20 on the following page).

144. DIBELS Maths has now been incorporated into the Acadience assessment suite.

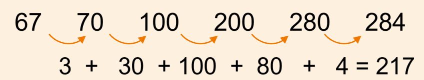
Box 19: Phase 2 meetings at Ballarat Clarendon College

At Ballarat Clarendon College there is a high degree of alignment in maths teaching underpinned by a common set of PowerPoint slides, booklets, and assessments for lessons. This also provides a framework that supports powerful professional learning.

After every topic test, teachers conduct a 'Phase 2' meeting, named as such because the school has graduated from the first phase of work (creating materials and establishing consistency) to the second phase (refining the curriculum). Teachers unpack the assessment data question-by-question to find the class that fared best on each. That class's teacher then models how they taught the relevant concept or skill for that question. This process helps reveal effective teaching strategies that are then incorporated into the lesson plans for the following year. It also allows newer teachers to observe strong practice and clarify their own understanding.

During the Phase 2 meeting we observed, teachers discussed the 'build up' strategy for subtraction, where students bridge the gap between two numbers in multiple 'jumps', and then add up the jumps to find the difference. Teachers took turns demonstrating how they modelled solving $284 - 67$ to their class. It became clear that there were two approaches. Some teachers identified all the jumps first, and then summed them. Others tallied the jumps as they went. Teachers agreed the first method involved less task switching, and a lower cognitive load for students, and updated the lesson plan for next year accordingly.

Solve 284 – 67 using the build-up strategy.



Box 20: Schools should use three main types of assessment tools

Universal screening tools

Universal screeners typically assess a small subset of maths skills shown to be highly predictive of broader maths achievement.[a] They are 'universal' because they are administered to all students.

Norris (2024) and Lembke et al (2024) identify that effective screening tools are:

- *Valid* – Scores from the tool are a good indicator of maths achievement, and are correlated to students' maths performance now (concurrent validity) and in the future (predictive validity). The tool is appropriately sensitive (it identifies children who will go on to have learning difficulties) and specific (it does not identify children who would catch up anyway).
- *Reliable* – The tool gives consistent results across populations.
- *Efficient and easy to use* – The tool is cost effective, and not onerous to administer (ideally 10 minutes or less and able to be administered in a group, rather than via one-to-one interviews).
- *Reports against age-level norms* – Reports on student achievement against typical achievement for their age.

Screening assessments in maths are typically administered three times a year, and as new students enter the school. The best screeners compare students' results to data collected from a large group of students of the same age or grade. Students whose results fall below a minimum benchmark (usually defined by the test) are likely to benefit from targeted intervention. If the screening results reveal that many students are below the benchmark, it may indicate a class-wide need, or a problem with whole-class teaching (Tier 1).

Diagnostic assessments tools

Diagnostic assessments help pinpoint the specific challenges holding back students identified through universal screening as needing extra support. This means they are typically only administered to students receiving – or about to receive – Tier 2 or Tier 3 support. Their purpose is to target intervention by revealing *why* students are not responding to instruction and *what* their specific learning difficulties might be.[b]

Diagnostic assessments are often administered as interviews aimed at understanding students' thinking. They are typically narrow and target specific maths skills to reveal persistent sources of error. This means teachers may need to use a range of diagnostic assessments to identify a student's particular challenge.

Progress monitoring

Progress monitoring tools allow schools to evaluate how students are responding to intervention. For students receiving Tier 2 support, it is best to monitor progress fortnightly.[c] For students receiving Tier 3 support, weekly progress monitoring may be needed.

a. A universal screener in Foundation might – among other things – assess students' ability to name numbers, discriminate between quantities, and sequence numbers (e.g. 'What is one less than 8?'). Some screeners are adaptive, selecting items based on students' performance. For a detailed discussion see Lembke et al (2024) and Norris (2024).
b. See Victorian Department of Education (2018) for example diagnostic assessments of different content areas.
c. AERO (2024b).

4.7 Schools need to provide catch-up support to struggling students

The cumulative nature of maths means that schools should screen students early, monitor their progress, and support them if they fall behind.[145] To get these students back on track, schools should use a multi-tiered system of support (MTSS) model. MTSS is a response-to-intervention approach which provides different tiers of support to students, based on their needs.[146] All students should receive high-quality classroom instruction ('Tier 1'). Done effectively, Tier 1 instruction should keep as many students as possible on track, so few students need intervention.

But even with high-quality Tier 1 instruction, some students will need more support. Some may need targeted additional teaching 'doses' for short periods in small groups or one-on-one support ('Tier 2' or 'Tier 3'). Tier 2 and 3 support should, in most cases, be a supplement to (not substitute for) classroom teaching.[147]

At each stage, assessment data can determine who needs help, the type of help they should get, and whether that help is making a difference (see Figure 4.1 on the next page).

At Charlestown South Public School, about 10 students receive support for maths in addition to their regular maths class. Year 1 and Year 2 students get priority, because the school leaders have found that early intervention reaps significant benefits.

Students get support two or three times a week from a trained teacher, in groups no larger than four students, or individually if they have acute needs. The teacher focuses on weaknesses in key skills that are holding the students back, such as counting forwards and backwards, and making 10 (e.g. 'What number do I need to add to 2 to make 10?'). The school's growing population of English-as-an-additional-language students means that sometimes the focus of intervention is building students' literacy, and mathematical vocabulary in particular.

The model has had a big impact. One leader told us:

> There was one Year 2 student who could not count. So we withdrew her every day and we did the same thing for a number of weeks. We did things like counting backwards from 30, and repeating it. We made it fun and engaging and when she could finally 'count back' and 'count on', we moved onto friends of 10.[148] [Now] she can certainly hold her own in Year 4.

Another teacher told us about a Year 1 student who struggled to name the number of fingers on one hand. With dedicated Tier 2 support, that student – now in Year 2 – has improved significantly. The teacher said: 'I know they can do the basic stuff now. We differentiate well, but I never would have been able to give them that much dedicated support.'

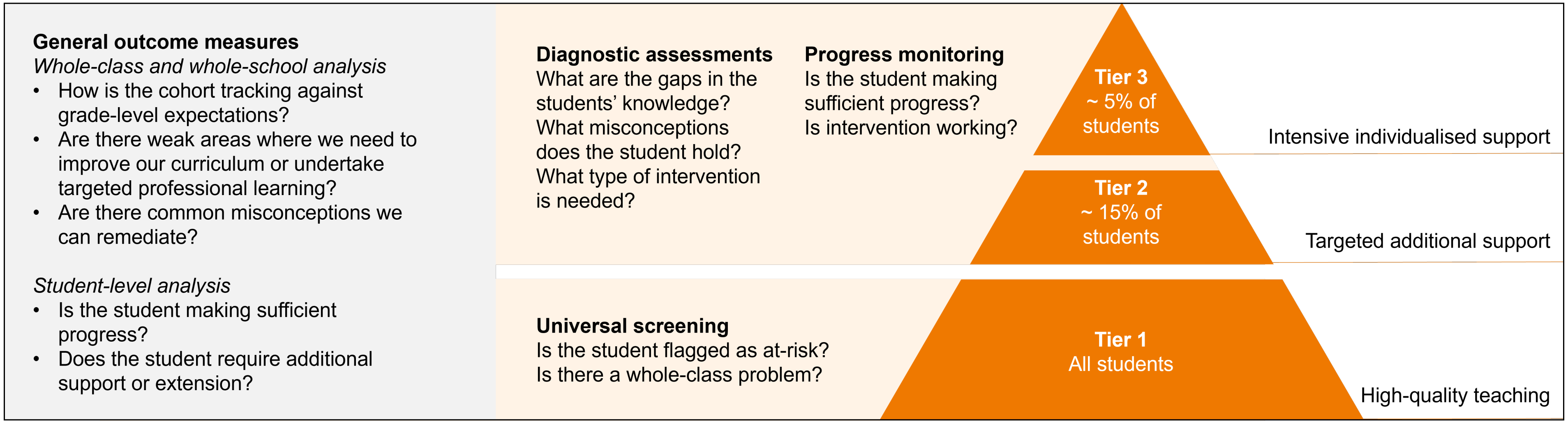
4.8 Schools should extend high-achievers

Students who have demonstrated mastery over a topic in maths benefit from maths questions that stretch them further.[149] Schools should include some options for extension in maths lessons, such as questions for early finishers that target the same topic being taught but with extra dimensions of challenge. For a small number of students, further extension options may be necessary.

Bentleigh West Primary School builds a lot of extension into regular maths class. During daily reviews and guided practice, there are early-finisher and extension questions for students to attempt on a mini-whiteboard while they wait for peers to do the main 'above-the-line'

145. AERO (2024a).
146. AERO (2024c).
147. Ibid.
148. Friends of 10 are pairs of numbers that, when added together, make the number 10.
149. Kalyuga et al (2003), and Kalyuga (2007).

Figure 4.1: Reliable assessments are an essential part of identifying students who are struggling



Sources: Norris (2024) and Bruin and K. Stocker (2021).

question (see Figure 4.2). During independent practice, there is extra work for early finishers, including additional problem solving tasks. And, on Fridays, around three quarters of the class participate in a re-teach lesson, while the remaining quarter complete extension activities.

Some extension also occurs in addition to regularly timetabled maths lessons. High achievers are invited to extension classes, which include challenging, open-ended tasks, drawing on resources like those from Cambridge University's NRICH suite of materials. Some of these classes occur before school.

Similarly, high-achieving upper primary students at St Bernard's Primary School are offered weekly extension classes. Using devices, students complete individualised extension activities through the Maths Pathways program, with a teacher providing individual and small group assistance as needed.[150]

At Wattle Grove Primary School and Ballarat Clarendon College, ability grouping helps teachers extend students. At Ballarat Clarendon College, each year level includes an 'earlier' progress class, and

150. Maths Pathways is a platform that provides individualised learning pathways for students based on a diagnosis of what they can do in maths and gaps in their knowledge. Students progress along a learning map, completing modules that are a mix of explanation videos, example maths problems, and worked solutions. Students' learning pathways might include content from across the curriculum. And at St Bernard's, students in the extension classes tackle pathways which include some difficult content normally encountered in Year 10. Entry and exit quizzes for each module, and a fortnightly test, ensure students have mastered the content before they move on. Maths Pathways provides live data to teachers, helping them know where they might need to provide targeted support or pause the individual practice to bring students together for a whole-class explanation.

multiple 'mid-further' progress classes. All classes cover the same essential maths concepts and problems. The difference is that the 'earlier' classes will spend more time in guided practice, whereas 'mid-further' classes will more quickly move to independent practice.

At Wattle Grove Primary School, roughly ten students from each level are selected for two full-time, high ability 'multi-age classes' (grades 1 to 3, and 4 to 6). These classes cover all learning areas with an accelerated curriculum, with students returning to their age groups for extra-curricular activities like dancing lessons and swimming.

4.9 Schools should ensure teachers have the knowledge and skills they need to teach maths well

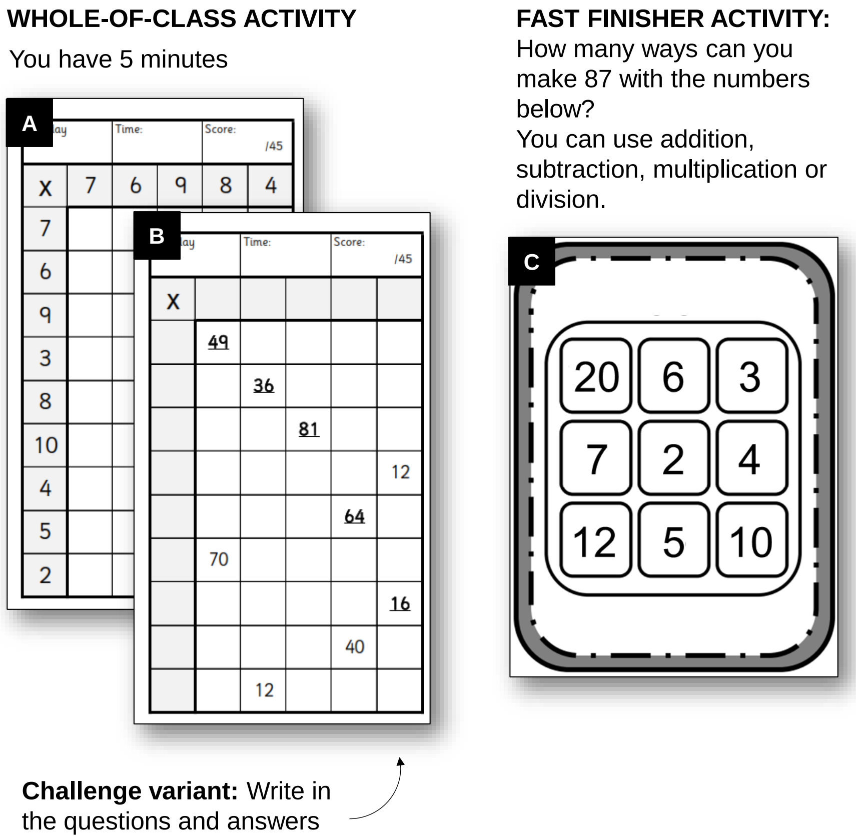
High-quality professional learning is essential to build the quality of maths teaching (see Section 3.4.1 on page 38).

To meet teachers' needs, our case study schools used a range of professional development options. Bentleigh West Primary School, for example, ran whole-of-staff professional learning workshops on teaching problem solving. St Bernard's Primary School used coaches sourced via its Archdiocese.

At The Entrance Public School, two assistant principals were dedicated instructional coaches. They spent most of their week in classrooms, observing teachers, running 'demo lessons' or covering their coachees' classes so they could observe a peer. They aimed to observe each teacher each week. Coaching enabled teachers to get the highly granular and personalised feedback they needed to continuously improve. One teacher, for example, told us they had recently received pointers on a lesson about lines of symmetry. After observing her, a coach suggested she turn off the PowerPoint when not using it to minimise visual distractions that add to students' cognitive load.

Figure 4.2: Example of in-class extension at Bentleigh West Primary School

Materials taken from a Year 4 daily review



Notes: A = This is the standard times tables sheet given to most students. Students write in the product of the row and column multiplicands. B = This is a version of the times tables sheet providing extra challenge for students who need it. Students write in both the multiplicands and the answer. C = This is an early finisher task providing another level of challenge. It has multiple possible solutions.

Source: Provided by Bentleigh West Primary School.

New teachers may require additional support to find their feet, particularly if a systematic approach to teaching maths differs from the approach used in their previous school or advocated by their university.

Wattle Grove Primary School has grown from a very small school of about 100 students 20 years ago to around 900 students today. The rapid growth means the school has many new teachers. Leaders have designed a thorough induction process for new teachers. Leaders run weekly 30-minute mini-professional development workshops for new staff. The workshops are also open to experienced staff who need a refresher. The sessions cover a range of topics, from cognitive load theory to specific whole-school instructional strategies teachers can use to engage all students. While all teachers at the school receive formal observation feedback at least four times a year, new teachers are given additional opportunities to observe teaching in action and receive feedback.

A professional, 'open-door' culture helps teachers hone their craft. When classrooms are open to coaches, leaders can get a better sense of teachers' strengths and areas for development. A leader at Wattle Grove Primary School said that unless leaders are 'visiting classrooms frequently, we might falsely assume that strategies are being implemented effectively'.

Even with strong professional learning, teachers will have different preferences and varied effectiveness, so school leaders should assign subjects and grade levels accordingly. Research points to the benefits of consistent teacher assignments to grade levels, and finds teachers may experience lighter planning loads and more satisfaction when stretched across fewer subject areas.[151]

151. See Bastian et al (2023), Bastian and Fortner (2020), Condie et al (2014), N. Hwang and Kisida (2022), Medlock (2020), Oresanya (2022), Tawil et al (2024), and Wellington et al (2024). For evidence of mixed effectiveness, see Fryer (2018) and IES (2019).

Leaders in our case study schools considered teachers' relative strengths, so they were confident that teachers assigned to teach maths had the knowledge needed to teach it effectively to that year level.

One way that Ballarat Clarendon College achieved this was through a dedicated primary maths teacher model (this is also the standard model in Singapore, see Box 31 on page 79). This model, in place at the school for the past ten years, means that all subjects are taught by subject specialists from Year 1. Primary maths teachers teach about three classes each; for example, one Year 1 class and two Year 2 classes. Maths teachers' timetables are typically arranged with three 90-minute lessons before lunch, with the afternoon left free for planning while students are being taught by non-maths teachers.

The specialist maths teachers we spoke to at Ballarat Clarendon College were extremely passionate about the model and felt it had made them more effective maths teachers. They said that focusing on one subject area had allowed them to develop deep professional expertise. It also built their professional knowledge by exposing them to teaching maths at different year levels.

When asked whether they felt the model involved a trade-off to developing deeper relationships with a single class of students, they said that it didn't: they noted that they had ample time to develop strong relationships with all of their students, particularly since most of them had a home group and had also taught many of their students in consecutive years. One teacher said that being a specialist means he 'just gets many more great relationships with students' than he would otherwise.

4.10 System support can make a big difference

A concerning finding from some our case study schools was that they had – to some extent – chanced upon an effective maths teaching approach. These schools were lucky that an exceptionally dedicated staff member chose to read research in their own time and understood the implications of the evidence base for effective maths teaching. They had also had the good fortune to be led by principals who knew change was needed, and had the grit to manage it, sometimes in the face of pushback from some teachers and even education department representatives.

The schools in the EAST network were also fortunate enough to be located nearby high-performing schools that had adopted exemplary approaches they could turn to for inspiration. Others were early movers at a time when the government took a mostly hands-off approach to pedagogy or supported less effective teaching approaches.

Leaders across the schools spoke frankly about the difficulty of making change without adequate system support and a network of peer schools moving in the same direction. There was the risk that an education department's regional staff or principal supervisors held different views on what effective maths teaching involved, rather than backing an approach supported by the best evidence. And if staff attended a professional development course on maths, there was no guarantee it would reflect best practice maths teaching. One leader said:

> We haven't really relied on external support. They [external professional learning providers] don't really target what you're looking for. You feel like you could do a better job.

The result was that the schools often had to 'build the plane while flying it,' and problem-solve their way to implementing an effective approach.

But there was one clear exception. Catholic Archdiocese of Canberra and Goulburn Education played a part in shifting practice at St Bernard's Primary School. The school had already started examining how it could improve teaching but the Archdiocese's support spurred-on improvement. The Archdiocese's leaders helped the school to bring in external coaches and provided the school with clear scope and sequences in the early stages of its improvement journey.[152] The Archdiocese continues to provide key support today, running training for new starters on effective pedagogy.

Schools should not be expected to stumble upon effective approaches to maths teaching on their own. As the transformation at St Bernard's Primary School makes clear, school systems can help schools get there faster, and take the chance out of whether students and teachers are lucky enough to find themselves in a school with an evidence-informed approach.

The next chapter explains what systems should do to make this happen.

152. A scope and sequence maps out what to teach and when to teach it.

5 Governments must step up

Australian governments, and the Catholic and independent school sectors, should commit to implementing effective maths instruction in every primary school. This will need a system-wide strategy that ensures a sustained effort, with ambitious targets underpinned by long-term, comprehensive, and coherent reforms across the education system. Figure 5.6 at the end of this chapter provides a roadmap for how the strategy could be sequenced over 10 years.

As well as learning from states, sectors, and schools that have already made a start on these reforms, Australia can also look to international systems that have had significant success (Box 21 on page 58).

Many of the recommendations here align closely with those in Grattan's 2024 report, *The Reading Guarantee: How to give every child the best chance of success*, which also focused on improving the quality of school-wide and classroom instruction across Australia.[153]

As with system-wide reforms to how we teach reading, implementing reforms to how we teach maths won't be easy. A suite of reforms is needed to overcome barriers at the system, school, and classroom level (see Figure 5.1 on the next page).

We estimate the total cost of our proposed reforms would be $152 million per year.[154] This is less than 0.4 per cent of annual government spending on primary schools.[155] It amounts to about $67 per primary student per year.[156]

These reforms are affordable, particularly in the context of the new money on the table as part of the *Better and Fairer Schools Agreement 2025-2034 (BFSA)* – the new Commonwealth-state school funding agreement.[157]

5.1 Commit to at least 90 per cent of primary students becoming proficient in numeracy

Australian governments should raise their level of ambition and commit to a long-term aspiration that at least 90 per cent of Australian students who sit NAPLAN reach proficiency in numeracy.[158] It is important to keep aspirations high. Almost all students can learn maths when provided with high-quality teaching and catch-up support.[159]

153. Hunter et al (2024).
154. This is once all recommendations have been implemented at scale. One-off upfront costs have been annualised over four years. See Appendix C for detail on how we estimated the cost of the recommendations.
155. We have assumed about half of all education spending is apportioned to primary schools. See Productivity Commission (2025).
156. Some of our reforms – such as setting up a national curriculum quality-assurance body – benefit secondary schools too. We have nevertheless chosen to present the cost of the total reform package as shared only among primary students. This means our estimate of about $67 per primary student per year is an upper estimate.
157. The federal government has committed to increasing contribution from 20 per cent to 25 per cent of the Schooling Resource Standard (SRS): the estimated public funding a school needs to meet its students' educational needs. See Albanese and Clare (2025). Our reform package is designed to benefit students across all school sectors. Reforms should be affordable for the Catholic and independent sectors within existing budgets, because these sectors are already fully funded to the SRS.
158. Non-participation rates should continue to be tracked so performance is not inflated in states or years where participation is low.
159. Unlike in early reading – see, for example, Torgesen (2004) – there is a lack of studies on the proportion of students who do not respond to intensive intervention

Figure 5.1: Our recommendations are designed to ensure high-quality maths teaching in every primary classroom

	1. Commit to targets	2. Develop detailed guidance	3. Ensure access to quality resources		4. Build and deploy expertise more effectively					5. Strengthen monitoring and accountability		
			Curriculum materials QA body	Evaluate catch-up programs, apps, and assessments	ITE reforms	Micro-credentials	Master teachers	Maths hubs	Specialist teachers	Year 1 screening	School reviews	Principal reviews
System-level barriers												
Not a policy priority	✔											
Lack of alignment on evidence within departments		✔										
Lack of knowledge about what's happening in classrooms							✔			✔	✔	
Departments are not accountable for outcomes	✔									✔		
School-level barriers												
Culture of school autonomy		✔				✔	✔	✔		✔	✔	✔
School leaders lack of knowledge about the evidence		✔				✔		✔				
No information about the quality of materials and assessments			✔	✔								
Poor implementation support								✔				
Weak accountability for quality of maths teaching	✔									✔	✔	✔
Classroom-level barriers												
Highly variable teacher knowledge		✔			✔	✔	✔	✔	✔			
Limited time to plan and upskill			✔									
Teacher resistance to change		✔	✔	✔	✔	✔	✔	✔	✔		✔	

Notes: QA = Quality assurance. ITE = Initial Teaching Education.

Source: Grattan analysis.

Setting high expectations is critical: it motivates governments to lift achievement, rather than simply giving up on students who struggle.

The federal government should encourage each state and territory to set ambitious but realistic interim targets to lift the proportion of its students who meet the NAPLAN proficiency benchmark in numeracy by 15 percentage points over the next 10 years (see Figure 5.2 on the following page).[160] Achieving this target would mean that in 2034, about 46,000 more students across Australia would be proficient in numeracy in Year 3 compared to today. This translates to about six more Year 3 students per primary school, on average (see Table 5.1 on page 60), an achievable goal. These targets are more ambitious than those in the BFSA.[161]

There should be an annual report tabled in Federal Parliament that provides precise information on progress against the targets by different demographic groups, including indigenous students, to ensure all students are benefiting from reforms.[162] In addition, the report

in maths. But there are good reasons to believe that 'virtually all' students can meet grade level expectations with effective teaching and intervention. See Norris (2024, p. 1). And there is no evidence suggesting that a 90 per cent proficiency target is not achievable.

160. This rate of improvement over 10 years is possible. Overseas, targets have been used widely and successfully in jurisdictions like Ireland. See Section 4.1 in Hunter et al (2024) for further detail.

161. Jurisdictions signing onto the BFSA commit to increasing the proportion of students who meet NAPLAN proficiency benchmarks for reading and numeracy by 10 per cent by 2030. The current approach, using a relative percentage improvement target (as opposed to an absolute percentage point improvement target), effectively locks in inequity by committing governments to varying degrees of improvement. For example, despite having the most room for improvement, the Northern Territory only needs to increase the proportion of students meeting proficiency in numeracy by 3.8 percentage points, whereas the ACT needs to improve by 7.1 percentage points.

162. Note, states and territories that have signed up to the BFSA have committed to public reporting on progress via an online dashboard.

Box 21: Singapore and England offer compelling examples of policy reforms geared at improving primary maths teaching

Grattan conducted case studies of two peer countries – England and Singapore – to understand what it takes to implement successful system-wide reforms (see Appendix B for more details). Though they operate in very different contexts, these countries' education systems share enough similarities with Australia to offer useful insights into reforms to enhance teacher expertise and classroom effectiveness.

For the case study of **England**, we spoke to policy makers, a peak maths professional association, and school leaders. We also visited several schools, a Maths Hub, and an English Hub, to understand England's unique approach to professional development.[a] At each stage of a teacher's career – initial teacher training, early career support, middle leadership, and senior leadership – professional development is now underpinned by an evidence-informed and independently reviewed 'golden thread' of essential content that logically builds on what's come before. England's hubs model also provides an impressive example of school-led implementation support, whereby outstanding schools provide support to other schools in their local area.

We also visited **Singapore**, which has long been the top-performer on international maths tests and has a highly effective model of teacher training and curriculum development. There we interviewed policy makers, Master Teachers, and curriculum leaders to understand Singapore's approach to developing teacher expertise, the role of Primary Maths Master Teachers, subject specialisation in primary schools, and quality-assured curriculum materials.

a. See English Department of Education (2022) for further detail.

should include sector analysis and information on the proportion of high-achievers (those in the 'exceeding' category on NAPLAN).

Ambitious public targets would help focus government efforts and sustain commitment over time, by preventing maths performance from falling back down the list of priorities.

Policy reform in education is hard work. Negotiating with powerful sector stakeholders can be challenging. Without sufficient accountability to the public, governments can shy away from meaningful action. Committing to these transparent targets raises the political cost of inaction. It signals to the community and schools the urgent step-change required in policy settings.

Our targets are focused on boosting proficiency as this is the right place to start and will benefit all students. The changes that improve teaching quality and reduce the number of low-achievers are likely to shift the whole achievement distribution right.[163] And with fewer students struggling, teachers can maintain a faster pace and pitch their lessons at a higher level of challenge.

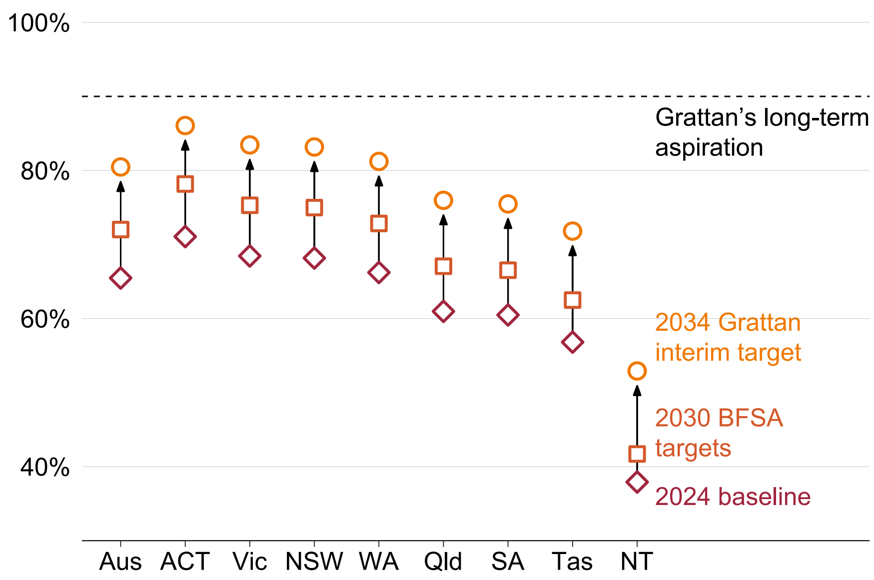
5.2 Give teachers and school leaders specific guidance on how to teach maths according to the evidence

Much of the guidance on how to teach maths is missing, vague, inconsistent, or not aligned to the evidence. And verbal advice given to schools often varies wildly. This has to change.

All Australian governments, along with Catholic and independent school sector leaders, should carefully audit the guidance they provide schools. Guidance that does not align with the evidence base – or is too vague to be helpful – should be removed and replaced with specific,

163. Reductions in the proportion of low-achieving students in Ireland coincided with increases in the proportion of high achieving students. See Irish Department of Education and Skills (n.d.).

Figure 5.2: All governments should commit to targets to lift the proportion of students who are proficient in numeracy
Proportion of students who were proficient in numeracy in 2024 (the baseline), and who would be proficient according to different targets



Notes: BFSA = Better Fairer School Agreement. Students are proficient if they are categorised as either 'strong' or 'exceeding' in 2024 NAPLAN data. The 2030 BFSA target is a 10 per cent increase from 2024 performance, Grattan's 10-year interim target is a 15 percentage point increase from 2024 performance. The 2024 baseline for each jurisdiction is a weighted average across Year 3, Year 5, Year 7, and Year 9.

Source: Grattan analysis of ACARA (2024a).

practical guidance on best practice for teaching maths (see Figure 5.3 on the following page).

Current guidance on how to teach maths is inadequate

Australian schools lack consistent, specific, evidence-informed guidance on how to teach maths. Other countries provide more useful guidance to their schools.[164]

Until recently, Australian governments' guidance for primary schools tended to emphasise activity-based approaches to teaching maths over systematic instruction, including the explicit teaching of new content. Most governments have since announced a shift to align more closely with the evidence base, but this has often resulted in simply adding to existing guidance for schools, rather than governments taking a more disciplined approach to removing legacy guidance.

The result is that schools encounter a hodgepodge of confused messages and less effective – or even counterproductive – advice (see Box 22). Even where governments have made a commitment to explicit teaching when students are acquiring new maths skills and knowledge, it is easy for teachers to find examples of outdated or inconsistent guidance on department websites – just as we did.

This confusion is not limited to published guidance either. Different teams inside the same education department or its agencies often adopt different positions. And schools report that advice from regional office staff often varies considerably.

Table 5.1: Grattan Institute's interim 10-year target is achievable – it requires only six more Year 3 students per school to be proficient

	Year 3 proficiency rate at 2024 baseline	10-year target (+15 percentage points)	Additional Year 3 students proficient by 2034	Additional Year 3 students proficient per school
Aus	63%	78%	46,100	6
NSW	66%	81%	14,300	6
Vic	68%	83%	11,800	6
Qld	59%	74%	9,500	7
WA	60%	75%	5,310	6
SA	59%	74%	3,010	5
Tas	58%	73%	885	4
ACT	69%	84%	840	8
NT	37%	52%	421	3

Notes: The targets assume future NAPLAN participation rates are the same as in 2024. Special schools are not included in the school count.

Source: Grattan analysis of ACARA (2024a).

164. See English Department for Education (2021) for England's maths guidance, which includes specific guidance for different maths topics and year levels as well as resources to support curriculum planning and professional learning. The US Institute of Education Sciences has also published detailed guidance based on a rigorous review of the evidence. See Fuchs et al (2021) and Gersten et al (2009a).

It is unreasonable to expect schools to shift to evidence-informed maths teaching when some education departments still haven't agreed internally on the best approach for teaching maths. Departments need to get their own house in order so that schools receive a clear and consistent message.

Governments should remove bad guidance

Governments should thoroughly audit the guidance they currently provide to schools, including published guidance, advice provided by departmental staff, and training for teachers and principals.

Governments should ensure guidance is consistent and aligned to the evidence, and that their websites are kept up-to-date. Guidance should also be publicly available, rather than behind departmental logins. Transparency enables parents, the community, and researchers to understand the maths teaching approaches recommended for use in classrooms, and supports continuous improvement.

It is good news that some departments have begun to decommission bad guidance. But updating a webpage is the easy part. Departments need to communicate clearly to school leaders and teachers that guidance has changed, explaining what guidance has been rescinded and why, and how it has been replaced. Without concerted effort, it could take years to roll back the impact of bad guidance now entrenched as business as usual in schools.

Governments should commission detailed guidance on the most effective way to teach maths

Australian governments should develop comprehensive, written guidance through a rigorous and transparent process, led by AERO, Australia's national education evidence institute. The guidance should be informed by an expert panel that includes researchers and practitioners. The guidance should acknowledge the strength of the

Figure 5.3: Evidence-informed guidance on maths teaching would help anchor best practice across a system

Source: Grattan analysis.

Box 22: Guidance on how to teach primary maths is insufficiently practical and often inconsistent

At a national level, the Australian Education and Research Organisation (AERO) has produced an introduction to developing maths proficiency.[a] This is a good start. But it does not provide enough of the concrete details that schools need to teach maths effectively.[b]

The federal government's online Mathematics Hub offers inconsistent advice to teachers. Modules on explicit teaching sit alongside a professional learning series that advocates a potpourri of pedagogies without consideration of what it would mean to pull them together.[c] The professional learning series also encourages teachers to design lessons for 'productive struggle' (the idea that students should grapple with a concept before being shown what to do), without clarifying that this is best reserved for once students have achieved mastery.[d]

Some of South Australia's guidance includes suggestions to use exploratory activities in which teachers guide students to discover concepts on their own, rather than explaining those concepts upfront.[e]

NSW is committed to explicit teaching and provides detailed advice.[f] Guidance inconsistent with this position has mostly been removed. For example, the department recently removed a webinar which downplayed the need for fluency practice and endorsed materials that are inconsistent with the instructional hierarchy.[g]

Victoria has also committed to explicit teaching and is decommissioning guidance inconsistent with this position, though this remains a work in progress.[h] For instance, Victoria recently took down guidance that encouraged loosely-structured lessons, in which there is no immediate solution pathway, without making clear that these are more appropriate once students are proficient.[i] The Victorian Academy of Teaching and Leadership, which runs professional learning for Victorian schools, also offers mixed advice. For example, a recent blog post advocates productive struggle, without clarifying that this is likely to be less effective for novices.[j]

The NT and Tasmania provide guidance that supports explicit teaching, but their schools still lack the specific, practical direction required to teach maths effectively.[k]

In Queensland, WA and the ACT there is very limited public information on the recommended approach to maths instruction.

a. AERO (2024a).
b. This compares to the more detailed guidance AERO has developed for secondary schools on how to support students struggling to read. See AERO (2024d).
c. See Education Services Australia (2025).
d. See course module 'Maths investigations' in Vivian et al (2023). See also discussion about productive struggle in Ashman et al (2020).
e. See, for example, South Australian Department for Education (2013).
f. New South Wales Department of Education (2024a), NESA (2025), and New South Wales Department of Education (2024b).
g. New South Wales Department of Education (2024c). See also New South Wales Department of Education (2024d). Materials accessed as of March 2025.
h. Carroll (2024).
i. Victorian Department of Education (2022). Materials accessed as of March 2025.
j. Allott (2025).
k. E4L (2022), and Tasmanian Department for Education, Children and Young People (2024).

evidence behind the recommendations, and, in areas where there is limited evidence, the guidance should recommend 'best bets' based on available evidence and expert advice.

The guidance should not only outline *what* school leaders and teachers need to know, but also *how* they can effectively implement a whole-school approach to maths instruction. The guidance should be a one-stop-shop for the practical tools schools need to implement evidence-informed maths instruction so that even a harried or inexperienced school leader can be confident they are adopting the best approach for their school.

The guidance should include:

- What effective teaching looks like in maths, including specific teaching practices with examples (such as video recordings of effective practice).
- Gateway skill milestones that should be mastered at each curriculum level because they predict later success in maths (e.g. fluency with particular maths facts such as times tables, or procedures such as column addition).
- The relative importance to future learning of each topic in the maths curriculum, and how to prioritise time and attention given to each throughout the year. This could include indicative pacing guides for how to allocate teaching time to different parts of the national maths curriculum and state variants.
- Suggested schedules and decision tools for assessment, to enable progress monitoring and identify students needing additional support.
- Lists of quality-assured maths programs and curriculum materials, validated assessment tools, intervention programs, and tech applications for different year levels across primary and secondary school (see Section 5.3).
- 'Do-not-do' lists of practices, programs, and/or assessment tools that have been shown, by the research evidence, to be ineffective.
- Guidance on providing targeted catch-up supports for struggling students and extending students who are excelling.

Because the research evidence on how students learn maths is universal, state governments and Catholic and independent sector leaders do not need to reinvent the wheel. States should adopt national guidance in their advice – or pick up strong guidance provided by another state – and adapt it as needed to incorporate any state-specific requirements, such as mandated assessments, so schools in their jurisdiction have a single source of reliable and coherent advice.

The cost of developing practical guidance is small relative to how much Australia invests in school education and how much impact teaching quality has on student learning. In the US, for example, it costs about US$2 million to develop one set of practice guidelines.[165] We estimate it would cost less than AUD$6.5 million to provide two sets of detailed guidelines for Tier 1 and Tier 2 and 3 instruction in primary maths.[166]

5.3 Ensure schools have high-quality curriculum materials, intervention programs, and assessments

State governments, along with Catholic and independent sector leaders, should ensure all schools and teachers have access to quality-assured, comprehensive curriculum materials for primary maths,

165. Consultation with the US Institute of Education Sciences. The Australian guidelines could cost a little more because we recommend additional operational guidance be included.
166. See Appendix C for detail on costings.

and for targeted catch-up support in maths.[167] They should also ensure schools have road-tested intervention programs and reliable maths assessments to monitor learning progress and identify students at risk of falling behind, so they can be helped to catch up.

Most schools don't have the time to create or select high-quality curriculum materials

Comprehensive maths curriculum materials include a curriculum map that sequences maths content across each year of learning, unit plans for each topic, and classroom materials that are ready to use and adapt (e.g. lesson plans, textbooks, handouts, presentation slides, and background materials and guidance for teachers), as well as embedded assessments so teachers can track student progress.

Comprehensive curriculum materials improve student learning and save the average teacher three hours per week.[168]

But they are onerous to create. School systems simply cannot expect individual primary teachers to develop high-quality maths curriculum materials on their own. Our research finds that it takes about 500 hours to develop a year's worth of high-quality curriculum materials in one subject. This is time that teachers simply don't have.[169]

There are a number of externally-developed, comprehensive curriculum materials available for schools to use in primary maths. But choosing the best ones is tricky, and teachers can't possibly be expected to road-test every option in the classroom.

Governments and sector leaders often take a 'hands-off' approach and are reluctant to provide advice on quality. In contrast, many international schooling systems officially endorse specific curriculum materials. The Singapore Ministry of Education, for instance, publishes a list of textbooks that have been approved for use in schools.[170] This list serves as an authoritative guide for principals and department heads when selecting appropriate learning materials for their students.

Governments have invested in creating materials themselves, but quality varies widely

Several state governments have developed maths lesson plans in-house (see Box 23). These initiatives are well intended and show that governments across the country have realised that they cannot expect individual teachers and schools to develop high-quality lesson materials on their own. But governments do not always have the expertise to develop high-quality materials, and often struggle to maintain materials.

While governments sometimes draw on curriculum experts to create these materials, none of the commissioned materials have been quality assured by a robust, independent, and transparent review body, leaving schools unsure about the quality of the materials. Governments also rarely maintain the materials, or update them based on feedback or new evidence. In some cases, governments explicitly decide not to update materials for new versions of the Australian Curriculum. In others, materials appear to simply languish on department websites, victims of shifting priorities or a 'one-and-done' mentality. For example, Grattan found several broken links in some government materials.

Sometimes government-produced materials are thought of as 'free'. This is misleading. While these materials are 'free' for schools, they cost governments considerable money to produce, using up funding that could be spent in other ways. Instead of governments attempting to create curriculum materials in-house, students may be better off

167. Note that maths programs have assessments embedded in them, but these focus on whether students are learning the program content, rather than looking more broadly at whether the materials and resources are working.
168. See Hunter et al (2022a).
169. Ibid (p. 11).
170. Singapore Minister of Education (2024).

if governments simply subsidised access to high-quality curriculum materials produced by commercial or not-for-profit publishers who are willing to maintain their materials and subject them to robust independent quality assurance.

Establish an independent curriculum materials quality-assurance body

Australian governments should fund an independent quality-assurance body to review comprehensive curriculum materials, including textbooks and web-based curriculum materials, that are aligned with the Australian Curriculum, the NSW Syllabus, and the Victorian Curriculum. Given the complexity of Commonwealth-state relations in school education, and the fact that many governments are themselves active participants in the creation of curriculum materials, the new body should be established as a not-for-profit, non-government organisation, to ensure integrity and confidence in its reviews, irrespective of whether the curriculum materials were created by a government or private publisher.[171]

There are several international examples of robust approaches to quality-assuring curriculum materials.[172] EdReports, for example, is a US not-for-profit that reviews the quality of comprehensive curriculum materials and publishes the results on its website (see Box 24 on page 67).[173] A similar model would work well in Australia's federal

171. One way to ensure the body's independence would be to set it up as a not-for-profit with endowment funding.
172. In addition to the example from the US described in detail here, there are curriculum quality-assurance mechanisms in Singapore, Poland, and Japan. See Singapore Minister of Education (2024), Jensen et al (2016), and Tarkowski and Voicu (2018).
173. EdReports is designed to quality-assure curriculum materials against transparent criteria. It does not evaluate the impact on student learning of using particular curriculum materials, such as through randomised controlled trials (RCTs) or other empirical studies. This is an important distinction. While rigorous empirical research is valuable, studies such as RCTs are relatively costly and

Box 23: It's hard for governments to develop and maintain high-quality materials

In 2022 and 2023, Victoria created maths lesson plans that were mainly activity-based (i.e. without much explicit modelling and guided practice). They also included no advice to teachers on which topics to cover when, and how long to spend on them. Recognising these shortcomings, Victoria has since invested a further $16.4 million to develop new maths materials that better align to the evidence base.[a] At the time of writing, lesson plans and retrieval practice resources have been developed for Foundation to Year 2.[b]

NSW has also developed sample units for its new primary maths syllabus. Some lessons include instructional approaches that prioritise activities and investigations and may not have sufficient explanations, teacher modelling, and practice opportunities. Lessons that rely solely on these materials risk not having sufficient teacher modelling and practice opportunities to build the foundations students need to tackle the suggested activities successfully. These units are being reviewed and amended.

South Australia, Queensland, and the ACT have also developed materials, but it is unclear if these are being maintained.

a. Carroll (2024).
b. Victorian Department of Education (2024b).

system. In the US, different state governments and school districts use EdReports' reviews to inform which curriculum materials they purchase, subsidise, or recommend to schools.

The federal government should lead on funding a teacher-led quality-assurance body for curriculum materials in Australia, drawing on lessons learnt from international review processes. An endowment of about $60 million could fund the quality-assurance body for the next 20 years.[174] This body would be able to quickly quality-assure almost all of Australia's comprehensive curriculum materials options for primary maths.

The federal government, and the states and territories, should also commit to ensuring that any comprehensive curriculum materials they develop in-house or commission from third parties are also subject to independent quality assurance. Governments should subsidise schools to purchase curriculum materials only if the materials have been independently assured as high quality.

Schools lack valid and reliable maths assessments

Australian schools increasingly have access to evidence-informed assessments and interventions to identify and support students struggling to read.[175] The same cannot be said for maths.

Existing maths assessments give Australian schools and school systems an incomplete picture of students' progress. As is the case with reading, research shows that schools should use periodic, benchmarked assessments in maths that indicate whether students are on-track.[176] Universally screening students and periodically monitoring their progress with trusted tools differs from a 'wait-to-fail' approach where schools only investigate why a student is struggling when they are already well behind.[177]

NAPLAN assessments, while important, are not sufficient. NAPLAN first occurs in the fourth year of primary school and results are not available until Semester 2 of the school year. Further, NAPLAN mainly tests students' ability to solve worded problems. This is important, but it does not tell us about foundational sub-skills, such as students' fluency with maths facts and procedures.[178] This makes NAPLAN quite different to England's tests of computational fluency such as its Year 4 multiplication check and its Year 6 arithmetic papers (see Box 25 on page 69).

A school wanting to supplement NAPLAN with another external assessment has few options. Australia has no research-validated maths screeners to identify students who need more support.[179]

Schools lack research-tested maths catch-up programs

Australia has too few maths catch-up programs.[180] And there is scant information about the effectiveness of the few existing programs.[181]

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time-consuming. An EdReports-style quality-assurance process can review a broader set of materials more quickly, providing schools and teachers a good indication of quality that can be supplemented by later RCTs or other rigorous experiments.

174. Grattan estimates an initial $24 million endowment would support the curriculum materials quality-assurance body for a start-up period of six years. See Appendix C for details on how we estimated the cost of this recommendation.
175. See, for example, AERO (2024d), AERO (2024e), Dyslexia - SPELD Foundation (2025), and Five from Five (2024).
176. See Hunter et al (2024, p. 58) for a discussion on assessments in reading. For a discussion of assessment in maths, see Lembke et al (2024), Nelson et al (2023), VanDerHeyden and Burns (2005), and VanDerHeyden et al (2017).
177. AERO (2021).
178. See discussion on sub-skill assessment in Nelson et al (2023).
179. Norris (2024).
180. There is little data about what intervention programs are used in primary schools. A survey of secondary schools found that most schools did not use an intervention program. See Weldon et al (2023, Tables 3.25 and 3.27 on p. 54).
181. In 2017, Evidence for Learning conducted a randomised controlled trial of QuckSmart Numeracy: a supplemental maths program designed to be delivered

Box 24: EdReports' independent curriculum quality assurance has boosted the quality of maths materials in the US

Established in 2015, EdReports is a US not-for-profit that reviews the quality of comprehensive curriculum materials — such as textbooks and web-based curriculum materials — and publishes the results on its website.

Reviews are conducted by accomplished teachers — with 17 years of experience on average — who receive more than 25 hours of training before they join a review team.

Teams spend four to six months reviewing the content in each set of materials. This takes hundreds of hours. The criteria for reviewing Foundation to Year 8 maths curriculum materials, for example, are set out in a 100-page guide.[a] Reviewers examine materials page-by-page. For example, when assessing Year 1 maths curriculum materials, one criterion is whether materials provide students with enough opportunities to practise so that they can fluently add and subtract numbers below 20.

EdReports has reviewed 97 per cent of the comprehensive (Foundation-to-Year 12) materials available on the market in English and Maths. Of the maths curriculum materials reviewed, 49 per cent fully passed EdReport's quality benchmark.[b] The existence of an independent and reputable review body such as EdReports means curriculum publishers compete on the quality of their materials, not the gloss of their brochures.

Australian publishers have had their materials reviewed and have improved their quality as a result. Mathspace, an Australian-based maths publisher, went through an EdReports review in 2023. Mathspace subsequently improved its materials by better sequencing knowledge and skills across year levels; providing more support materials for teachers; and ensuring that conceptual understanding, procedural skills and fluency, and application were all appropriately addressed.

Many states and districts in the US use EdReports reviews to inform which curriculum materials they purchase for their teachers. Currently 22 per cent of US districts, and 124 of the largest 200 districts, use EdReports reviews for state plans, policy, and advice to teachers and school leaders.[c]

US states can also tailor the EdReports process to their specific needs. Massachusetts, for example, has a two-step process to whittle down the options recommended by EdReports. In Foundation-to-Year 8 maths, 32 sets of curriculum materials meet EdReports benchmarks. The Massachussets Education Department shortlists and subsidises seven options based on alignment with state standards, and the materials' support for students who speak English as an additional language.

Now more American teachers regularly use high-quality materials. In 2018, only 31 per cent of maths teachers reported regularly using curriculum materials that had passed EdReports' quality-assurance process. By 2023, that had risen to 51 per cent.[d]

a. EdReports (2023).
b. EdReports (2024).
c. Ibid.
d. Results are from a national survey panel of over 25,000 teachers: Doan and Shapiro (2023, Figure 1).

Schools need significantly more guidance about which programs are most effective in which circumstances.

Commission new research to arm schools with information about which maths assessments and interventions are most effective

Australian governments should invest $20 million in new research on effective maths teaching and catch-up supports. The priority should be to arm schools with much better information on the effectiveness of maths assessments, catch-up programs, and digital education applications.[182]

This research should be rigorous and publicly reported in a way that is easy for principals and teachers to interpret. England's Education Endowment Foundation provides an example: it conducts high-quality research to determine the impact of different maths programs on student learning (see Box 26 on page 71).

New research should include:

- Randomised controlled trials or quasi-experiments that test the impact of interventions and digital applications on student maths achievement.
- Empirical validity and reliability studies that determine whether an assessment measures what it is supposed to measure, and produces the same result consistently. Universal screeners should be the priority given their usefulness in identifying students who need catch-up support.

Governments should look at overseas catch-up programs and assessments that have been shown to be effective. These could be adapted and tested in Australian schools. This would help increase the availability of effective maths interventions and robust assessments in Australia.

Once there is a sufficient research base, Australia should ensure schools and school systems have easy ways of understanding the evidence base for different interventions and assessments. The US National Centre on Intensive Intervention is a useful example (see Table 5.2 on page 70).

5.4 Ensure primary teachers have the knowledge and skills they need to teach maths well

Australian governments, together with the Catholic and independent school sectors, should invest in developing primary teachers' knowledge and skills in effective maths instruction, assessment, and catch-up support.

Improving teacher quality will boost maths outcomes, so effective teacher training and professional development to upskill teachers is critical. Professional development should be aligned to the practice guidance on effective maths teaching commissioned by the government (see Section 5.2), as well as what we know is effective for teacher and school leader professional development.[183]

to Year 4-to-8 students by teaching assistants in three 30-minute supplementary sessions per week over 30 weeks. See Evidence4Learning (2019). It found no statistically significant impact on maths achievement, but the study was affected by patchy attendance rates at sessions. There is also non-experimental research carried out by the authors of other intervention programs: see Gervasoni et al (2012) and Kalogeropoulos et al (2019).

182. See Appendix C on page 87 for further costing detail.

183. A 2021 systematic review found that teacher professional development was more effective if it included at least one of four different mechanisms: building teacher knowledge effectively, motivating teachers, developing teaching techniques, and helping embed practice. The more mechanisms a professional development program had, the greater the effect on student performance: Sims et al (2021).

Box 25: How England monitors students' progress in maths

The English government has thought carefully about the assessments schools must use to track students' progress in maths.

Early Years Foundation Stage Profile

In the final term of the year in which a child reaches age five, an Early Years Foundation Stage (EYFS) Profile must be completed. This is usually done by Foundation teachers. The profile reports on whether students:

- have a deep understanding of numbers to 10, including the composition of each number;
- can subitise (recognise quantities without counting) up to 5;
- have automatic recall of number bonds up to 5 (including subtraction facts like $5 - 3 = 2$) and some number bonds up to 10 (e.g. $6 + 4 = 10$), including double facts;
- can verbally count beyond 20;
- can compare quantities up to 10 in different contexts;
- can explore and represent patterns in the numbers up to 10; and
- can distribute quantities equally.[a]

Year 4 Multiplication Tables Check

In 2020, a mandatory online Multiplication Tables Check (MTC) was rolled out across English schools.[b] It consists of 25 questions: students have 6 seconds to answer each question, with a 3-second pause between questions. It only takes about 5 minutes to administer (plus time to set up the devices) and can be sat by the whole class at once. Results are available the Monday after the test window closes.[c]

Results have improved since the check was introduced. The share of students who achieved full marks increased from 27 per cent in 2021-22 to 34 per cent in 2023/24.[d]

Year 6 maths papers

Students in England sit standardised tests at the end of Year 6. This means that – unlike in Australia, where NAPLAN is sat at the beginning of Year 5 and Year 7 – England has a direct measure of where students are at by the end of primary school.

These standardised tests also differ from NAPLAN in that they consist of one paper-based arithmetic test (30 minutes) and two paper-based reasoning tests (40 minutes). No calculators are allowed.[e]

The reasoning tests are similar to NAPLAN. But the arithmetic test provides an understanding of students' procedural fluency – something Australian teachers don't get from NAPLAN. It consists of 36 questions, meaning students must work quickly.

Example questions from the 2024 paper include:

- 43% of 900
- $2 + 3^3$
- $2\frac{1}{6} - \frac{2}{3}$
- 6312×14
- $4234 \div 73$
- 0.7×26

a. English Department for Education (2024a).
b. English Department for Education (2024b).
c. English Department for Education (2024c).
d. English Department for Education (2024d).
e. English Department for Education (2024e).

Table 5.2: Example of some of the information the US National Centre on Intensive Intervention provides on Grade 4 progress monitoring tools

Title	Measure type	Reliability	Validity	Bias analysis	Admin format	Scoring time	Scoring format	Availability of rates of improvement (ROI) and end-of-year (EOY) benchmarks
Acadience Math	End year goal	●	○	No	Individual, Group, Other	3 minutes	Manual	Both available
aimswebPlus Math	End year goal	●	●	Yes	Individual, Group, Computer-administered	4 minutes	Automatic	Both available
Classworks Progress Monitoring	End year goal	●	●	No	Computer-administered	20 minutes	Automatic	Only ROI available
easyCBM	End year goal	○*	◑	Yes	Individual, Group, Computer-administered, Other	20 minutes	Automatic	EOY benchmarks available
FAST CBMmath	Short-term skill	●	○	No	Computer-administered, Other	2 minutes	Automatic	Both available
i-Ready Diagnostic and Growth Monitoring	End year goal	●	●	Yes	Individual, Computer-administered	15 minutes	Automatic	Both available
Istation	End year goal	●*	●*	Yes	Individual, Group	30 minutes	Automatic	Both available
Star	Short-term skill	●	●	Yes	Individual, Group, Computer-administered	20 minutes	Automatic	Both available

*Notes: Only a subset of Year 4 progress monitoring tools are shown. ● = Convincing evidence ◑ = Partially convincing evidence ○ = Unconvincing evidence. * = Disaggregated data available, ROI = Rates of improvement, EOY = End-of-year. Rates of improvement refers to the availability of standards for minimum acceptable growth (i.e., average weekly gains, by grade level). End-of-year benchmarks refers to the availability of benchmarks for minimum acceptable end-of-year performance.*

Source: NCII (n.d.).

Reforms to initial teacher education should improve the maths skills of teachers over time

After a 2021 federal government review found initial teacher education (ITE) courses in Australia do not adequately prepare graduates to teach using evidence-informed teaching approaches, education ministers agreed to and begun implementing reforms to ITE.[184]

The national reforms include:

- Mandating core content that ITE providers must embed in their courses by the end of 2025 in order to be nationally accredited. This content includes specific knowledge of how the brain learns, and explicit teaching approaches in maths.[185]
- Providing $7.1 million to support ITE providers to implement the core content and share strong practice.
- Setting up a new independent ITE Quality Assurance Oversight Board to provide oversight of state-level accreditation processes and ensure core content remains up to date.[186]

These are good first steps. But they will mean nothing if they are not implemented. And implementation may prove challenging, since course accreditation is conducted at the state-level and can vary widely. In all states, the process will involve a panel reviewing documentation, and it *may* – but does not have to – include a site visit or meeting with ITE staff.

184. Department of Education, Skills and Employment (2022), and Australian Education Ministers (2023).
185. AITSL (2023c). Existing ITE accreditation requirements mandate that primary ITE courses must include at least one-quarter of a year on maths curriculum and instruction, but has not previously specified what content needs to be covered in this time: AITSL (2023a).
186. Commonwealth Department of Education (2024a).

Box 26: England's Education Endowment Foundation's evaluation of the *onebillion* maths app

In 2018, England's Education Endowment Foundation commissioned a randomised controlled trial of the education app, *onebillion*, which supports students in the early years of primary school to develop basic maths knowledge and skills (such as counting, classifying shapes, and working with number lines).[a]

The trial involved 1,124 students identified as needing extra support, in 113 schools. Students in the intervention group used the app for half an hour, four days a week over 12 weeks. Schools in the control group continued their usual methods of supporting students struggling with maths. Students completed pre- and post-tests on a standardised measure of maths achievement.

The trial found that pupils who used *onebillion* made an additional three months' progress, on average, compared to the control group.[b] Teaching assistants also commonly reported that children enjoyed the application.[c]

The trial took two years (from ethical approval and school recruitment, through to data analysis and reporting) and cost £230,000 (about $A465,000).[d]

a. EEF (2019).
b. There was some evidence that disadvantaged students – those eligible for a free school meal – made less progress, but this result was not statistically significant. See Nunes et al (2019).
c. Ibid (Table 20, p. 57).
d. EEF (2018).

In contrast, in England all ITE providers are independently inspected over four days and must demonstrate that they are teaching pre-service teachers core content.[187] These inspections are conducted on-site and can include consultation with university staff and pre-service teachers, observations of training, and examining documentation. Results are published publicly and providers who fail to meet minimum benchmarks may have their accreditation withdrawn.

ITE core content should continue to be informed by the guidance on effective maths teaching commissioned by the government (see Section 5.2). Future updates should provide greater detail about the core content that is particular to primary maths teaching, such as the importance of building fact fluency and moving from concrete to pictorial to abstract representations (see Chapter 2 for further detail).

While these reforms will improve the quality of ITE, they are a drop in the ocean in the broader context of what is needed. It will take more than 40 years for the benefits to flow through to the whole workforce.[188] That means a comprehensive approach to up-skilling current teachers is also needed.

Develop micro-credentials on how best to teach primary maths and lead maths improvement

Australian governments – including the federal government – should develop and subsidise three micro-credentials on the best way to teach and lead improvement in primary maths.

Governments can look to England's National Professional Qualifications and Singapore's suite of professional development courses as models (see Box 27 and Box 28 on the next page for further detail).

187. Ofsted (2024), English Department of Education (2021), and English Department of Education (2019).
188. Goss and Sonnemann (2020, p. 10).

Box 27: England's National Professional Qualifications

England's National Professional Qualifications are a national, voluntary suite of qualifications, which provide either specialist training in a specific area (e.g. literacy, maths, behaviour management) or broader leadership training.

The 'Leading Primary Maths' NPQ, for instance, is aimed at teachers and leaders who are aspiring to or currently lead maths instruction in their school. It is a fully-funded 12-month program, with a mix of face-to-face and online learning for one-to-two hours a week, and a final assessment, which participants must pass. Schools receive £200-£800 for every teacher who participates.[a]

NPQs are rigorously designed and their delivery is subject to ongoing review. An independent body – the Education Endowment Foundation – has endorsed the learning requirements for each NPQ to ensure they are underpinned by rigorous evidence.[b] Trained reviewers visit a qualification's lead provider at least once every two years, gathering evidence across four days and assessing against a quality framework. The team interviews and surveys trainers and participants, reviews documentation, and sits in on training sessions. Grades and reports are made public, so schools and teachers know where to go for high-quality professional development.[c]

Early evaluation results are promising. The majority of participants surveyed (84 per cent) would recommend their NPQ to others. For participants who took on new leadership roles, 56 per cent agreed that their NPQ strongly contributed to securing this position.[d]

a. English Department of Education (2024).
b. EEF (2023).
c. Ofsted (2022).
d. CFE Research (2024). The impact evaluation is due for release in 2026.

The three different micro-credentials should build on one another, be between 12-24 months in length, and be tailored for different roles and expertise. The courses should be designed so they can be completed with time commitments of between one and two hours per week, so they can be undertaken by teachers who are working full time. Teachers who do not wish to commit to the full micro-credential should be able to take individual modules from the course, with options to 'build up' to a micro-credential if they later choose to do so.

The three micro-credentials should include:[189]

- A course for primary school teachers or teaching assistants mainly focused on the content of the primary maths curriculum and how to effectively teach it:
  - Content would be maths topic-specific, focusing on all of the gateway skills that primary students need to master from Foundation to Year 6.
  - The full course should be 12 months in length.
  - A flexible option should be available, so that teachers can either complete the full course or select specific modules to complete as necessary (e.g. if a teacher is moving from the early years to upper primary and wants to upskill in maths topics like decimals, angles, and the Cartesian plane for these year levels).

189. Grattan also recommends a primary principalship micro-credential for aspiring or current primary principals. This would be 12-24 month course covering key knowledge and skills primary principals need to lead effective schools. A portion of the content would focus on leading primary maths, including building participants' understanding of evidence-informed maths practices, timetabling, workforce development, and whole-school assessment and monitoring.

Box 28: Singapore's professional development modules

Singapore has a suite of training modules to upskill primary teachers in maths. Scholarships, sponsorships, and study leave schemes support teachers to develop their skills and foster a culture of professional excellence.

There are two longer (six months plus) courses available for teachers who wish to specialise in primary maths:[a]

- *Certificate in Primary Maths Education* – A five-subject course for teachers wanting to brush up on their subject knowledge and specialise in maths.
- *Advanced Diploma in Primary Maths Education* – A ten-subject course that targets teachers with at least two years of experience hoping to spearhead improvement in maths at their schools.

There is also a suite of shorter, one-off courses available through the National Institute of Education (which also form part of, and can be credited towards, the longer courses).[b] These include:

- Error Analysis and Remediation – 12 hours
- Formative Assessment in Primary Mathematics: Effective Implementation and Practice – 12 hours
- Challenging Mathematically Able Lower Primary Pupils – 12 hours
- Teaching and Learning of Measurement at Lower Primary: Teaching Towards Big Ideas About Measurement – 24 hours

a. Nanyang Technological University (2025a), and Nanyang Technological University (2025b).
b. National Institute of Education (2025).

  - The modules should be spaced out, so that participants in the full course have the opportunity to put what they have learnt into practice in their classrooms.

- A course for aspiring or current primary maths leaders who want to lead maths instruction in their school:
  - This course should be 24 months in length, with the first year focused on building participants' specialist knowledge and skills in maths instruction and catch-up support, and the second year focused on leading change and coaching fellow teachers.
  - Content for this would include how to implement a whole-school maths curriculum, rigorous assessment practices, set up school-wide systems for student support and extension, and deliver instructional coaching for teachers.
- A course on multi-tiered systems of support in primary maths, suitable for school leaders, maths instructional leaders, and teaching assistants / school learning support officers:
  - This course should be 12 months in length, and focused on screening, catch-up support, and extension.
  - Content would include screening and progress monitoring, diagnosing maths learning difficulties, effective intervention, and evidence-informed extension practices.

These courses should be underpinned by evidence-informed practice guidelines (see Section 5.2 on page 59 for further detail on guidelines). Like the Education Endowment Foundation in England, AERO should have a role in reviewing the content of professional development to ensure it aligns with guidance (see Box 27 on page 72 for details on this role in England).

These micro-credentials should set a new bar for evidence-informed, intensive professional development.[190] Successful completion of a micro-credential should require passing a final assessment on the knowledge and skills covered by the course.

There is an opportunity for the federal government to take a leadership role on this reform initiative. Ideally, there would be a single set of national micro-credentials to promote consistency and coherence within the teaching profession Australia-wide. Grattan estimates it would cost about $2.25 million to design the three courses, and about $6 million to deliver them each year.[191] States could then adapt these, if necessary, to meet local conditions.

To kick-start this reform, governments should offer a pool of $10 million per year in small incentive payments to teachers and schools for every course completed (or equivalent). The teacher bursary should be $2,000 per teacher.[192]

Establish Maths Hubs as demonstration schools that showcase best practice and provide intensive support to other schools

Australian governments should establish 50 'Maths Hubs', drawing on aspects of England's hubs model (see Box 29 on page 76).[193] Hubs could be cross-sectoral, and would act as demonstration schools and showcase best practice, deliver practical training directly to teachers

190. For instance, the federal government has recently invested in a course on phonics, which is designed for Foundation-to-Year 2 teachers and includes seven modules of 20-to-45 minutes each.
191. Delivery costs scale with teacher participation. We assume about 8 per cent of primary teachers have completed one of the courses or equivalent within four years. See Appendix C for details.
192. Teacher bursaries should be cash-in-hand and encourage participation. See Appendix C on page 87 for further costing details.
193. See Appendix C for further details on how we estimated the required number of Maths Hubs, their staffing requirements and annual costs.

and leaders, and work intensively with partner schools to improve maths performance. They would help bridge the gap between research evidence, education policy, and classroom practice.

Only schools with effective existing maths practice and performance should be selected as Maths Hubs. Hubs would serve, on average, 150 primary schools in their local area (though at any one time, they would only provide intensive support to a smaller number of schools). Each hub should receive about $930,000 in additional funding per year to employ a Maths Hub Lead Coordinator, a Lead Maths Specialist, and up to three full-time maths coaches (or equivalent staff employed on a part-time basis). The total cost of operating 50 hubs each year would be about $52 million.

Maths Hubs coordinators and coaches would:

- Provide training to all teachers in their area, including teacher visits and observations of teaching at the hub school, topic-specific training, and primary maths micro-credentials (as needed). This would be delivered on-site at the hub school.
- Offer intensive, two-year-long support to partner schools who are prioritised based on certain eligibility criteria (e.g. low performance, high disadvantage, inexperienced staff, or high staff turnover). This would involve coaches visiting partner schools to observe practice and provide support.

Within about 10 years of being established, Maths Hubs would be able to provide intensive partnership training to all primary schools in Australia.

All Maths Hub professional development should be aligned with evidence-informed practice guidelines (see Section 5.2 on page 59 for further detail).

Create an expert career path for specialist Master Teachers of maths

Australia should follow Singapore's example and appoint Primary Maths Principal Master Teachers and Master Teachers (see Box 30).

Australia should have eight Primary Maths Principal Master Teachers: one in each state or territory. The Principal Master Teachers would be the chief expert on primary maths teaching in their jurisdiction. They should be proven leaders, and deep subject matter experts. Their responsibilities would include ensuring that advice given by their system reflects the national guidance on effective maths teaching. They would oversee all Primary Maths Master Teachers and may help design and deliver the micro-credentials offered in their system.

There should be about 50 Primary Maths Master Teachers appointed across the country. In larger states, Primary Maths Master Teachers would be based in different geographic regions and their responsibility would be for improving maths teaching across the schools in that region, including by overseeing the region's Maths Hub (see Section 5.4 for further detail). They would report to their system's Principal Master Teacher. They would have no direct teaching load. They should be remunerated at about $100,000 more than the top rung of the teacher salary scale to reflect their genuine expertise in primary maths and track record in leading improvement across schools.[194]

We estimate it would cost only about $18 million a year to implement this reform nationally.[195]

194. See Goss and Sonnemann (2020). In 2025 a Primary Maths Master Teachers' total remuneration would be about $232,000.
195. See Appendix C for further details on how we estimate the costs.

Box 29: England's Maths Hubs help spread great practice across schools

In 2014 England's Department for Education established the 'Maths Hubs' program — a school-to-school support program.

The Department has selected 40 'Maths Hub' schools across England for their excellent track record in maths. These schools are funded to deliver nation-wide professional development to all maths teachers as well as more intensive support to 'partner' schools.[a]

Tailored support to schools can include showcasing best-practice teaching, auditing how schools teach maths (which includes developing an action plan to improve practices), and providing partner schools with six days of in-house support from a Maths Specialist over a year. See Figure 5.4 for an example of what this looks like in one Maths Hub.

Qualitative research shows positive results from Maths Hubs. In 2023, England's school inspectorate reported findings from research visits to 50 schools, concluding that there had been 'a resounding, positive shift in mathematics education' in primary schools.[b] The inspectorate attributed this in part to Maths Hubs.[c]

In case study research of one Maths Hub, teachers reported that the program had increased their confidence and expertise in teaching maths and improved the quality of their teaching.[d]

While there is not yet public data on the impact of Maths Hubs, a 2022 evaluation found that a broadly similar model – English Hubs – led to improved Year 1 Phonics Screening Check in participating schools.[e]

Figure 5.4: Support provided by London South West Maths Hub

Standard offer (All schools)	**Developing Teaching for Mastery ~ 1 year** • Most schools start here • ~2 participants per school • £1,000 funding to school to cover staff release • 3 x school visits from primary maths specialists a year • 6 x meetings with other schools a year **Embedding Teaching for Mastery ~ 1 year** • All schools move to this phase • £500 funding to school to cover staff release • 1 x school visit from primary maths specialists a year • 6 x meetings with other schools a year **Sustaining Teaching for Mastery ~ ongoing** • All schools move to this phase • 6 x meetings with other schools each year
On-demand (All schools)	• Short courses available through the Hub • Focused on specific topics and roles, such as teaching number, patterns and structures for early-career teachers • Available on-demand to any teachers from a school
Intensive support (Partner schools)	• ~6 days of bespoke support for a school • For schools that require longer-term, intensive support • Schools are identified through student learning outcomes, school inspection reports, levels of student disadvantage or an assessment of school capacity
Enhanced support (Partner schools)	• ~1-2 days focused on a specific area of school need • Delivered by one of the Maths Hub's trained maths specialists • For schools, regardless of whether they are in the 'developing', 'embedding', or 'sustaining' stage

Source: Consultation with London South West Maths Hub.

a. Maths Hub schools and partner schools need to meet eligibility requirements.
b. Ofsted (2023a). Research visits were carried out between September 2021 and November 2022.
c. Ofsted (ibid). This report contrasts starkly with Ofsted's 2012 report, which identified serious inequalities in maths curriculum and instruction in England: Ofsted (2012).
d. Straw and Bradley (2022).
e. Shepherd and Fortescue (2023).

Governments should encourage primary schools to employ dedicated maths teachers where appropriate

As explored in Section 3.3.1, a some Australian primary school teachers do not feel confident teaching maths. A few say they would prefer not to teach maths at all.

A model where maths is taught by a dedicated subject specialist could help. This approach may also have benefits even in schools where most teachers feel confident, as it recognises that some teachers will still have a preference for – and comparative advantage in – maths. This is the approach used in Singapore (see Box 31) and at Ballarat Clarendon College.

One cost-neutral way of implementing the model is a team-teaching approach in which one teacher is allocated two classes for maths, science and digital technologies (for example) and another teacher takes those same classes for English and Humanities.[196] Other cost-neutral timetabling options are possible too. Figure 5.5 on the following page provides an illustrative timetable of a Singaporean primary teacher with a dual specialisation in maths and science.

Where consistent staffing allows it, schools should consider 'looping' teachers, so they teach the same students for two or more years.[197] They should also consider how to allocate home room and co-curricular duties so that dedicated maths teachers can further build relationships with students and their families outside of maths lessons.

196. This assumes 21 hours of face-to-face teaching time, with five hours of maths per class per week, two and a half hours of science and digital technologies per class per week, and six hours of additional teaching duties such as home room, library, and 'class cover' when other teachers are sick.
197. The intention of looping is that student-teacher relationships remain stable, so that when teachers loop with students, they bring with them a strong picture of students' progress in maths, and – from day one of term one – classes can dive straight into maths content. There is some research evidence supporting the practice of 'looping'. See Cistone and Shneyderman (2004).

Box 30: Master Teachers in Singapore

The Ministry of Education in Singapore established a 'Teaching Track' in 2001 to provide teachers new professional development and advancement opportunities. The Teaching Track comprises several tiers: Senior Teachers, Lead Teachers, Master Teachers, and, at the pinnacle, Principal Master Teachers.[a]

Master Teachers play a crucial role in fostering professional excellence by sharing effective pedagogies, trialling new teaching methods, and supporting policy work related to teaching and learning at the national level.

Master Teachers are primarily based at the Ministry of Education to facilitate coordination of professional development at the system-level. They maintain connections to the classroom through school attachments. Since 2021, some Master Teachers have been school-based. School-based Master Teachers spend most of their time teaching in classrooms, co-planning and co-teaching lessons, and leading various professional development groups.[b]

A rigorous accreditation process is in place for teachers advancing through the Teaching Track. New Master Teachers, for example, complete a year-long program to equip them for leadership at a national level. This comprehensive approach ensures that Teacher Leaders possess true expertise.

Today there is one Principal Master Teacher and 15 Master Teachers in maths, of which three are school-based and seven are specialised in primary maths. They work closely with a couple of schools each year, typically visiting each school once a week. This ensures they are grounded in what works in the classroom.

a. Singapore Ministry of Education (2023).
b. Singapore Ministry of Education (2020).

Governments should encourage trials in which primary school maths is taught by a dedicated subject teacher.[198] Trials should be rigorously and publicly evaluated, and report the impact both on student performance, and teacher satisfaction and workload. The trials should be funded through the $20 million for new research recommended in Section 5.3.

5.5 Encourage best-practice teaching through closer monitoring and strengthened school performance reviews

Australian governments and the Catholic and independent school sectors should better track school progress to understand if government policies are adequate and to provide robust information on where additional support for schools and teachers is needed.

Mandate a robust national early years screening tool

Australia needs a high-quality maths screening tool to use in the early years. It is encouraging to see a commitment to developing and rolling out such a tool from 2028 as part of the BFSA.[199] If designed effectively, the commitment would finally provide a national indicator of maths achievement before Year 3 NAPLAN. It would also be a powerful predictor of Australian students' future maths performance.[200]

The use of the same maths screening tool should be mandatory for all schools, irrespective of sector or state.[201]

198. The empirical evidence on this model is mixed but, on balance, suggests potentially positive impacts for teachers without drawbacks to student achievement. See N. Hwang and Kisida (2022), Oresanya (2022), Tawil et al (2024), and Wellington et al (2024).
199. Commonwealth Department of Education (2024b).
200. International studies have found results on universal maths screeners are highly correlated to later student performance. See, for example, A. A. Allen et al (2024) and Jordan et al (2010).
201. It is unclear whether the BFSA requires the mandatory use of a new screening tool. The wording of the new agreement simply says the tool will be 'made

Figure 5.5: Most Singaporean primary teachers are subject specialists
Illustrative example of a Singaporean primary teacher's weekly timetable

Time	7:30 – 8.30	8:30 – 9.30	Recess	10:00 – 11:00	11:00 – 12:00	Lunch	12:30 – 1:30
Mon	Maths P5b	Maths P5a	Yard duty	Maths P6a	Science P5a		
Tue	Maths P5a	Maths P5b		Maths P6a			
Wed	Science P5a	Maths P5b		Maths P6a	Maths P5a		Form period
Thu	Maths P5b	Maths P5a	Yard duty				Maths P6a
Fri	Maths P5b			Maths P6a	Maths P5a		Form period

Notes: Assumes the teacher has no leadership responsibilities and is not a beginning teacher. Does not include after-school co-curricular activities. The average class size in Singaporean primary schools is 34 students. See Singapore Ministry of Education (2024). Singaporean teachers teach about 18 hours per week – two hours less than Australian teachers. See Thomson and Hillman (2019, Table 2.1, p.24), noting data is unavailable for primary teachers.

Source: Adapted from Soo et al (2022).

Box 31: All primary school teachers in Singapore have subject specialisations

In Singapore, a significant shift has occurred in primary education – from a model in which most primary teachers taught many subjects to one class (the generalist model), to a model were primary teachers specialise in two disciplines and teach them to more than one class.

In the past, Singaporean students might have had another teacher for specialist subjects like languages, but they spent most of their school week with one teacher. As one teacher explained, 'When I first started teaching, in 2007, we had to teach English, maths, science, PE, and art, and sometimes music, depending on the year'.[a] Now this teacher only teaches maths and science to one Year 4 and one Year 6 class.

The shift began organically, prompted by the value Singapore places on teachers' disciplinary expertise. Some teachers approached their principals, keen to focus on teaching subjects they were more passionate and knowledgeable about. They also hoped this would reduce their planning loads. Their principals agreed, and this initiative became government policy around 2014. Now, incoming primary teachers have their areas of specialisation identified (Maths and English is a possible combination, as is Maths and Science).

Singaporean teachers spoke to Grattan about the benefits of specialisation. They felt their workload had become more manageable, and while they still worked hard, they felt less stretched across multiple learning areas. They appreciated the opportunity to teach the same lesson multiple times, allowing for refinement.

Teachers and policy makers Grattan interviewed said the shift has not harmed student-teacher relationships. Even before the shift, students were accustomed to having multiple teachers – for English, music, and languages, for example.[b] And alongside specialisation, most teachers maintain primary pastoral responsibility for a group of students as form teachers, engage with students in co-curricular activities, and often use looping (teaching the same group for at least two consecutive years).

Policy makers told us of the benefits of a more specialised primary school workforce. Because specialists move between classes, all Singaporean primary schools have timetables with subject blocks (see Figure 5.5 on the previous page). This reduces the between-class variability of the time spent on different subjects, and helps schools avoid narrowing the curriculum.

In addition, initial teacher education for primary teachers is now more specific. For example, all incoming primary teachers aspiring to have a maths specialisation must have performed well themselves at maths in primary school. They will also have done an undergraduate degree in maths, or be undertaking a mathematics major alongside their education degree. Additionally, as part of the degree, they undertake between three and four subjects on maths pedagogy and assessment.

Grattan heard that specialisation also sharpened in-service teacher training, and means primary teachers now have more clarity about what professional development to pursue.

The transition required some teachers to undertake additional training to build their subject-specific knowledge and skills. Teachers in Singapore are provided funded professional development, and offered leave and other incentives to undertake further formal learning. Teachers could, for example, study a course on Geometry offered by the National Institute of Education.

a. Musfirah Abdul Khamid (2016).
b. Singaporean students must study one of Chinese, Malay, or Tamil. There are some exceptions. See MoE (n.d.).

The screening tool should focus on gateway skills known to predict future success in maths, like knowledge of whole numbers and counting, the relationships between whole numbers, and how whole numbers can be taken apart and put together.[202] It should be efficient to administer – ideally no more than 10 minutes and possible for a trained teacher to do with a group of students at once. Australian governments should publish technical details on the reliability and validity of the numeracy screener after testing it with a large, representative group of Australian students. This should be funded through the $20 million for new research recommended in Section 5.3.

Without further research to test their validity, the government should *not* adopt the early-years maths assessments already in use across states and territories, including the existing Year 1 Number Check (see Box 32 for further detail).[203] Existing tools have not been independently validated by public, empirical research and are likely more suited to diagnostic purposes than universal screening. While useful to reveal students' mathematical thinking, there is no guarantee that they genuinely identify at-risk students and they come at significant cost to instructional time if administered to all students.

Once a screener has been designed and rigorously tested in schools, state and territory governments should require all schools to use it, and should publish aggregate results at both state and sector levels.

available' to schools. See Commonwealth Department of Education (2024b, p. 19).

202. See Norris (2024) for details.

203. Arrangements vary across the country. A Year 1 Number Screening Check is being trialled in NSW government schools this year 2025. See Car (2025). WA requires students beginning primary school to do a one-on-one interview during Term 1 in which a teacher poses them several questions designed to reveal mathematical thinking. Similarly, in Victoria and South Australia schools are encouraged to do 30 to 45-minute one-on-one interviews to assess students' understanding across a range of maths curriculum content. See Norris (2024).

Box 32: The Year 1 Number Check is not a suitable tool for universal screening

In 2017, the federal government commissioned the development of a Year 1 Number Check. The resulting check is a 20-item interview (with a shorter 12-item option) that mainly focuses on counting, number recognition, and ordering numbers.

The Number Check is relatively labour-intensive to administer. Norris (2024) suggests it would take up to 16 instructional hours to interview a class of 24 students, at a cost of $1,600 for a relief teacher to cover the class. This does not include the time needed to analyse the results.

For this level of time commitment, screening assessments should give schools the best chance at identifying students who are not on track. But in its current form, the Year 1 Number Check is not well positioned as a universal screener – even if it could be a useful diagnostic tool.

It likely does not give enough attention to number relations (for example, putting numbers on a number line) or operations (for example, addition and subtraction).[a] And it is possible to achieve the 'on track' score of 75 per cent without demonstrating any skills in number operations beyond counting by ones. The validity of the Year 1 Number Check has also not been determined through empirical research (for example, no data is available on its reliability or predictive validity, and the 75 per cent cut-off score is not based on research).

Further, none of the Number Check tasks specifically measure students' computational fluency, despite its importance.[b]

a. Norris (2024).
b. Ibid.

Students who do not meet the 'expected level' should be re-assessed after receiving additional catch-up support.

Trial a middle years fact fluency test

A short Year 3 or 4 test of students' fact fluency would give school systems a better picture of students' mastery of the core knowledge that matters for later mathematical success. State and territory governments should trial such a test in a sample of schools, building on the model of England's Year 4 Multiplication table check (see Box 25). The test should be efficient to administer (delivered via devices and taking 20 minutes or less per class), so not to add to teachers' and schools' workload. States, territories or Catholic dioceses could also trial a Year 6 fluency test that assesses students facility with gateway skills at that age (such as operations with fractions, decimals and percentages).[204]

School reviews should examine curriculum and teaching approaches in maths

School reviews should be strengthened to include a rigorous examination of student achievement, curriculum implementation, and instructional approaches to teaching primary maths.

Currently, school reviews tend to be weak; they are often a 'tick-and-flick' exercise. Only some schools receive a thorough review of their curriculum approach and are provided with concrete, improvement-focused feedback and support. Other schools receive only a cursory review of their curriculum; some are simply required to self-assess their performance and submit limited documentation.[205] This leaves schools without enough meaningful feedback and education departments with limited information about teaching quality inside classrooms.

School reviews provide one of the potential windows into school and teacher practices on the ground. They are a key opportunity for government to provide additional tailored support to improve principal and teacher capacity, classroom practice, and student learning.

Departmental school reviews should be conducted by independent reviewers including members who are well trained in the evidence on maths teaching. Reviews should be conducted at least every four years, and poorer-performing schools – those that have a high proportion of students not meeting the NAPLAN proficiency benchmark in numeracy – should be reviewed more regularly.[206]

A thorough examination of a school's curriculum and instructional approach should take about three to five days (including two days on-site), depending on the size of the school. Reviews should consider if adequate time is dedicated to maths, and review alignment between the planned, taught, and learnt curriculum, using classroom walk-throughs, observations, and student assessment data. The reviews should examine whether the teaching aligns with the practical guidelines on best-practice primary maths instruction (see Section 5.2 on page 59), leading to targeted improvement support where performance is poor. Reviewers should also look at schools' assessment schedules, and check they are using reliable assessments and regularly screening students for maths difficulties. We estimate that the cost of more rigorous school reviews would be about $43.5 million per year. Some of this may be offset by repurposing existing spending on school reviews.[207]

State governments should publish annual aggregated reports of the proportion of primary schools that have implemented effective maths instruction, and detailed descriptions of the 'top five' schools that provided excellent maths instruction in their jurisdiction. The

204. See, for example, Siegler et al (2012) and Spring Math (2020).
205. Hunter et al (2022a).
206. See England's risk-based approach to inspections: Ofsted (2023b).
207. See Appendix C for details.

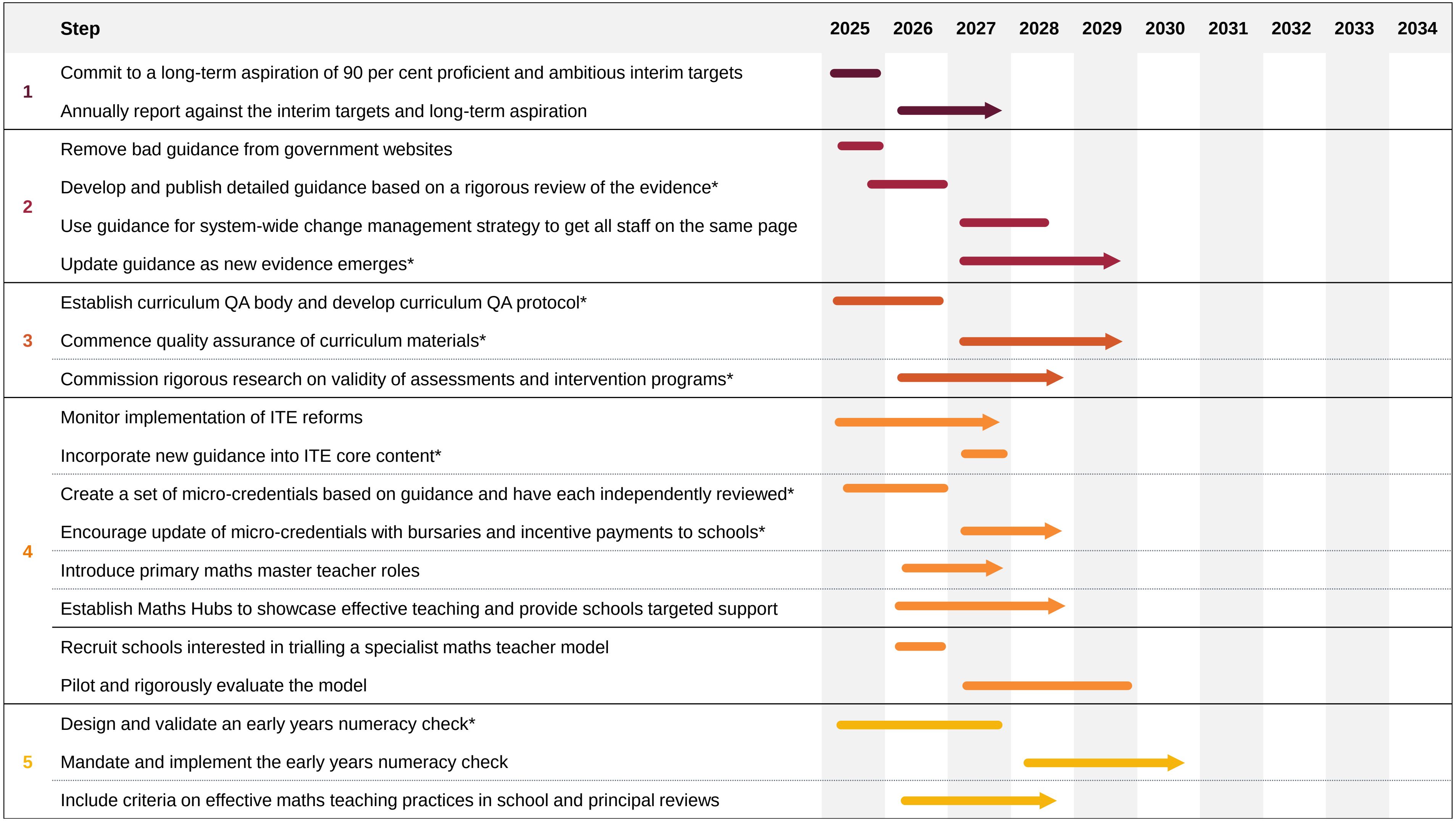
aggregated reports could also provide commentary on key areas of strength and improvement observed across schools.[208]

Enhance the performance reviews of school principals

Australian governments and Catholic and independent school sectors should improve the performance reviews of primary school principals by including criteria on evidence-informed maths teaching practices. Principals should be held responsible if their students are not making adequate progress *and* if their school’s practices do not meet the established guidelines.[209]

208. See Ofsted (2023a) for an example.
209. See Hunter et al (2024, p. 69) for further discussion of principal performance reviews.

Figure 5.6: Grattan Institute’s 10-year strategy to improve primary maths teaching



*Notes: *Step that the federal government should lead. QA = Quality Assurance. ITE = Initial Teaching Education. Numbers correspond to the five overarching reforms and five subsections in this chapter: commit to targets; develop detailed guidance; ensure schools have high-quality resources; build teacher expertise; and strengthen monitoring and accountability.*

Source: Grattan analysis.

Appendix A: Our school case study methodology

Research for this report included case studies in seven schools. For four of the case studies – Bentleigh West Primary School, Ballarat Clarendon College, St Bernards' Primary School, and Wattle Grove Primary School – Grattan Institute staff spent two days on-site. For the final case study, Grattan Institute staff spent two days studying the Explicit and Systematic Teaching (EAST) Network in regional NSW, including visits to three schools – Charlestown South Public School, The Entrance Public School, and Budgewoi Public School.

The purpose of the case studies was to understand how real schools bring to life the practices identified as most effective in Chapter 2. Case study research is well suited to investigating complex organisational processes. It is frequently used for this purpose in public policy, health, education, and business research.[210]

Grattan used a purposive case study selection approach to identify schools that had proven especially successful in embedding effective maths teaching practices.[211] To identify potential case studies, Grattan researchers considered a range of factors, including:

- a demonstrated commitment to, and a success in, embedding teaching practices that broadly align to those identified by robust research syntheses of effective instruction
- achievement at or above NAPLAN numeracy results relative to similar schools
- interest and ability to host Grattan for the duration of the visit
- the broader mix of case studies, to enable some variation in contexts across states, school sectors, student demographic factors, and stage of implementation of effective instructional practices (from mature through to recent adopter).

We did not seek to identify 'non-example' case studies for this project (i.e. schools with less effective teaching practices). There are significant practical challenges in securing school participation on this basis.

Before on-site visits, Grattan Institute staff reviewed a range of documentation provided by the school. This included school timetables, school-wide maths curriculum maps, unit plans, assessment schedules and timetables, classroom materials (such as PowerPoints, quizzes, and textbooks), and accompanying policies or guidelines (e.g. a school's instructional handbook or professional development policy).

Before and during on-site visits, Grattan Institute staff had separate meetings with:

- the principal (multiple times)
- the school leadership team (multiple times)
- maths instructional leaders
- classroom teachers from across year levels (in focus groups).

Meeting staff at different levels and in different roles provided us with a range of views on implementing effective maths teaching at each school.

At each school, we visited several classrooms to see defining features of the school's teaching approach. These 'learning walks' lasted between 30 minutes and several hours.

210. Yin (2009), Stake (1995), and Flyvbjerg (2006).
211. The 'extreme' or 'atypical' case selection approach in Flyvbjerg (2011, p. 306).

Appendix B: Our international reference systems

This report references reforms to lift the quality of primary maths teaching in England and Singapore.[212] We chose these systems both for their higher performance than Australia on international maths assessments and for their suite of initiatives that constituted a coherent set of national policies to support effective maths teaching.

Grattan Institute researchers spent time in both countries, consulting policy makers and practitioners, in addition to reviewing published research and documentation on their respective approach.

This appendix provides additional contextual detail on each system.

England

Key initiatives to improve the way maths is taught in England's 16,000-plus primary schools include:

- incentives to attract skilled candidates into maths teaching
- changes to initial teacher training that emphasise practical experience and the science of how humans learn
- an early-career framework: a fully-funded package of structured training for teachers in their first two years on the job
- a national commitment to mastery approaches in maths[213]
- fostering a high-quality market of curriculum materials
- nationally-vetted professional development programs
- introducing a school hub model to share best practice
- establishing a mandatory Year 4 Multiplication Tables Check
- a focus on maths curriculum and pedagogy in school inspections
- funding the Education Endowment Foundation as a custodian of education research.

These initiatives are underpinned by a 'golden thread': the body of high-quality evidence underpinning the support, training, and development available to teachers through their careers.

England's results have been impressive. In 1995, England's average Year 4 maths score in TIMSS was 484, below Australia's 495.[214] By 2023, it had risen to 552, surpassing Australia's score of 525.[215]

Singapore

Singapore has long been the top performer in international maths tests. The average Singaporean 15-year-old was four and a half years ahead of their Australian counterpart on the 2022 PISA maths test,[216] while just 19 per cent of Singaporean students fell short of Australia's national proficiency benchmark in PISA (levels 3 and above), compared to 49 per cent of Australian students.[217]

Singapore is highly urbanised, with just 180 very large primary schools, which means there is a tight feedback loop between schools and the

212. While policies in education cannot be adopted without careful consideration of context, the approach in England and Singapore show what's possible.
213. Mastery approaches are those that ensure the vast majority of students have mastered key concepts before moving on to the next topic. See EEF (2021b) and NCETM (n.d.).
214. Note that Australia's 1995 sample did not satisfy the TIMSS sampling guidelines of at least a 75 per cent participation rate (it was 66 per cent).
215. Wernert et al (2024b, p. 23).
216. De Bortoli et al (2023, p. xvii). This assumes 20 PISA points are equivalent to about one year of learning. See De Bortoli et al (ibid, p. xxxvii).
217. OECD (2024, Table I.B1.3.1.).

education department.[218] Still, there are parallels to Australian school systems. For example, while Australia has many rural and remote schools, the vast majority of students (90 per cent) are educated in metro or inner-regional schools.[219] By number of schools, Singapore's system is also a similar size to our Catholic systems and some Australian states and territories.[220]

Singapore's performance is sometimes attributed to difficult-to-replicate 'cultural factors'.[221] But in reality, Singapore had poor literacy rates and maths proficiency fifty years ago, and has worked hard to turn this around.[222]

Key among its reforms are:

- Thorough teacher preparation through rigorous initial teacher education
- The introduction of a teacher-leader pathway which includes Primary Maths Master Teachers
- The common use of high-quality text books
- Highly detailed guidance to accompany the national curriculum
- Content-specific Professional Learning in primary maths through the Academy of Singapore Teachers and facilitated by its Master Teachers in primary mathematics
- The introduction of teacher subject specialisation in primary schools, so teachers can focus on developing deeper expertise.

218. Singapore Ministry of Education (2024, p. 2).
219. Grattan analysis of ACARA (2024j).
220. For example, Brisbane Catholic Education has 140 schools, and the Tasmanian and ACT government systems have 124 and 58 primary schools respectively.
221. Donnelly (2014).
222. Goh (1978), and Kaur (2014).

Appendix C: How we estimated the cost of our reforms

We estimate the total cost of our recommended primary maths reforms would be about $152 million per year. This is less than 0.4 per cent of annual government spending on primary schools and amounts to about $67 per primary student per year.

This appendix explains the key assumptions that underpin this costing, including specific detail for each reform. All estimates are in 2024 dollars.

C.1 Calculating the total cost

The total cost of about $152 million per year assumes that our recommendations have been fully implemented. The first year of a progressive rollout (for reforms such as establishing Maths Hubs) would cost less.

We have annualised one-off upfront costs over four years.

We have assumed that half of all education spending is apportioned to primary schools.[223]

To get our estimate of just over $67 per student, we divided the average annual cost by the number of primary students.[224] We have chosen to present the cost of the total reform package as shared only among primary students, even though some reforms will benefit secondary students too. For instance, a national curriculum materials quality-assurance body would be expected to review secondary curriculum materials too. Our estimated cost per student is an upper-estimate.

223. See Productivity Commission (2025).
224. This includes students in government and non-government schools. Student numbers sourced from ABS (2025b).

We have also applied the following assumptions:

- School counts include all primary and combined schools (schools that have both primary and secondary year levels). Special schools are not included, because they have unique needs.
- For staffing costs, annual wage growth is 3.7 per cent and overheads costs are 25 per cent.[225]
- The cost estimates for the Maths Hubs, micro-credentials, and Master Teachers recommendations each include an allocation for a rigorous, public evaluation, valued at 5 per cent of the reform's cost.[226]

Note that some of our estimates are highly sensitive to dosage. For instance, delivery costs increase if more teachers undertake the micro-credential.

C.2 Estimating the annual cost of each proposed reform

Table C.1 summarises the estimated cost of each reform over a four-year period, as an annual cost, and as an annual cost per student. The table also estimates the annual costs for each state and territory. The allocation of costs to federal or state governments is illustrative only. For all levels of government, the costs of the reform package are very small relative to current spending on primary schools.

225. Annual wage growth is based on assumptions in the Intergenerational Report: Treasury (2023, p. 231).
226. This is based on guidance from the New South Wales Department of Education (2024e) that the total cost for evaluating programs should not exceed 5 per cent of a program's budget.

Table C.1: Estimated cost for governments of Grattan Institute's proposed reforms to primary maths

	New guidance	Curriculum quality assurance	New research	Maths Hubs	Micro-credentials	Master Teachers	More rigorous school reviews	Annual total	Proportion of 2022-23 spending on primary schools
Federal govt	$1.6M	$5.0M	$5.0M		$13M			$25M	0.2%
NSW	-	$3.0M	-	$13.5M	$1.4M	$4.3M	$13.8M	$36M	0.4%
Vic	-	$2.8M	-	$10.4M	$1.3M	$3.4M	$10.3M	$28M	0.4%
Qld	-	$2.1M	-	$9.3M	$950k	$3.1M	$8.1M	$23M	0.4%
WA	-	$1.1M	-	$6.2M	$500k	$2.2M	$5.1M	$15M	0.5%
SA	-	$650k	-	$4.1M	$300k	$1.6M	$3.4M	$10M	0.6%
Tas	-	$200k	-	$3.1M	$95k	$1.3M	$1.2M	$6M	0.9%
ACT	-	$200k	-	$2.1M	$85k	$950k	$950k	$4M	0.7%
NT	-	$100k	-	$3.1M	$55k	$1.3M	$600k	$5M	1.4%*
Average annual cost	$1.6M	$15M**	$5M	$52M	$17.5M	$18M	$43.5M	$152M	<0.4%
Annual cost per student	$1	$7	$2	$23	$8	$8	$19	$67	-
Estimated cost over four years	$6.4M	$60M	$20M	$208M	$70M	$72M	$174M	-	-

*Notes: Totals vary due to rounding. To avoid a false level of precision, costs above $1M have been rounded to two significant figures, costs between $100k and $1M have been rounded to the nearest $50k, and costs below $100k have been rounded to the nearest $5k. Average annual costs include fixed costs shared over a four-year period. *The latest spending data are from the 2022-23 financial year. Funding is set to substantially increase in the NT: Clare et al (2024). **Average annual cost assumes a $60M cost in Year 1, with no subsequent costs in the subsequent three years.*

Sources: Grattan estimates. Where estimated costs are pro-rated per capita, staff and student numbers are sourced from ABS (2024). Total spending from Productivity Commission (2025).

Develop new, detailed national guidance on primary maths teaching

We have estimated that it would cost about $6.4 million over four years ($1.6 million per year) to produce comprehensive practice guidance for primary school maths.

Our costs for producing one suite of practice guidance are based on the $US2 million cost to produce the US Institute of Education Sciences' practice guidelines.

We assume the Australian Education Research Organisation (AERO) produces two sets of practice guidance for primary school maths – one set for Tier 1 practices, and one set for Tier 2 and 3 practices.

Independently quality-assure curriculum materials

We have estimated that a $60 million endowment would be sufficient to establish and operate an independent curriculum materials quality-assurance body for the next 20 years.[227]

Given there is demand for high-quality curriculum materials across subject areas, this body would be designed to quality-assure materials across primary and secondary Maths, Science, Humanities, and English.

We assume a board would oversee the establishment of the quality-assurance body.

Staff employed by the body would include a chief executive officer, a chief academic officer, a business manager, a communications manager, and subject and deputy subject leads for subject areas (e.g. Maths), alongside other administrative roles.

227. We estimate that a smaller start-up endowment of $24 million would cover a six-year establishment phase for such a body.

Over its first six years of operation, the body would expand to conduct reviews across primary and secondary Maths, Science, Humanities, and English.

Review teams would include one paid subject advisor and practising teachers, who would receive training and be paid a small stipend.

And we assume that at full capacity, review teams would be able to complete 32 reviews per year.

Commission new research on maths interventions and assessments

We estimate it would cost $20 million over four years ($5 million per year) for about 20 new research projects and trials into:

- The effectiveness of maths assessments, interventions, and digital education applications
- The validity of a national early years numeracy screener
- The effectiveness of primary schools having maths taught by a dedicated maths teacher.

We estimate trials would cost on average about $850,000.[228] The cost would include training, time release and program costs for schools, and evaluation costs. Actual trial costs would vary, depending on factors such as research methods, trial length, and sample size.

Establish Primary Maths Hubs

We recommend that 50 Primary Maths Hubs be established across Australia. We estimate it would cost about $930,000 per year to run one Maths Hub. Once fully established, the Maths Hubs would cost about $208 million over four years (or about $52 million per year), which includes $10 million for high-quality, public evaluations of the program.

228. The total $20 million accounts for 20 trials and a $3 million contingency.

Collectively, Maths Hubs would provide intensive support to 1,500 schools per year. This would enable every Australian primary school to participate in the Maths Hub program within 11 years.

The following assumptions underpin our calculations:

- Each Primary Maths Hub would be located at and run by an existing primary school. The Hub would use the school's existing buildings to deliver professional development, and draw on existing school administrative staff for some functions.
- Staff employed to work at the Maths Hub would include a Primary Maths Hub Lead, a Lead Primary Maths Specialist, and a team of Maths Specialist coaches.[229]
- At full-scale, there would be 50 Primary Maths Hubs across Australia, each providing intensive partner support to about 30 primary schools at any one time.
- Professional development provided by Hubs would be free for all schools. Any time-release costs required would be covered by participating schools.
- For intensive partner support, a Maths Specialist would work with a school intensively for two years. One full-time Primary Maths Specialist would provide intensive support to a portfolio of 10 schools at once.
- Maths Hubs would serve schools across sectors. Our estimates are conservative because they do not include any cost recovery (i.e. we have assumed non-government schools and school systems would not pay for Hub support).

229. Maths Specialists are coordinators and coaches that provide training to teachers and intensive support to partner schools.

- We have assumed a minimum of two Hubs in every state, even where that means they support fewer than 150 schools. Because of their unique contexts and remote schools, we have costed three hubs each for the Northern Territory and Tasmania (they would only have one and two hubs respectively if we had applied a 1:150 hub-to-schools ratio).

Design and delivery of quality-assured micro-credentials

We estimate it would cost about $70 million over four years ($17.5 million per annum) for the design and delivery of national, quality-assured micro-credentials. This is made up of about $2.25 million for design, $24.5 million for delivery, $40 million for incentive payments and $3.25 million for evaluation.

The following assumptions underpin this calculation:

- The three micro-credentials would include 80 hours of course content per year, involving a mix of in-person, live online, and pre-recorded on-demand delivery.
- Design of the courses would be done at a national level, with trained partners delivering the course at a state-level.
- Delivery costs would include training for delivery partners, preparation time for delivery providers, travel costs, and time spent grading participants' end-of-course assessment tasks.
- Course content would be quality-assured, and course delivery reviewed to ensure effectiveness.
- Each year, 3,000 micro-credentials (or an equivalent number of modules) would be completed.
- A $2,000 bursary would be offered to individuals completing a micro-credential, and a $1,000 bursary to their school, to

encourage participation. Federal government bursaries would be capped at $10 million per year for four years. Additional allowances could be offered to rural and remote participants.

- The federal government would fund the micro-credentials' design, the bursaries, 25 per cent of the delivery costs, and the independent evaluation. State and territory governments would fund the remaining delivery costs. Our estimates do not account for costs to states and territories if they choose to make local adaptations to the national micro-credentials' design.

Select, train, and deploy primary maths Master Teachers

We estimate the cost of selecting, training, and deploying Primary Maths Master Teachers and Principal Primary Maths Master Teachers would be about $72 million over four years (about $18 million per year).

The following assumptions underpin this calculation:

- Primary Maths Master Teachers would be paid about $232,000 per annum.[230]
- Principal Primary Maths Master Teachers would be paid $250,000 per annum.
- Selection and training costs would be equivalent to 20 per cent of these salaries.
- There would be one Principal Primary Maths Master Teacher per jurisdiction.
- We assume there would be 150 Primary Maths Master Teachers across the country.

Increase the rigour of school reviews

We estimate that the cost of more rigorous primary school reviews would be roughly $174 million over four years (about $43.5 million per year). We expect each review would cost about $21,500.

The following assumptions underpin this calculation:

- We include all primary and combined schools (those with both primary and secondary year levels) in our calculation. Secondary schools are not included.
- Reviews are completed by a team of three trained and experienced reviewers who are employed on a casual basis.
- Reviews take four days.
- Schools are reviewed every four years.
- A sample of reviews are audited to ensure consistency.
- We did not specifically account for travel to remote schools, but we have factored in 25 per cent in non-salary overheads and a 15 per cent contingency to cover some indirect costs such as travel.
- Our estimates are probably conservative, because some of the estimated costs may be offset by re-purposing existing spending on school reviews.

230. Based on applying superannuation and wage inflation to the $180,000 base salary recommended in Goss and Sonnemann (2020).

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