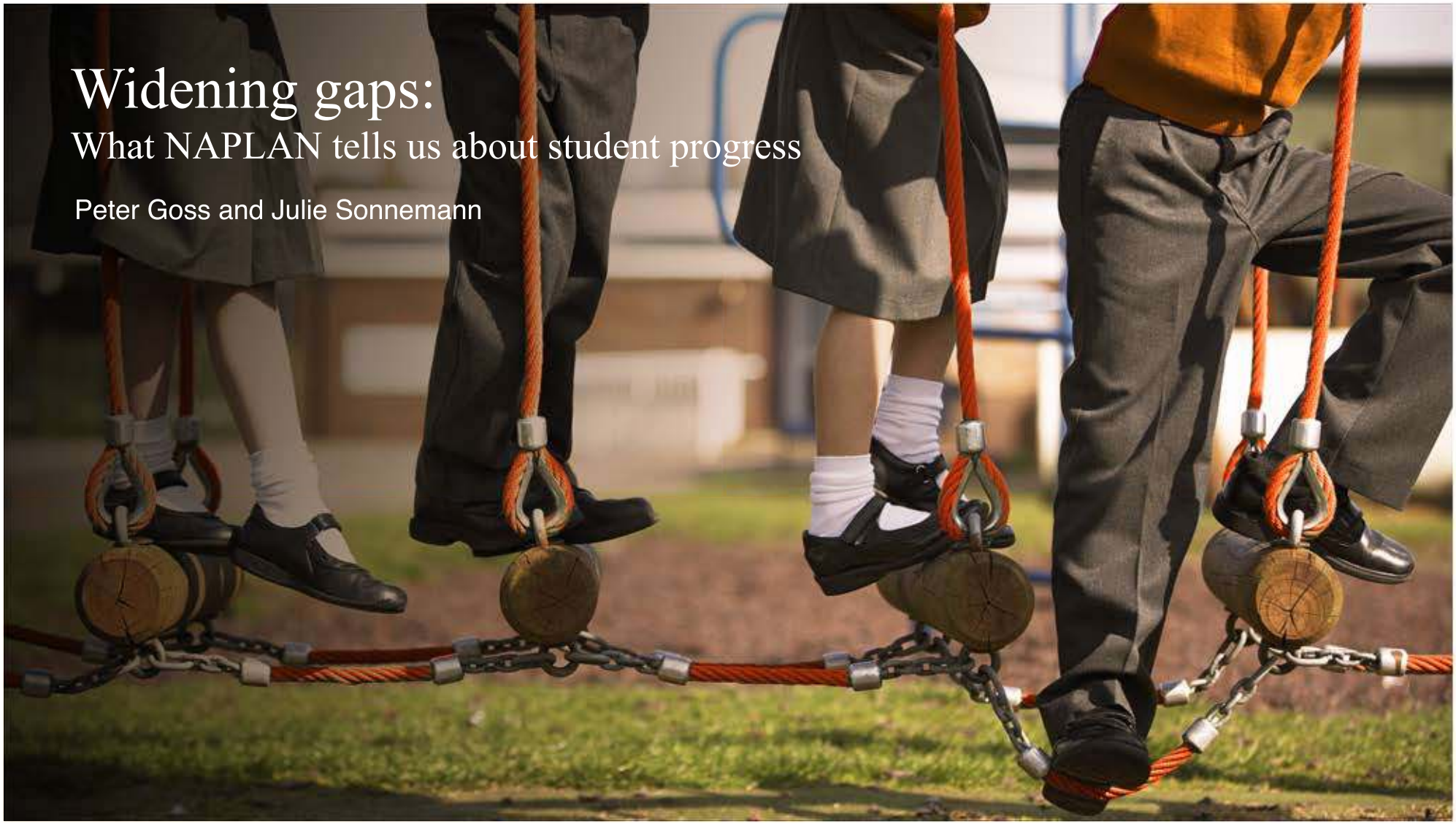
GRATTAN Institute

March 2016

Widening gaps:

What NAPLAN tells us about student progress

Peter Goss and Julie Sonnemann



Grattan Institute Support

Founding Members

Australian Government

VICTORIA

THE UNIVERSITY OF MELBOURNE

bhpbilliton resourcing the future

Program Support

Higher Education Program

THE MYER FOUNDATION

Affiliate Partners

Google
Origin Foundation
Medibank Private

Senior Affiliates

EY
PwC
The Scanlon Foundation
Wesfarmers

Affiliates

Ashurst
Corrs
Deloitte
GE ANZ
Urbis
Westpac

Grattan Institute Report No. 2016-3, March 2016

This report was written by Dr Pete Goss, Grattan Institute School Education Program Director and Julie Sonnemann, School Education Fellow. Jordana Hunter, School Education Fellow, Cameron Chisholm, Senior Associate and Lucy Nelson, Associate, provided extensive research assistance and made substantial contributions to the report.

We would like to thank the members of Grattan Institute's School Education Program Reference Group for their helpful comments, as well as numerous industry participants and officials for their input.

The opinions in this report are those of the authors and do not necessarily represent the views of Grattan Institute's founding members, affiliates, individual board members reference group members or reviewers. Any remaining errors or omissions are the responsibility of the authors.

Grattan Institute is an independent think-tank focused on Australian public policy. Our work is independent, practical and rigorous. We aim to improve policy outcomes by engaging with both decision-makers and the community.

For further information on the Institute's programs, or to join our mailing list, please go to: http://www.grattan.edu.au/

This report may be cited as:
Goss, P., Sonnemann, J., Chisholm, C., Nelson, L., 2016, Widening gaps: what NAPLAN tells us about student progress, Grattan Institute

ISBN: 978-1-925015-82-9

Overview

NAPLAN – Australia's first national test of literacy and numeracy – is a powerful tool. It allows policymakers to measure students' achievement in core literacy and numeracy skills. It provides data on the progress students make as they move through school.

But it is hard to compare different groups of students using the NAPLAN scale. If students in remote areas score 40 NAPLAN points below their inner-city peers, what does this mean? Are they one year behind, or two? Does a 40-point gap even mean the same thing in Year 7 as it does in Year 5 or 9?

The way we measure learning progress is vitally important. Without meaningful comparisons, we can lose sight of how far behind some students really are.

New analysis in this report shows that learning gaps widen alarmingly as students move through school. By Year 9, the spread of achievement spans eight years. NAPLAN's minimum standards are set too low to identify the stragglers. A Year 9 student meets the minimum standard even if they are reading below the level of a typical Year 5 student.

Many of those falling behind have parents with low levels of education. The gap between children of parents with low and high education grows from 10 months in Year 3 to more than two years by Year 9. Even if they were doing as well in Year 3, disadvantaged students make one to two years less progress. Bright kids in disadvantaged schools show the biggest losses.

Importantly, the learning gaps grow much larger after Year 3. Disadvantaged students are falling further behind each year they are at school, on our watch.

These gaps matter. Achievement in Year 9 is a strong predictor of success in study and work later on. A good school education helps a young person stand on their own two feet as an adult, and the benefits ripple through future generations.

Our findings use a new time-based measure, 'years of progress', which makes it easier to compare different groups of students. Rather than say a group of Year 5 students scored 540 in NAPLAN, we can say they achieved two years ahead of their peers.

This resembles the approach used in cycling road races, where gaps between riders are measured in minutes and seconds, not metres. Time gaps between riders are more meaningful than distance if some are on the flat, while others are grinding up a hill.

The new measure does not mean the NAPLAN scale has to change: indeed, it relies on NAPLAN. But it does make the data easier to interpret. It also allows policymakers to compare students' progress at different stages in their learning. Policymakers can identify which groups of students are making slow progress, and set system-wide priorities accordingly.

Policymakers should act on these findings. Student progress and learning gaps should be put at the centre of education policy. In light of the large spread in achievement, policymakers should give schools better support to target teaching to each child's needs.

And, given the very large gaps, policy leaders must work harder to improve the progress of disadvantaged students so that every child in every school can achieve their potential.

Key findings

Converting NAPLAN data into *years of progress* provides striking insight into relative learning progress between Year 3 and Year 9. While most findings are based on Victorian students, the patterns of widening gaps have national relevance. [1]

The spread of student achievement (Chapter 3)

The spread of student achievement more than doubles as students move through school in Australia. The middle 60 per cent of students in Year 3 are working within a two-and-a-half year range. By Year 9, the spread for these students is five-and-a-half years. The top ten per cent of students are about eight years ahead of the bottom ten per cent.

NAPLAN national minimum standards (NMS) are set *very* low. A Year 9 student can meet NMS even if they are performing below the typical Year 5 student. They can be a stunning four years behind their peers.

Low achieving students fall ever further back. Low achievers in Year 3 are an extra year behind high achievers by Year 9. They are two years eight months behind in Year 3, and three years eight months behind by Year 9.

Educationally disadvantaged students (Chapter 4)

Students of parents with low education fall *very* far behind. The gap to students whose parents have a degree is ten months in Year 3 but two and a half years by Year 9.

Most of this learning gap develops between Year 3 and Year 9, not before Year 3. The gap that exists in Year 3 (ten months) triples by Year 9 (thirty months).

Even when capabilities are similar in Year 3, disadvantaged students fall between 12 months and 21 months behind more advantaged students by Year 9.

These patterns play out geographically. Students in low socio-economic areas start behind, and make less progress in school. Many regional and rural students make up to two years less progress than students in inner city areas between Year 3 and 9.

Students who attend disadvantaged schools (Chapter 4)

Students in disadvantaged schools make around two years less progress between Year 3 and Year 9 than similarly capable students in high advantage schools.

Bright students in disadvantaged schools show the biggest learning gap. High achievers in Year 3 make about two-and-a-half years less progress by Year 9 if they attend a disadvantaged school rather than a high advantage school. In fact, high achievers in disadvantaged schools make *less* progress than low achievers in high advantage schools over the six years.

[1] Preliminary analysis suggests that most patterns in the Victorian data are evident nationally. Data includes both government and non-government schools.

Summary of policy recommendations

Recommendation 1: Put analysis of relative student progress and learning gaps at the centre of the policy agenda and use it to target policy and resources more effectively

1a. Policy makers should adopt Grattan's new *'years of progress'* approach to better understand relative student progress and learning gaps.

1b. Use analysis of relative student progress to inform system priorities, resource allocation and needs-based funding policies.

1c. Education departments should continue to link up student data, and implement a national student identification mechanism.

Recommendation 2: In light of the very large spread in student achievement, implement better systematic support for targeted teaching so that all students make good learning progress, regardless of their starting point

2a. Strengthen system-wide policies around targeted teaching and provide practical support, with an emphasis on giving teachers *time*, *tools* and *training*.

2b. Either raise the NAPLAN national minimum standard or remove it entirely. Lift the bar to focus on proficiency.

Recommendation 3: Given the very large gaps that open up by Year 9, increase efforts to lift the progress of disadvantaged students

3a. Make it a priority to increase the rate of learning progress of educationally disadvantaged students, especially low performers. Start early but also provide ongoing support:

- give all students at least one year of quality pre-primary education
- target teaching from the first week of primary so students have strong foundational skills by the end of Year 3
- continue to support progress after Year 3, providing remedial support as early as possible
- involve various government and non-government bodies
- given new findings, do more analysis that isolates the impact of schools to identify what works and why.

3b. Strengthen support for bright students whose parents have low levels of education.

3c. As a priority, the Education Council should initiate and oversee a coordinated national review of the quality and effectiveness of school education for disadvantaged students.

Table of contents

Overview 1

Key findings 2

Summary of policy recommendations 3

List of Figures 5

1 Measuring student progress is important 6

2 A new way to compare student progress using NAPLAN data 12

3 The spread in achievement widens dramatically as students progress through school 18

4 Students whose parents have low education fall very far behind 25

5 Closing the gaps would generate big economic benefits 33

6 What policymakers should do 40

Glossary 48

Appendices 50

References 57

List of Figures

Figure 1: Higher performing countries have fewer low achieving and more high achieving students than Australia 7
Figure 2: NAPLAN scale scores suggest remote students are closing the gap, but the gap in years shows the opposite 11
Figure 3: In cycling, it is better to estimate gaps using time rather than distance 12
Figure 4: NAPLAN scale scores are converted to *equivalent year levels* along the estimated student growth trajectory 13
Figure 5: NAPLAN scale scores suggest the spread stays constant, but *equivalent year levels* shows it is increasing 19
Figure 6: Many students are performing several years ahead or behind the median for their year level 19
Figure 7: NAPLAN gain scores can be misinterpreted to suggest low achievers in Year 3 start catching up 21
Figure 8: In fact, low achievers fall further behind by Year 9 if *equivalent year levels* are used 21
Figure 9: National minimum standards are set very low 23
Figure 10: The gap between students with low and high levels of parental education grows alarmingly between Year 3 - 9 26
Figure 11: From the same Year 3 score, students of parents with low education make much less progress to Year 9 27
Figure 12: Fewer low-SES Australian students perform at the highest levels of achievement than a decade ago 28
Figure 13: Students in disadvantaged schools fall very far behind between Year 3 and Year 9 29
Figure 14: From the same Year 3 score, students in disadvantaged schools make much less progress to Year 9 30
Figure 15: Inner-city students make the most learning progress 32
Figure 16: Average school advantage is higher in inner-city areas 32
Figure 17: New Zealand analysis shows the high cost to the state of individuals with no formal qualifications 35
Figure 18: Metropolitan students gain more points between NAPLAN tests than remote students with the same starting score 50
Figure 19: Learning curves and percentiles, numeracy 54
Figure 20: Learning curves and percentiles, reading 54
Figure 21: In a typical school, *equivalent year levels* show that the spread of achievement is increasing 55
Figure 22: Gain scores could be interpreted to show low achievers whose parents have low education making more progress 56
Figure 23: Our new measure shows the opposite: high achievers from whose parents have high education make more progress 56

1 Measuring student progress is important

1.1 Literacy and numeracy matter

The literacy and numeracy skills students attain by Year 9 will substantially affect their life outcomes. Low achievement can limit options for further study and work later on.[2] Poor educational results are linked with higher risks of unemployment and lower lifetime earnings.[3]

Low achievement at school can be part of a cycle of inter-generational disadvantage. A student whose parents are poorly educated, unemployed or of low occupational status is less likely to do well at school, as discussed in Box 1.[4] Low achievement in turn reduces a student's chances of completing secondary school and obtaining a tertiary education, and affects future employment prospects. Down the track, adults' own low levels of education affect the learning outcomes of their children. The cycle goes on.

A quality education enables all individuals to improve their socio-economic situation on the basis of merit, not circumstance. An effective education system maximises the potential of every student. It sets and supports high expectations for all learners.

Successful schooling is vital for low achievers, who will struggle in life if they do not build strong educational foundations in school. Education has been shown to impact positively on self-reported health outcomes as well as community engagement and likelihood of volunteering. Society also benefits from higher levels of education, which are linked to greater tolerance towards people of different cultures and social cohesion generally.[5]

Making good progress at school is just as relevant for high achievers. These students have potential to reach great heights, and Australia's ability to innovate depends on them.

Box 1: New NAPLAN findings around cycles of disadvantage

While many studies show that student achievement is strongly related to parental education, occupation and employment status, there is little research done in Australia using National Assessment Program – Literacy and Numeracy (NAPLAN) data. However one recent study by the Australian Bureau of Statistics (ABS) on Tasmanian students shows disturbing patterns:

- Students with no parent employed are more than twice as likely to achieve below NAPLAN national minimum standards than those with at least one parent employed.
- Children of workers in less skilled occupations are five to seven times more likely to achieve below national minimum standards than children of more highly skilled parents.
- Most Tasmanian students who achieve at or below NAPLAN national minimum standards left school early. Four years later, about one in three were not engaged in work or study.

Source: ABS (2014a)

[2] OECD (2014a), p. 252
[3] Leigh (2010); Cassells, *et al.* (2012); ABS (2014a)
[4] ABS (2014b)
[5] *Grattan Institute* report Norton (2012)

1.2 Our school system must do more for low *and* high achievers

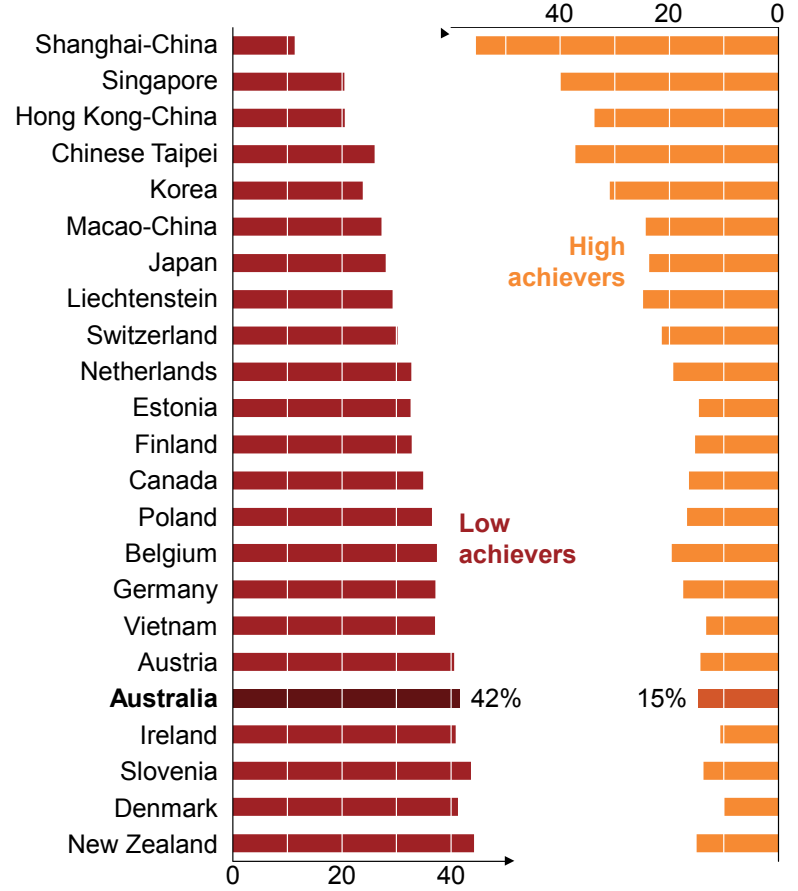
Low parental education and other social factors can hold students back, but a young person's background should not determine their future. Schools across Australia are working with parents, communities and schools systems to break the cycles of disadvantage. Some are having real and sustained success.

Yet Australia can do a lot more to lift the performance of every student, particularly those at the bottom and top end of student achievement. Almost every higher performing country in the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment (PISA) has fewer low achievers and more high achievers than Australia at age 15 (see Figure 1).

Further, Australia's performance in these areas has worsened between 2003 and 2012. Australia's proportion of low performers in mathematics grew by a third, while our proportion of high achievers dropped by a quarter.[6] This trend is indicative of a broader overall decline in Australia's PISA track record. Since 2000 and 2003, Australia's overall performance dropped by a significant 16 PISA points in literacy and 20 PISA points in mathematics.

But change is possible. Poland is a good example where impressive progress has been made. Between 2003 and 2012, Poland increased the proportion of high performers in PISA mathematics, reduced the proportion of low performers, and increased its average by 27 points.[7]

Figure 1: Higher performing countries have fewer low achieving and more high achieving students than Australia
Percentage of students by PISA proficiency level, mathematics, 2012



Notes: Countries ordered by mean score in PISA in maths 2012. Low proficiency below level 1, level 1 and level 2, and high proficiency levels 5 and 6 in PISA.
Source: OECD (2014b), Table I.2.1a and Table I.2.3a

[6] See OECD (2014a) p. 70 Figure I.2.23.
[7] Ibid. Poland now outperforms Australia in maths, and is on par in literacy.

1.3 Success at school is all about learning progress

The best way to improve achievement is to focus on individual learning progress.[8] Understanding student learning growth, not just achievement, is important.[9] Student progress measures tell us how much students improve from one year to the next. Students who fall behind will never start to close the gap unless their rate of learning accelerates.

When policymakers can track student progress they can see which groups of students are thriving and which are struggling. It helps them answer relative questions such as:

- Are low achieving students catching up to their peers?
- Are high achievers being stretched enough?
- How do different groups of students progress with time, for example, with different family circumstance, gender, or geographical location?
- Is progress different in different types of schools, and at specific stages of schooling?

Comparing how some students progress relative to others is an important lens. Without relative comparisons, we can lose sight of how far behind some students are. All students operate on the same playing field for further study and work once they leave school. Those who fail to reach their potential can miss out on important opportunities in life.

Measuring student progress is important as it enables policymakers to see how students are progressing across the system. This data should influence how priorities are set, and where resources are allocated. Those who are making the least progress, or those who are failing to reach their potential, should be the focus of our policy efforts.

1.4 NAPLAN is a great first step towards analysing progress

NAPLAN data opens up unprecedented opportunities to understand student progress. It is the first national longitudinal comprehensive dataset of its kind in Australia, and one of the few in the world.

Since 2014, NAPLAN data has become available for full cohorts of students who have completed all four tests: Year 3, Year 5, Year 7 and Year 9.[10] We can now track how students perform from Year 3 to Year 9 to assess whether their progress is adequate given early indications of potential.

A key feature of NAPLAN is that scores can be compared across tests sat in Years 3, 5, 7 and 9, and over time, through a common scale. For example, a student who took the Year 5 NAPLAN reading test in 2012 and scored 500 is assumed to be reading at

[8] See Grattan Institute's report *Targeted Teaching,* Goss*, et al.* (2015).
[9] See Grattan Institute's report *Student Progress,* Jensen (2010).

[10] There are now two full sets of NAPLAN student cohort data, for students who completed Year 3 to Year 9 between 2008-14 and 2009-15.

Box 2: What is NAPLAN?

In 2008 the National Assessment Program – Literacy and Numeracy (NAPLAN) was introduced as an annual test for Year 3, 5, 7 and 9 students. Testing covers four domains: Reading, Writing, Language Conventions (spelling, grammar and punctuation) and Numeracy.[11] It provides a standardised measure of student achievement around the country.

The test provides each student with a NAPLAN 'scale score', which is an estimate of student ability at a given point in time. Scale scores typically range from 0 to 1000, and are organised into 10 NAPLAN proficiency bands.

From 2017, *NAPLAN Online* will be introduced. It will include adaptive 'branch testing' where the difficulty of questions are adjusted depending on whether students are struggling or under-challenged. Through more precise testing, this feature helps elicit more accurate information on what students can do. The results of NAPLAN online will also be available to teachers sooner after the test.

For policymakers and researchers, one of the big benefits of NAPLAN Online is that the measurement error will decrease, especially for low performing and high performing students. The adaptive testing process means that more of the questions faced will be at an appropriate level. Currently, most questions in NAPLAN are aimed at the middle, rather than the top or bottom.

[11] ACARA (2013b)

the equivalent level[12] of a student who took the Year 7 reading test in 2013 and received the same scale score.[13]

NAPLAN does not test everything, but the things it does test matter. A study by the ABS shows that NAPLAN scores in Year 9 are a strong predictor of high school completion as well as success after school in study and work.[14] This means NAPLAN data can now be used to identify certain groups of students who are struggling early on in school, before low performance becomes entrenched.

Importantly, NAPLAN can also help show which policies and practices are working, and whether system settings are right.

1.5 But it is not easy to compare progress with existing NAPLAN measures

While NAPLAN provides invaluable data, something has been lost in policy discussions around student progress using NAPLAN scale scores. If remote Year 7 students are 40 NAPLAN points behind their metropolitan peers, what does this actually mean? Are they one year behind, or two years, or more? And does 40 points behind at Year 7 mean the same thing as at Year 5 or 9?

This is not a technical quibble: without meaningful comparisons, we lose sight of how far behind some students really are.

[12] That is, the students are demonstrating equivalent skills in the areas tested by NAPLAN. Whenever we talk about student achievement in this report it is in reference to the skills tested in NAPLAN.
[13] This assumption becomes more problematic for very high or very low scores, since the number of relevant questions is small and measurement error is high.
[14] ABS (2014a); see also Houng and Justman (2014)

It would be easy to make these comparisons if students gained NAPLAN scores at a steady pace as they moved through school. But they do not. The Australian Curriculum, Assessment and Reporting Authority (ACARA) notes that:

> *students generally show greater gains in literacy and numeracy in the earlier years than in the later years of schooling, and that students who start with lower NAPLAN scores tend to make greater gains over time than those who start with higher NAPLAN scores.* [15]

NAPLAN is a very sophisticated testing system, yet this non-linear growth curve makes it hard to compare gaps between different groups of students, or their learning progress. It is especially difficult to compare students of different backgrounds, who are likely to be at very different scores on the curve (in other words, at different stages of their learning), even though they are the same age and in the same year level.

1.6 NAPLAN gain scores do not show the full picture

'Gain scores' are the difference in NAPLAN scale scores between two points in time. They measure student progress in NAPLAN points, but need to be interpreted very carefully.[16]

In particular, gain scores have limitations when policymakers want to compare different groups of students from different starting points (i.e. answer questions of relative progress). In these cases, a face-value interpretation of gain scores can suggest students are catching up when they are actually falling further behind. [17]

The challenges can be illustrated using a real example, by comparing the progress of kids from the bush with kids from the city. Figure 2 shows two charts with identical data comparing the progress of remote and metropolitan students between Year 3 and Year 9. The chart on the left hand side shows the gap in gain scores, the chart on the right hand side shows the gap in time.

In NAPLAN points, the gap between remote students and metro students decreases with time, from 56 NAPLAN points in Year 3 to 38 points in Year 9. Looked at in another way, as shown in the table at the bottom of Figure 2, remote students make larger gains in NAPLAN between Year 3 and Year 9 (+185 points) than metropolitan students (+168 points).

But this should not be misinterpreted to mean that remote students are catching up to metropolitan students in a broader learning sense. Looking at the gap in years and months of learning (right hand side), it is clear that this gap gets wider over time. Remote students are 1 year 3 months behind in Year 5, and this gap grows to 2 years behind by Year 9. They are falling further behind.[18]

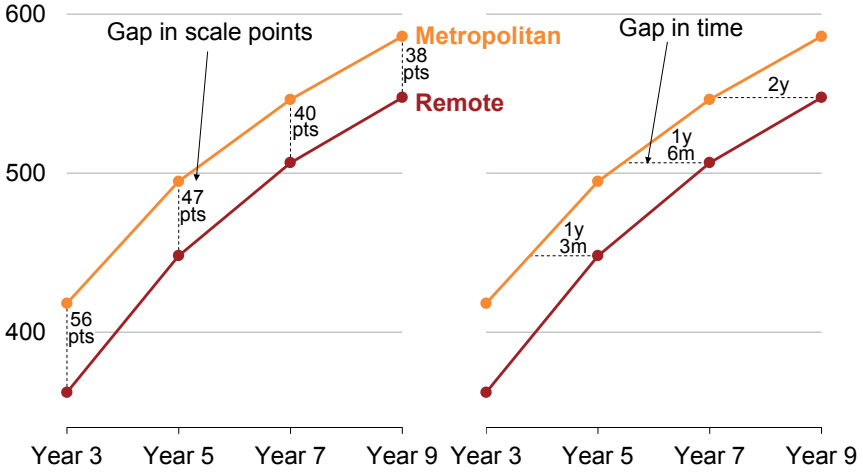
[15] ACARA (2016a) p.5.

[16] For example, a group of students with a 30 point gain over two years could be falling relative to their peers (their percentile ranking in the population decreasing), keeping pace (percentile ranking steady) or advancing (percentile ranking increasing). Without knowing the NAPLAN starting score it is impossible to know. The Victorian Curriculum and Assessment Authority (VCAA) 'relative growth measure' is designed to address just this issue VCAA (2012). For a description of the various measures used in NAPLAN data see Appendix 2.

[17] 'Face-value interpretation' refers to an interpretation that more gain points means better learning progress in a broader sense than NAPLAN points.

[18] This interpretation can be confirmed by looking at the average gain scores for remote and metropolitan students with the same Year 3 scores. Metro students consistently gain more points between successive NAPLAN tests than

Figure 2: NAPLAN scale scores suggest remote students are closing the gap, but the gap in years shows the opposite
NAPLAN scale scores, reading, Australian students, 2014



Gain scores

	Yr 3 – 5	Yr 5 – 7	Yr 7 – 9	Yr 3 – 9
Metro	+77	+51	+40	+168
Remote	+86	+58	+41	+185

Notes: points on both charts are identical.
Source: Grattan analysis of ACARA (2014b)

1.7 How this report is structured

This chapter emphasises why a new measure of relative student progress in NAPLAN is needed, and how this can change what we see in the results.

Chapter 2 proposes a new way to use NAPLAN data to compare the progress made by very different groups of students.

In Chapters 3 and 4, the new approach is applied to the data, revealing a striking picture of student performance. There is a remarkably wide spread of achievement in every year level, and a learning gap that widens between Year 3 and Year 9. Students whose parents have low levels of education are much further behind than most people may realise.

Chapter 5 discusses the loss to individuals and the economy from the dramatic learning gaps that open up between Years 3 and 9.

Chapter 6 summarises our policy recommendations.

comparably capable remote students, whatever the starting score (chart provided in Appendix 1).

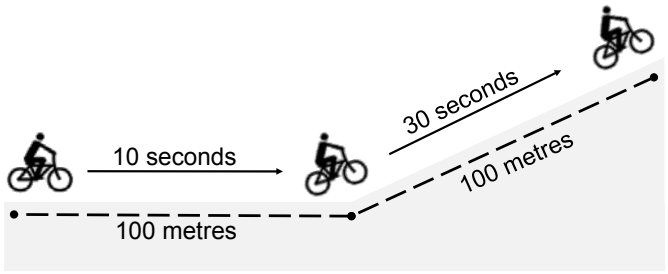
2 A new way to compare student progress using NAPLAN data

This chapter establishes a new time-based measure, *years of progress,* to compare relative student performance. The measure estimates what a year of learning progress looks like on the NAPLAN scale.

2.1 It's time that matters most, not distance

Imagine a cycling road race. To gauge the gap between a rider and the main pack, we talk about *minutes and seconds*, not *distance*. That's because while a gap of 100 metres might not look like much, it really depends on the terrain. On the flat it might take 10 seconds; on a hill it might take 30 seconds (see Figure 3).

Figure 3: In cycling, it is better to estimate gaps using time rather than distance



Differences in NAPLAN scores are like a measure of distance rather than time. This would not matter if growth along the NAPLAN scale was steady. But it is not. For example, it typically takes less time to go from a score of 400 to 450 in NAPLAN than from a score of 550 to 600. It is as though the NAPLAN 'road' gets steeper as students learn more.[19]

To extend the cycling analogy: students at low achievement levels in NAPLAN are on the flat and riding fast (big gain scores), while those at high achievement levels are on a steep hill and riding slowly (small gain scores). But riding faster on a flatter road does not necessarily mean riding better. When those on the flat hit the hills, they too will slow down. So distance alone does not tell us how well a rider is really doing; more information is needed.

This non-linearity makes it hard to compare the relative progress of different groups of students, since both gain scores (speed) and prior NAPLAN scores (terrain) need to be taken into account.

2.2 Benchmarking progress to the typical student

To address this limitation we create a new measure, *years of progress,* which benchmarks student performance in NAPLAN to the typical student. It allows us to see if students are catching up or falling further behind relative to others.[20]

For example, instead of saying that a group of Year 5 students are achieving at a NAPLAN score of 540, we can now say they are achieving in Year 5 what the typical student would achieve in

[19] This pattern is consistent across NAPLAN domains, year levels and for students from different backgrounds.
[20] To limit the effect of measurement error, both this discussion and our proposed methodology focus on large groups of students rather than individual students.

Year 7. In other words, they are two years in front of the typical Year 5 student.

To create the new approach, we use national NAPLAN data to estimate the growth trajectory of the typical student (Figure 4).[21] NAPLAN scale scores are mapped onto the typical student's growth pathway across the schooling years. Based on this curve, we define a first measure:

1. *Equivalent year level* (EYL): the year level in which the typical student would be expected to achieve a given NAPLAN score.

By comparing two NAPLAN scores in this way, we can deduce a second measure:

2. *Years of progress*: the years and months of learning it would take the typical student to move from one NAPLAN score to another. It estimates the difference between *equivalent year levels* at two different points in time.

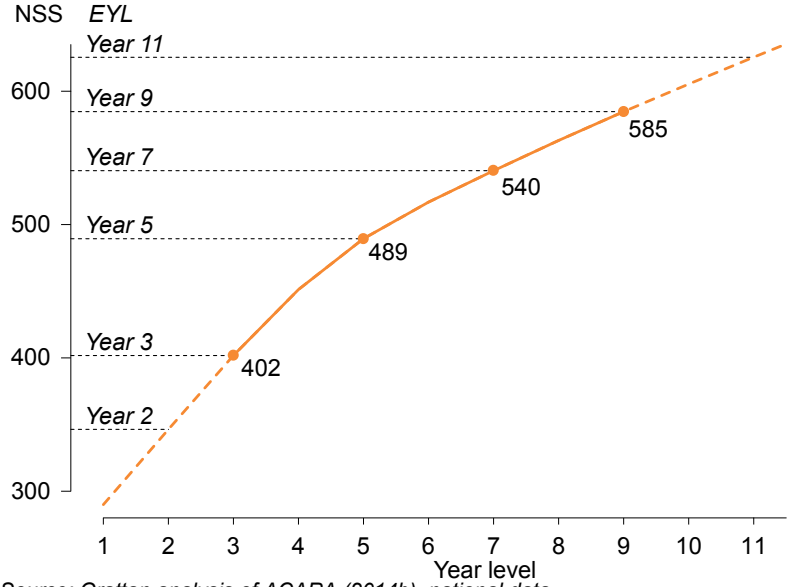
Table 1 summarises how our two new measures relate to existing NAPLAN measures.[22] More detail on the methodology and assumptions are described in the *Technical Report*.

[21] The curve is anchored using the observed median student achievement in Years 3, 5, 7, and 9. The curve is smoothed between these points. Outside of Year 3 to 9 the curve is estimated using a regression based on students who fall outside of the median Year 3 and Year 9 scores. Data from all states and territories is used. See the *Technical Report* for details. Goss and Chisholm (2016)

[22] Further information is available in the Appendices on; the conversion of NAPLAN scale points to EYL (Appendix 3); cut points for NSS and EYL (Appendix 4); and the observed learning curve and percentiles (Appendix 5).

Figure 4: NAPLAN scale scores are converted to *equivalent year levels* along the estimated student growth trajectory

Estimated median NAPLAN scale score (NSS) by year level, numeracy, Australian students, 2014



Source: Grattan analysis of ACARA (2014b), national data.

Table 1: Two new NAPLAN measures proposed in this report

Concept	NAPLAN measure	Proposed new measure
Achievement	**Scale score:** the NAPLAN score a student receives in a given test	**Equivalent year level (EYL):** the year level at which a typical student would be expected to achieve a given scale score
Progress	**Gain score:** the difference in NAPLAN scores between two points in time	**Years of progress:** the difference in years and months between *equivalent year levels* across two points in time

Examples of new interpretations now possible

Four illustrative examples of how the new measures change our interpretation of NAPLAN are shown in Table 2. It shows the progress of four groups of students between Year 5 and 7 and how simply their performance can now be compared.

Group A made the best progress; making three years of learning progress between Years 5 and 7. Next is Group D, which made two years and three months of progress over the same time period. This group made better than average progress from a lower base and partly closed the gap to their peers. Group B is next in order – they are well behind but kept pace with their cohort, making two years of progress over the period. Group C made the worst progress of only one year and eight months and dropped further behind their cohort.

Table 2: Four illustrative examples showing who makes the most progress between Year 5 to 7 using *years of progress*

Group	*Equivalent year level* in Year 5	*Equivalent year level* in Year 7	*Years of progress* from Year 5 -7
A	Year 5	Year 8	**+3Y 0m**
B	Year 3	Year 5	**+2Y 0m**
C	Year 4 month 8	Year 6 month 4	**+1Y 8m**
D	Year 4 month 1	Year 6 month 4	**+2Y 3m**

Note: years of progress is defined in terms of years and months. For example +3Y 0m refers to three years and zero months of progress.

By benchmarking all groups to the typical student we can compare how well they are progressing relative to each other. This is the case even when they have different starting points.

The new measure shows us observed progress, without trying to account for different characteristics that might influence expected rates of learning. It helps us see 'what is' more clearly.

2.3 Benefits of the new approach

Because growth is not linear in NAPLAN scores, gain scores cannot be directly used to compare the relative learning progress of different groups of students. This is true especially of student groups who are at different parts of the growth curve.

Several mechanisms have been developed to avoid this limitation. For example, *My School* allows comparisons of school-level gain scores for students with the same starting scores, as well as comparisons to schools with similar students.[23] The Victorian Curriculum and Assessment Authority (VCAA) created a relative growth measure that restricts gain score comparisons to students with the same starting scores.[24]

Our approach removes this restriction. As noted above, the *years of progress* measure allows comparison of relative progress from *different* starting scores. This is especially valuable for policymakers involved in resource allocation or balancing priorities across the system.

In addition, the new measure shows the rate of progress and the scale of gaps in a way that is intuitive and tangible. Understanding what a *'year of progress'* looks like is accessible to policymakers when setting system priorities.

[23] See www.myschool.edu.au.
[24] VCAA (2012). An explanation of relative growth measures and other NAPLAN reporting measures are included in Appendix 2.

Lastly, our metrics are based on the growth curve of the typical student using national data. When state-level data on student progress is benchmarked against this, it provides insights into how progress at the state level compares to national trends.

2.4 How new is our proposed approach?

The concept of comparing student performance in years and months of learning is not new. Internationally, the OECD expresses differences in PISA scores in years and months of schooling when comparing the performance of different groups of students, states and territories and different countries.[25] While this measure shows meaningful comparisons at age 15, it does not show the progress of the same students over time now possible with NAPLAN data.

The NSW Centre for Education Statistics and Evaluation (CESE) has introduced a value-added modelling technique using years and months of learning gain. This measure accounts for non-linearity in NAPLAN scores but is used for the purpose of understanding school effectiveness – a different focus to the new measures suggested here.[26]

There is also an established concept of 'grade equivalent scales', which has similarities to our *equivalent year level* metric.[27] Our method builds on this approach but uses different statistical techniques to improve the accuracy of estimates, particularly in how we estimate *equivalent year levels* below Year 3 and above Year 9.[28] Importantly, we apply our measure in a way designed to avoid the key limitations of grade equivalent scales; in particular we avoid comparisons at the individual student level.[29]

2.5 Don't change the NAPLAN scale

Our proposed new measures should not be taken to imply that the NAPLAN scale is wrong or should be changed – indeed, our approach would not be possible without it. NAPLAN scale scores have been developed using the Rasch model, an advanced psychometric model for estimating a student's skill level. Our measure simply builds on the existing scale to make it easier to analyse relative student progress.

2.6 Limitations of this approach

Trade-offs have been made in the design of the proposed measures between statistical purity, ease-of-use and the benefit of being able to compare the progress of groups at very different stages of learning. The metrics should only be used to analyse large groups of students and should avoid extreme scores. When

[25] See Thomson, *et al.* (2013) for examples of how the OECD uses years and months of learning, p. xvii. The OECD estimate is different to our new measure as it uses a different statistical technique in calculating years and months learning, and does not reference progress to a common benchmark. Another international body that uses a similar concept is the *UK Learning Toolkit* which transformed effect sizes of successful interventions into years and months of learning, see Education Endowment Foundation (2016).

[26] They produce an estimate of years and months of learning for the difference between the 10th and 90th percentile school. CESE (2014) p. 29.

[27] Grade (or age) equivalent scales are derived by calculating the mean or median score for each given grade, and then interpolating the year-and month values between. Angoff (1984)

[28] To the best of our knowledge, it is the first time this concept has been applied to a vertically equated scale such as NAPLAN.

[29] Angoff (1984); Sullivan, *et al.* (2014); Pearson (2016). The limitations of grade equivalent scales are most pronounced for the comparison of individual students.

used this way, we consider the new metrics are sufficiently robust for informing policy decisions.

Of course, the new measures have limitations. A key area for further development is refining the estimation of *equivalent year levels* before Year 3 and after Year 9.[30] NAPLAN does not test students outside these years. Our EYL estimates are based on a very large amount of observed data, but caution must be taken in interpreting results outside these ranges, for the reasons discussed in Box 3.[31] But on balance, extending the EYL scale to cover most of the observed range of student achievement makes the approach much more useful to policymakers.

This new measure should not be used to make high stakes decisions for individual students (e.g., placement into a remedial or accelerated class) or teachers (e.g., promotion). In part this is because measurement error in NAPLAN scores is high for individuals or small groups. Linking the measure to high-stakes decisions could also increase the likelihood of 'teaching to the test', and other adverse outcomes.[32]

Without further testing of the measure, we would also caution against using this measure to directly compare school progress. It is designed primarily to compare progress at a system level.

In this report we only analyse data at a group level using large groups. We have taken further precautions to limit the impact of measurement error.[33] This report primarily examines numeracy results, but reading results display similar patterns. All findings (including a full set of charts for reading and numeracy and the associated 99 per cent confidence intervals) can be downloaded from the Grattan website.

The new measures should be part of a suite of metrics

Our new measures should be used as part of a suite of metrics answering a range of important questions on student performance. Data on student progress should be considered from multiple angles when setting system priorities.

The new measures help answer relative questions on student performance. While these relative questions are critical, they are not the only questions that matter.

For example, to understand the impact of school quality on student outcomes – a very important but different question – it is necessary to look at value-added measures. Value-added measures help to identify the impact of the school which is useful in understanding which interventions are working well and why. [34]

[30] Restricting results to students who score between EYL 3 and EYL Year 9 would severely limit analysis.
[31] The EYL scale below Year 3 is estimated from the observed progress to Year 5 of students who were below the median in Year 3. By definition, this is half the Year 3 population. Above Year 9, the EYL scale is estimated from the observed progress to Year 9 of above-median Year 7 students; again, half the population.
[32] See Box 5 in Goss*, et al.* (2015), p. 39.
[33] We compare EYL and progress for large sub-groups of students, and avoid calculating statistics for extreme scores where measurement error is likely to be high. For most of our estimates the 99 per cent confidence interval is between 3 and 10 NAPLAN points, and less than 6 months in equivalent year levels.
[34] Value added measures compare the progress each student makes relative to all other students with the same initial level of achievement, while controlling for socio-economic factors.

Box 3: Interpreting equivalent year levels

Our *equivalent year level* (EYL) metric needs to be interpreted carefully, especially in relation to the school curriculum. For instance, a group of Year 5 students at EYL 9Y 0m in numeracy are not necessarily ready to solve mathematics equations aimed at a Year 9 student; they may not have been exposed to concepts that need to come first.[35]

However, on the tasks tested in NAPLAN, these Year 5 students demonstrate comparable numeracy skills to the median Year 9 student. Further testing may be appropriate to see whether they need to be stretched in their learning.

Interpreting *equivalent year levels* below Year 3 requires care. NAPLAN tests are not designed for students below Year 3. Yet, many students in Year 1 do have reading and numeracy skills that are comparable to the expectations for Year 3 students.[36] Likewise, many Year 3 students demonstrate reading and numeracy skills at a Year 1 level.

Interpreting *equivalent year levels* above Year 9 is even more challenging. A student who is two years ahead of the NAPLAN Year 9 median in numeracy is said to be at EYL 11y 0m.[37] This does not necessarily mean the typical Year 9 student will reach this skill level in Year 11. Students choose specialised subjects in senior secondary school, and teaching may focus more on specific content than general literacy and numeracy skills.

In a technical sense, it is more precise to say EYL 9 + 2Y 0m rather than EYL 11Y 0m. But this notation is cumbersome and confusing, and so has not been used in this report. Instead, we report *equivalent year level*s directly in years and months between EYL 1 and EYL 12.

In addition, *equivalent year levels* are more limited in assessing the performance of high achieving students and high performing schools. Because NAPLAN testing stops at Year 9, there is no reference for how well high achieving students are progressing in higher year levels at present. Within our methodology, we can still compare high performing students to an estimate of how the typical student would perform. However, we also suggest that international test data (such as PISA) is used when assessing the performance of high achieving students.

[35] Likewise in reading, Year 5 students at EYL 9 have much stronger reading skills than the median Year 5 or even Year 7 student, but may not be ready for the concepts in a book aimed at Year 9 students.
[36] See, for example, Figure 6 and Box 1 in Goss*, et al.* (2015), pp. 27-28. Students' counting abilities were tested using the Mathematics Assessment Interview, a one-on-one test administered by their teachers. About one quarter of the Year 1 students (16 out of 66) already demonstrated counting skills at or above the level of skills typically taught in Year 3.
[37] Conceptually, this is estimated by analysing the typical progress of students who achieved the median Year 9 score when they were in Year 7.

The following chapters analyse relative student progress in Australia and Victoria using the *equivalent year level* and *years of progress* measures. Chapters 3 and 4 set out the findings revealed by the new approach, and Chapter 5 discusses their economic implications.

3 The spread in achievement widens dramatically as students progress through school

This chapter shows the spread in student achievement across a given year level, and how the spread changes from the first time students sit NAPLAN in Year 3 to the time they sit it in Year 9.[38]

Our *equivalent year level* measure shows that the spread widens dramatically after Year 3, suggesting that certain students are falling further behind as they progress through school. It paints a very different picture to the one we see using NAPLAN scale scores.

Understanding the spread in student achievement is important for policymakers. It directly affects the work of every teacher. Teaching a class full of students who are at different stages in their learning is inherently difficult. A large spread makes the challenge greater.

An increasing spread also has implications for learning. As students move through school, some fall very far behind. Effective learning involves ideas and concepts that build on one another. Early delays in foundational literacy and numeracy skills can affect the ability to catch up later on. Our findings show there are real dangers for students who fall behind in their early years at school. Most will never catch up without effective targeted teaching or specific remedial support that accelerates their learning.

3.1 The achievement spread widens during schooling

Two different ways to measure the spread in student achievement are contrasted in Figure 5. Using NAPLAN scale scores (the chart on the left hand side), the spread remains relatively constant at each year level shown after Year 3. This holds true for students achieving in the middle 60 per cent of results (i.e. between the 20th to 80th percentiles), as well as for students achieving in the middle 80 per cent of results (between the 10th and 90th percentiles).

A different picture emerges using our new measure *of equivalent year levels* (the chart on the right hand side). On this measure, the spread actually widens after Year 3. In fact, the spread for the middle 60 per cent of students more than doubles between Year 3 to Year 9, from 2 years 5 months to 5 and a half years.[39] We estimate that by the time they reach Year 9, the top 10 per cent of students are around eight years ahead of the bottom 10 per cent.

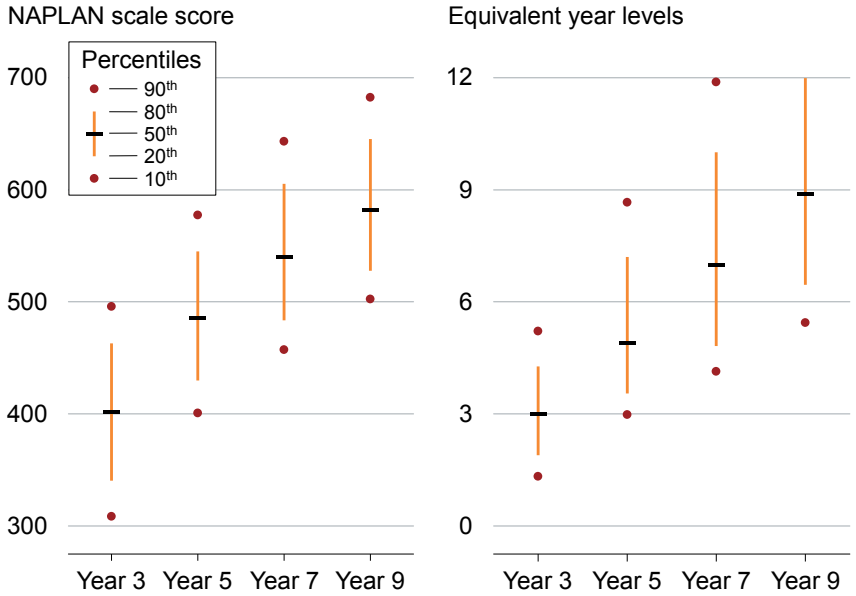
These findings refer to the spread in achievement across all students in the Victorian population. When data is analysed at the school level, the spread is only slightly smaller. In a typical school, the spread in Year 9 is around seven years.[40] This presents an extremely challenging task for any teacher.

[38] Two different datasets are used in this chapter. National data (2014) is used to analyse student spread. Victorian linked data is used to analyse student progress. It is a linked dataset that allows us to track the results of each student from 2009 to 2015. Victorian data is compared to a national growth curve to provide insight on how Victoria compares to other states and territories.

[39] In numeracy, the spread in equivalent year levels between the 20th and 80th percentile student is 2Y 5m in Year 3; 3Y 8m in Year 5; 5Y 2m in Year 7; and 5Y 6m in Year 9. A similar pattern, of a greatly widening spread of learning, is also seen when we translate NAPLAN reading data into equivalent year levels.

[40] This estimate is based on Grattan analysis of ACARA (2014b). It is based on students in the 10th and 90th percentiles for a typical school, see Appendix 6.

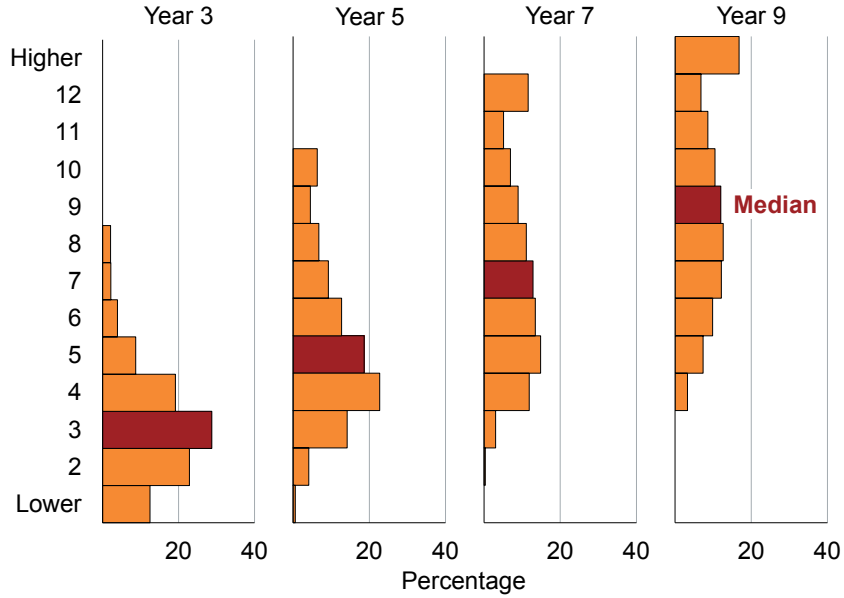
Figure 5: NAPLAN scale scores suggest the spread stays constant, but *equivalent year levels* shows it is increasing
Achievement spread by actual year level, numeracy, Australian students, 2014



Notes: Data includes all Australian students who sat NAPLAN numeracy tests in 2014. The top ten per cent in Year 9 are above equivalent year level 12 and are not shown on this chart. Results at the 10th and 90th percentiles are subject to higher measurement error.
Source: Grattan analysis of ACARA (2014b).

Figure 6 shows that many students are performing several years ahead or behind the average group in their year level. The proportion of students performing far away from the median group increases each year level after Year 3 (i.e. the shape of the distribution flattens with time). In Year 3, approximately 10 per cent of students are at least 3 Years above or below the median group. By Year 9, around 45 per cent of students are at least 3 years above or below.

Figure 6: Many students are performing several years ahead or behind the median for their year level
Equivalent year level grouping, numeracy, Australian students, 2014



Notes: Data includes all Australian students who sat NAPLAN numeracy tests in 2014. We account for measurement error associated with students who did not sit the NAPLAN tests.
Source: Grattan analysis of ACARA (2014b).

A large spread is not only difficult for low achievers, but high achievers as well. They are unlikely to be challenged by the standard tasks for their year level, which are years below their capability. Targeted teaching is vital to keep pushing them to the next stage in their learning (see Box 4).

Box 4: Targeted teaching is vital given the increasing spread

This report uses NAPLAN data to show just how wide the spread in achievement is at any given year level. Given this spread, it is very important that teachers understand what level students are at in their learning and how they can tailor teaching to their needs. To do this, teachers need more accurate and timely data about what each student knows and is ready to learn next. This data must then be used: it has no impact unless teachers change their classroom practice.

While NAPLAN data can tell us about the spread of achievement, a child only sits the NAPLAN test every two years, so it is no substitute for regular in-class evaluation. Teachers need to adapt their teaching to student needs from week to week.

Using data to meet each student at their point of need is targeted teaching – the subject of our last school education report. Targeted teaching benefits all students, especially those students working well outside year-level expectations. High performing students get stretched. Struggling students get supported.

Source: Goss et al. (2015) Targeted Teaching

3.2 Low achievers fall more than three years behind

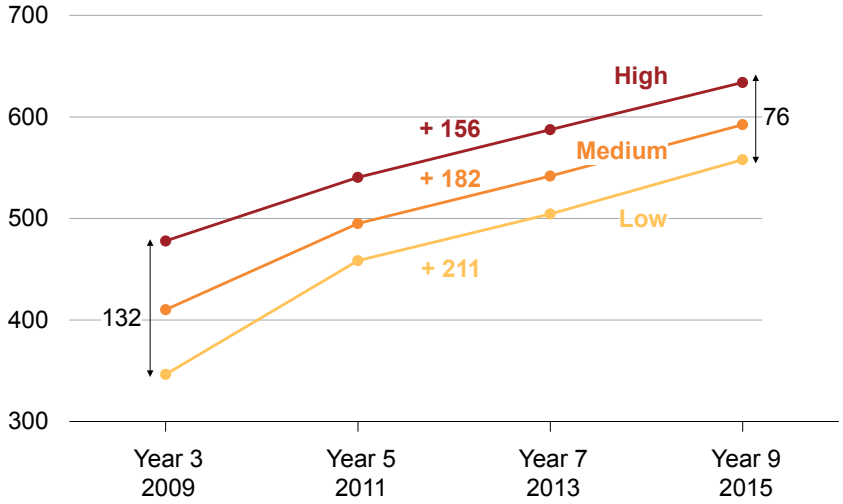
Our findings show that spread is much greater after Year 3, suggesting that some students are falling very far behind while others are very far ahead. We test this by analysing groups of Victorian students who sat NAPLAN in Year 3, 5, 7 and 9 over 2009-2015.[41] The progress of high and low achievers is compared between Year 3 and Year 9.[42] Again, the findings under our new approach are contrasted to the outcomes that are suggested using a face value interpretation of NAPLAN gain scores.

NAPLAN gain scores (see Figure 7) suggest the gap between high and low achievers narrows between Year 3 and 9. Gain scores are larger for low achievers (+211 points) compared to median achievers (+182 points) and high achievers (+156 points). Taken at face value, this suggests that low achievers make better learning progress during this period than high achievers.

By contrast, our *equivalent year level* measure (Figure 8) tells a different story. The gap does not narrow, but increases with time. Between Year 3 and Year 9, the students with a low score in Year 3 are an extra year behind the top students by Year 9. These students are two years eight months behind in Year 3, and three years eight months behind by Year 9. They make one year less relative progress over the same timeframe.

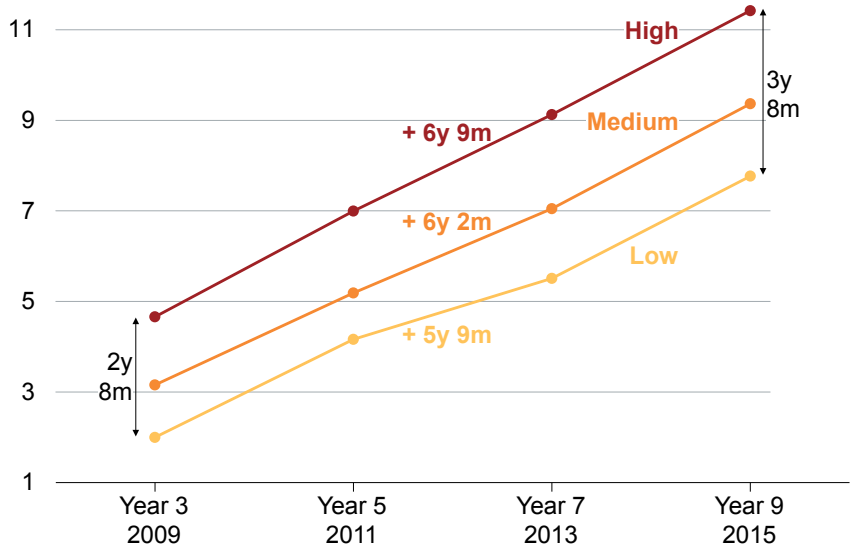
[41] The Victorian data is compared to a national estimated learning trajectory to provide relative comparisons.
[42] 'Low' and 'high' achievers are those who achieve in the lower 20th percentile and top 80th percentile in Year 3 respectively. Results for Years 5 to 9 are the predicted growth trajectory for the median student in each of these percentiles. See the *Technical Report* for further details.

Figure 7: NAPLAN gain scores can be misinterpreted to suggest low achievers in Year 3 start catching up
NAPLAN scale score, numeracy, median, Victoria, 2009–15



Notes: Results show the estimated gain scores between Years 3 and 9 of low, medium and high achievers in Year 3 (students who scored at the 20th, 50th and 80th percentiles). Black values indicate the gap between highest and lowest groups. Coloured values are the gain scores over the six year period from Year 3 to 9.
Source: Grattan analysis of Victorian Curriculum and Assessment Authority (VCAA) (2015) and ACARA (2014b).

Figure 8: In fact, low achievers fall further behind by Year 9 if *equivalent year levels* are used
Equivalent year level, numeracy, median, Victoria, 2009–15



Notes: Results show the estimated progress of low, medium and high achievers (students who scored at the 20th, 50th and 80th percentiles in Year 3) between Years 3 and 9. Black values indicate the gap between highest and lowest groups. Coloured values are the years of progress gained over the six-year period from Year 3 to Year 9.
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

In Figure 8, Victorian low achievers make particularly little progress between Years 5 and 7 (the slope is flatter during this period). Because Victorian data is benchmarked to the national growth curve, this suggests that Victoria's slower growth than the national average.[43]

Divergence can now be seen in NAPLAN results

Our new findings show a widening gap in student achievement as students progress through school that until now has been difficult to see in NAPLAN data. This gap aligns with a large body of evidence on divergence. Early low achievers tend to become further and further behind with time, while high performers continue to excel (see Box 5).

Many factors may contribute to differences in rates of learning, including inherent student learning ability. However the divergence literature tells us there is often a mix of cognitive and motivational forces at play once students miss key concepts early on.

Box 5: Divergence: early struggles affect future learning

The literature shows that early low achievers often face an ongoing struggle through their schooling years, while initial high achievers continue to reap rewards from early success. Over time we expect to see divergence in student results.[44] Early reading and mathematics skill acquisition is linked to future success in learning, also known as the 'Matthew Effect'.[45] How does this occur?

Learning involves ideas building on one another. Concepts or skills that are missed early on can impede the take-up of new skills down the track. In addition to cognitive barriers, there are also motivational effects.

For example, with reading, students who struggle to master 'decoding' of spelling-to-sound early on tend to read fewer words than their peers.[46] With limited vocabulary, these students start to enjoy reading less and spend less time practising, so their overall reading development slows. This can then affect participation in other subjects such as science and history which depend on reading to learn, and they can fall further behind in other subjects as well.[47]

[43] Victorian median achievers also make less than two years of progress between Years 5 and 7, which is low compared to the national growth curve. Further exploration is required to understand related factors for this slump for Victoria during these years.

[44] Masters (2005); Allington (2008); Masters (2013); Claessens and Engel (2013); O'Donnell and Zill (2006)

[45] Masters (2005), p. 17; Allington (2008); Dougherty and Fleming (2012); Hanson and Farrell (1995)

[46] Cunningham and Stanovich (1997)

[47] Stanovich (1986); Cunningham and Stanovich (1997); Claessens and Engel (2013)

3.3 NAPLAN national minimum standards are too low

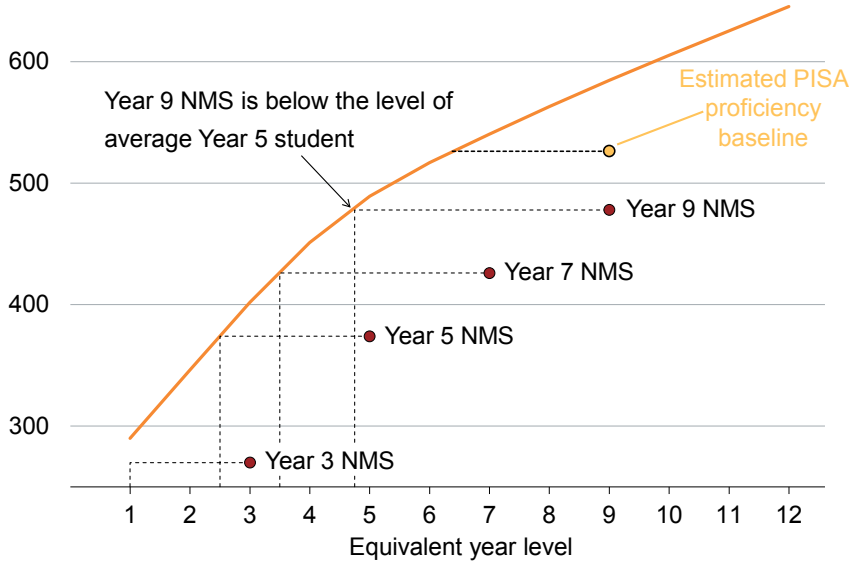
The Australian NAPLAN national minimum standards (NMS) seek to identify *"students who may need intervention and support to help them achieve the literacy and numeracy skills they require to satisfactorily progress through school."*[48] The standards also represents the basic level of knowledge and understanding needed to function at a given year level.[49]

The minimum standard is extremely important not only for schools, teachers and parents, but especially for policymakers who need to know which students require extra support.

NMS are set extremely low in Australia. Figure 9 shows that in numeracy:

- a Year 5 student at NMS is functionally operating below a Year 3 level (over two years behind their peers)
- a Year 7 student at NMS is functionally operating below a Year 4 level (over three years behind their peers)
- a Year 9 student at NMS is functionally operating below a Year 5 level (four years behind their peers).

Figure 9: National minimum standards are set very low
NAPLAN scale score, median growth curve, numeracy, Australian students, 2014



Note: Results show NMS and PISA minimum proficiency standard mapped to EYL.
Source: Grattan analysis of ACARA (2014b), and PISA minimum standard OECD (2012).

In other words, students who are two, three, and four years behind others in their class are, according to current definitions, considered to be 'at minimum standard'. Can these students effectively participate in a class where the curriculum and teaching is often aimed at those much closer to the average student?

Further, the NMS slips by almost one *equivalent year level* every cycle of NAPLAN testing; i.e. in Year 5 it is *over two years* behind peers, in Year 7 it is more than *three years* behind, and in Year 9 it is *four years* behind. This tacitly accepts a minimum standard

[48] ACARA (2015), p. v. More specifically, ACARA specifies that 1) students who *do not meet* the national minimum standard at any year level may need intervention and support, and 2) students who are performing *at* the national minimum standard may require additional assistance to enable them to achieve their potential.
[49] ACARA (2016b)

that assumes students will slip one year of learning further behind each time they sit the NAPLAN test. This is similar for reading.

The Australian NMS appear very low by international standards. The minimum standard set by the OECD in PISA mathematics for 15 year olds is about two years above Australia's numeracy standard for Year 9 students, as seen in Figure 9.[50]

Nationally, very few students are below the NMS. In 2015, 7.7 per cent do not meet NMS in reading in Year 9. In other years of NAPLAN testing, the proportion below NMS ranges from around 4 per cent to 7 per cent for reading and numeracy.[51] In fact, very few students below the NMS actually sit the test (many are students which are exempt).[52]

Internationally, a much higher proportion of Australian learners are below expected standards set in international tests. For example, in the PISA 2012 test results, an estimated 14 per cent of students fail to achieve a baseline proficiency level in reading.

The situation is worse in mathematics where 20 per cent of students fail to achieve the international baseline level.[53]

The transition to NAPLAN Online is the time to make the change

The Australian NMS accept a very slow rate of student progress and are well below international standards. They were set in 2008 with the introduction of NAPLAN. There has been public criticism of their very low level, and there is little publicly available justification for setting such a low level.[54]

Australian policymakers are currently reviewing the NMS, and new measures will be announced in 2016 to accompany the transition to NAPLAN Online. We understand that a new, higher proficiency level is likely to be defined. We would welcome such a move. Our analysis suggests that NMS should either be raised or removed altogether.

Baseline levels of skills can be politically difficult to reform, but other countries have successfully raised standards when required. For example, many US states recently raised their proficiency standards to reflect the tougher standards in Common Core.[55]

[50] PISA sets their level 2 as baseline proficiency and defines this as the level at which students begin to demonstrate the mathematical literacy competencies that will enable them to actively participate in life situations. Thomson, *et al.* (2013), p. 20. We find that a NMS set equivalent to the PISA proficiency standard would be around 2 years higher for Year 9 NAPLAN numeracy. We estimate the PISA minimum standard by equating the percentile at which students were below PISA proficiency in 2012 numeracy (19.7 per cent) to the same percentile of achievement for Australian students in NAPLAN numeracy 2014. We note that PISA test takers are about six months older than Year 9 students, on average.

[51] ACARA (2016a).

[52] The proportion of students below NMS includes many exempt students. Students commonly exempt from testing include those with a language background other than English, who arrived from overseas less than a Year before the tests, and students with significant disabilities.

[53] Thomson, *et al.* (2013), p. 26, 175

[54] Main (2013); Lamb, *et al.* (2015)

[55] Peterson, *et al.* (2016)

4 Students whose parents have low education fall very far behind

Chapter 3 shows that low achievers continue to fall further behind their peers between Year 3 and Year 9. In general, low achievers and high achievers have different rates of learning over time. But are there other factors at play?

This chapter examines differences in progress made by students according to their:

- level of parents' education (section 4.1)
- school's level of disadvantage (section 4.2)
- geographic location (section 4.3) [56]

For this analysis, parental education is used as a proxy for a student's socio-economic status (SES), but results are similar for family occupation.

Victorian students are analysed simply because the data is readily accessible. Some of the findings may look bad for Victoria, but the overall pattern for Australia is likely to be worse. Evidence from international PISA tests suggest educational outcomes in Victoria depend less on student socio-economic background than in other Australian states. [57]

Box 6: Distinguishing between the effects of student capability, parental education, school and location

Some findings in this chapter overlap. Differences in student progress for disadvantaged students (Section 4.1) are also captured in findings of students who attend disadvantaged schools (Section 4.2). This is because disadvantaged schools by definition have more students whose parents have low levels of education. Similarly, disadvantaged geographic areas have clusters of students with parents with low levels of education, employment and income (Section 4.3).

Our findings show that on average, students whose parents have lower levels of education have lower levels of achievement by Year 3. So it is not surprising that this is also true of disadvantaged schools and disadvantaged geographies.

What is surprising are our results showing differences for students with similar capabilities. For students with the same level of initial achievement in Year 3 (a proxy for similar capability), less progress is made by disadvantaged students, at disadvantaged schools, and in disadvantaged areas. This strongly suggests that equally capable students are failing to reach their potential. This holds for disadvantaged students at all ability levels in Year 3, especially bright students from poor backgrounds in disadvantaged schools.

[56] Analysis by level of parental education, school disadvantage and geographic location uses the same statistical techniques and process as used in the analysis of student spread. See the Technical Report for further details.
[57] Thomson, *et al.* (2013), p. 274-275

4.1 Gaps widen for students whose parents have low education

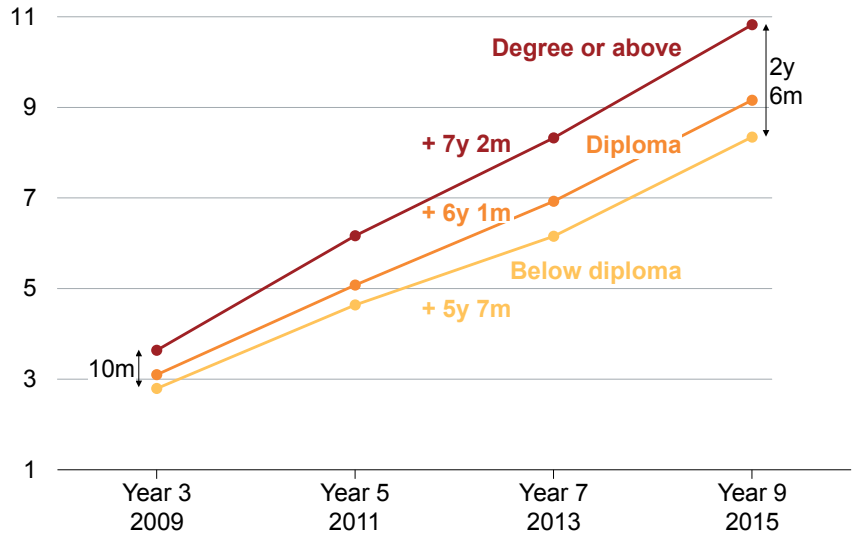
Our findings show that students make less progress over time on average if their parents have low levels of education themselves.[58] This is not news. But the *size* of the gap is alarming.[59]

Students whose parents have low levels of education fall two and a half years behind by Year 9

This section compares the progress of students according the level of education of their parents (where a 'low' level of parental education is defined as below diploma, 'medium' is diploma level, and 'high' is degree or above).[60]

When Victorian students sat their first NAPLAN test in Year 3, students of parents with low education performed on average ten months below their peers from families with high education. By Year 9, this gap had widened to over *two years and six months* (30 months). The gap tripled during this timeframe, as seen in Figure 10. It widens significantly during the middle schooling years.

Figure 10: The gap between students with low and high levels of parental education grows alarmingly between Year 3 - 9
Equivalent year level, numeracy, median, Victoria, 2009-15

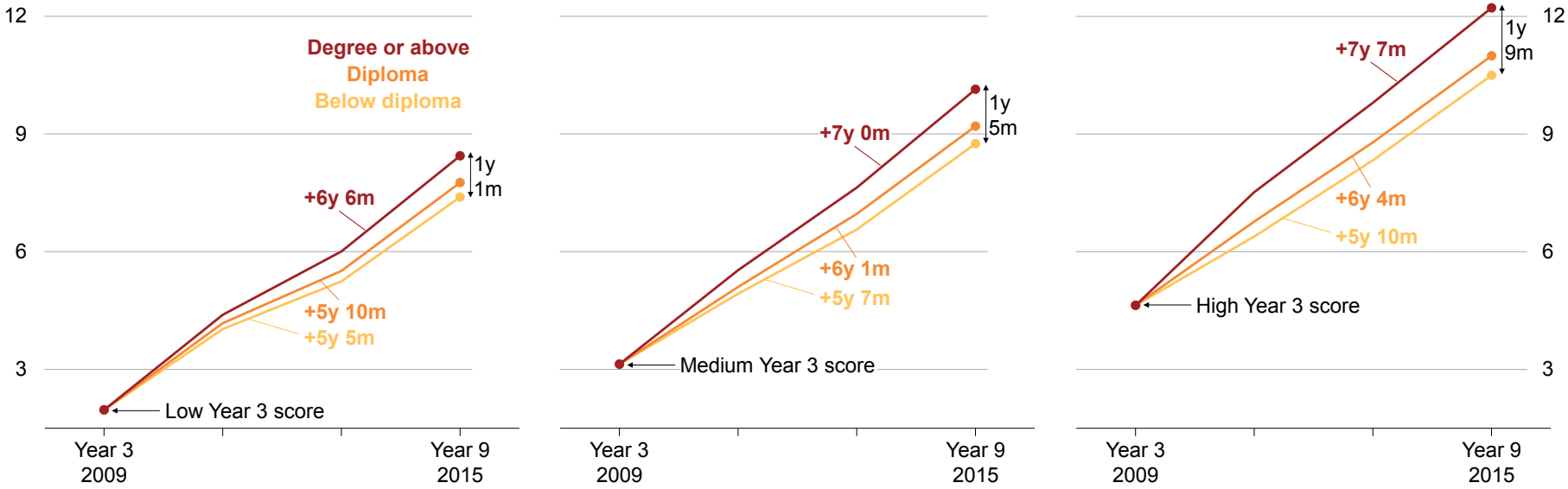


Notes: Results show the estimated progress of students grouped by their parents' highest level of education as a proxy for socio-economic status. Black values are the gap between highest and lowest groups. Coloured values are the years of progress gained from Year 3.
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

[58] Findings are for NAPLAN cohort (2009-2015) using Victorian data. Analysis of the other complete NAPLAN cohort (2008-2014) shows a similar picture with minor exceptions.
[59] Results for numeracy are generally similar to findings for reading, with the full set of charts available on the Grattan website.
[60] Results for Years 5 to 9 are the predicted growth trajectory using quantile regression for the median student in Year 3 from each group (by starting score, parental education, ICSEA or LGA). See the Technical Report for further details. Use of a cohort analysis minimises the impact of individual student differences and the influence of measurement error. Analysis of the other complete NAPLAN cohort (2008-2014) shows similar patterns, as does analysis of reading scores (data not shown).

Even when capabilities are similar in Year 3, students whose parents have low education fall up to two years behind

Figure 11: From the same Year 3 score, students of parents with low education make much less progress to Year 9
Years of progress between Years 3 and 9 by Year 3 score and highest level of parental education, numeracy, Victoria, 2009–15



Notes: Results show the estimated progress of low, median and high achievers (students who scored at the 20th, 50th and 80th percentiles in Year 3) grouped by their parents' highest level of education as a proxy for SES.
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

The findings for disadvantaged students are even more concerning when we take into account student capability. We compare the progress of students with the same score in Year 3. We then track their progress between Year 3 and Year 9 to see whether any significant differences open up.

Students who display similar potential in Year 3 have very different growth trajectories depending on their parents' education level, as seen in Figure 11. Between Year 3 and Year 9, students with poorly educated parents consistently make less progress than similarly capable students whose parents are highly educated.

This holds for any ability grouping of disadvantaged students:

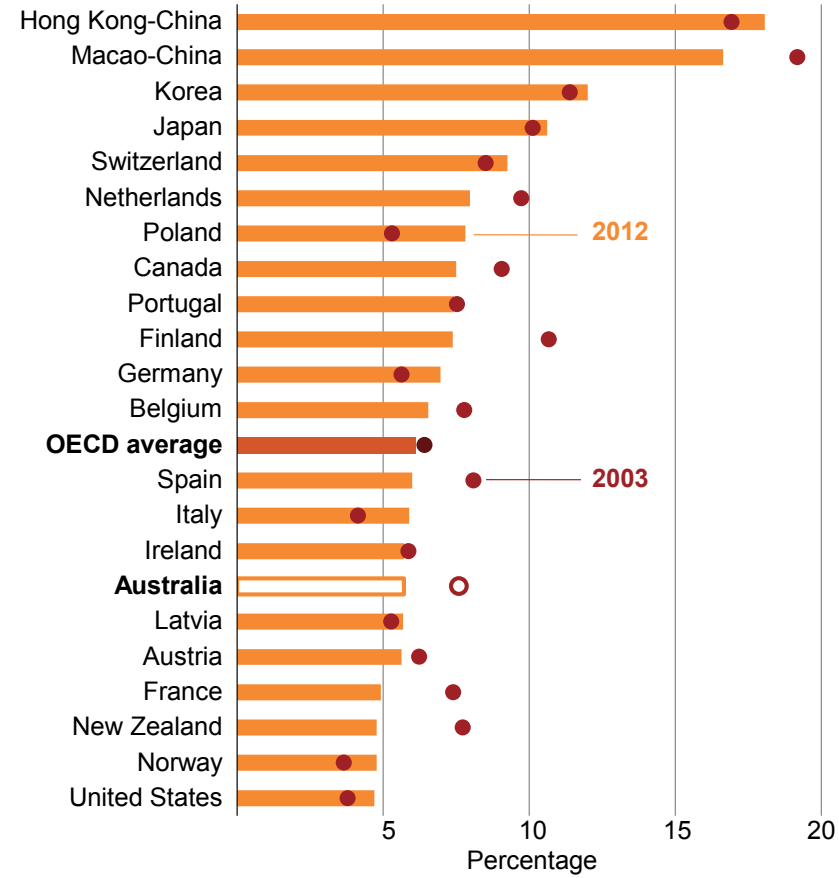
- Of students with low Year 3 scores, disadvantaged students make one year and one month less progress than similarly capable students with better educated parents.
- Of students with medium Year 3 scores, disadvantaged students make one year and five months less progress.
- Of students with high Year 3 scores, disadvantaged students make one year and nine months less progress.[61]

High achievers from disadvantaged families have the greatest lost potential, losing one year and nine months between Year 3 and 9.

In fact, bright students from poor backgrounds make less progress in total (5 years 10 months) than low achievers with highly educated parents (6 years 6 months) between Year 3 and Year 9.[62]

PISA data shows that in terms of giving students of low education backgrounds the support to become high achievers Australia has slipped backwards slightly. Figure 12 shows the proportion of students at age 15 who come from low socio-economic status (SES) backgrounds but nevertheless achieve high scores. Australia's proportion slipped slightly between 2003 and 2012, dropping from 8 per cent to 6 per cent. Australia now sits slightly below the OECD average, and well behind many high performing countries.

Figure 12: Fewer low-SES Australian students perform at the highest levels of achievement than a decade ago
Proportion of students from low SES backgrounds who perform in top two bands of PISA tests



Source:OECD (2013a), page 590

[61] It is hard to accurately estimate the performance of high achievers using equivalent year levels. However, it is well above what we would expect the typical Australian student to achieve by Year 12.
[62] The two approaches of NAPLAN gain scores and EYL show a very different picture of student progress, explained in Appendix 7.

4.2 Students in disadvantaged schools make less progress

This section analyses differences in student performance according to whether they attend a low, medium or high advantage school. We find that students in low advantage schools perform worse on average.[63] Again, this is not surprising. However, the size of the gap is alarming.

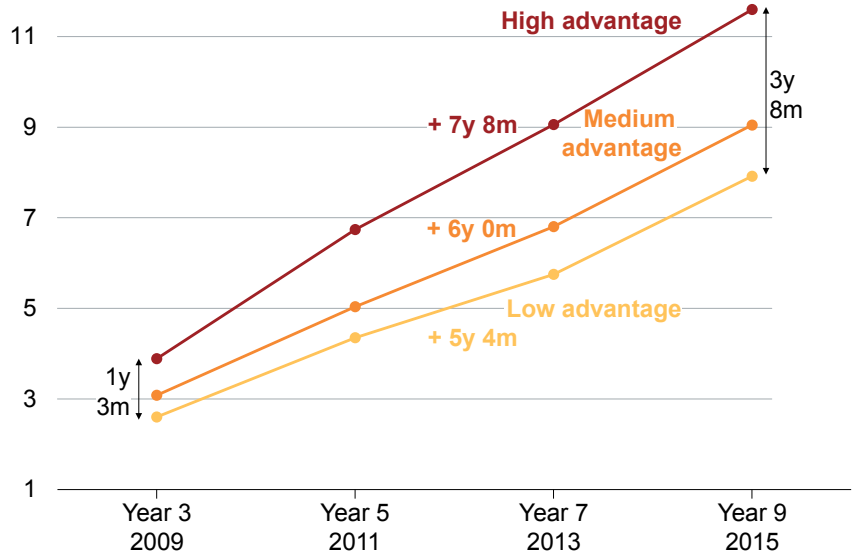
Students in disadvantaged schools are over three and half years behind students in high advantage schools by Year 9

Students in disadvantaged schools perform well below their peers in high advantage schools by Year 3, but the gaps grow much larger as they move through school. As shown in Figure 13, the gap grows from one year and three months in Year 3 to a dramatic three years and eight months in Year 9.

Students in medium advantage schools are also reasonably far behind. The gap grows to over two years behind their more advantaged peers by Year 9.

Figure 13: Students in disadvantaged schools fall very far behind between Year 3 and Year 9

Equivalent year level, numeracy, median, Victoria, 2009-15

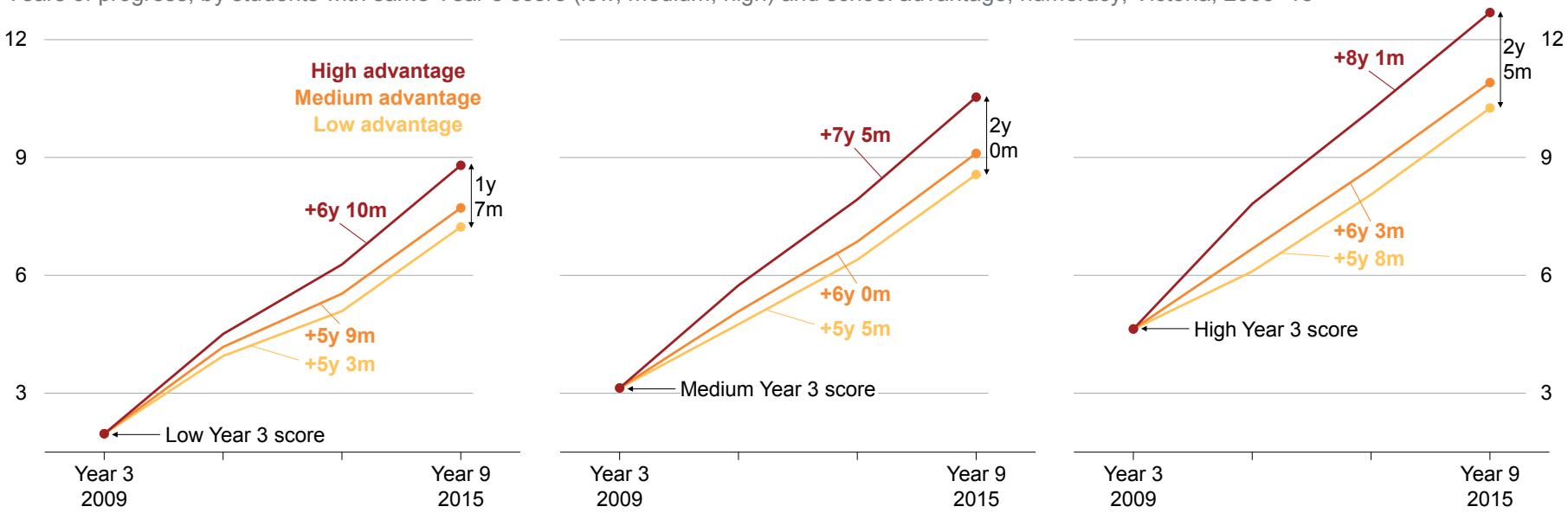


Notes: Results show the estimated progress of students grouped by their school ICSEA. Low, medium and high advantage schools are the bottom ICSEA quartile, middle two ICSEA quartiles and top advantage ICSEA quartiles respectively. Black values are the gap between highest and lowest groups. Coloured values are the years of progress gained from Year 3.
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

[63] We classify students into high advantage (top quartile), low advantage (bottom quartile) and average advantage (middle two quartiles) schools according to the Index of Community Socio-Educational Advantage (ICSEA) of the school they attend. The VCAA (2015) data used reports an ICSEA range for the school each student attended at the time of each NAPLAN test. ICSEA is an aggregate measure at the school level of the socio-educational background of all students at a school. For further information on the ICSEA measure see ACARA (2014a).

Students with similar early potential do worse in disadvantaged schools, especially high achievers

Figure 14: From the same Year 3 score, students in disadvantaged schools make much less progress to Year 9
Years of progress, by students with same Year 3 score (low, medium, high) and school advantage, numeracy, Victoria, 2009–15



Notes: Results show the estimated progress of low, median and high achievers (students who scored at the 20th, 50th and 80th percentiles in Year 3) grouped by their school ICSEA (referred to as low, medium and high advantage schools).
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

Figure 14 shows the progress of students with similar abilities in low, medium and high advantage schools. As can be seen in all three charts, even when students have similar scores in Year 3, students in disadvantaged schools make less progress than students in high advantage schools.

This finding holds true for all ability students in Year 3 attending disadvantaged schools:

- Of students with low Year 3 scores, those in disadvantaged schools make one year and seven months less progress than similarly capable students in high advantage schools.

- Of students with medium Year 3 scores, those in disadvantaged schools make two years less progress than similarly capable students in high advantage schools.
- Of students with high Year 3 scores, those in disadvantaged schools make two years and five months less progress than similarly capable students in high advantage schools.

Bright students in disadvantaged schools show the biggest losses in potential, making two years and five months less progress than similarly capable students in high advantaged schools.

In fact, between Year 3 and Year 9, bright students in disadvantaged schools make less progress (five years and eight months) than low achievers in a high advantage school (six years and ten months).

These findings do not mean that teachers, principals and other staff in disadvantaged schools are doing a bad job. The results reflect a mix of influences affecting students who attend these schools (discussed in Box 7).[64] What they do highlight is a large variation in student progress for different schools – and a gap that, by Year 9, is simply too wide.

[64] Once levels of parental education are taken into account, there is still a residual gap. This finding should be treated with caution as indicating school effects given some of the residual amount may be picking up unmeasured family factors, discussed in Box 7. In addition, estimates in Figure 14 are only for students who are in similar status schools in both Year 3 and Year 9, so are not representative of all students. This partly explains why the gap for students of low parental education is lower than findings at the school level.

Box 7: What our analysis can and cannot say about disadvantaged students and disadvantaged schools

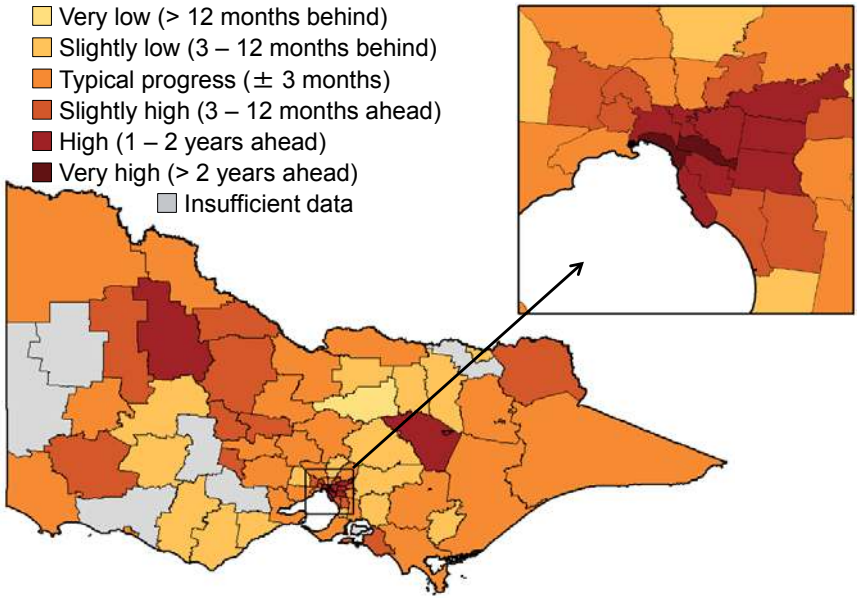
Our findings should not be interpreted as showing a direct causal link between parental education and student progress (Section 4.1), or the impact of a school on student progress (Section 4.2). This is because our analysis does not attempt to isolate the effects of specific factors on student achievement, as some other studies do using techniques that isolate the impact of different factors in a systematic way.

When we look at differences in student progress by parental education, as in Section 4.1, for example, our results capture some of the impact of other factors related to parental education, such as household income, general expectations for learning, and some school-level factors. We do not isolate the direct impact of parental education on student progress, but we capture much of the combined impact of a range of factors correlated with parental education on student progress.

Similarly, the estimated gaps in student progress by school advantage, as in Section 4.2, are capturing the impact of many factors related to school advantage. Importantly, our findings do not isolate the impact of the quality of the teaching in certain schools – there are a range of other reasons why advantaged schools make higher progress. For instance, the results capture some household-level factors that correlate strongly with school advantage – high-income households are more likely to send their children to more advantaged schools, for example. The results also capture other factors from within the school, such as student peers, the school environment, and the general expectations for learning from parents and the community. The quality of teaching is only one factor that may be reflected in the results.

4.3 The impact of disadvantage plays out geographically

Figure 15: Inner-city students make the most learning progress
Median years of progress between Years 3 and 9, numeracy, Victoria, 2009-15

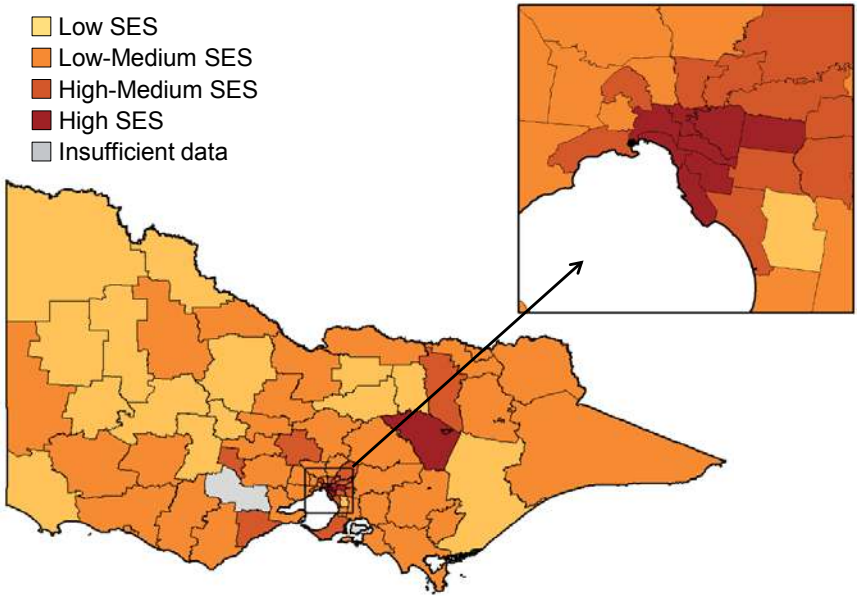


Notes: Results show the estimated progress of students grouped by the Local Government Area of their Year 3 school.
Source: Grattan analysis of VCAA (2015) and ACARA (2014b).

Does learning growth vary depending on where students live? Figure 15 shows that it does. In fact, learning progress closely mirrors the pattern of edu*cational disadvantage across Victoria, shown in* Figure 16.

Students in the inner city make more progress than outer metropolitan students (seen in the magnified chart in top right hand corner of Figure 15). But the greatest difference in growth is clearly between city and country. Inner-city students make at least one to two years more progress than suburban students, and are up to two years in front of regional and rural students in some areas. Policymakers wanting to support educationally disadvantaged students can target them geographically, with regional and rural areas most in need.

Figure 16: Average school advantage is higher in inner-city areas
Average student ICSEA, 2009-15 cohort



Notes: Students are allocated to the Local Government Area of their Year 3 school. ICSEA (a measure of school advantage) in this dataset is attached to student data, as there is no school identifier.
Source: Grattan analysis of VCAA (2015).

5 Closing the gaps would generate big economic benefits

The previous chapters show that some students fall many years behind their peers by Year 9, especially those from disadvantaged backgrounds. Achievement at school has real long-term impacts on young people – it affects further study, employment, lifetime earnings, as well as health and community engagement.[65]

But improving educational outcomes will require tough decisions. Some initiatives will need investment, from within the existing schools budget or beyond.

How can policymakers decide which investments are justified? One approach is to look for policies where social goals align with economic growth. Even better are policies with positive financial payback, because their long-term budgetary benefits outweigh their costs.

This chapter explores three economic benefits of better educational outcomes: higher individual earnings; lower welfare costs; and stronger economic growth.

Economic returns should not override the goal of delivering a quality education for all. The economic benefits simply strengthen the case for improvements in education as a 'win-win' for policymakers.

[65] Norton (2012); OECD (2012b); ABS (2014a); ABS (2014b)

5.1 Higher individual earnings

Strong learning progress at school leads to higher achievement and better skills later on. Higher achieving students are more likely to complete Year 12, and more likely to find work or move into further study once they leave school. This impacts lifetime earnings.

Completing Year 12 increases lifetime earnings by nearly 20 per cent compared to an early exit from school.[66] A bachelor degree boosts lifetime earnings by a further 40 per cent compared to the expected earnings of a high school graduate.[67] For each additional year of education, income is estimated to rise by an average 10 per cent.[68]

It is not just quantity of schooling that matters, but also levels of achievement at school. But there is limited research on the impact of higher achievement on earnings, given difficulties researchers have in accessing confidential test score data. The few studies available suggest a positive relationship between achievement and earnings.[69]

[66] Cassells, et al. (2012), p. 30. Studies taking into account natural aptitude find in the order of 8 to 30 per cent increases in annual earnings for each additional completed year of schooling from Year 12 to Postgraduate qualifications. Leigh and Ryan (2008); Leigh (2010)
[67] Leigh and Ryan (2008); Leigh (2010)
[68] Leigh and Ryan (2008); Leigh (2010). Cassells, *et al.* (2012) estimate an individual with a bachelor's degree is projected to earn $830,000 more than a Year 12 graduate over their lifetime. For further literature see Jensen (2010).
[69] French, *et al.* (2010); Ceci and Williams (1997). French et al. find that a 1 unit increase in high school test scores (the GPA) in the US is associated with a 12 –

Other educational research shows a link between higher achievement at school, and attainment and achievement later on.[70] Students who do better at school are more likely to continue their education, and then reap the benefits of higher attainment. Higher test scores are associated with a greater likelihood of completing school and attending university.[71]

A recent ABS study showed that higher scores on NAPLAN Year 9 reading increased the likelihood that Tasmanian students would finish Year 12. This was true in both disadvantaged and advantaged areas.[72] Even for the Tasmanian students who left school early, high achievers in Year 9 NAPLAN were twice as likely to be engaged in work or study, compared to those in the bottom two NAPLAN bands. [73]

5.2 Initial modelling shows that poor life outcomes can have large budgetary impacts

Poor outcomes in school can have costs for individuals and society. A good school education helps adults stand on their own two feet.

New Zealand is using linked data to look at the relationships between known risk factors (for example, parental education and family welfare dependency) and the likelihood of poor outcomes (welfare dependency and crime) as an adult. Importantly the analysis does not identify causative impacts at this stage, only simple correlations.[74]

Initial modelling shows that poor life outcomes can have big budgetary impacts, seen in Figure 17. Students who leave school with no formal qualifications cost the New Zealand government an average of $NZ 22,000 from age 16 to age 23. Most of this cost is for welfare benefits, but about one fifth is for corrections. The total cost is two to four times higher than for students who attain formal qualifications.

The linked data offers the New Zealand Ministry of Education a new way to break the intergenerational cycle of disadvantage. A child whose mother has no formal qualifications is estimated to be 50 per cent less likely to obtain a school qualification.[75] The ministry can identify the specific students most at risk of leaving schools without qualifications, and intervene early.[76]

14 per cent increase in annual earnings. The standard deviation of GPA is 0.838 and 0.798 for males and females respectively.

[70] French, *et al.* (2010)

[71] Ibid.

[72] ABS (2014a)

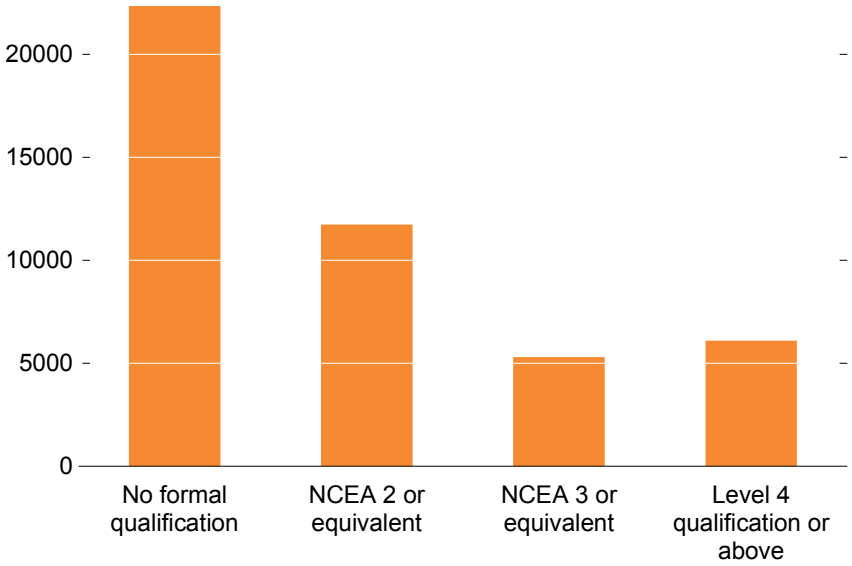
[73] Ibid.

[74] Low education at school is not necessarily the direct cause of welfare and correction costs to the state. The New Zealand Ministry of Education is currently identifying correlations which will be used to target interventions with the intention of improving life outcomes for at risk children. In time the project will be able to provide greater insight on each factor's causative impact and the effectiveness of interventions.

[75] Ball, *et al.* (2016). Within the linked data, the future outcomes before age 21 estimate found that 17.5 per cent of students would not obtain any school qualification, whereas of students whose mother had no formal qualification 27.1 per cent would not receive any school qualification.

[76] Data is linked across the Ministries of Education, Social Services, and Justice.

Figure 17: New Zealand analysis shows the high cost to the state of individuals with no formal qualifications
Average individual welfare and corrections cost ages 16 to 23, by highest educational qualification, $NZ



Notes: National Certificate of Educational Achievement (NCEA) is the main national qualification for secondary school students in New Zealand.
Source: New Zealand Ministry of Education (used with permission in 2015).

5.3 Stronger economic growth

Economic growth and social development are closely linked to the skills of the population.[77] Better education drives increased productivity in the workforce and top-level skills that deliver innovation in products and services.[78]

Improving school education outcomes has a huge impact on countries' Gross Domestic Product (GDP). Across countries, education and economic growth rates were strongly linked over the forty years from 1960 to 2000.[79]

Better educational outcomes are a major national asset, just as much as a highway or a railway. But there is one important difference: while infrastructure assets tend to depreciate in value over time, the value of better education tends to increase. Better skills foster greater innovation. Better educated adults tend to raise better educated children. Unfortunately the reverse is also true, which is part of the cause of intergenerational cycles of disadvantage.

There is good evidence that higher literacy and numeracy skills increase GDP growth. A series of studies estimate that one standard deviation in test scores would lift the long-run GDP growth rate by between 0.6 and 2.0 percentage points.[80] Using a

[77] OECD (2015)
[78] Ibid. p. 77
[79] Ibid.
[80] This range is based on a number of studies cited in Jensen (2010) p. 18., as well as OECD (2015)

conservative estimate, an increase of 25 PISA points would boost Australia's long-run GDP growth rate by 0.25 percentage points.[81]

The economic benefits from better education outcomes accrue over decades as higher skilled school leavers gradually form the a larger and larger part of the workforce. The long-term rewards are large.

Obviously, these estimates involve large degrees of uncertainty, particularly given the length of time. But the evidence clearly shows that lifting education outcomes can make a real difference to the economy.

Is there scope for Australia to make large learning gains with significant economic benefits?

Australia ranks in the top 20 countries in numeracy and reading on PISA tests in 2012. But there is still much scope for improvement.

Given the large decline in PISA points since 2000, we should start by reclaiming lost ground and aim for where we once were.[82] Large change is hard, but not impossible. Examples of other jurisdictions that have made large gains in reading and numeracy are discussed in Box 8.

Box 8: Making large learning gains is tough but possible

Large learning gains can be made. Several other jurisdictions have made big gains within a decade or so:

- Poland made exceptional progress, gaining 39 PISA points in reading since 2000 and 27 points in numeracy since 2003. Poland now out-performs Australia in numeracy and is on par in reading.
- Hong Kong and Germany are high achieving countries that have made large gains in reading and numeracy over time. Germany gained 24 points and Hong Kong 19 points in reading between 2000 and 2012. Germany gained 11 points in numeracy between 2003 and 2012.

A number of Australian states and territories have also made large learning gains:

- Since 2008, Queensland and Western Australia have both made gains of over 6 months in a range of NAPLAN reading and numeracy tests. The gains are too recent to have shown up in PISA tests.

Source: Grattan analysis of OECD (2012) Table I.2.3b and Table I.4.3b; NAPLAN data from ACARA (2014) and ACARA (2015).

[81] This is estimated using a conservative estimate of 1 percentage point per standard deviation.
[82] Australia's performance has dropped by 16 PISA points in literacy and 20 PISA points in mathematics since 2000 and 2003 respectively. OECD (2014a)

5.4 Smart investments

How can Australia significantly boost learning in school? While our report shows that disadvantaged students are falling very far behind, further analysis is required to identify exactly what the best policy solutions are, and where the gains may be the greatest.

Broadly speaking, there are three obvious areas likely to deliver substantial improvements.

Firstly, investing early is likely to have large learning benefits.

The case for early investment in education is well established.[83] Queensland's focus on the early schooling years since 2007 appears to have contributed to positive results. The introduction of a Prep Year in 2007 provides a real-world experiment to test potential impacts. Queensland's NAPLAN scores have certainly gone up since 2010, broadly in line with the cohort that first had the extra year of Prep, although further evaluation is required to confirm this strength of this relationship. The boost to future Year 9 NAPLAN performance looks like it will be about 6 months (discussed further in Box 9).

While this analysis is very rough, it suggests that Queensland's investment in primary school will definitely deliver benefits. Even after the high cost of adding a year of schooling has been accounted for, the decision should deliver large economic benefits derived from higher achievement levels in future.

[83] Stanovich (1986); Cunningham and Stanovich (1997); Allington (2008)

Box 9: Queensland's investment in early years of schooling and likely benefits

Queensland has made several large investments in the early years. It introduced a Prep Year in 2007.[84] It also raised the compulsory school starting age for Year 1, and invested in a significant strategy to improve schools, principals and primary teaching.

Since 2008, Queensland's NAPLAN scores have increased significantly for Year 3-7 reading and Year 3-5 numeracy.[85] The 2014 and 2015 cohorts both performed about 6 months ahead of the comparable 2008 cohort across all Year 3-7 NAPLAN tests.

The first cohort with the extra Prep Year is now in Year 9. The pattern suggests that Queensland's Year 9 NAPLAN results will improve from 2016 on, potentially by six months of learning.

The investments in the early years appear to have delivered substantial learning gains. The higher achievement of school graduates in future is likely to provide Queensland with the skills for a stronger and more prosperous economy in the long term.

Source: Grattan analysis, based on NAPLAN data from ACARA (2014) and ACARA (2015), Tables TS.R14-TS.R21 and TS.N14-TS.N21.

[84] The Prep Year was not made compulsory for all students when it was introduced in 2007. It will be compulsory from 2017.

[85] NAPLAN gains were estimated using linear regression on a three-year rolling average score to minimise year-to-year fluctuations. Gains (or drops) were then translated into equivalent years of learning. Comparing 2015 to 2008, reading scores improved about 10 months for Year 3 ($p<0.001$), 13 months for Year 5 ($p<0.001$) and 4 months for Year 7 ($p<0.05$). Numeracy scores increased by about 5 months for Year 3 ($p<0.001$) and 7 months for Year 5 ($p<0.001$), but dropped by about 4 months for Year 7 (not statistically significant, $p>0.1$).

Secondly, closing the progress gap for disadvantaged students can increase productivity.

Closing the gap is an obvious area for reform, especially for those students who demonstrate potential in Year 3 but make much less progress than their more advantaged peers by Year 9 (discussed in Chapter 4). This is a clear productivity loss.

As an interim target, we estimate that closing the progress gap by half (for those of similar scores in Year 3) would add around four months of learning on average across the student population.[86] This would add around 11 PISA points, and help to regain much of our lost ground since 2000.[87] An interim target of this kind would also bring Australia closer to countries such as Canada on equity. Reaching this target will be hard, but it is achievable.

Thirdly, investing in better systemic support for targeted teaching would be a clear win.

Helping teachers to teach to the very large spread in student achievement that opens up (discussed in Chapter 3) is a key policy priority. Unless teaching is well targeted to the current level of each student, the low achievers will be lost in class, and the high achievers will be bored. Neither will learn as much as they could. Again, this is a big productivity loss.

The evidence shows that 'targeted teaching'[88] has one of the strongest evidence bases for improving learning outcomes (discussed further in the policy recommendations in Chapter 6).

[86] Grattan estimates the size of the gap for students from same Year 3 score is an average of eight months (rounded from 7.65) across the Year 9 student population in Victoria. This refers to the gap between students in low and medium advantage schools compared to students in high advantage schools. This estimate is based on our findings that students in low-advantage schools are 1 year and 1 month behind in Year 9 from the same Year 3 starting score, and students in medium-advantage schools are 10 months behind in Year 9 from the same Year 3 starting score. Closing this gap by half is four months (3.83 months). This is a conservative estimate of the national progress gap, given learning outcomes in Victoria are more equitable than in other states according to PISA data, Thomson*, et al.* (2013) p. 274-275.

[87] Grattan estimates these PISA points based on the OECD research that shows 34.73 PISA points is equal to one year of schooling. OECD (2014c), Table A1.2. Using this ratio, an increase of 3.83 months on average across the population would increase learning by 11.1 PISA points.

[88] 'Targeted teaching' is discussed in a recent Grattan Report by Goss*, et al.* (2015)

Box 10: Education funding and outcomes

Good education policy can improve education outcomes and bring big economic benefits. Yet changing practice is hard and takes resources. And effective reform is not a matter of throwing money at the problem.[89]

Three things are undeniable. The first is that how every dollar is spent matters. A dollar that is wasted on an ineffective intervention,[90] or on poor school infrastructure planning,[91] could have been better spent elsewhere. When considering expensive reforms the first question must always be: can existing money be re-allocated to key priorities and away from waste?

The second thing is that money alone does not improve learning. What matters is what is done with it, and what support is given to schools to improve practice.[92] The third is that learning will not improve unless classroom practice changes. This takes time, especially for teachers and school leaders, who are the most valuable – and costly – resource we have. Not investing the right level of funding in this, whether from existing budgets or new funding, will guarantee failure.

Australia needs a much more sophisticated discussion about the education policies of our political parties. We spend too much time talking about the amount of funding and not enough about how to improve learning.

Even when we do talk about money, we should learn to ask the questions that really matter. For example:

- Is the existing level of funding being used strategically to address the biggest education priorities?
- Do schools get the support they need to help all students make good learning progress, regardless of their background or circumstances?
- Is existing funding being used to support evidence-based policies, with a clear and realistic plan to improve classroom practice?
- Where are we wasting money (i.e., spending money on things that have little impact on learning, or that cost far too much for the impact they have)?

The Gonski Review of Funding for Schooling (December 2011) proposed that all schools, both government and non-government, be funded on a transparent, consistent basis that takes into account student need. The principle of needs-based funding received broad support. Schools need certainty. However, current funding arrangements remain complex and disputed.

[89] High income countries that spend more on education do not necessarily have better outcomes. OECD (2012a)
[90] CESE (2015)
[91] See Goss (2016).
[92] OECD (2012a)

6 What policymakers should do

This final chapter offers recommendations to policymakers about what they should do with our new approach and its findings.

First, they should put relative student progress and learning gaps at the centre of the policy agenda.

Second, implement better systematic support for targeted teaching, given the wide spread of student achievement discussed in Chapter 3.

Third, improve efforts to lift the progress of disadvantaged students to address the gaps discussed in Chapter 4.

The chapter concludes with a brief discussion of what not to do.

Recommendation 1: Put analysis of relative student progress and learning gaps at the centre of the policy agenda and use it to target policy and resources more effectively

While NAPLAN data tells us a lot, it is difficult to see *relative* student progress at present. How can policymakers set priorities and make informed policy and resource decisions if they cannot see how well different students are progressing relative to each other?

Many of the current analytical approaches to assessing relative progress in NAPLAN are highly technical. Other approaches only allow comparisons between students from similar backgrounds or with similar scores. This is too limiting and confusing.

1a Adopt Grattan's new *'years of progress'* approach to better understand relative student progress

Grattan's *years of progress* measure helps to assess relative performance and is easy to use and interpret. It is designed for Education departments and non-government system leaders to use for their own internal analysis. It helps to identify patterns of fast or slow progress and any issues that warrant further analysis.[93] A better understanding of learning gaps helps leaders set strategic priorities and targets, and see whether they are being met.

The new measure should be used as part of a suite of measures to assess student performance; understanding the data from multiple angles is important.

1b Use relative progress analysis to set system priorities, inform resource allocation and needs-based funding policies

Students who make good learning progress during school have the opportunity to realise their educational potential. Analysis of current progress and learning gaps should therefore inform system priorities, resource allocation, as well as needs-based funding policies.

This is not just about money. Students with low progress or poor outcomes may need different types of resources or support. Or existing resources may need to be used more effectively.

[93] It would also complement the value-added models that some education systems use, which analyse the difference between expected and observed progress.

Additional support is warranted where progress or outcomes remain too low, despite best efforts, or if gaps remain too wide. Failure has too high a cost – for the individual, for society and for the economy.

To help fund this, education system leaders must ensure they get good value from every existing dollar.

1c Education departments should continue to link up their student data, and implement a national student identification mechanism

Targeting funding to where it is needed most relies on fine-grained analysis of student progress and learning gaps. Linked datasets that track individual student progress over time are an invaluable resource for policymakers.

Much of the analysis presented in this report depends on the linked student dataset provided by Victoria. Not all state and territories in Australia have a linked dataset of this quality.[94] Those that don't are missing a valuable analytical tool. They should link up their own student data. This should begin with NAPLAN data; over time, other achievement and administrative data could be added.

Linked datasets would be much easier to develop and maintain if there were better mechanisms to identify students. Student identifiers have traditionally been managed at school and/or sector level.[95] But students move between interstate and between school sectors. With NAPLAN moving online, now is the time to implement a national student identification mechanism.

In this light, we welcome a recently announced Productivity Commission Inquiry which will examine ways to improve the use of data by the school and early childhood sectors.[96]

Recommendation 2: In light of the very large spread in student achievement, implement better systematic support for targeted teaching so that all students make good learning progress

Everyone knows that students are different. Some are well ahead in their learning; others are well behind. Chapter 3 shows just how large spread in achievement is, especially in secondary school.

Grattan's previous school education report, *Targeted teaching*, directly addresses the challenge of this spread. The best teachers assess what each student knows already, target their teaching to meet each student's learning needs, track students' progress over time, and adapt teaching practices according to what works best.[97]

Targeted teaching is not new, but it is still much too rare in Australia. Too often, schools are left to figure it out on their own. This has led to pockets of great practice, but not systemic improvement. All schools have high and low achievers, all of whom deserve to be taught at their current level. Targeted teaching accelerates learning and would improve the productivity of school education.

Better system-wide policies and systematic support for targeted teaching are needed. While a number of good initiatives exist, in

[94] It is unclear if linked datasets are widely available to non-government sectors.
[95] Australia has three school sectors: government, Catholic and independent.
[96] See Productivity Commission (2016).
[97] Goss, *et al.* (2015)

many cases schools are left to reinvent the wheel themselves with limited support.

2a Strengthen system-wide policies around targeted teaching, with an emphasis on giving teachers the *time*, *tools* and *training*

Education systems should support schools to give teachers the *time*, *tools*, *training* to target their teaching.[98] When they do, change can be achieved at scale.[99]

Targeted teaching will not happen for free. Changing established practice never does.[100] One option for funding targeted teaching is to re-allocate funding away from grade repetition, a practice that is known to be ineffective. Reducing the number of students currently held back in school due to low performance would open up funding for higher impact initiatives.[101] These two policy levers are directly linked: targeted teaching reduces the need for low performers to repeat a year of school.

[98] *Trust* and *teamwork* also matter.
[99] See Goss, *et al.* (2015); chapter 6 includes detailed recommendations, and chapter 5 shows how some systems are delivering change at scale.
[100] The main investment needed is on-the-ground professional development for existing teachers. Relying on better Initial Teacher Education is far too slow.
[101] Grade repetition is expensive and ineffective. Yet one in twelve Australian students will repeat a year of schooling, three times as high as in the UK. It costs at least $8000 to have a student repeat a grade, much more in some schools. We estimate about $200 million is wasted on every new cohort of Prep (or kindergarten) students as they move through school. Our estimate was simply calculated by multiplying $8000 by 8.4 per cent – one in 12 – of the 310,198 students in Year 1 of schooling in 2014. Romanes and Hunter (2015). OECD (2013b).

2b Shift the focus in NAPLAN to proficiency. Either raise the national minimum standard or remove it entirely

It is hard to aim high when the bar is set low. We do students no favours by defining acceptable performance or progress using inadequate benchmarks.

Yet a Year 9 student reading at the national minimum standard is achieving below the typical Year 5 student. No wonder only 8 per cent of Year 9 students failed to meet this standard in 2015.[102] Worse, a student performing just above the national minimum standard in Year 3 needs to make only about one Year of progress every two years to stay above the minimum standard in Years 5, 7, and 9.[103]

The bar we are setting with the national minimum standard is just too low. Importantly, setting such low standards increases the risk of overlooking students who require additional support to make adequate progress. Australia must raise its sights.

The focus of NAPLAN should shift to proficiency. We welcome indications from ACARA that new standards of proficiency and competency will be introduced along with NAPLAN online. The national minimum standard must also be raised. If it is not, it should be removed entirely.

[102] ACARA (2015)
[103] See Section 3.3

Recommendation 3: Given the very large gaps that open up by Year 9, increase efforts to lift the progress of disadvantaged students

Our analysis shows just how big the gaps between students of different backgrounds are. Educationally disadvantaged students – especially those with parents with limited education – tend to start behind in Year 3. But they then fall much further behind between Year 3 and Year 9, even from the same Year 3 score.

Reducing the impact of disadvantage has big potential benefits. But it is hard to do. Previous efforts to improve outcomes for disadvantaged students and schools have met with limited success.[104] Policymakers must increase efforts to do better.

3a Make it a priority to increase the rate of progress of educationally disadvantaged students, especially low performers. Start early but also provide ongoing support after Year 3

Educational disadvantage can become an intergenerational cycle of poverty, especially for those who show signs of low performance early on. Assisting these students to break the cycle can have a massive impact on their lives. They must be a key priority in system level policies.

Educational disadvantage is complex, and so are potential solutions. Disadvantaged students can face multiple challenges: lower levels of parental education; higher levels of parental unemployment; living in communities with fewer resources, and complex behavioural issues. Such factors can make it difficult to attend school, reduce parental support, and weaken students' attitudes towards schooling and expectations of themselves.

Schools with higher proportions of disadvantaged students often face additional challenges. For example in attracting and retaining staff, [105] equipping teachers with the skills to meet the learning needs of disadvantaged students; and engaging parents and carers in their children's schooling.[106]

Analysis of specific policy initiatives to address educational disadvantage at the individual and school level is beyond the scope of this report. However, five broad steps seem clear.

Firstly, give all students at least one year of quality pre-primary education.

Recent Australian evidence suggests that disadvantaged students may benefit from starting early childhood education earlier.[107] Nearly 40 per cent of Australian students with no pre-primary education were low performers in PISA mathematics at age 15. By contrast, students with at least one year of pre-primary education were half as likely to be low performers, even after accounting for student background.[108] The Universal Access to

[104] Productivity Commission (2012), p. 274. Evaluations of the *Smarter Schools National Partnership,* which provided $2.5 billion in funding to disadvantaged schools, should be explored as a priority. One Victorian study shows positive effects in some cases, Department of Education and Training (2016).

[105] Low socio-economic primary schools are four times more likely to express major difficulty in suitably filling staff vacancies than high socio-economic primary schools. They are more than six times more likely to express major difficulty in retaining suitable staff. Low socio-economic secondary schools and remote schools report similar challenges. Productivity Commission (2012), Table 9.1

[106] Ibid. p. 253, 257-267

[107] Australian Institute of Health and Welfare (2015)

[108] OECD (2016), Figures 2.13 and 2.14. The OECD analysis showed relatively little additional benefit of attending more than one year of pre-primary education.

Early Childhood Education Program should be permanent.[109] The quality of the programs is also vital.[110]

Secondly, target teaching from the first week of primary school, so that students have strong foundational skills by the end of Year 3.

Targeting teaching from the first week of primary school would benefit all children. It would provide most benefit to children who are developmentally vulnerable when they start school.[111] Research shows that schools in the most disadvantaged areas have a higher proportion of these developmentally vulnerable children starting school. This concentration of vulnerable children in disadvantaged areas intensified during the period 2009 to 2015.[112]

Children who are developmentally vulnerable when they start school can get 'back on track' in their education, but it's harder for those from disadvantaged backgrounds.[113] If they are going to get back on track, efforts need to start early. This makes disadvantaged schools the ideal place for the 'funding switch' described above, where investments in targeted teaching could at least in part be funded by holding back fewer students later in school.

Targeting teaching early will help build strong foundational skills by Year 3, in reading, writing, and numeracy. John Hattie, the Chair of the Australian Institute for Teaching and School Leadership (AITSL), has emphasised that all children need to learn to read and write by age 8 (generally Year 3), as those who do not very rarely catch up.[114]

Our analysis supports this claim. *Early Action for Success* – which focuses on targeted teaching for students in early primary – is a good example of a policy initiative that is working, even in the most disadvantaged NSW schools.[115]

Queensland's recent experience of funding an extra year of prep shows that investing early can deliver large benefits (see Box 9 in chapter 5). Queensland students at or above national minimum standards in Year 3 reading increased from 87.1 per cent in 2008 to 95 per cent in 2015.

Thirdly, provide extra support after Year 3, providing remedial support as early as possible to all students who fall very far behind their peers.

Efforts must not stop at Year 3. Our analysis shows that the gaps between students of different backgrounds exist at Year 3, but grow much wider by Year 9. Struggling students – whatever their background – need remedial support as early as possible. It is important to disrupt the cycle of low performance that leads to

[109] See https://www.education.gov.au/universal-access-early-childhood-education, accessed 14 March 2016.
[110] Barnett (2011)
[111] The Australian Early Development Census (AEDC) is run every three years, to assess the developmental readiness of children as they enter their first year of full-time school. It covers five domains: physical health and wellbeing; social competence; emotional maturity; language and cognitive skills (school-based); and communication skills and general knowledge. AEDC (2016)
[112] For the language and cognitive skills domain, children in the most disadvantaged areas in 2009 were 2.9 times more likely to be developmentally vulnerable, relative to children in the least disadvantaged areas. By 2015, they were 4.1 times more likely to be developmentally vulnerable. Ibid., p. 14.
[113] Lamb, *et al.* (2015)
[114] Hattie (2015)
[115] Early Action for Success focuses on students in K-2 in over 300 of the most disadvantaged NSW government schools. Goss, *et al.* (2015), p. 35-36.

early disengagement.[116] The best way to fund effective remedial support is to stop delivering remedial programs that have been shown not to work, such as Reading Recovery.[117]

As an interim target, closing the progress gap by half (for those of similar scores in Year 3) would add around four months of learning on average across the student population.[118] This would add around 11 PISA points, and help to regain much of our lost ground since 2000.[119] Achieving this target would have potentially big benefits for individuals and the economy. It would also bring Australia closer to countries such as Canada on equity.

Fourthly, various government and non-government bodies need to be involved in these efforts.

The effects of family background on education outcomes are complex. Education departments and schools can't deliver great outcomes on their own. Other departments and non-government bodies play key roles in addressing the full range of challenges that can impact student outcomes. [120]

For example, positive role models and mentors from the community can help to lift student expectations. Involving parents in the learning of their children is also important. Community and welfare groups can be vital in addressing serious family problems that affect learning at school.[121]

Education leaders need to work closely with the many other bodies doing important work to improve educational outcomes for disadvantaged students.

Finally, given the size of the gaps, system leaders should undertake further analysis on school effectiveness to isolate what is working and why.

Our report examines how certain groups of students perform relative to one another. While it highlights that some levels of student progress are very low, our findings do not isolate the specific impact of the school or teachers – it simply captures the multitude of factors at play associated with the progress of specific groups of students. Understanding the impact of the school on student learning is a key in understanding what more can and needs to be done.

To examine how good a job schools are doing requires analysis that isolates the school effects (for example through regression analysis or value added modelling). Further research in this area should be pursued as a priority, given the new findings. Our *years of progress* measure could be considered for this purpose in future.

3b. Strengthen support for bright students whose parents have low education

The biggest relative gaps in learning progress are for bright Year 3 students from families with low educational backgrounds. Lifting

[116] OECD (2016), p. 194.
[117] CESE (2015)
[118] See Chapter 5 for an explanation of how this is estimated.
[119] We estimate these PISA points based on the OECD research that shows 34.73 PISA points is equal to 1 year of schooling. According to this ratio, an increase of 3.83 months in learning on average across the population would increase PISA test points by 11.1. OECD (2014c)
[120] For example, the Smith Family's *Learning for Life* program is a large non-government initiative working with disadvantaged students. The Smith Family (2016)
[121] Discussed further in *Turnaround Schools*. Jensen and Sonneman (2014)

their progress between Year 3 and Year 9 may be help to lift the number of high performing students overall.

Targeted teaching would help. Beyond that, there is limited evidence about what works to promote excellence for educationally disadvantaged students. A major policy priority is to identify what works to support and stretch bright students from poor backgrounds.

3c. As a priority, the Education Council should initiate and oversee a coordinated national review of the quality and effectiveness of school education for young people from disadvantaged backgrounds

In 2012, the Productivity Commission found that "deficiencies in evaluation make it difficult to identify the most effective ways to address educational disadvantage".[122] The evidence base was weakest for initiatives related to low socio-economic status.

In response to this finding, the *Schools Workforce* review recommended a coordinated national review of "existing evidence on the effectiveness of programs and policies to help ameliorate educational disadvantage".[123] The recommendation has not been implemented.

The newly announced Productivity Commission inquiry appears to focus more on the quality of data collection and use rather than the evidence of what works.[124] It will be very valuable. However, the published terms of reference suggest it will not tell us how well school education is working for young people from disadvantaged backgrounds, or what programs, policies or practices work best.

A broader review is needed.

What not to do

Any analysis that shows large and growing learning gaps among students could trigger well-meaning but inappropriate responses. We highlight four things policymakers should *not* do as a result of this report.

First, do not use the wide spread of achievement as an argument for early streaming, or holding students back.[125] While streaming may have small positive effects for bright students, taking these students out of the classroom can have detrimental effects on the learning of others. There are better ways to improve the learning of every student, as discussed in our policy recommendations.

Second, do not use our *years of progress* approach to assess *individual* student learning progress. It is not designed for this purpose. Measurement errors are large, and the consequences of poor decisions are too big.

Third, do not use our new approach as the basis for new ways to reward or punish teachers and principals. Judging teachers and schools based on their impact on student learning sounds highly attractive. But it is very easy to get performance management or incentive schemes very wrong, and no metric captures everything.

[122] Productivity Commission (2012), p. 251
[123] Ibid., Recommendation 10.3
[124] "[T]his inquiry will help to identify current investment in national data collection and education evidence, opportunities to collectively invest further, and how we can improve the effectiveness of our investment through a more streamlined, comprehensive and collaborative national approach." Productivity Commission (2016)
[125] The OECD recommends avoiding formal early streaming to reduce inequity in education systems. OECD (2012b), p. 89; OECD (2016), p. 185

Finally, do not change how NAPLAN scores are calculated, beyond what is needed for the shift to NAPLAN online. Australia is fortunate to have a national assessment tool that is consistent over time, and comparable across years of schooling. Instead, it is the responsibility of those who use NAPLAN data to interpret it appropriately and use the results responsibly, including to inform and make policy. This report is our contribution to that effort.

Glossary

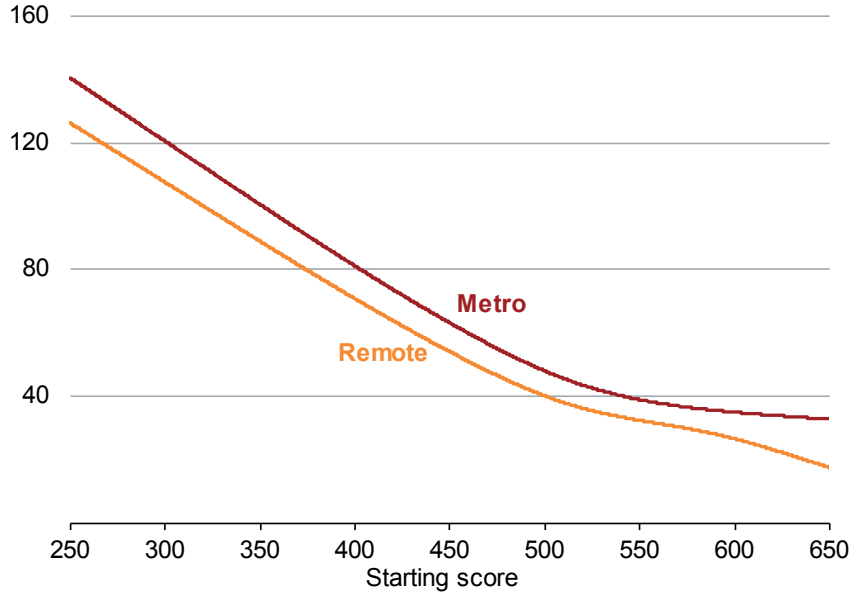
ACARA	The Australian Curriculum, Assessment and Reporting Authority is an independent statutory authority responsible for managing and developing the national curriculum and managing the Australian National Assessment Program. It is responsible for the central management of NAPLAN.
Actual Year Level	The grade or year level of the student taking the NAPLAN test. For the median student, equivalent year level is equal to actual year level in test years.
Equivalent Year Level (EYL)	Corresponds to the NAPLAN scale score we expect the median student in the same actual year level to achieve.
Gain score	Gain scores are the difference in a student's NAPLAN scale scores between two points in time.
ICSEA	The Index of Community Socio-Educational Advantage (ICSEA) is an aggregate measure at the school level of the socio-educational background of all students at a school. It enables comparisons to be made across like-schools, that is, schools whose students share similar socio-educational advantage.
National Minimum Standards (NMS)	The Australian NAPLAN NMS seek to identify students at risk of not making satisfactory progress without targeted intervention. *Students who do not achieve the national minimum standard at any Year level may need intervention and support to help them achieve the literacy and numeracy skills they require to progress satisfactorily through their schooling.* For further information, see: http://www.nap.edu.au/results-and-reports/how-to-interpret/standards.html
NAPLAN	The National Assessment Program - Literacy and Numeracy (NAPLAN) was introduced as an annual test for Year 3, 5, 7 and 9 students in 2008. Testing covers four domains; Reading, Writing, Language Conventions (spelling, grammar and punctuation) and Numeracy. It provides a standardised measure of student achievement around the country.
OECD	The Organisation for Economic Co-operation and Development (OECD). The OECD Secretariat is responsible for the day-to-day management of PISA.

PISA	The Programme for International Student Assessment (PISA) is a triennial international survey which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. Students representing more than 70 economies have participated in the assessment.
Scale score (or NSS)	A current NAPLAN measure. The scale score is an estimate of student ability at a given point in time. Scale scores range from 0 to 1000, and are organised into 10 NAPLAN proficiency bands. All students who sit the test in either Year 3, 5, 7 or 9 are scored along the same NAPLAN point scale within a given testing domain.
School advantage	In this report's analysis, school 'advantage' / 'disadvantage' status is derived from the Index of Community Socio-Educational Advantage (ICSEA). Low advantage schools are those schools within the bottom quartile of ICSEA scores for Victoria. Medium advantage schools cover the middle two quartiles and high advantage schools are those in the top quartile.
Parental education status	In this report's analysis, parental education status is used as the proxy for student socioeconomic status. Parental education status is known to be correlated with a range of other socio-economic factors that influence student achievement.
Typical student	The typical student refers to the median student's estimated learning progression through school. The 'typical' student is a simple reference point for an abstract concept of the median student's learning progress as observed in NAPLAN tests.
VCAA	The Victorian Curriculum and Assessment Authority is an independent statutory body responsible to the Victorian Minister for Education, serving both government and non-government schools. The VCAA provides curriculum, assessment and reporting. It is the NAPLAN Test Administration Authority in Victoria.
Years of (learning) progress	The difference in years and months between equivalent year levels between two points in time for a given student or for the median student within a group of students. This estimates how far a student (or group of students) is in front of or behind their peers in years and months of learning.

Appendices

Appendix 1: Metropolitan students consistently gain more NAPLAN scale points than remote students

Figure 18: Metropolitan students gain more points between NAPLAN tests than remote students with the same starting score
Median NAPLAN gain score over two years by starting score and location of school, numeracy, Australian students, 2012–14



Notes: Median gain score estimated by absolute deviation regression of gain scores on starting score. Source: Grattan analysis of ACARA (2014b).

Appendix 2: NAPLAN measures of student achievement and progress

A large number of publicly reported NAPLAN measures focus on student achievement. A common measure is the proportion of students meeting national minimum standards, and how this changes from one year to the next. Student achievement at the top end is also a focus in key reporting metrics, including the proportion of students in high-level NAPLAN proficiency bands.

In addition a number of NAPLAN measures help to track student progress:

- *Gain scores.* Gain scores compare the difference in NAPLAN points between two points in time.
- *Student cohort gain.* Used in national NAPLAN reports, this measure looks at the gain score for a population of students. It is reported for each state and territory, as well as by student characteristics (for example indigenous, gender, remote students). The gain is estimated over two years for Year 3-5, Years 5-7 or Years 7-9.[126]
- *Student gain – average for schools.* Reported on the *MySchool* website, this measure shows the difference in NAPLAN points between two points in time while controlling for student starting score. It is a proxy for comparing the growth of students with similar ability.[127] Results can be compared to schools with similar students as well as the average achievement of students with the same starting scores.
- *Relative growth measures.* These measures compare student growth (as measured by gain scores) to what was typical for a student with the same initial level of achievement. For example, the Victorian Curriculum and Assessment Authority reports student growth as 'high', 'medium' and 'low'. This identifies if a student was in the top 25%, middle 50% or bottom 25% (respectively) of gain scores for their initial score (it is similar to a value-added model).[128] Accounting for the difference in expected gain from different starting scores helps to provide an indication of how well students are doing.
- *Value-added models.* The OECD has defined value-added as the contribution of a school to students' progress.[129] It compares the progress each student makes relative to all other students with the same initial level of achievement, while controlling for socio-economic factors.

[126] In the annual NAPLAN report, this measure is reported with a focus on differences among the two-year gains that are statistically significant (i.e. unlikely to arisen by chance).

[127] Matched students in the selected school are compared with students-in statistically similar schools and across Australia with the same starting scores. For further information: ACARA (2013a).

[128] NSW uses a similar approach in 'SMART' which defines expected growth as being above the 25th percentile for the students initial score.

[129] OECD (2008)

Appendix 3: Conversion of NAPLAN scale scores to *equivalent year levels*

Table 3: Conversion of NAPLAN scale points to *equivalent year levels*, Australian students, 2014,

Equivalent Year Level	NSS Reading	NSS Numeracy
1	308	290
2	365	346
3	421	402
4	466	451
5	500	489
6	525	517
7	547	540
8	566	563
9	583	585
10	600	605
11	616	625
12	632	646

Source: Grattan analysis of ACARA (2014b).

Appendix 4: Cut points for NAPLAN scale scores to *equivalent year level*

Table 4: Cut points for NAPLAN scale scores and e*quivalent year level*, reading, median, Australian students, 2014

	NAPLAN Scale Score (NSS) Cut points		Reading Equivalent Year Level Cut points		
	Bottom	**Top**	**EYL Bottom**	**EYL Top**	***Span***
Band 1	*0*	270	<1Y	<1Y	*unknown*
Band 2	270	322	<1Y	1y 3m	*unknown*
Band 3	322	374	1y 3m	2y 2m	11m
Band 4	374	426	2y 2m	3y 1m	11m
Band 5	426	478	3y 1m	4y 4m	1y 3m
Band 6	478	530	4y 4m	6y 2m	1y 10m
Band 7	530	582	6y 2m	8y 11m	2y 9m
Band 8	582	634	8y 11m	12y 2m	3y 3m
Band 9	634	686	12y 2m	>13Y	*unknown*
Band 10	686	*1000*	>13Y	>13Y	*unknown*

Source: Grattan analysis of ACARA (2014b).

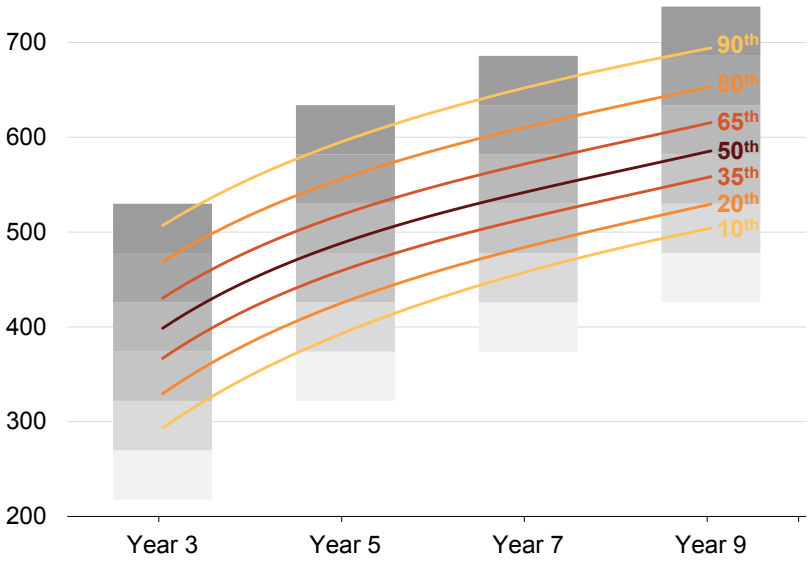
Table 5: Cut points for NAPLAN scale scores and e*quivalent year level*, numeracy, median, Australian students, 2014

	NAPLAN Scale Score (NSS) Cut points		Numeracy Equivalent Year Level Cut points		
	Bottom	**Top**	**EYL Bottom**	**EYL Top**	***Span***
Band 1	*0*	270	<1Y	<1Y	*unknown*
Band 2	270	322	<1Y	1y 7m	*unknown*
Band 3	322	374	1y 7m	2y 6m	11m
Band 4	374	426	2y 6m	3y 6m	1y 0m
Band 5	426	478	3y 6m	4y 8m	1y 2m
Band 6	478	530	4y 8m	6y 7m	1y 11m
Band 7	530	582	6y 7m	8y 10m	2y 3m
Band 8	582	634	8y 10m	11y 5m	2y 7m
Band 9	634	686	11y 5m	>13Y	*unknown*
Band 10	686	*1000*	>13Y	>13Y	*unknown*

Source: Grattan analysis of ACARA (2014b).

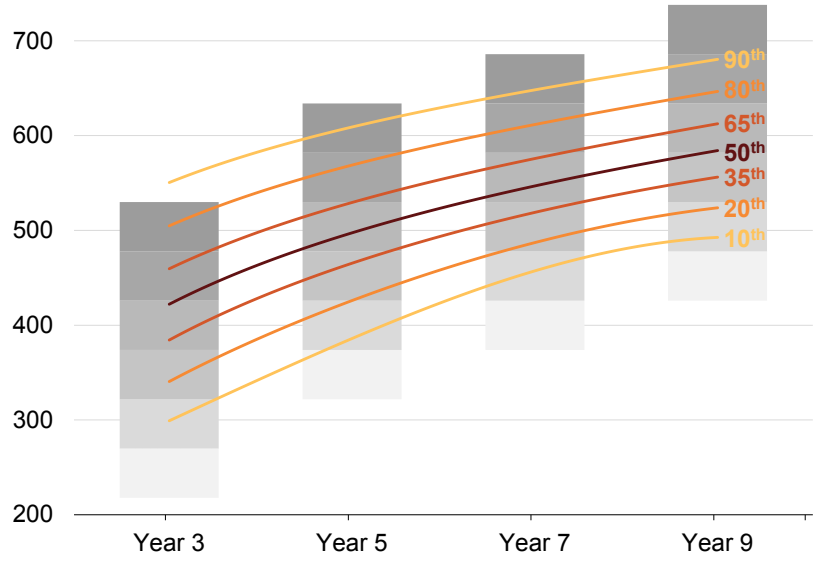
Appendix 5: Observed learning curve and percentiles

Figure 19: Learning curves and percentiles, numeracy
Estimated numeracy NAPLAN learning curve by percentile and NAPLAN bands, median, Australia, 2014



Source: Grattan analysis of ACARA (2014b).

Figure 20: Learning curves and percentiles, reading
Estimated reading NAPLAN learning curve by percentile and NAPLAN bands, median, Australia, 2014

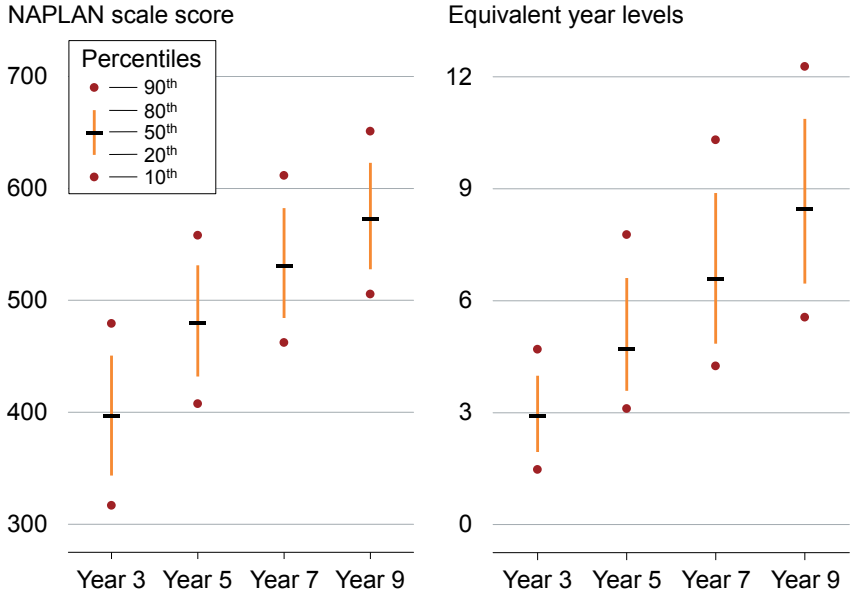


Source: Grattan analysis of ACARA (2014b).

Appendix 6: Spread in student achievement in a typical school

Figure 21: In a typical school, *equivalent year levels* show that the spread of achievement is increasing

Achievement spread in a typical school by actual year level, numeracy, Australian students, 2014



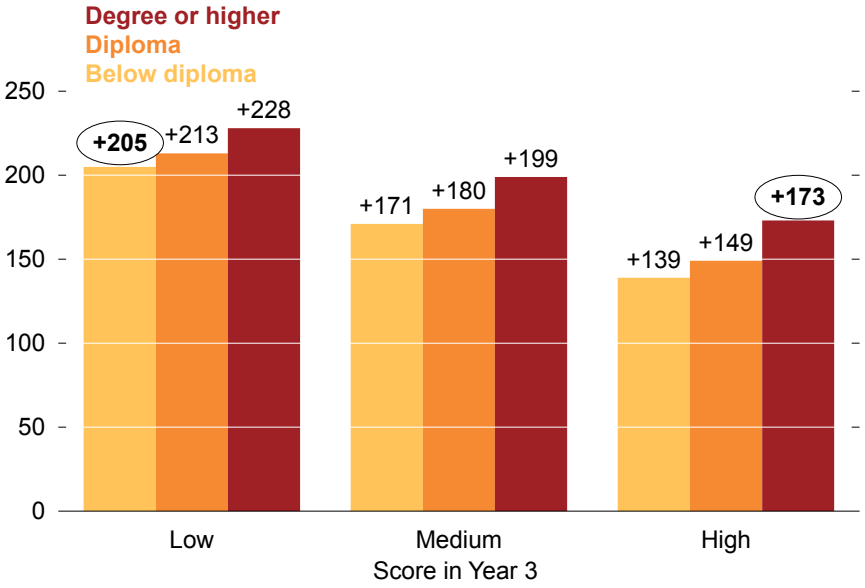
Notes: Results show the median spread of student achievement in a school. Data includes all Australian students who sat NAPLAN numeracy tests in 2014. The top ten per cent in Year 9 are above equivalent year level 12 and are not shown on this chart. Results at the 10th and 90th percentiles are subject to higher measurement error.
Source: Grattan analysis of ACARA (2014b).

Appendix 7: Two approaches, two different pictures of student progress

The two approaches show different pictures about which students make the most relative progress. In Figure 22, NAPLAN gain scores show that high achieving students from highly educated parents have lower gain scores (173 gain score points) than low achieving students of parents with low education (205 gain score points) between Year 3 and Year 9. This suggests that high achievers from highly educated parents make *less* progress than low achievers from poor backgrounds.

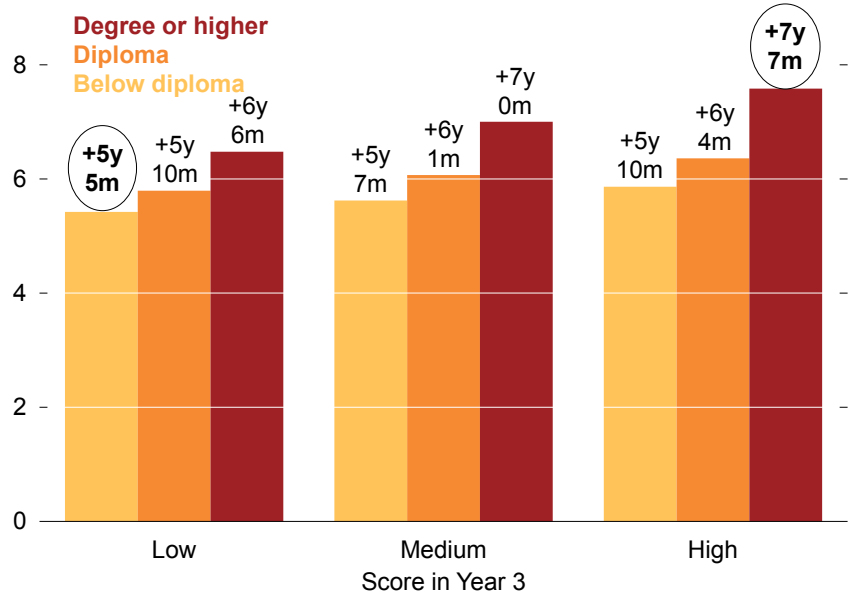
By contrast, our approach suggests the reverse. Students from highly educated parents make more relative progress. They make 7 years and 7 months of progress compared to only 5 years and 5 months of progress made by low achieving students whose parents have low education. This finding aligns with existing research on divergence that low performance early on can lead to snowballing effects, creating wider gaps over time.

Figure 22: Gain scores could be interpreted to show low achievers whose parents have low education making more progress
Gain scores between Year 3 – 9, numeracy, median, Victoria, 2009–15



Source: Grattan analysis of VCAA (2015)

Figure 23: Our new measure shows the opposite: high achievers from whose parents have high education make more progress
Years of progress Year 3 – 9, numeracy, median, Victoria, 2009–15



Source: Grattan analysis of VCAA (2015) and ACARA (2014b)

References

ABS (2014a) 'Educational outcomes, experimental estimates, Tasmania 2006-2013', accessed 2 March 2016, from http://www.abs.gov.au/ausstats/abs@.nsf/mf/4261.6?OpenDocument

ABS (2014b) 'Socioeconomic factors and student achievement in Queensland', accessed 18/3/2016, from http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4261.3Main+Features32011

ACARA (2013a) *Guide to understanding student gain*, accessed 2 March 2016, from http://www.acara.edu.au/verve/_resources/Guide_to_understanding_Student_Gain.pdf

ACARA (2013b) 'NAPLAN', accessed 2 March 2016, from http://www.nap.edu.au/naplan/naplan.html

ACARA (2014a) 'About ICSEA', accessed 2 March 2016, from http://www.acara.edu.au/verve/_resources/About_icsea_2014.pdf

ACARA (2014b) *Deidentified student-level NAPLAN data, 2014 results linked to 2012*, Australian Curriculum Assessment and Reporting Authority

ACARA (2015) 'National Assessment Program- Literacy and Numeracy: National Report for 2015', accessed 2 March 2016, from http://www.nap.edu.au/verve/_resources/2015_NAPLAN_national_report.pdf

ACARA (2016a) 'Interpreting NAPLAN results', from http://www.acara.edu.au/verve/_resources/Interpreting_NAPLAN_results_file.pdf

ACARA (2016b) 'Standards', accessed 18/3/2016, from http://www.nap.edu.au/results-and-reports/how-to-interpret/standards.html

AEDC (2016) *Australian Early Development Census National Report 2015: A Snapshot of Early Childhood Development in Australia*, from https://www.aedc.gov.au/resources/detail/2015-aedc-national-report

Allington, R. L. (2008) 'Why Struggling Readers Continue to Struggle', in *What Really Matters in Response to Intervention: Research-based Designs*, Pearson

Angoff, W. H. (1984) *Scales, Norms, and Equivalent Scores*, Educational Testing Service from https://www.ets.org/Media/Research/pdf/Angoff.Scales.Norms.Equiv.Scores.pdf

Australian Institute of Health and Welfare (2015) *Literature review of the impact of early childhood*

education and care on learning and development: working paper, from http://aihw.gov.au/workarea/downloadasset.aspx?id=60129552948

Ball, C., Crichton, S., Templeton, R., Tumen, S., Ota, R. and MacCormick, C. (2016) *Characteristics of Children at Greater Risk of Poor Outcomes as Adults*, The Treasury (NZ) from http://www.treasury.govt.nz/publications/research-policy/ap/2016/16-01

Barnett, W. S. (2011) 'Effectiveness of Early Educational Intervention', *Science*, 333(6045), p 975-978

Cassells, R., Duncan, A., Abello, A., D'Souza, G. and Nepal, B. (2012) *Smart Australians: education and innovation in Australia*, AMP NATSEM

Ceci, S. J. and Williams, W. M. (1997) 'Schooling, Intelligence, and Income', *American Psychologist*, 52(10), p 1051-1058

CESE (2014) *Value added models for NSW government schools*, Centre for Education Statistics and Evaluation (CESE) from http://www.cese.nsw.gov.au/images/stories/PDF/Value_Added_paper_July_2014_v2.pdf

CESE (2015) *Reading Recovery: A Sector-Wide Analysis*, Centre for Education Statistics and Evaluation from http://www.cese.nsw.gov.au/images/stories/PDF/Reading_Recovery_Evaluation_FINAL_25112015.pdf

Claessens, A. and Engel, M. (2013) 'How important is where you start? Early mathematics knowledge and later school success', *Teachers College Record*, 115(6), p 1-29

Cunningham, A. E. and Stanovich, K. E. (1997) 'Early reading acquisition and its relation to reading experience and ability 10 years later', *Developmental psychology*, 33(6), p 934

Department of Education and Training (2016) 'Universal Access to Early Childhood Education', from https://www.education.gov.au/universal-access-early-childhood-education

Dougherty, C. and Fleming, S. (2012) *Getting Students on Track to College and Career Readiness: How Many Catch up from Far behind?*, ACT Research Report Series

Education Endowment Foundation (2016) 'Teaching & Learning Toolkit', accessed 18/3/2016, from https://educationendowmentfoundation.org.uk/evidence/teaching-learning-toolkit/

French, M. T., Homer, J. F. and Robins, P. K. (2010) *What You Do in High School Matters: High School GPA, Educational Attainment, and Labour Market Earnings as a Young Adult*, Working Papers, University of Miami, Department of Economicsfrom http://www.bus.miami.edu/_assets/files/faculty-and-research/academic-departments/eco/eco-working-papers/2010/wp-2010-26-what-do-you-do-in-high-school-matters.pdf

Goss, P. (2016) 'Schools crisis comes with massive waste of tax dollars', accessed 2 March 2016, from http://grattan.edu.au/news/schools-crisis-comes-with-massive-waste-of-tax-dollars/

Goss, P. and Chisholm, C. (2016) *Widening gaps: what NAPLAN tells us about student progress. Technical Report*, Grattan Institute

Goss, P., Hunter, J., Romanes, D. and Parsonage, H. (2015) *Targeted teaching: How better use of data can improve student learning*, Grattan Institute

Hanson, R. A. and Farrell, D. (1995) 'The long-term effects on high school seniors of learning to read in kindergarten', *Reading Research Quarterly*, p 908-933

Hattie, J. (2015) 'Education State Possible', accessed 2 March 2016, from http://www.aitsl.edu.au/docs/default-source/multimedia/education-state-possible-john-hattie-article.pdf

Houng, B. and Justman, M. (2014) *NAPLAN scores as predictors of access to higher education in Victoria- Melbourne Institute Working Paper No. 22/14* accessed 2 March 2016, from https://www.melbourneinstitute.com/downloads/working_paper_series/wp2014n22.pdf

Jensen, B. (2010) *Investing in our teachers, investing in our economy*, Grattan Institute

Jensen, D. B. (2010) *Measuring What Matters: Student Progress*, Grattan Institute from http://grattan.edu.au/wp-content/uploads/2014/04/016_education_performance_measures_report.pdf

Jensen, D. B. and Sonneman, J. (2014) *Turning around schools: it can be done*, Grattan Institute from http://grattan.edu.au/wp-content/uploads/2014/04/805-turning-around-schools.pdf

Lamb, P. S., Jackson, J., Walstab, A. and Huo, D. S. (2015) *Educational opportunity in Australia 2015: Who succeeds and who misses out*, Centre for International Research on Education Systems, Victoria University, for the Mitchell Institute from http://www.mitchellinstitute.org.au/wp-content/uploads/2015/11/Educational-opportunity-in-Australia-2015-Who-succeeds-and-who-misses-out-19Nov15.pdf

Leigh, A. (2010) 'Returns to education in Australia', *Economic Papers*, 27(3), p 233-249

Leigh, A. and Ryan, C. (2008) 'Estimating returns to education using different natural experiment techniques', *Economics of Education Review*, 27, p 149-160

Main, S. (2013) *NAPLAN doesn't stand up to international tests*, The Conversation from https://theconversation.com/naplan-doesnt-stand-up-to-international-tests-14765

Masters, G. N. (2005) *Against the grade: In search of continuity in schooling and learning*, accessed 2 March 2016, from http://research.acer.edu.au/monitoring_learning/3

Masters, G. N. (2013) *Reforming Educational Assessment: Imperatives, principles and challenges*, 3, Australian Council for Education Research from http://research.acer.edu.au/aer/12/

Norton, A. (2012) *Graduate Winners: Assessing the public and private benefits of higher education*, Grattan Institute from http://grattan.edu.au/wp-content/uploads/2014/04/162_graduate_winners_report.pdf

O'Donnell, K. and Zill, N. (2006) 'Predicting Early and Later Reading Achievement of Children from Low-Income Families from Skills Measured at Kindergarten Entrance', Annual Meetings of the Population Association of America, Los Angeles, United States, from http://paa2006.princeton.edu/papers/61304

OECD (2008) *Measuring improvements in learning outcomes- Best practices to assess the value-added of schools*, OECD Publishing

OECD (2012a) *Does money buy strong performance in PISA*, 13, from http://www.oecd-ilibrary.org/education/does-money-buy-strong-performance-in-pisa_5k9fhmfzc4xx-en

OECD (2012b) *Equity and Quality in Education - Supporting Disadvantaged Students and Schools*, OECD Publishing

OECD (2013a) *PISA 2012 Results: Excellence Through Equity: Giving Every Student the Chance to Succeed*

(Volume II), PISA from http://dx.doi.org/10.1787/9789264201132-en

OECD (2013b) *PISA 2012 Results: What Makes Schools Successful? Resources, policies and practices (Volume IV)*, PISA from http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-IV.pdf

OECD (2014a) *PISA 2012 Results: What Students Know and Can Do (Volume I, Revised edition, February 2014)*, OECD Publishing

OECD (2014b) *PISA 2012 Results: What Students Know and Can Do: Annex B1.1 Results (tables): A profile of student performance in mathematics*, from http://dx.doi.org/10.1787/888932935667

OECD (2014c) *PISA 2012 Results: What Students Know and Can Do; AnnexA1: Indices from the student, school and parent context questionnaires*, from http://dx.doi.org/10.1787/888932937073

OECD (2015) *Universal Basic Skills What Countries Stand to Gain: What Countries Stand to Gain*, OECD from http://dx.doi.org/10.1787/9789264234833-en

OECD (2016) *Low-Performing Students- Why They Fall Behind and How to Help Them Succeed*, OECD Publishing

Pearson (2016) 'Interpretation Problems of Age and Grade Equivalents', accessed 18/03/2016, from http://www.pearsonclinical.com/language/RelatedInfo/interpretation-problems-of-age-and-grade-equivalents.html

Peterson, P. E., Barrows, S. and Gift, T. (2016) *After Common Core, States Set Rigorous Standards*, Education Next from http://educationnext.org/after-common-core-states-set-rigorous-standards/

Productivity Commission (2012) *Schools workforce*, accessed 2 March 2016, from http://www.pc.gov.au/inquiries/completed/education-workforce-schools/report/schools-workforce.pdf

Productivity Commission (2016) 'Education Evidence Base', accessed 18/3/2016, from http://www.pc.gov.au/inquiries/current/education-evidence

Romanes, D. and Hunter, J. (2015) 'Grade repetition: there are better ways to move kids forward than by holding them back', accessed 1 March 2013, from http://grattan.edu.au/news/grade-repetition-there-are-better-ways-to-move-kids-forward-than-by-holding-them-back/

Stanovich, K. E. (1986) 'Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy', *Reading research quarterly*, p 360-407

Sullivan, J. R., Winter, S. M., Sass, D. A. and Svenkerud, N. (2014) 'Assessing Growth in Young Children: A Comparison of Raw, Age-Equivalent, and Standard Scores Using the Peabody Picture Vocabulary Test', *Journal of Research in Childhood Education*, 28(2), p 277-291

The Smith Family (2016) 'Our Work: Education has the power to change lives and break the cycle of disadvantage', accessed 18/3/2016, from https://www.thesmithfamily.com.au/what-we-do/our-work

Thomson, S., De Bortoli, L. and Buckley, S. (2013) *PISA 2012: How Australia measures up*, accessed 2 March 2016, from https://www.acer.edu.au/documents/PISA-2012-Report.pdf

VCAA (2012) *A guide to the Relative Growth Report*, Victorian Curriculum and Assessment Authority from http://www.vcaa.vic.edu.au/Documents/naplan/GuidetoRelativeGrowthReport.pdf

VCAA (2015) *Deidentified linked student-level NAPLAN data, 2009 Year 3 cohort*, Victorian Curriculum and Assesment Authority