Submission into Productivity Commission's Review of the National School Reform Agreements

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Centre for Independent Studies
Level 1, 131 Macquarie Street, Sydney NSW 2000

Glenn Fahey
Program Director, Education Policy

Kitae Yoo
Research Assistant, Education Policy

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At CIS, we have long seen education reform as key to our mission. We advance the need for a high-quality education system in order to deliver economic prosperity for the next generation, to promote social mobility, and to foster social cohesion.

CIS welcomes the opportunity to contribute to the review of the National School Reform Agreement (NSRA) for negotiation in 2023, and the concurrent, related, Productivity Inquiry. As suggested in the Call for Submissions, the recommendations and analysis contained in this submission are intended to be considered also in relation to the Productivity Inquiry, where applicable.

CIS is supportive of the broad objective set out in the NSRA — for Australian schooling to provide a high quality and equitable education for all students. This objective is aligned with OECD countries and is consistent with the priorities of school sectors and education stakeholders.

As laid out in this submission, however, it is not clear that Australian school systems have made significant ground in improving outcomes, nor that there is a clear and meaningful link between all national policy initiatives (NPIs) and desired educational outcomes. In addition, to date, the experience has been that some NPIs have progressed more slowly than expected.

Given that most activity contained in NPIs is now either completed, nearing completion, or at varying stages of implementation, it is appropriate to reassess the NPIs and consider more ambitious items that are in mutual interest of the Commonwealth and states and territories.

It is our view that additional — but complementary and sequential — NPIs are needed to meet the educational demands facing all Australian jurisdictions. While national collaboration and coordination is not suited to all education policy reform efforts, the state of federal financial arrangements and shared intergovernmental responsibilities does mean that there are significant opportunities for national leadership. Formalising shared objectives and activity through the NRSA is necessary for system accountability.

In response to the information requests made by the Commission, this submission will primarily focus on the following areas:

- Informing the Commission of the progress against the educational outcomes outlined in the NSRA (not limited to those contained in the National Measurement Framework (NMF));
- Informing the Commission of the drivers of students' educational outcomes, in the context of informing current and future measurement of performance contained in the NSRA;
- Advising the Commission of additional considerations for student outcomes that differ across specific cohorts of students and how this should be incorporated into the NSRA;
- Recommending to the Commission how the National Policy Initiatives (NPIs) could better reflect policy needs and best contribute to improving educational outcomes.

This submission is structured as follows. It first tracks the progress of Australian schooling against the broad objectives established in NSRA. It then reviews evidence describing the pertinent factors that explain student outcomes as relevant to considering the appropriateness of current metrics contained in the NSRA and NMF. It then assesses the effectiveness and appropriateness of the NPIs, as well as recommending initiatives that could better support national reform directions going forward.

Against the reform direction: *Supporting students, student learning, and student achievement*, we make the following recommendations:

- Set an explicit, medium term national student achievement improvement target;
- Monitor progress against NAPLAN proficiency standards;
- Gain commitment to address poor literacy rates among male students;
- Monitor early competency and school readiness of children;
- Ensure all students receive a phonics screening check;
- Make suitable outcomes for students with disability visible in national measurement;
- Monitor youth proficiency in literacy and numeracy, not just attainment.

Against the reform direction: *Supporting teaching, school leadership, and school improvement*, we make the following recommendations:

- Ensure there is a flexible, diverse, and capable teacher workforce;
- Ensure teacher remuneration is better aligned with performance;
- Ensure all teachers benefit from initial teacher education that prioritises evidence-based practices;
- Develop a nationally consistent training pathway to transition paraprofessionals to teaching.

Against the reform direction: *Enhancing the national evidence base*, we make the following recommendations:

- Ensure there is timely and reliable macro and micro teacher workforce data;
- Improve the collection, coordination, and communication of early years data;
- Create a National Behaviour Survey to better monitor student engagement.

National progress against educational outcomes

The NSRA defines student outcomes in terms of: achievement, engagement, and skill acquisition. While these are broadly appropriate, progress against these outcomes has not generally improved — and in some cases, outcomes have markedly worsened.

Over recent decades, there has been sustained and consistent evidence of disappointingly low student outcomes for Australians across several age groups and domains. Given the specific deficits in student outcomes in mathematics and related fields, special emphasis is placed upon this area in this submission.

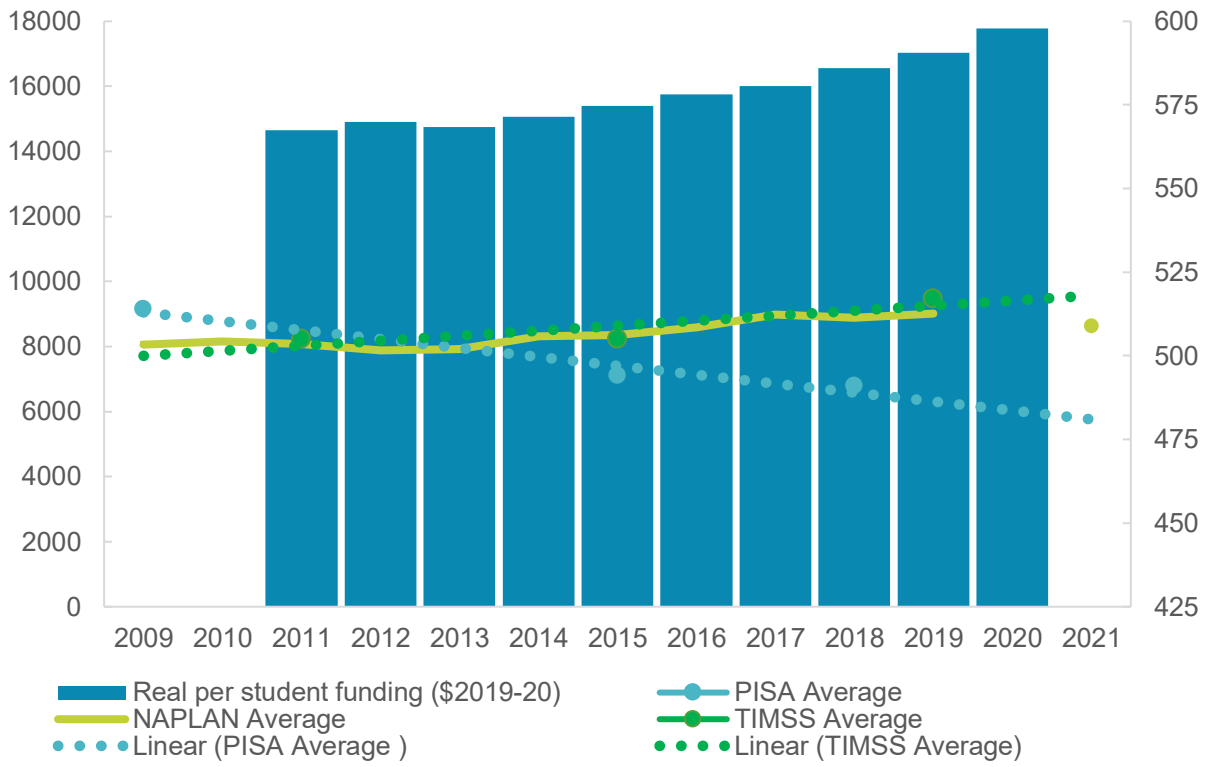
Academic achievement

Over recent years, Australian student achievement has been largely static or in decline — with some variation observed across competency-based international assessments (like the OECD-run Programme for International Student Assessment (PISA)) and curriculum-based assessments (like NAPLAN or the Trends in Maths and Science Study (TIMSS)).

The 2018 round of PISA revealed that Australian students' achievement decline over time has been steeper and more consistent than any other OECD country, except Finland. Compared to the average Australian student in 2003, today's Australian cohort is the equivalent of around 14 months behind in terms of mathematics outcomes.

This is despite increased funding — real public (recurrent) funding per student has increased significantly in recent years.

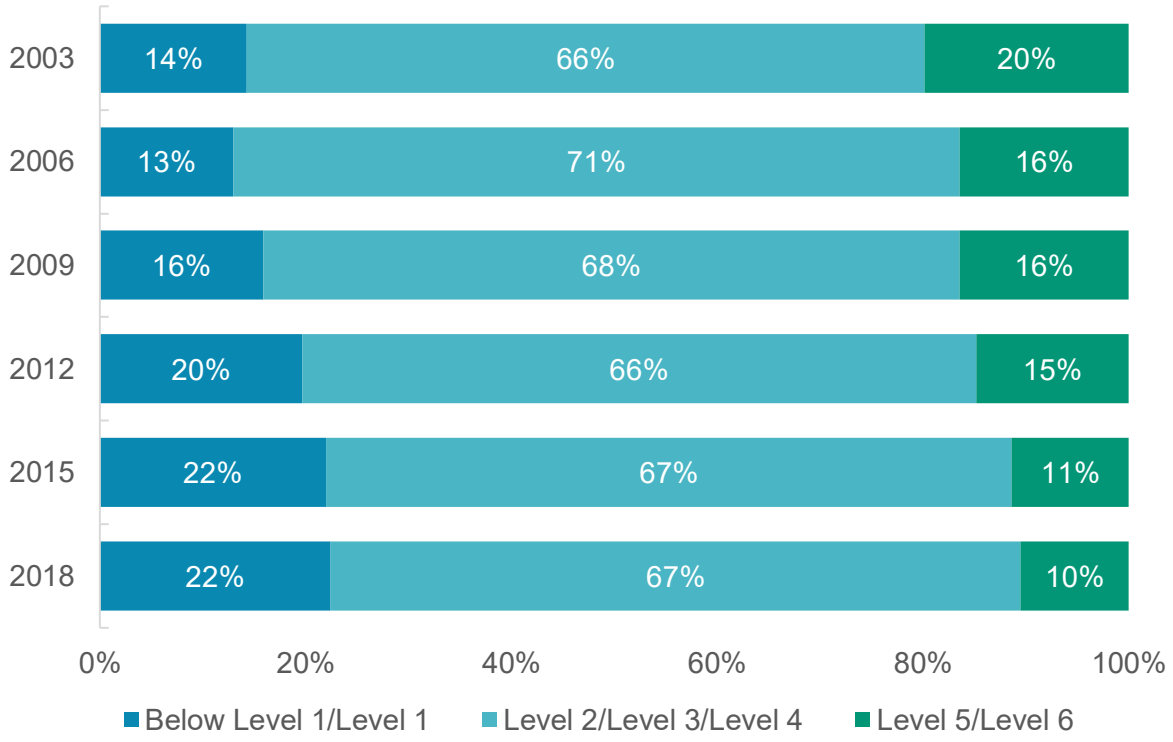
Student achievement in mathematics (RHS) and per student public funding (LHS), 2009 to 2021.



Source: Productivity Commission Report on Government Services (2022), Programme for International Student Assessment (15 year olds mathematics average), and National Assessment Program – Numeracy (average Year 3, -5, 7, and 9). OECD (2019). Programme for International Student Assessment, Trends in International Mathematics and Science Study (2019).

The decline in achievement recorded in PISA is not only due to reductions at the average level, but also adverse trends at both ends of the achievement distribution. At the same that the proportion of low achievers has increased, the proportion of high-achieving students has shrunk. The proportion of students who perform at the proficient level is now below the OECD average.[1]

Distribution of students' achievement in PISA, by proficiency, 2003 to 2018.



Source: OECD (2018). Programme for International Student Assessment.

In domestic assessments, NAPLAN shows mixed results over time and across different demographics.

Since NAPLAN was introduced, there has been some improvement in early reading achievement — with Year 3 students now around 9 months ahead of their peers in 2008 — but there have been negligible gains recorded in other domains. Moreover, the gains observed in the earlier years are not being enjoyed throughout students' schooling. By Year 9, students are achieving at lower levels today, especially in writing.

Equivalent months of learning difference in NAPLAN, 2021 average achievement compared to 2008 achievement (2011 for writing).

Source: Authors' analysis of ACARA's NAPLAN database.

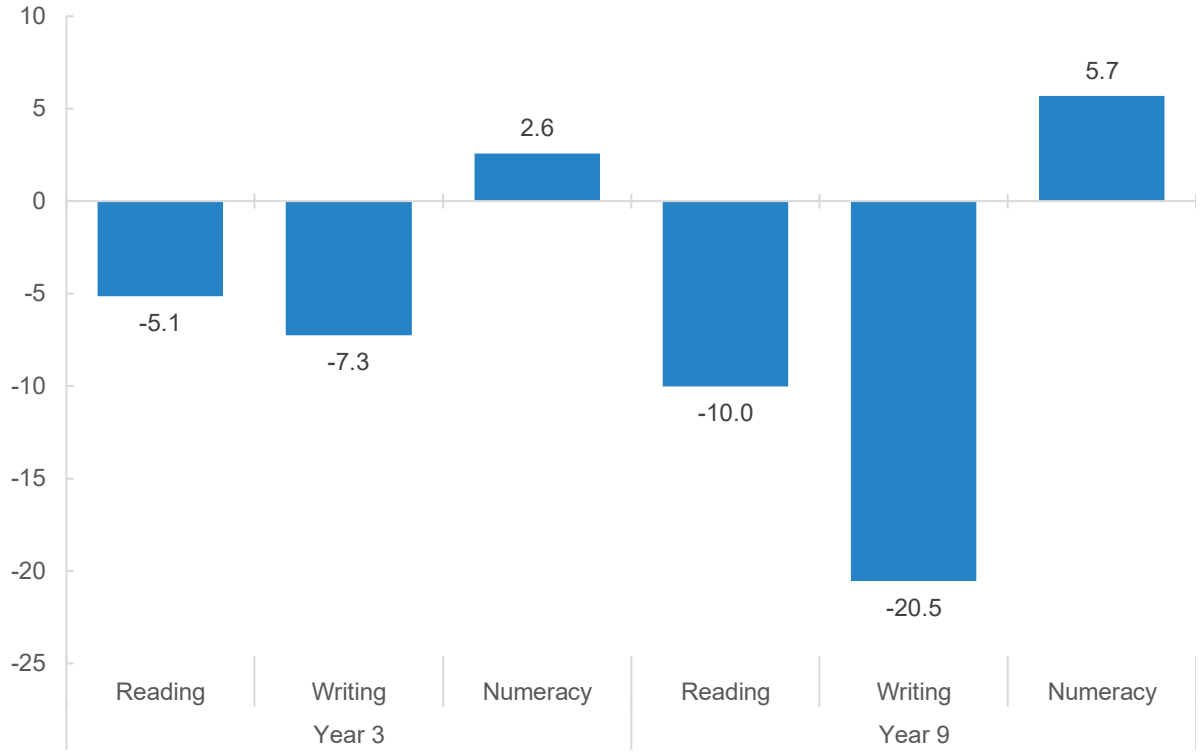
Group differences in achievement can be significant — including those based on students' sex, Indigeneity, and between additional educational needs; such as for students who suffer from learning difficulties or disabilities (though the latter are not reflected in the NMF).

For instance, there are meaningful differences in achievement between boys and girls.

By Year 9, Australian boys achieve an average of around 5.7 months ahead of girls in numeracy. And in PISA, boys achieved more highly than girls by the equivalent of around 2.6 months in mathematical literacy at the age of 15.

However, by Year 9, girls achieve well ahead of boys in literacy domains — by around 20.5 months in writing and around 10 months in reading (comparable to the 11.6 months that boys are behind girls in reading in PISA by the age of 15). Given that there is an especially strong association between writing proficiency and post-school educational attainment, the underachievement of boys in this domain is an area that requires more specific monitoring and policy response.

Average student achievement gap in NAPLAN domains (males compared to females), Year 3 and Year 9, in equivalent months of learning, 2021.



Source: ACARA (2021). NAPLAN National Student Report, 2021 results.

There are also sizeable achievement gaps between Indigenous and non-Indigenous students. PISA estimates that by the time students are 15 years of age, this gap amounts to around 2.5 years of learning.

A lack of monitoring of achievement for students who suffer from learning difficulties and disability means there is no ability to measure outcomes for these students. National measurement should recognise desired outcomes for students who are at high risk of underachievement and those who suffer from learning difficulties or disabilities.

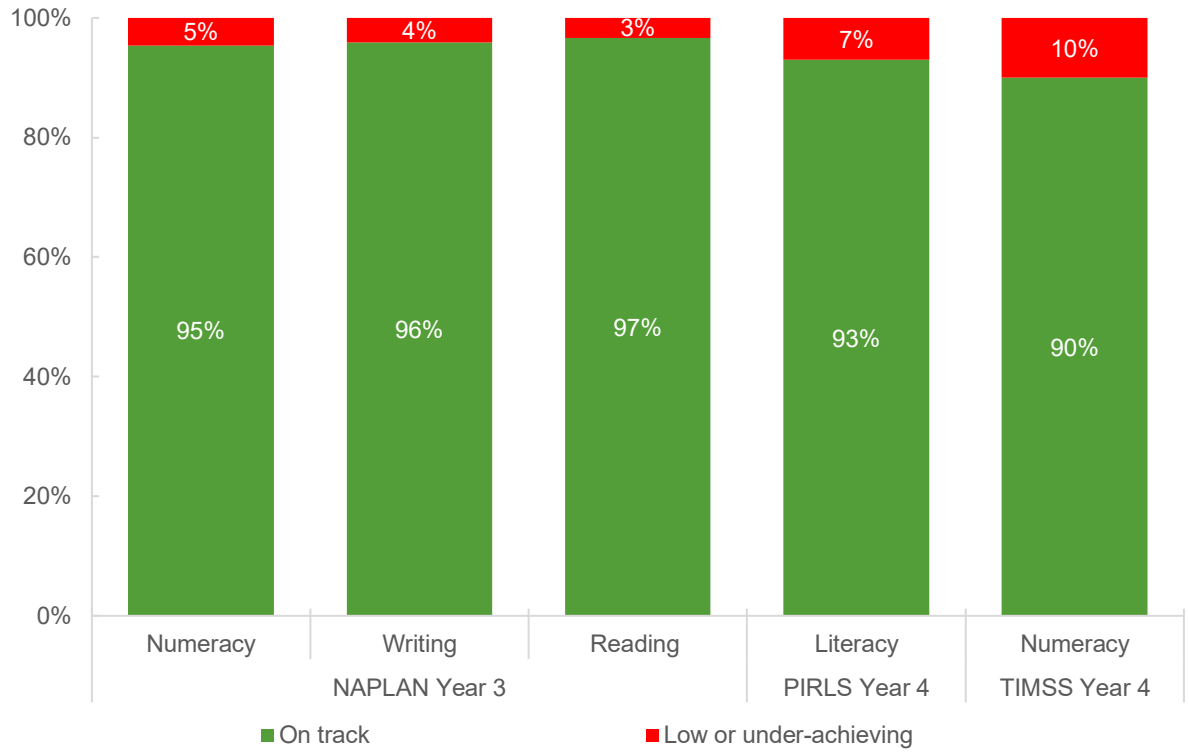
Of special note when observing NAPLAN results is the persistent proportion of students who fail to meet the national minimum standard (NMS).

This is despite the NMS representing an exceptionally low level of achievement. In addition, there is reason to believe that underperforming students may be underrepresented in NAPLAN's NMS, given that the proportion of students not meeting minimum levels in international assessments is around twice as high as those below NMS.

In both NAPLAN and international assessments, Australian primary school students are more likely to achieve below minimum expectations in numeracy than literacy.

Compared to high-performing countries, there are more Australian students failing to meet the numeracy benchmark in Year 4 — for instance, in Singapore and Japan, less than 1 per cent are below the minimum standard.

Proportion of low or under-achieving students across international assessments.



Source: Australian Curriculum, Assessment and Reporting Authority (2019), National Assessment Program – Numeracy, Writing, Reading (Year 3); International Study Centre (2016), Progress in International Reading Literacy Study (Year 4); Trends in International Mathematics and Science Study (Year 4).

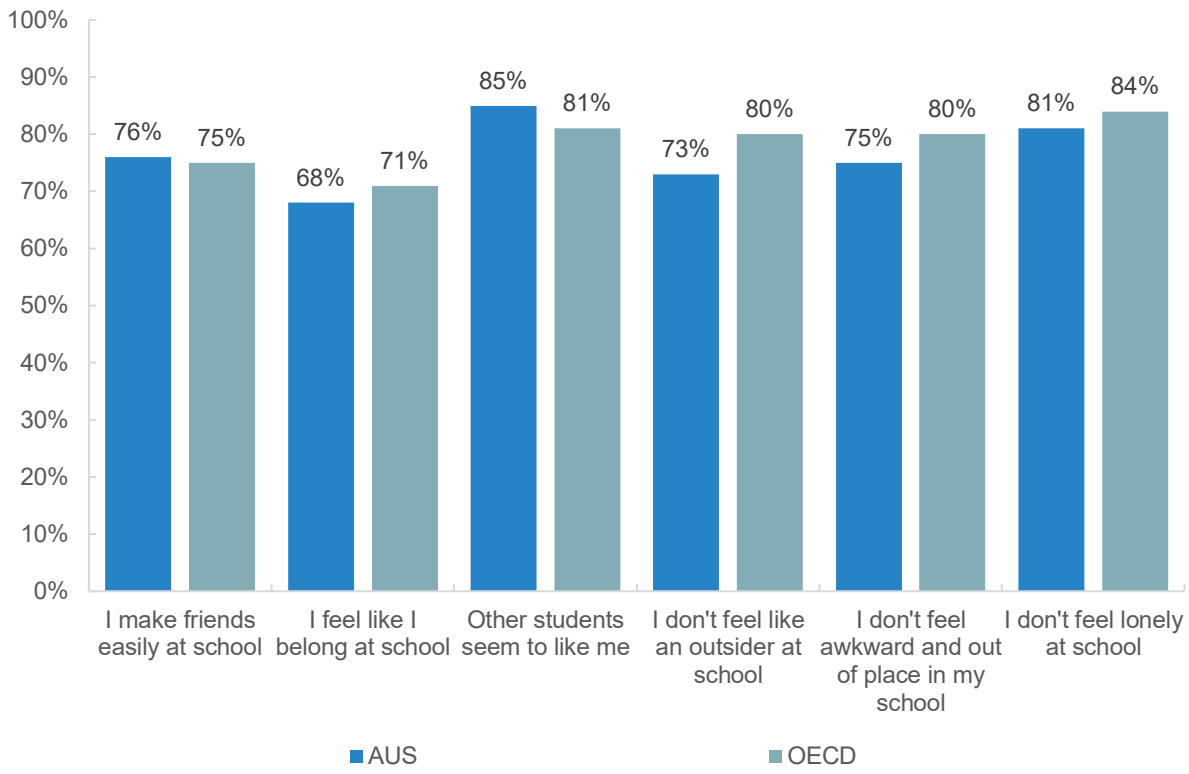
Student engagement

Student engagement in education is notoriously difficult to measure reliably and can represent many different concepts.

One useful distinction is between: *emotional engagement* (related to students' feelings, sense of belonging, and general emotional state); *cognitive engagement* (such as interest, motivation, confidence, and perceived value in the subject); and *behavioural engagement* (identified behaviours of engagement, like enrolment, attainment, and retention).[2]

Some national monitoring of student engagement is made against the OECD's Sense of Belonging Index — a construct that aligns with students' emotional engagement. Against the Sense of Belonging Index, Australian 15-year-olds record at a comparable level to similar countries. As outlined in further detail in a later section, this indicator may not be the most suitable performance indicator for monitoring Australian students' educational engagement.

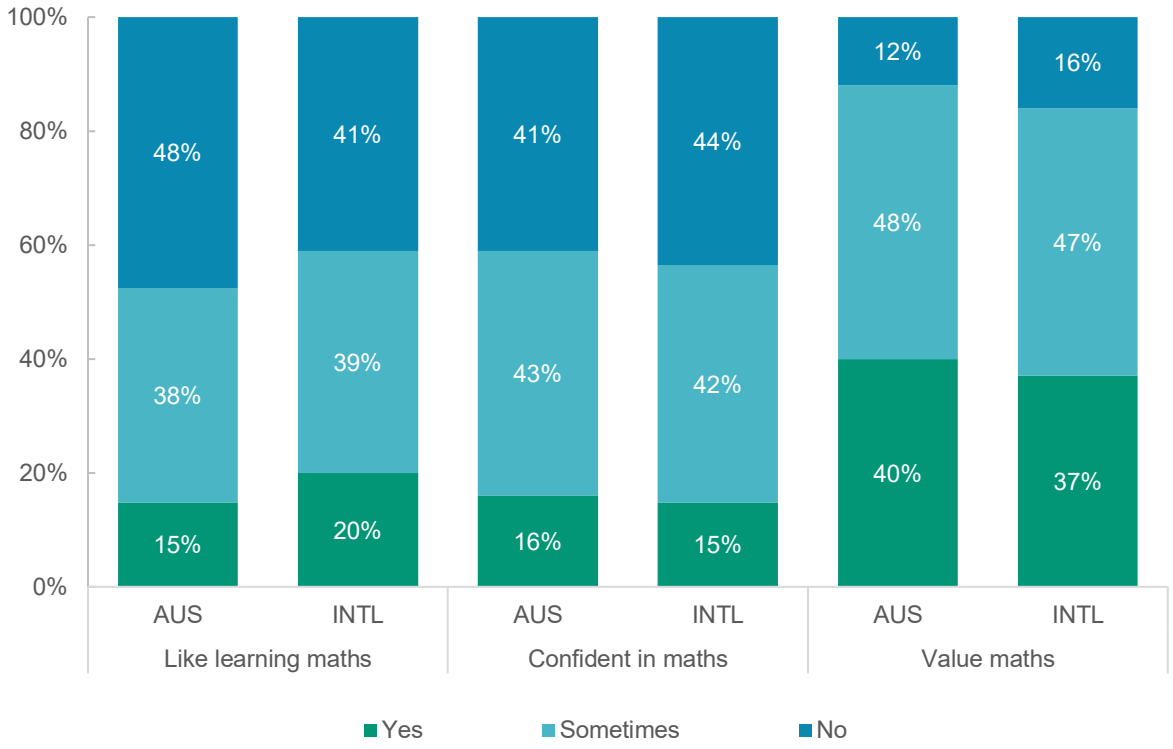
OECD Sense of Belonging Index components; Australia compared to the OECD average.



Source: OECD (2019). Programme for International Student Assessment 2018.

In the TIMSS data collection, engagement is measured in a more domain-specific way (meaning it provides a more mathematics-specific) — based on the proportion of students who report that they like learning, feel confident with, and value mathematics. Across these engagement metrics, Australian students also reported comparable levels to their international peers.[3]

Proportion of Year 8 students by mathematical engagement category, Australia compared to international average.

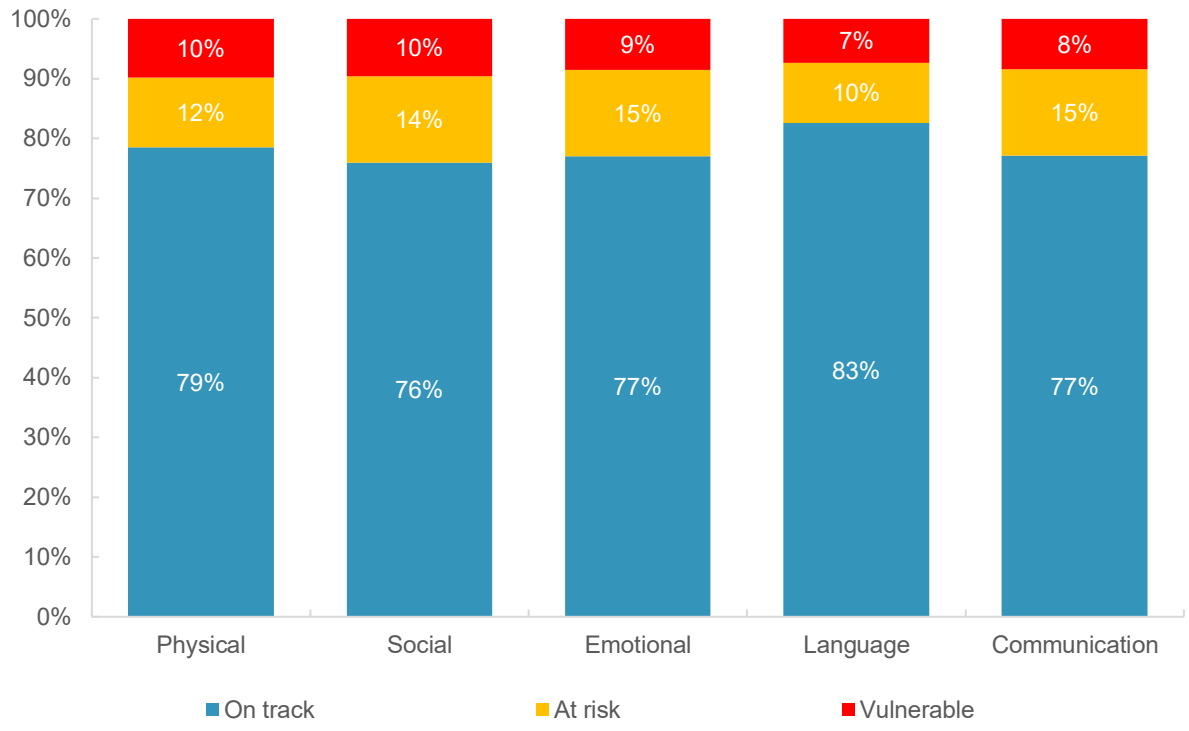


Source: Trends in International Results in Mathematics and Science Study 2019.

Some early indicators of students' engagement (and likely achievement) in school years can be observed in the Australian Early Development Census (AEDC). [4] This shows that, in some domains, up to one in four students are vulnerable or at risk of developmental difficulties at school entry. The proportion of students at risk of developmental vulnerability has remained broadly constant since data was first collected.

In any case, despite the importance of the data collected in the AEDC, it is not clear that it is currently informing educational practitioners and policymakers in ways that are likely to improve outcomes of impacted children.

Percentage of children aged 6-7 years, by developmental vulnerability and domain, 2021.



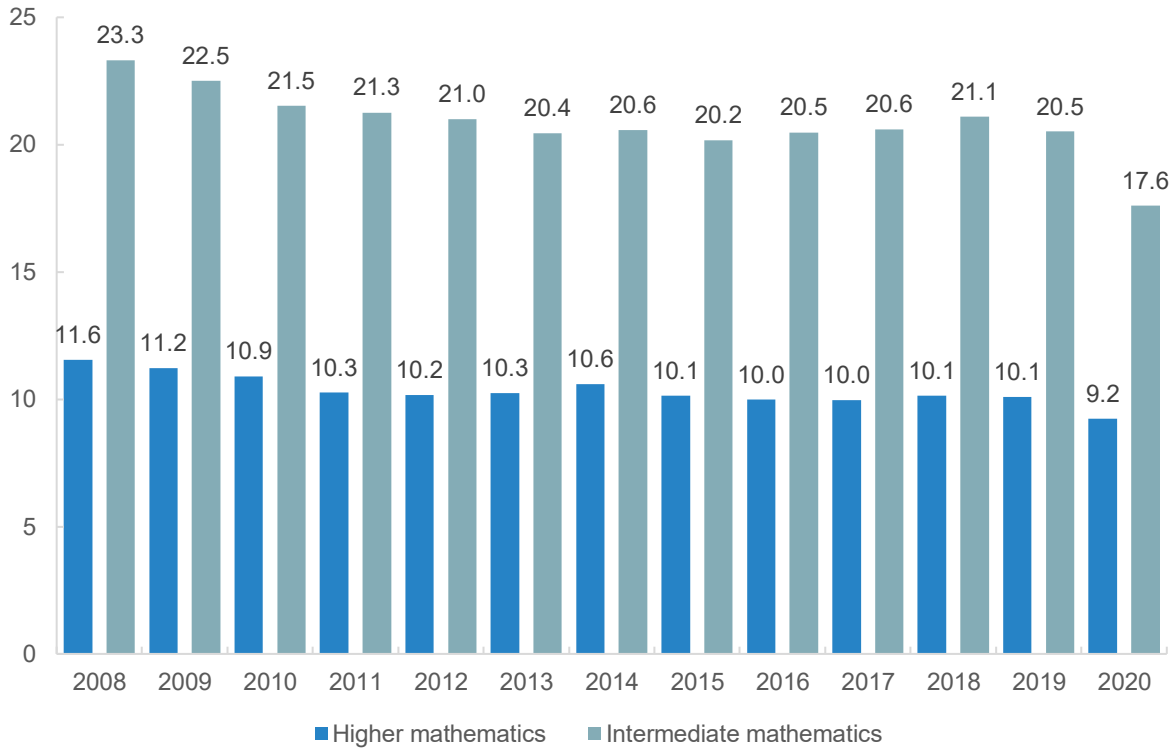
Source: Department of Education, Skills, and Employment (2021). Australian Early Development Census (AEDC).

Other relevant domain-specific indicators include students' engagement in higher mathematics in senior secondary schooling.

Australia's Education Ministers — through the Education Council — agreed in 2015 to the National STEM School Strategy 2016-2026, which included commitment to national action to increase students' engagement and participation in mathematics.[5]

However, in recent years, student enrolment in higher (intermediate or advanced) mathematics subjects has been in decline, recently falling to an unprecedented low.[6]

Percentage of Year 12 students completing higher and intermediate mathematics subjects.



Source: Wienk, M. (2022). Year 12 Mathematics Participation Report Card, The Australian Mathematical Sciences Institute.

Finally, a neglected aspect of student engagement is the nature of class and school learning environments.

Schools and classes with a more disciplined environment enjoy more class time spent on task and less school time is lost due to absenteeism due to issues like truancy, behaviour management, bullying, and the like.

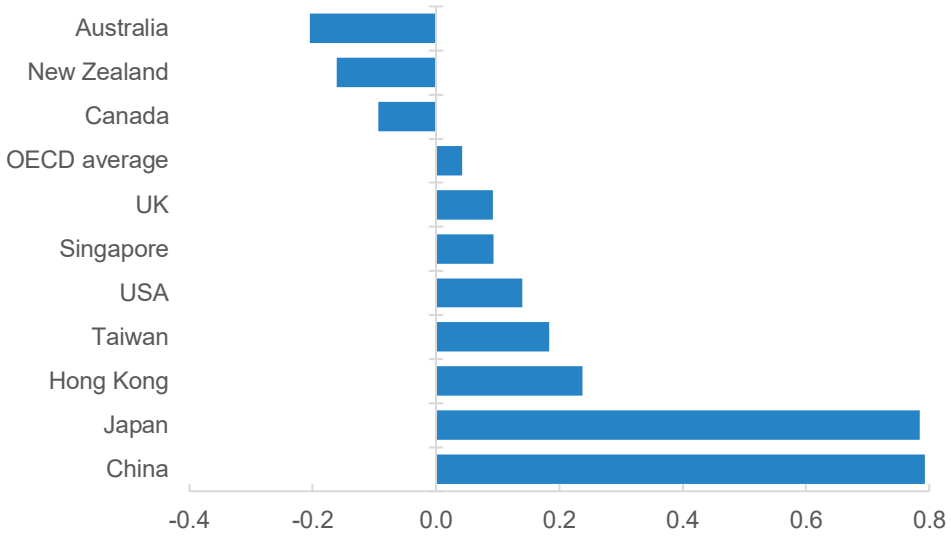
OECD analysis finds that students in schools with greater disciplinary environments record higher achievement — with Australian students achieving around 7 months higher in PISA's reading assessment with a one-unit increase in the disciplinary index (this is approximately the difference in discipline recorded between Australia and PISA-participating Chinese provinces).

Australia records among the lowest in internationally comparable measures of school disciplinary climates.

This is especially evident when compared with high-performing school systems, like PISA-participating Chinese provinces, Hong Kong, Taiwan, and Singapore. Australia also compares unfavourably compared to other Anglosphere school systems, indicating that differences in school climate cannot be attributed to macro cultural differences.

Students in less advantaged schools and Indigenous students report being in schools with poorer disciplinary climates. The impact of poor disciplinary climate in school disproportionately impacts upon achievement of boys, exacerbating related attitude and attention deficits, as discussed further below.

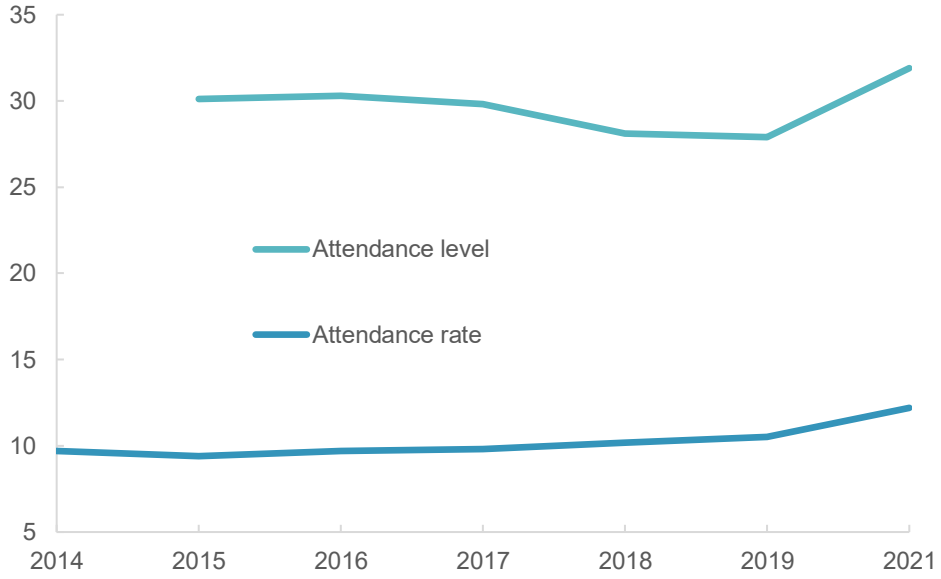
School disciplinary climate index (least disciplined to most disciplined), Australia vs OECD average and selected countries.



Source: OECD (2019). Programme for International Student Assessment 2018.

Student attendance is an important indicator of student engagement that is captured in the NMF (though not explicitly tracked in revised Closing the Gap targets). There is a wide and persistent gap in the attendance level and rate between Indigenous and non-Indigenous students — which has widened in the most recent year of data collection.

Difference in average attendance level and attendance rate between non-Indigenous and Indigenous students, 2014 to 2019.



Skill acquisition

Research shows that a population's knowledge is key to its future prosperity.[7] [8] The upshot is that, in time, smarter countries ultimately become richer countries.[9] [10]

This is because higher levels of literacy and numeracy proficiency are associated with greater individual economic returns as well as greater national living standards and future economic growth.

Across the OECD, highly literate and numerate workers earn around 65 per cent more per hour than those with low proficiency. And countries with a larger share of highly proficient adults enjoy higher per capita incomes.[11]

Importantly, the research shows that it is the *quality* of knowledge and skills acquisition — not just *quantity* of educational attainment (such as more years of schooling, higher levels of qualifications, and the like) — that is responsible for raising human capital, and ultimately economic growth.[12] [13]

As a result, skill acquisition must be considered not just in terms of attainment, but also proficiency. While attainment and proficiency are correlated, analysis in the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) shows that adults' literacy and numeracy *proficiency* uniquely explains differences in labour market outcomes, above and beyond the effect from levels of attainment.

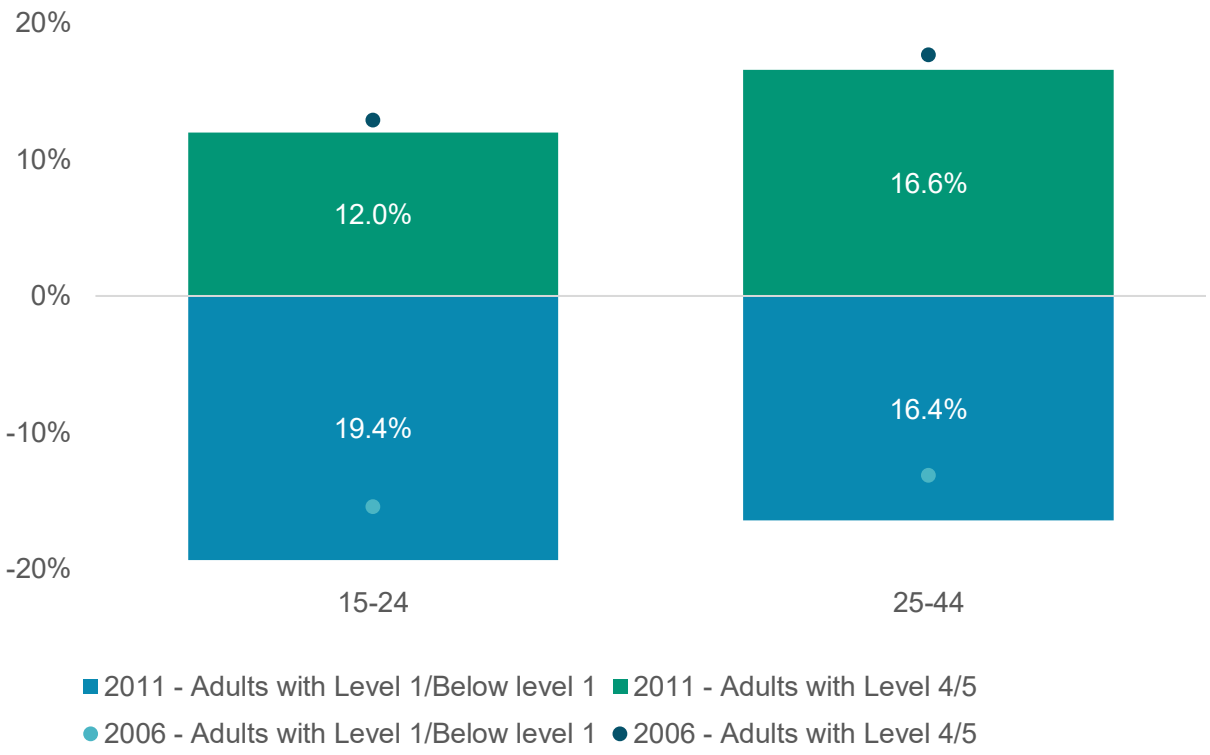
The steady decline in mathematics proficiency observed at school is also found among both youth and adults.[14]

16 per cent of Australian adults (aged 25- to 44-year-olds) perform at or below the lowest level of mathematics proficiency. These adults can, at best, perform one-step mathematical processes involving counting, sorting, and identifying elements of simple graphical representations. In addition, 19 per cent of Australian youth (15- to 24-year-olds) do not meet adult proficiency level in mathematics — struggling with the most basic skills such as calculation involving fractions and decimals.

There is no difference in adult numeracy results between Australian men and women.

It is likely that the declining trend in recent rounds of PISA (measuring 15-year-olds) will further translate into declining adult numeracy proficiency.

Proportion of Australian adults at high proficiency (above zero) and below proficiency (below zero), 2006 and 2011.

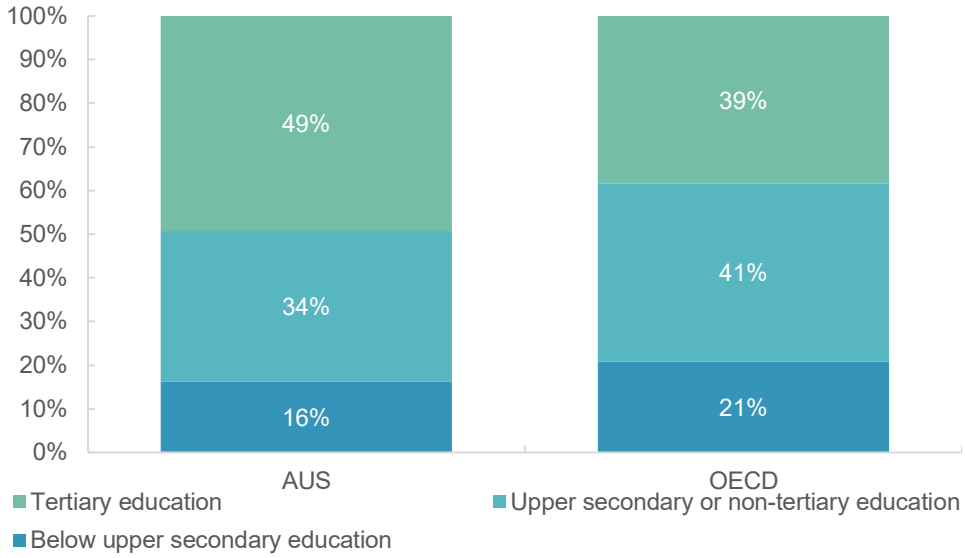


Source: OECD (2013). Programme for the International Assessment of Adult Competencies (PIAAC), Survey of Adult Skills.

Policymakers, employers, and tertiary institutions have regularly urged greater enrolment and graduation of Australian youth through the higher education system as key to skills acquisition.

Compared to OECD countries, a relatively high proportion of working-age Australians hold a tertiary educational qualification.

Share of population, aged 25-64, by educational attainment, Australia compared to OECD average, 2020.



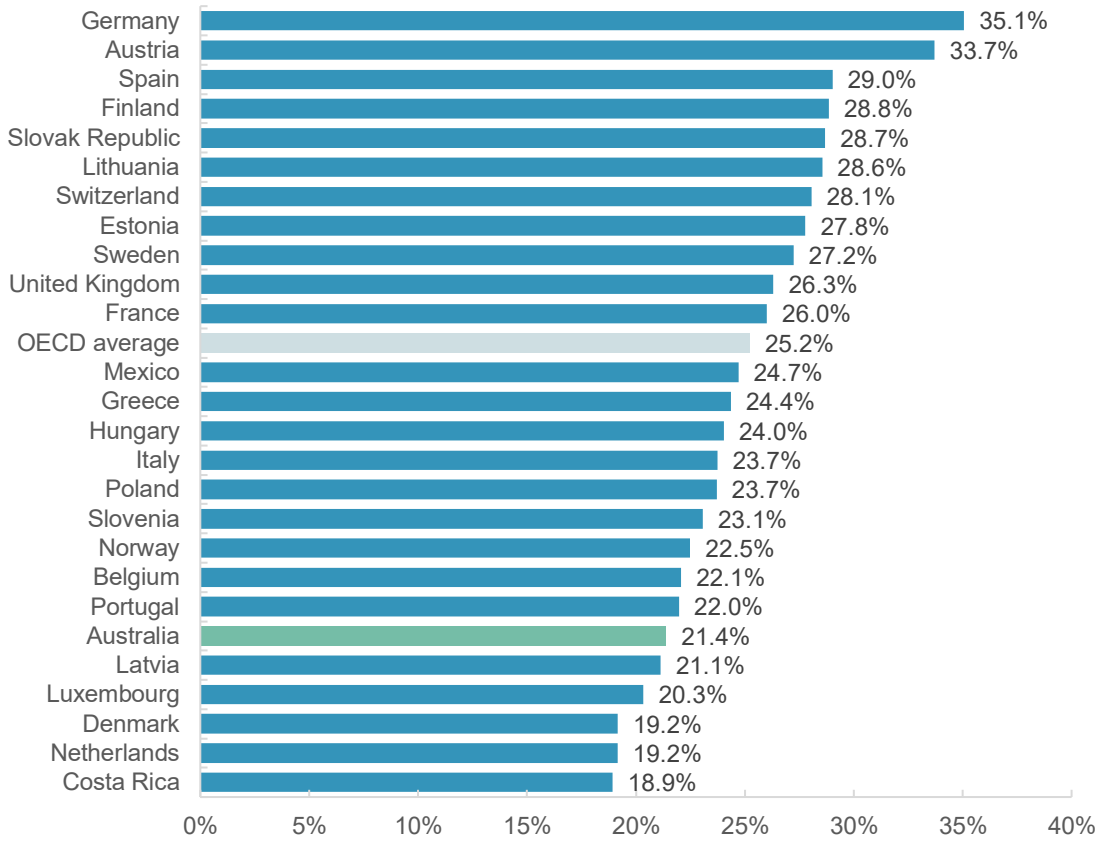
Source: OECD (2022). Education at a Glance 2021.

However, to ensure that educational attainment is matched with skills acquisition needs, it may be appropriate for the NMF to better focus on raising attainment and proficiency in areas of national priority.

Despite several national and intergovernmental commitments, Australia records among the lowest of OECD countries in the proportion of tertiary graduates in STEM programmes of study.

There are currently no explicit targets for the attainment level of Australian youth and adults in post-school study in STEM subjects.

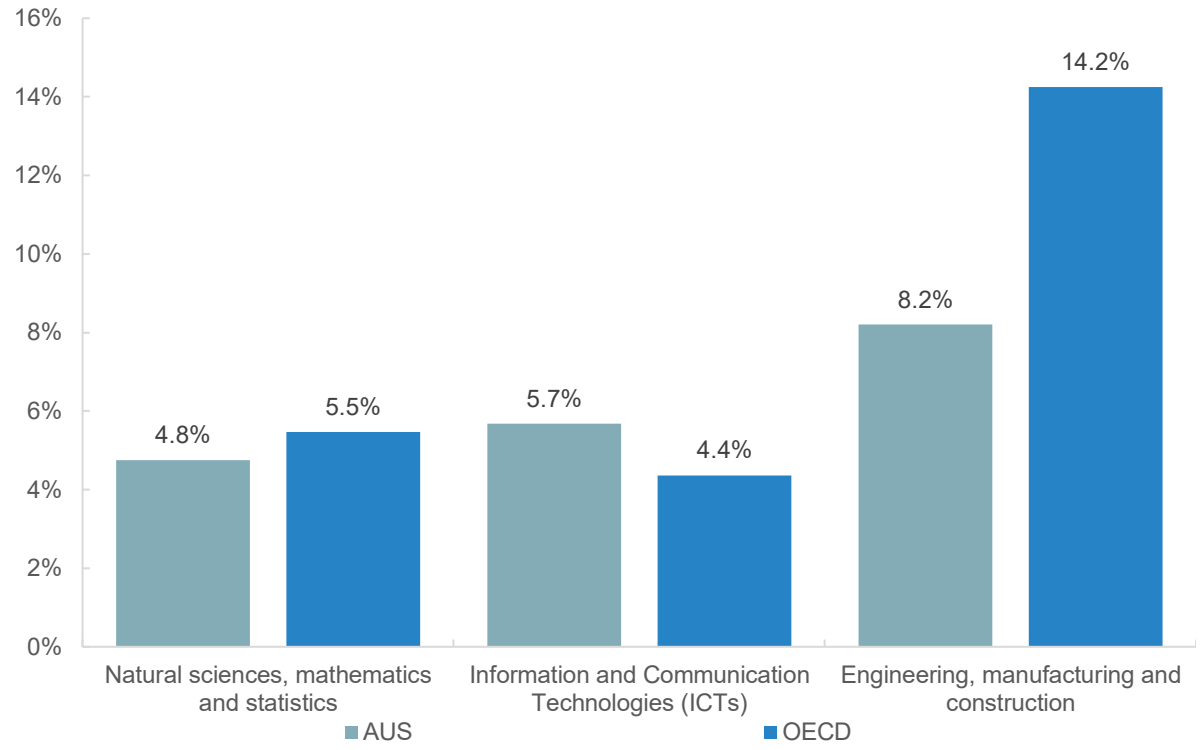
Proportion of tertiary educated adults with a STEM qualification, 2018.



Source: OECD Education at a Glance 2021.

However, the relatively small proportion of STEM tertiary students is not observed across all subjects. By and large, it is Australia's relatively small proportion of graduates specifically in engineering, manufacturing, and construction that contributes to the low overall outcomes. By way of comparison, countries like Germany and Austria each record around 26 per cent and 27 per cent of all tertiary degree holders respectively in engineering alone.

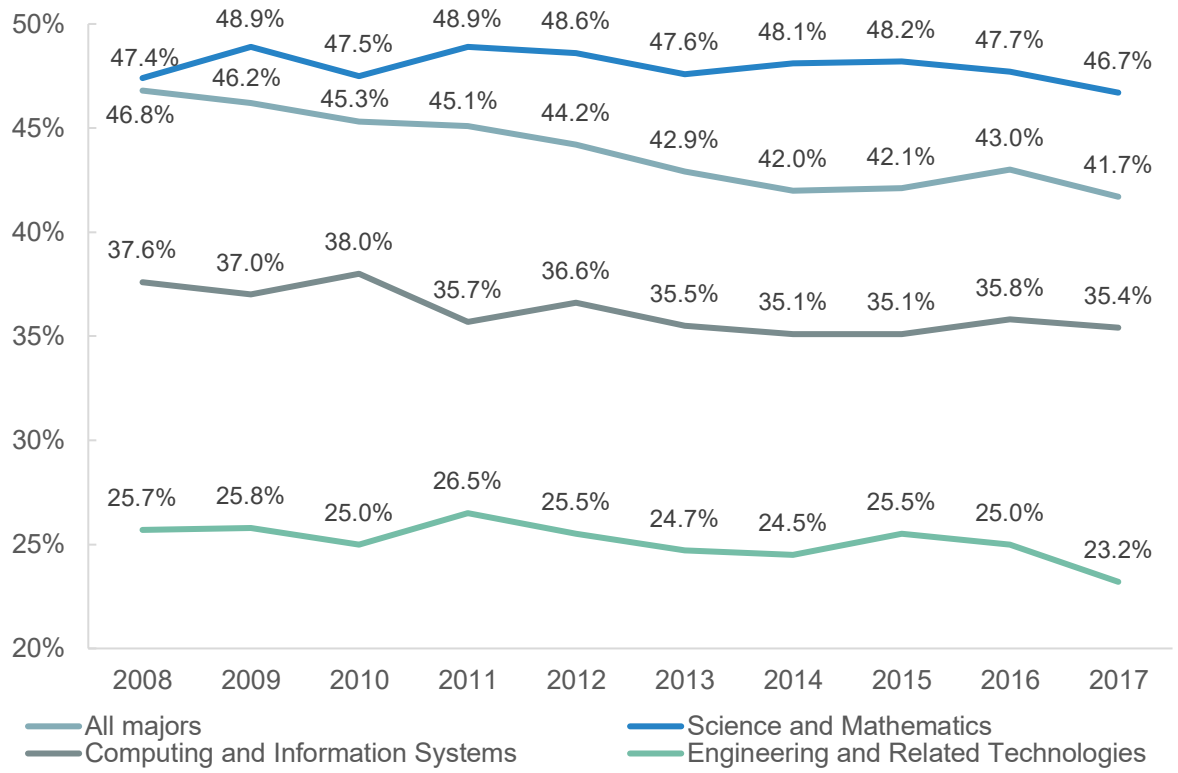
Distribution of tertiary degree graduates, by field of study (selected fields displayed only); Australia vs OECD average.



Source: OECD (2021). Education At a Glance.

The completion rates for some undergraduate STEM majors are much lower than the overall completion rate for undergraduate degrees. For instance, in engineering degrees, fewer than one in four students successfully complete their qualification within four years. And for computing and IT this is just above one in three. This could be related to generally low reported student satisfaction with IT and engineering degrees found in undergraduate surveys, which have identified these disciplines as being the highest risk for non-completion.[15]

Bachelor completion rates of domestic students, by field of study, 4-year cohort analysis.



Source: Department of Education, Skills, and Employment (2021).

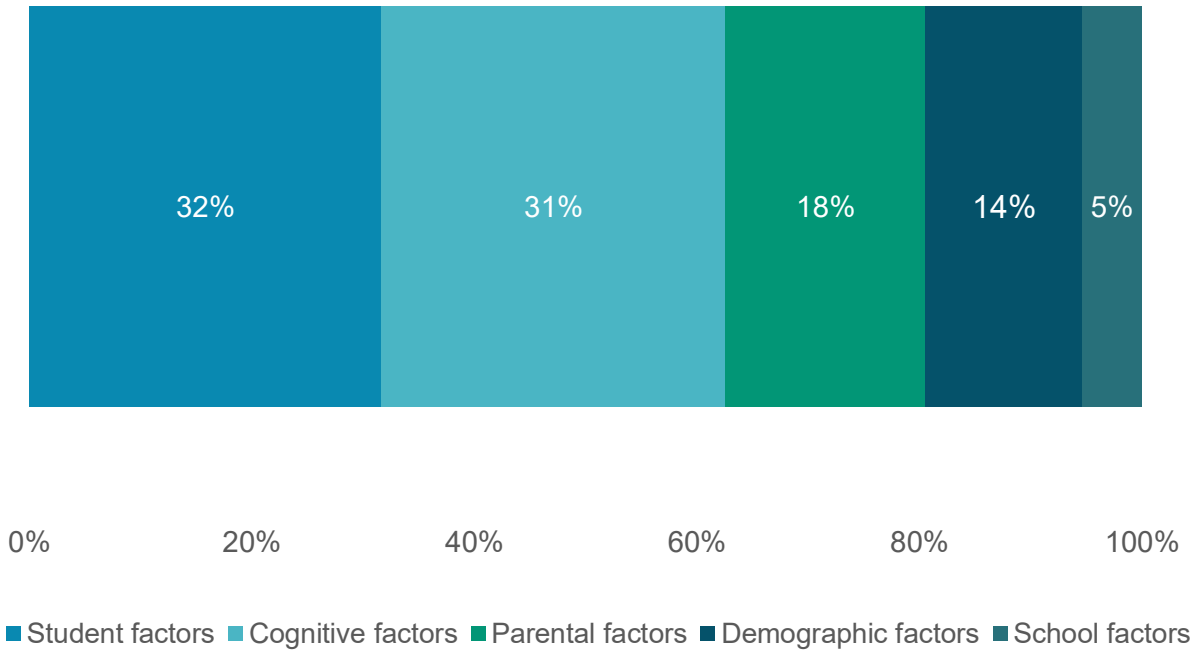
Drivers of student outcomes

Academic achievement drivers

Students' academic achievement at school is explained by a wide range of factors — including study-related characteristics and preferences (generally described here under the umbrella of 'student factors'), cognitive attributes (largely related to 'executive functioning' skills that are somewhat generic and not domain-specific), demographic and parental background, and school factors.

CIS analysis finds that around 56 per cent of the variation in students' mathematics achievement in Year 9 is accounted for by measured differences in student, cognitive, parental, demographic and school factors.[16] Differences in students' cognitive factors, as well as their differences in study-related characteristics and preferences are responsible for a large proportion of the explained variance.

Proportion of explained mathematics achievement in Year 9, by relevant factors.



Source: Author's analysis of NAPLAN and LSAC data.

Analysis of the gender gaps in achievement associated with between-group differences in measurable factors shows there is a large proportion of the gender achievement gap in numeracy that can't be explained by measurable factors — which is not the case for other domains. In Year 9, girls achieve around 20 NAPLAN points lower than boys in numeracy for reasons that cannot be accounted for by measurable factors. This provides some evidence of difficult-to-measure factors that may contribute to numeracy achievement gaps that impact upon boys and girls differently. Potential hypotheses may include societal and cultural biases concerning mathematics study, but this cannot be confirmed on available data.

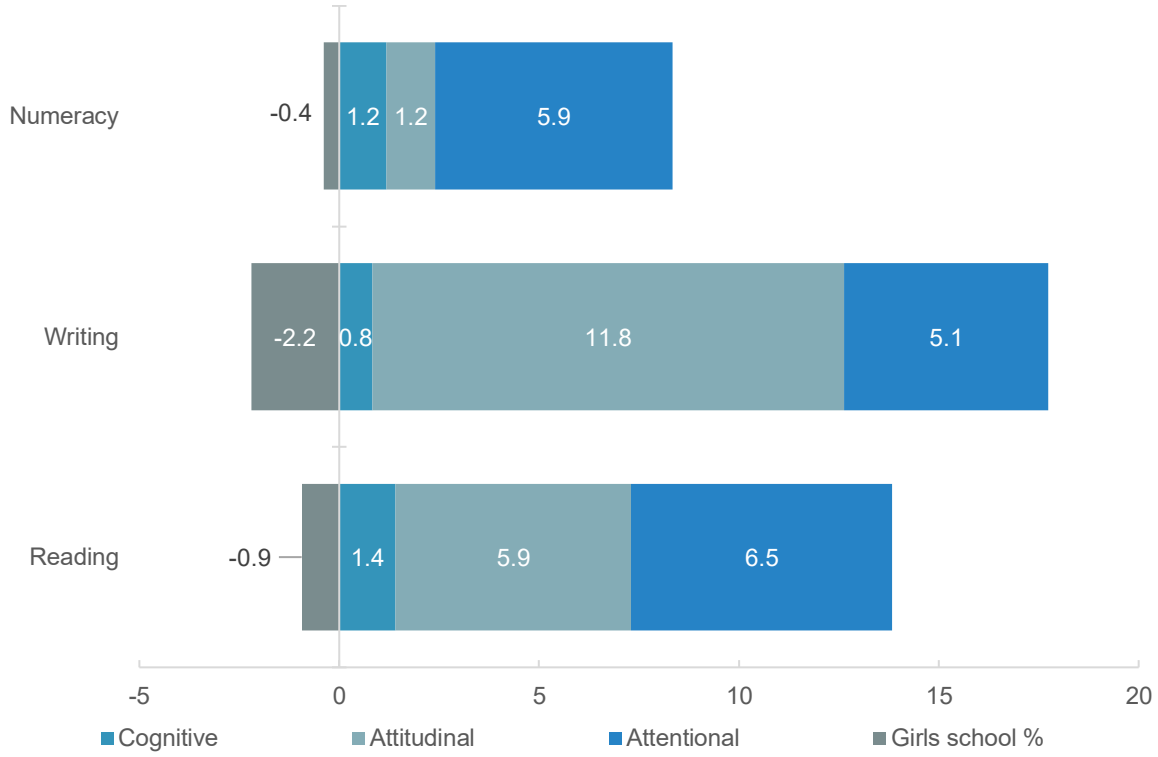
When focussed solely on factors that are measured and captured in the data, the analysis identifies that, across all domains, boys under-achieve compared to similar girls — and this is mostly due to boys recording more poorly on educationally-relevant attention and attitude factors.

If boys recorded similar levels as girls on relevant attentional factors, boys would achieve more highly in Year 9 NAPLAN by between 5.1 and 6.5 points.

If boys recorded similar levels as girls on relevant attitudinal factors, boys would achieve more highly in Year 9 in literacy domains. In writing, in particular, achievement would be around 12 points higher if boys had similar education-related attitudes to girls.

Gender differences in executive function and other related cognitive factors do not significantly contribute to the achievement gap, nor do differences in the proportion of female students attending schools.

Between group differences based on measured factors, boys' achievement gap (positive values indicate how much higher boys achievement would increase relative to girls).

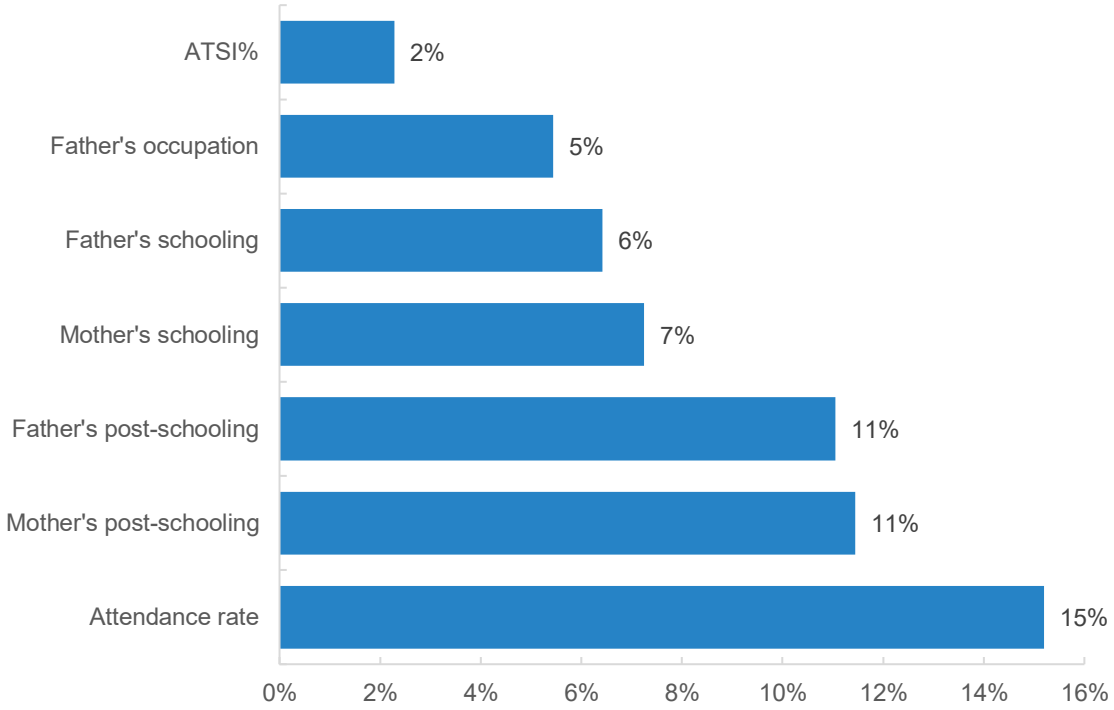


Source: Unpublished CIS analysis of data found in the LSAC.

CIS decomposition of differences in achievement between Indigenous and non-Indigenous students found that differences in attendance rates and differences in parental education levels account for most of the explained gap.[17] However, differences in school-level factors — such as differences in remoteness,

funding, staffing ratios, and proportion of Indigenous students in schools — do not significantly contribute to the achievement gap.

Proportion of decomposed measures of primary school student achievement gap between Indigenous and non-Indigenous students, Year 3.



NB: does not sum to 100% as negligible proportions are omitted from display.

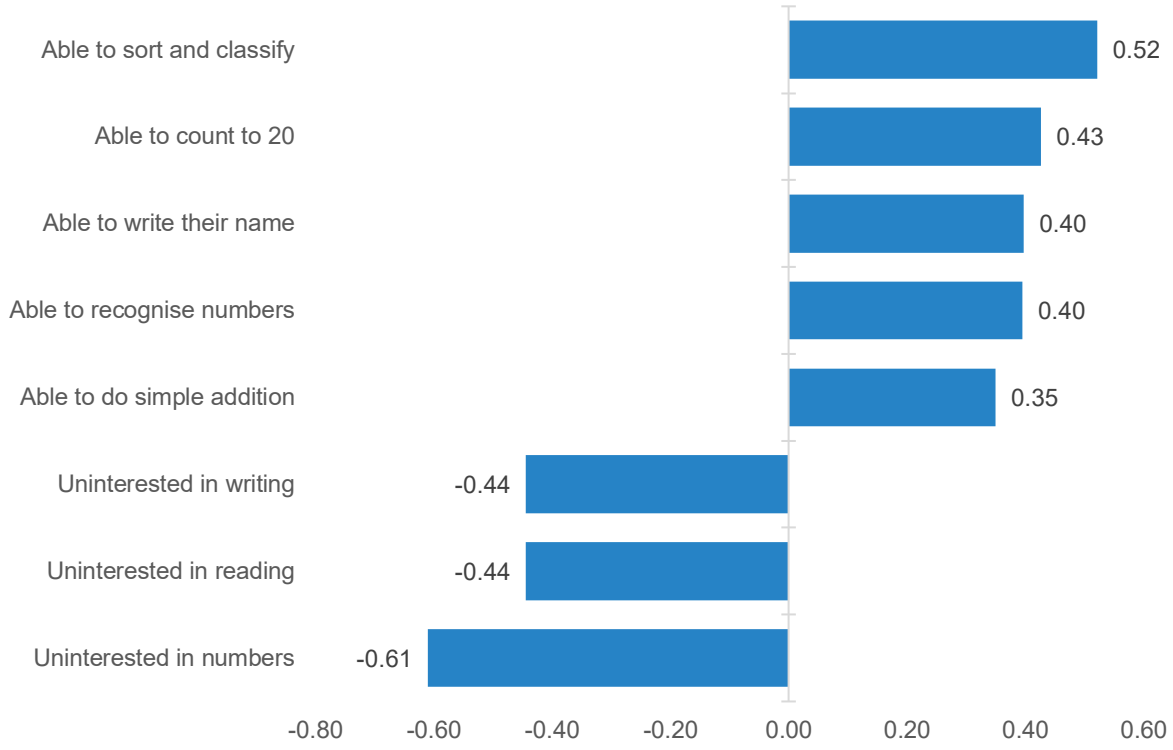
Source: Author's analysis of 2019 ACARA NAPLAN student record data

An important source of individual differences in student outcomes result from starting school with lower levels of foundational competencies. Longitudinal data reveals that basic numerical knowledge, in particular, of young children significantly predicts later mathematics achievement.[18]

For instance, CIS research shows that early competency and interest in mathematics at 4 to 5 years of age are correlated with later achievement[19] — including Year 9 NAPLAN numeracy scores. Interestingly, early mathematics abilities are also more highly correlated with later literacy achievement than indicators of early literacy abilities are.[20] For both numeracy and literacy, four of the top five early ability indicators related to mathematics include children's ability to sort, count and classify objects.

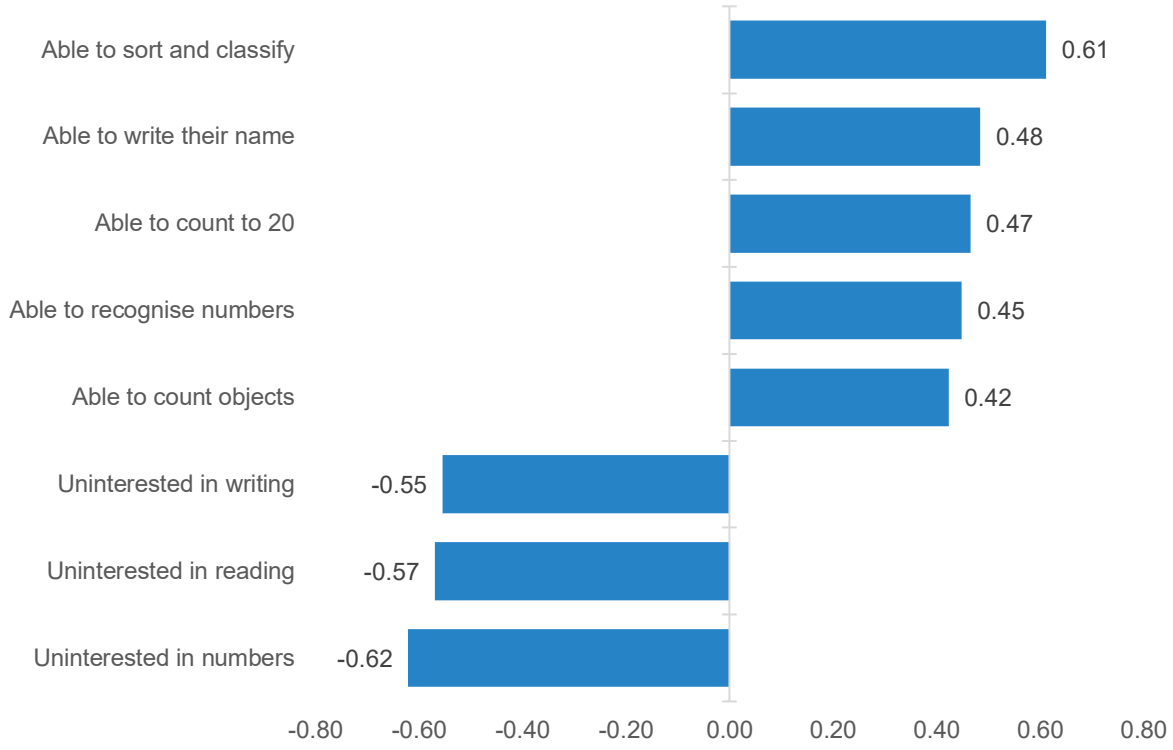
Yet, neither early markers of competency nor school readiness are well captured in the NPIs or NMF.

Year 9 NAPLAN numeracy correlation with early indicators



Source: Author's analysis on LSAC data.

Year 9 NAPLAN literacy correlation with early indicators



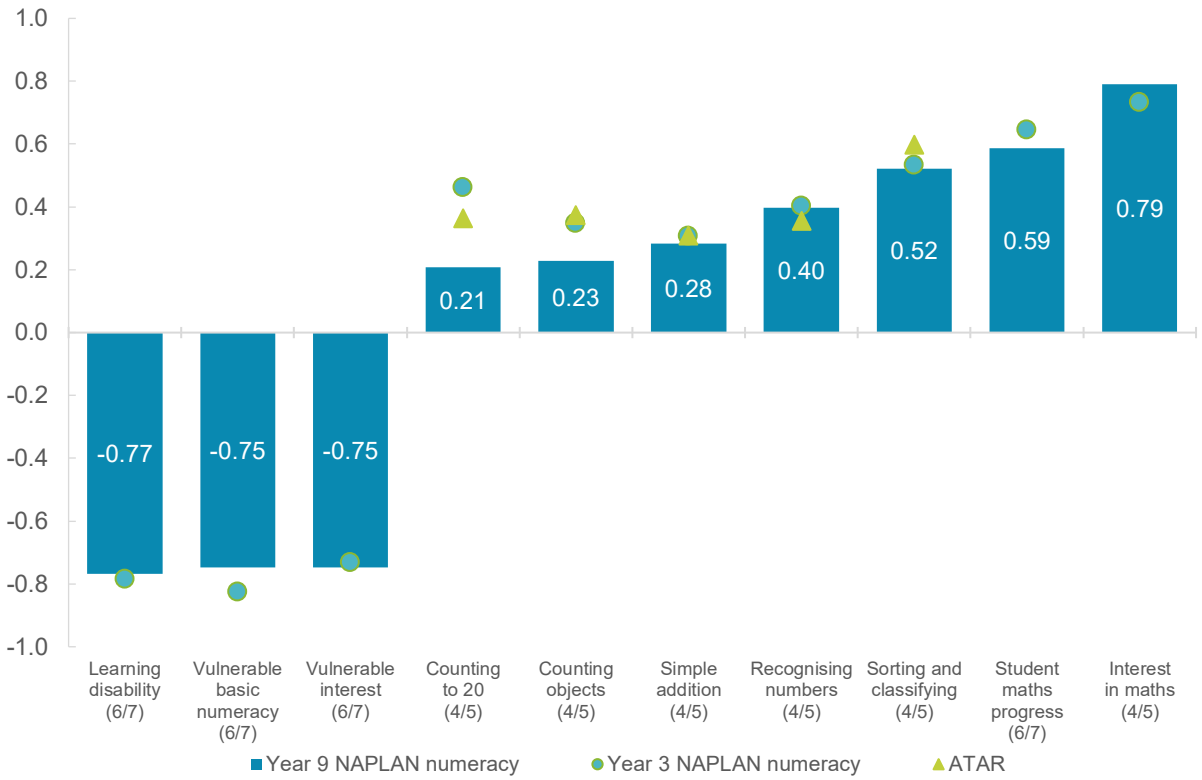
Source: Author's analysis on LSAC data

Core numerical skills that are appropriate for considering school readiness include children's ability to count numbers, use counting to determine numbers of objects, and their understanding of the cardinal values represented by number words.[21] [22]

Performance on these counting, enumeration and cardinality tasks at 6 to 7 years of age are highly predictive of children's academic outcomes throughout schooling, including their ATAR scores.[23] This means that how early and quickly children develop fundamental numerical and visuo-spatial competencies during childhood and early schooling — particularly the ability to determine the relation between number and quantity (known as 'cardinal principle knowledge') — significantly impacts upon their ability to learn formal mathematics and their chances of later academic success.[24] [25]

It also bears noting that the analysis shows that the magnitude of correlation of early competency indicators is similar for Year 3 achievement to the magnitude recorded for later school achievement, including the ATAR. This implies that students who record poorly on early indicators of competency are likely to underachieve at school and not benefit from any significant remediation. This is especially true for students with learning disabilities or developmentally vulnerabilities, as early as 4 years of age.

Correlations between early maths indicators and later achievement (age of measurement in brackets).



Source: Author's analysis on LSAC data

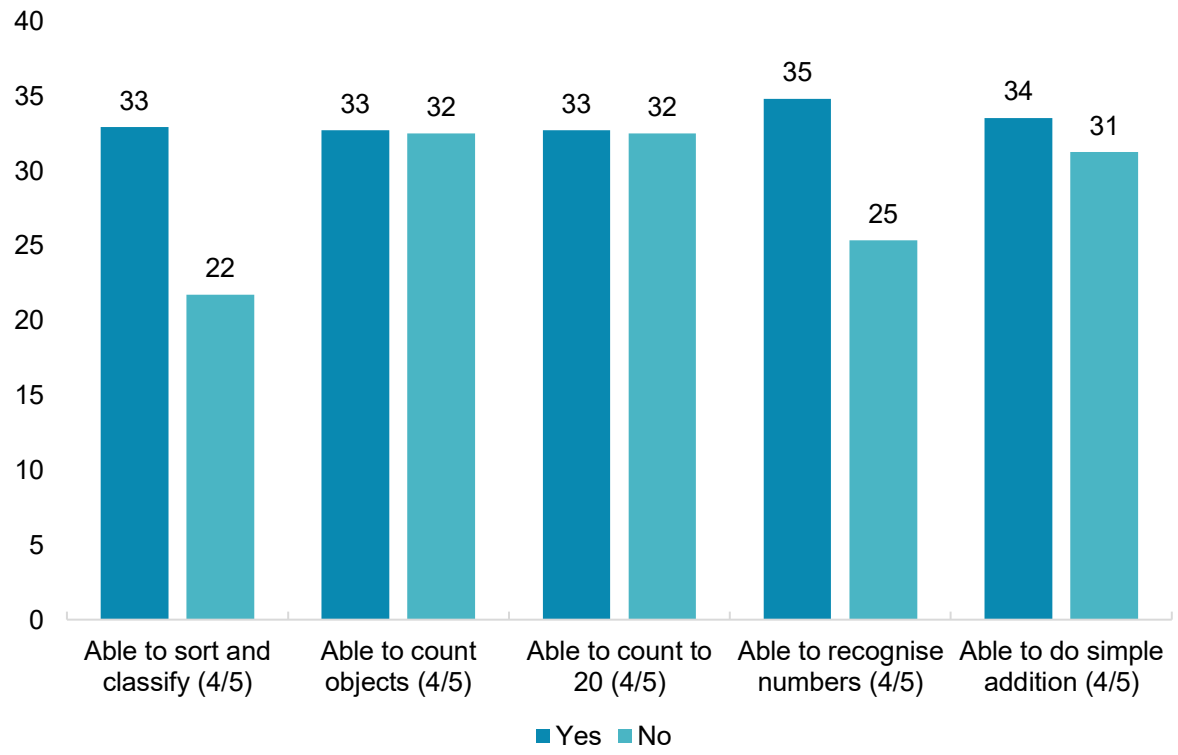
TIMSS data also indicates the importance of early educational activities for later progress in primary school.[26] Accordingly, fourth grade students had higher achievement, on average, when their parents had engaged them in literacy and numeracy activities during early childhood, when the students had attended pre-primary education, or when they could do foundational literacy and numeracy tasks when beginning primary school.

Our analysis confirms that children who lack foundational numerical knowledge when they start school can be substantively behind their peers.[27] By Year 3, children who couldn't sort and classify objects at school entry are almost one year behind their peers in terms of learning progress, while those who couldn't recognise numbers at 4 to 5 years of age are, on average, are around 10 months behind.

While only about 4 per cent of students are not being able to sort and classify objects at the age of 4 and 5, more than 1 out of 4 of students failed to recognise numbers.

There is no significant gender difference in the acquisition of early mathematics skills, with girls slightly outperforming boys in some of the foundational numeracy tasks such as number recognition, counting, sorting, and classifying.

Equivalent months of learning in Year 3 by early maths competencies



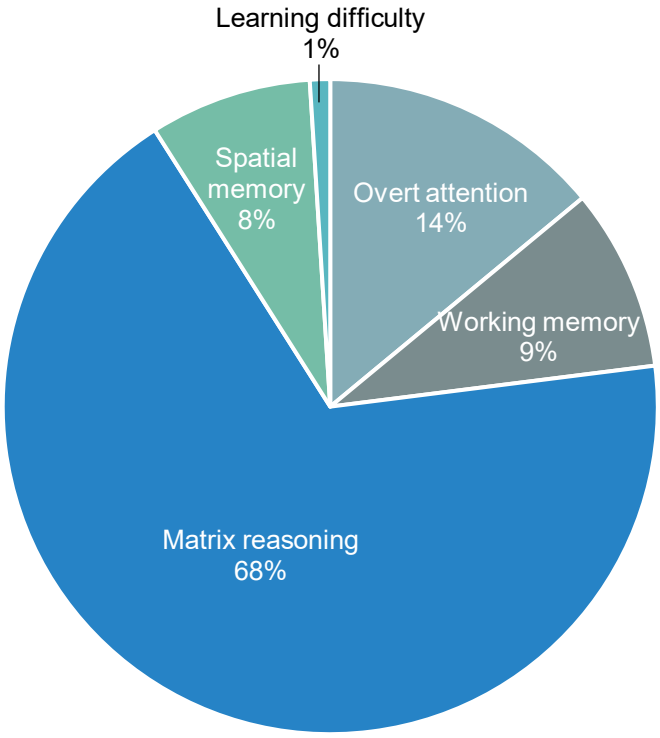
Source: Author's analysis on LSAC data

Given the clear educational risk factors associated with poor early numeracy competency, the NSRA should prioritise raising such capabilities as part of the reform directions of raising outcomes. Similarly, the NMF would benefit from incorporating systematic monitoring of early competencies and school readiness indicators to inform stakeholders of educational progress of early years education (pre-primary and K-2).

Individual differences between students' measures of cognitive and executive function explain a considerable proportion of achievement differences. Students' matrix reasoning — an indicator of fluid intelligence that largely reflects visuo-spatial acuity — explains a particularly large proportion of individual differences.

However, it is important to note that it is not executive function alone that explains student achievement[28], as there is also 'bidirectionality' — that is, as student achievement improves so do some measures of executive function.

Breakdown of explained variation from cognitive and executive function factors contributing to Year 9 numeracy achievement.



Source: Author's analysis on NAPLAN and LSAC data

While individual differences in achievement can be considerably explained by executive functioning and some cognitive factors, there exists no clear differences in cognitive abilities between male and female students that explain the gender achievement gap. By and large, males and females perform very similarly in measures of cognitive and executive functions.

Table 2. Cognitive indicators and gender difference

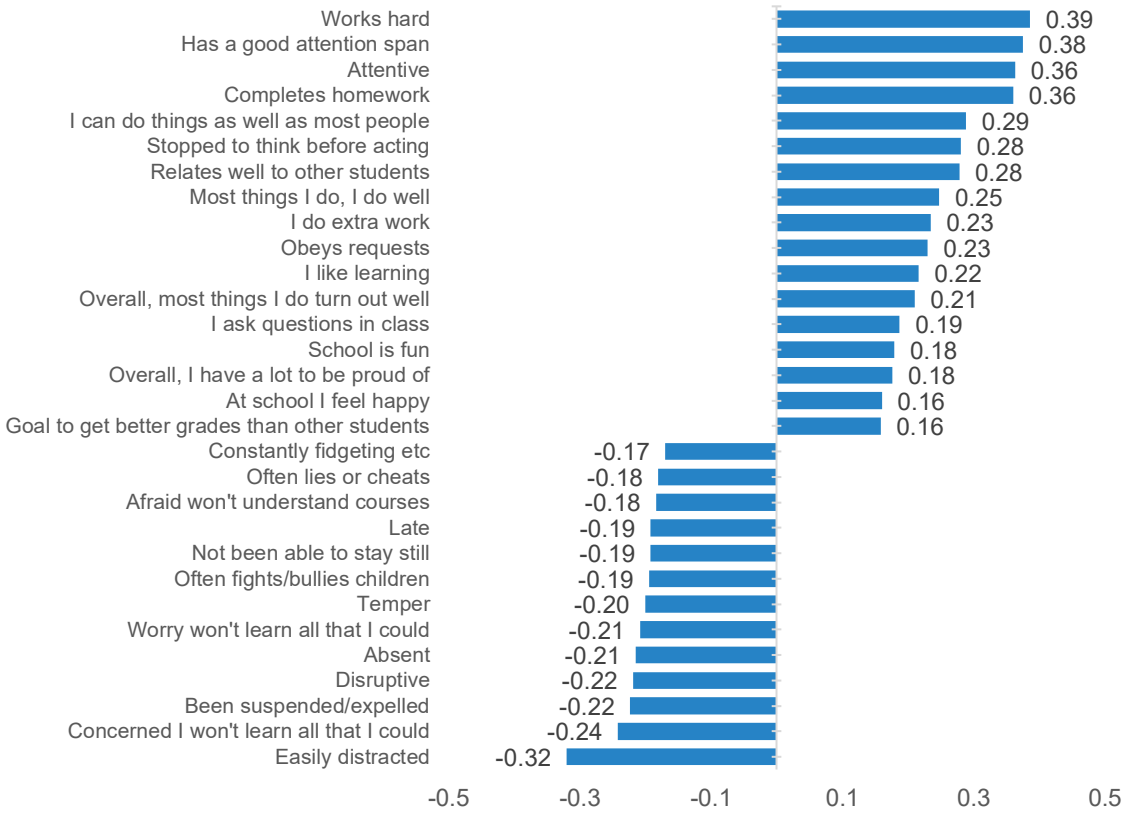
Cognitive variable	Cognitive function tested	Unit of measurement	Boys	Girls
Identification task (Age 14-15)	Overt attention; reaction time	Log10 milliseconds	2.68	2.69
One-Back task (Age 14-15)	Working memory	Log10 milliseconds	2.85	2.87
Groton Maze Learning test (Age 14-15)	Spatial memory; learning efficiency	Total number of errors	52.10	51.77
Learning difficulty (Age 14-15)	Whether child has learning difficulties	Yes/No	0.03	0.02
Matrix reasoning (Age 10-11)	Visual processing; spatial perception	Total number of correct items	10.24	10.58

Student engagement drivers

Analysis of PISA data shows there is no correlation between Australian student's sense of belonging (as measured by the Sense of Belonging Index) and their achievement, after controlling for socioeconomic status.

Analysis of data found in the Longitudinal Study of Australian Children (LSAC) shows that, while students' numeracy achievement is correlated with indicators of student engagement, this correlation is markedly stronger for *cognitive and behavioural engagement* — such as how hard students work, their attention span, attentiveness, distraction, homework completion, and the like — than *emotional engagement* — such as whether students feel happy at school, find school fun, and the like.

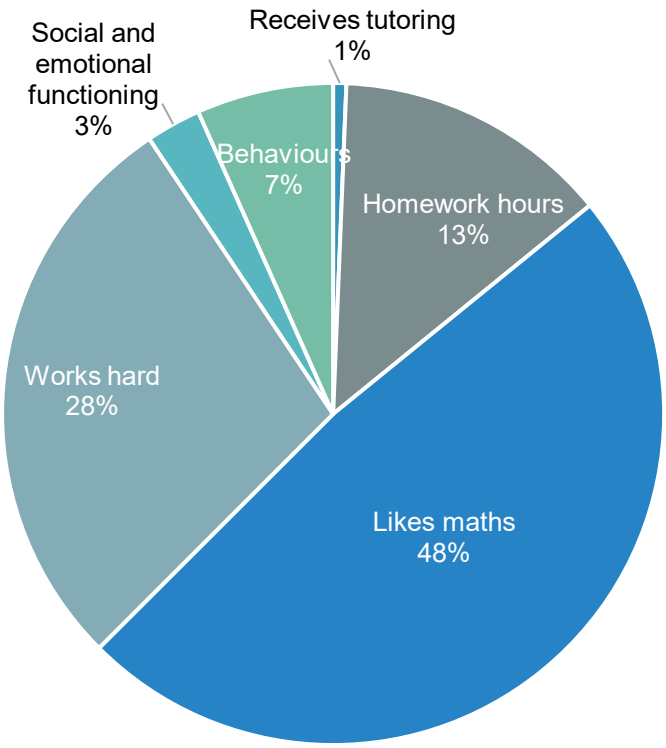
Correlation between student engagement factors and mathematics achievement in Year 9



Source: Authors' analysis of LSAC data.

A relatively large proportion of student achievement in NAPLAN is explained by how much students like maths (also observed in the TIMSS data) and how hard they work on their studies. Other factors, like students' social and emotional functioning, and general behaviours, do not significantly explain student achievement.

Breakdown of explained student engagement factors contributing to Year 9 numeracy achievement.

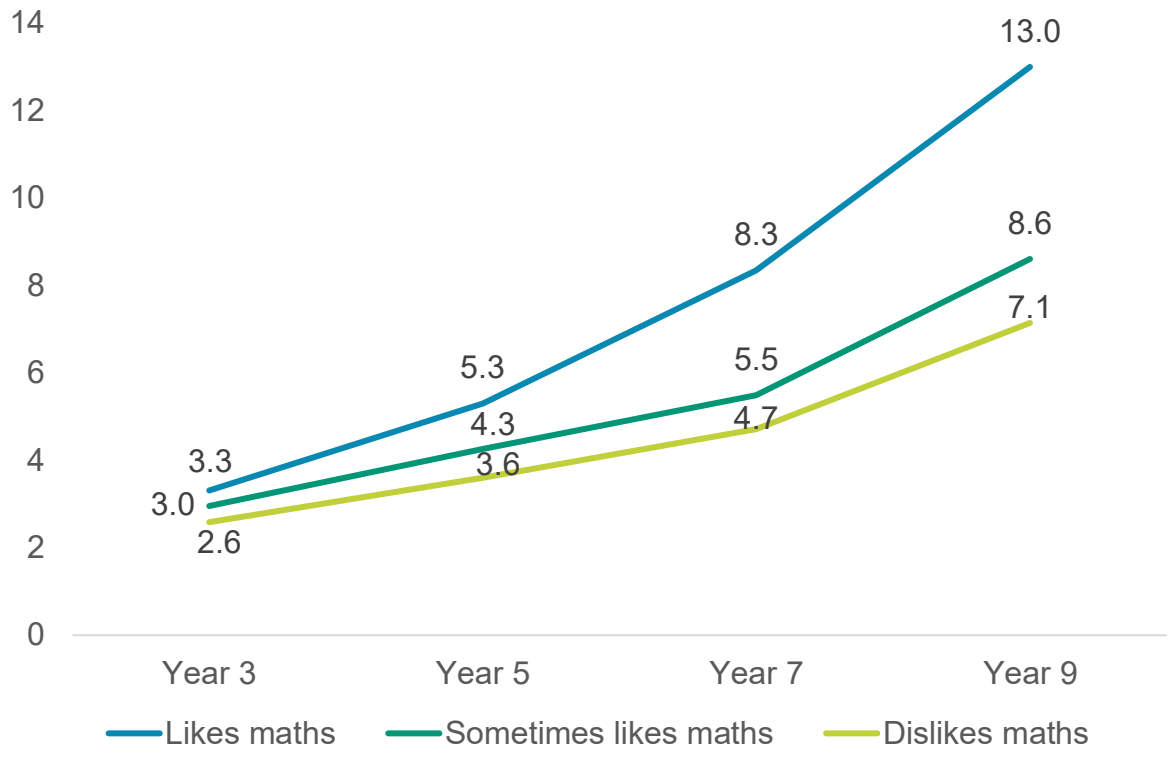


Source: Author's analysis on NAPLAN and LSAC data

The National STEM School Education Strategy notes that addressing difficulties in engaging and sustaining students' interest in mathematics is an area requiring national action.

CIS modelling shows a wide divergence in students' projected numeracy scores in NAPLAN based on whether students like or dislike mathematics — after accounting for other factors. By Year 9, the difference in achievement represents the equivalent of around 6 years of learning — both because students who record high levels of interest achieve well above their year level and because students with low levels of interest achieve below the expectation for their grade level.

Equivalent years of learning projected based on maths interest

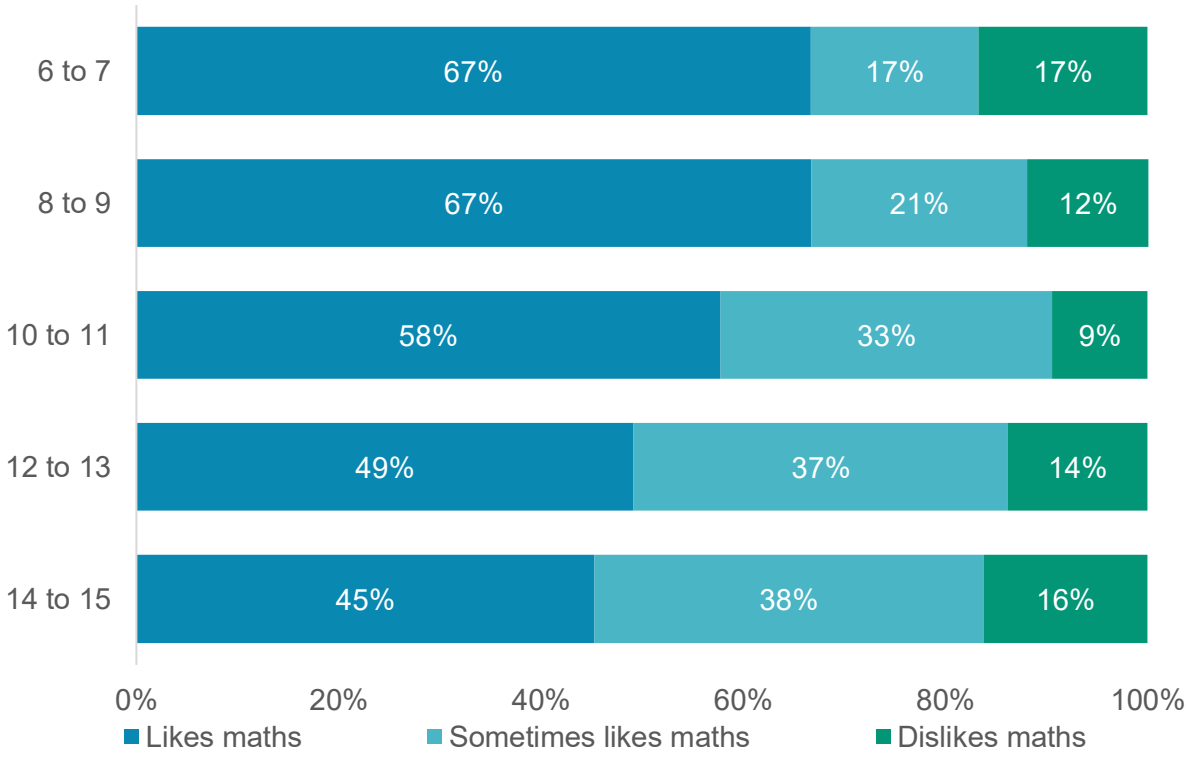


Source: Author's analysis on LSAC and NAPLAN data

While boys tend to report relatively high levels of interest in maths compared to girls, this gap is not present in the earliest years of schooling. Interest gaps can be observed from around 8 to 9 years of age and persist throughout the school years.

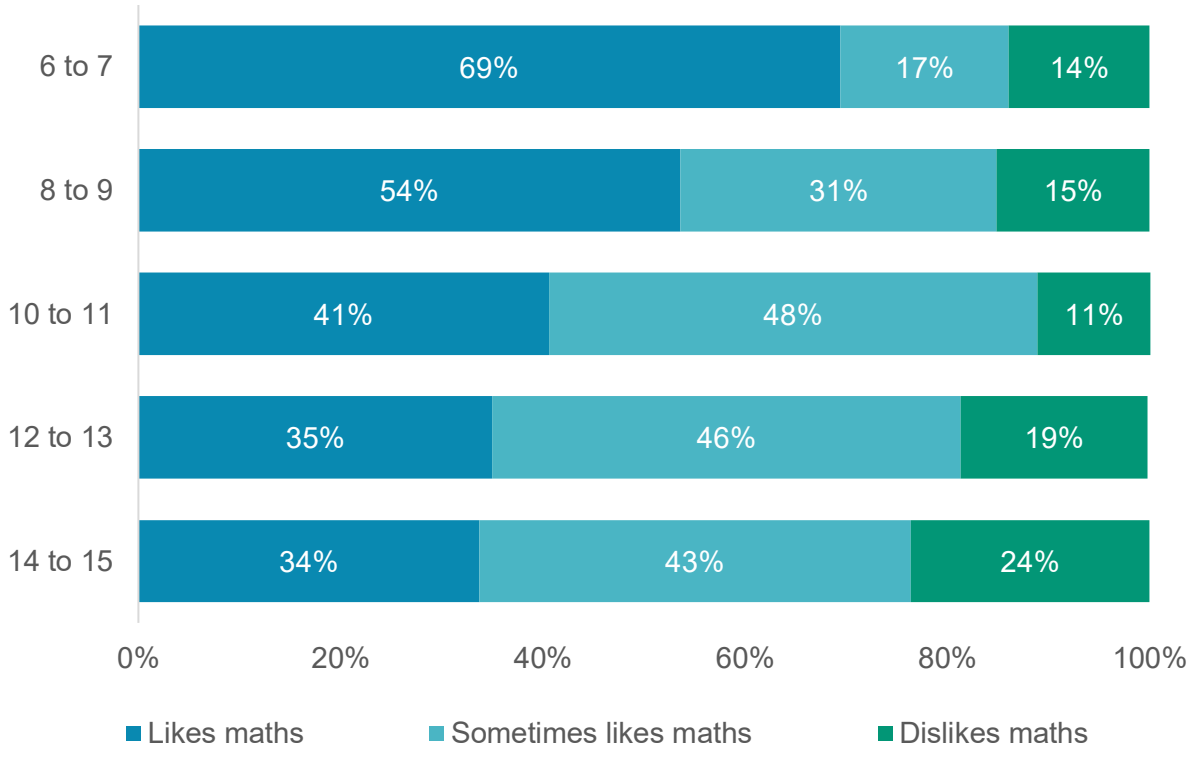
However, gender differences in mathematics interest do not appear to significantly explain gender differences in achievement. Namely, closing the gender gap in mathematics interest would only close the numeracy achievement gap by around 3 NAPLAN points in Year 9. This is because girls who record a similar level of interest in maths to boys still record lower achievement. This indicates that it is not differences in interest in maths per se that are directly contributing to gender gaps in achievement.

Boys' interest in maths, by age.



Source: Author's analysis on LSAC data

Girls' interest in maths, by age.



Source: Author's analysis on LSAC data

While education researchers and practitioners recognise the importance of engaging students' interest in learning (both in domain-specific and domain-general contexts), many misinterpret the causality and directionality of the relationship between students' achievement and motivation.

It is generally assumed that greater interest and motivation from students cultivates greater learning potential. However, while seemingly plausible, this assumption is not entirely correct and largely reflects some outdated theories of how students learn.[29]

This has mistakenly encouraged teaching approaches that have attempted to directly stimulate interest, motivation, and engagement of students — such as by incorporating games, project-based learning, open exploration, and the like, into lessons or study routines. As CIS analysis has found, such emphasis remains a feature of Initial Teacher Education in Australia's mathematics education degrees.[30]

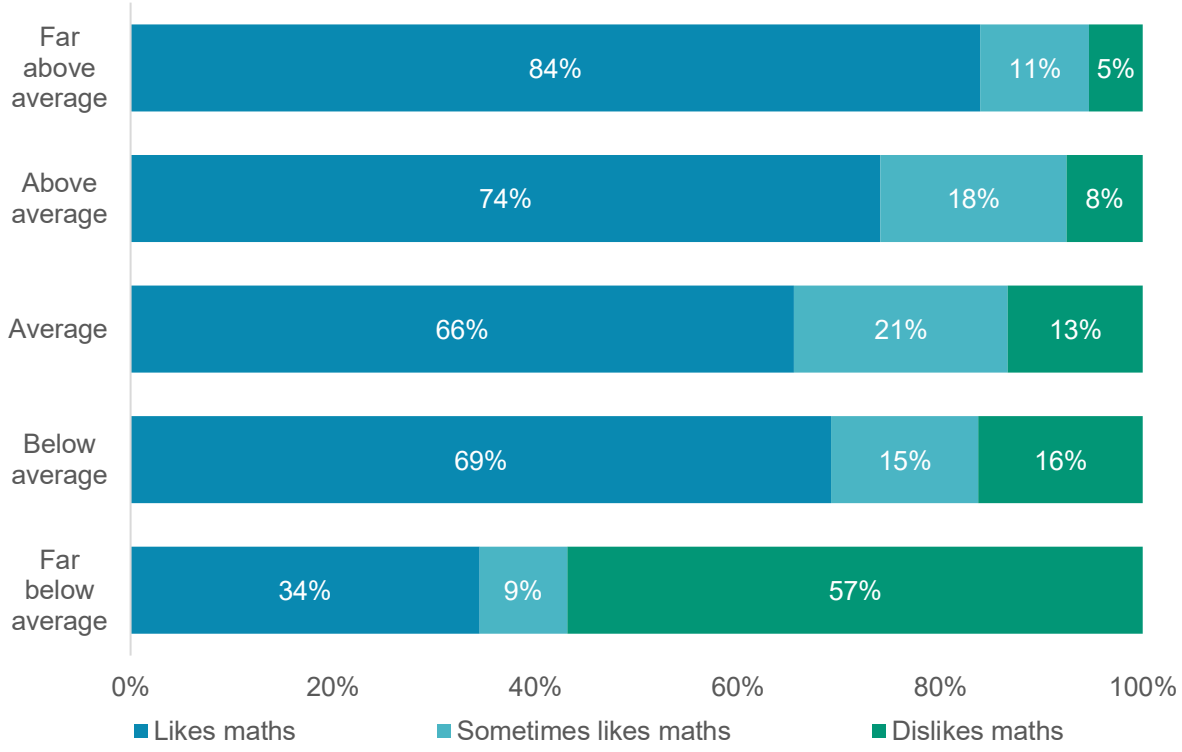
However, longitudinal data sets, in particular, have helped to demonstrate that there is largely a bi-directional relationship — students' prior achievement (especially, subject knowledge) supports students' interest in maths and number work, which further improves learning, which further engages interest, and so on — in a virtuous cycle.[31] [32] [33] This likely explains why our analysis demonstrates such strong returns to higher levels of interest in maths as students progress later in their schooling.

But it is making initial early progress in foundational mathematics that is responsible for initiating the virtuous cycle. CIS analysis shows that teacher-assessed early progress in mathematics is highly predictive of later interest in number and maths.

Year 1 students who are rated by their teachers as ‘far below average’ in their mathematics progress are almost five times more likely to lack later interest in maths and numbers. And for those whose teacher rates their progress as ‘far above average’, a very high proportion report being interested in number and maths.

For this reason, engaging students’ interest in mathematics at a young age is most likely to be acquired by ensuring more children in the early years of education are able to demonstrate a foundational level of capabilities.

Proportion of students, by ratings of liking numbers and maths work, by students’ maths progress at age of 6/7.



Source: Author’s analysis on LSAC data

As noted above, declining student enrolments in senior secondary mathematics are an area of concern across most jurisdictions.

A range of possible explanations have been proposed for why enrolments have been in decline — including heavy workloads and time commitment for the subject, changes to university course prerequisites, perceived gaming to optimise ATAR scores, and poorer teaching standards in mathematics.[34]

Students who enrol in higher levels of mathematics in Year 12 report liking maths and numbers work more than others, however there is no difference observed between students who choose to do no maths in Year 12 and those who enrol in general mathematics.

Importantly, however, the analysis does identify that a substantial proportion of students with appropriate levels of prior numeracy achievement do not enrol in higher mathematics — including those who also express interest in number and maths work. This provides suggestive evidence that some students may be discouraged from participating in higher mathematics in Year 11 and 12 for reasons other than their ability and interest.

Skill acquisition drivers

It is clear that there are skill acquisition needs related to STEM, especially in engineering. This means that investigating opportunities to increase enrolments in, and completions of, STEM (especially engineering) qualifications are of policy importance.

CIS analysis using the Longitudinal Survey of Australian Youth confirms that students with high mathematics proficiency are more likely to enrol in a STEM degree. The most significant factors associated with post-school participation in a STEM programme relate to proficiency, interest and confidence in mathematics recorded at 15 years of age.

Analysis also indicates that there are specific factors associated with, not only enrolling in, but completing a STEM degree.

Students are more likely to successfully complete tertiary education in STEM if they have higher proficiency levels, including in activities such as distance, area, and percentage calculation activities. In addition, students with a higher level of perceived importance of mathematics in helping realise their career goals and improving future job prospects also enjoy higher completion rates.

Teacher factors driving student outcomes

The quality of teaching is the greatest in-school, controllable factor affecting student achievement.[35] Across many studies, research suggests that around 30%,[36] and as much as 40%[37] of variation in student performance is at the class- and teacher-level. Accordingly, teachers can make a substantial difference in the education and life outcomes of their students.[38] [39] [40] [41] [42]

Yet, to the extent that quality of the teacher workforce is typically considered, it is in very narrow, input-based, ways — such as qualifications, teachers' school-leaving achievement (particularly the ATAR), years of experience, teachers' workplace conditions, teachers' self-efficacy and the like. In other words, teacher 'quality' is looked at in terms of the incoming attributes of teachers (effectively, their inputs), rather than what they can do (and ultimately the achievement of their students; their outcomes).

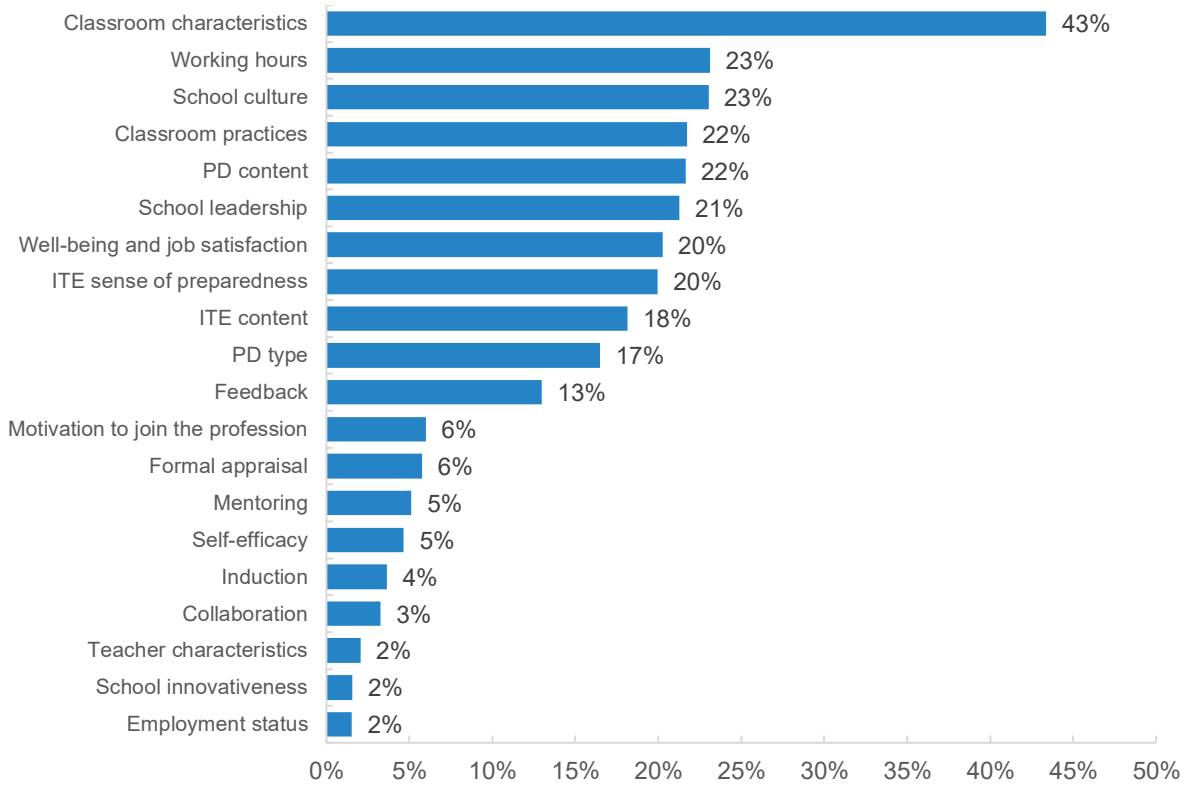
An OECD analysis linking student results and teacher data also confirms the significant relationship between teacher effects on student achievement.[43] Among the key findings from this analysis are:

- While there was no observed relationship with the overall working hours of teachers and student achievement, what teachers spend their working time on is consequential. In particular, students

recorded higher achievement when their teachers spent a higher proportion of working hours on marking and correcting student work and spent less time participating in school management activities recorded higher student achievement.

- Schools and teachers with better student-teacher relations, and those in schools where stakeholder involvement with parents and community in school-related activities is greater, record higher student achievement.
- Australian teachers who administer more class assessments and those who provide more immediate feedback on students' work record higher achievement, particularly in reading.
- Australian classes with a poorer disciplinary climate record lower achievement.
- Mathematics teachers who are more prepared in terms of 'general pedagogy' record slightly lower student achievement, but having a teacher more prepared in terms of subject pedagogical knowledge is positively related to achievement.
- Teachers who are more satisfied with working in their school consistently record higher achievement.
- There is mixed evidence regarding the relationship with how satisfied teachers are with their work as a teacher more broadly. There is no statistical relationship found between teachers' workload stress, satisfaction with salary and working conditions, or teachers' views of how the teaching profession is valued by society.
- Several factors that are regularly discussed as being significant determinants of teachers' effectiveness — such as years of experience, employment status (whether they are part-time or full-time), satisfaction with salaries, working conditions, their perceptions of teaching's status, motivation to join the profession, and self-efficacy — are found to have virtually no relationship with student achievement.

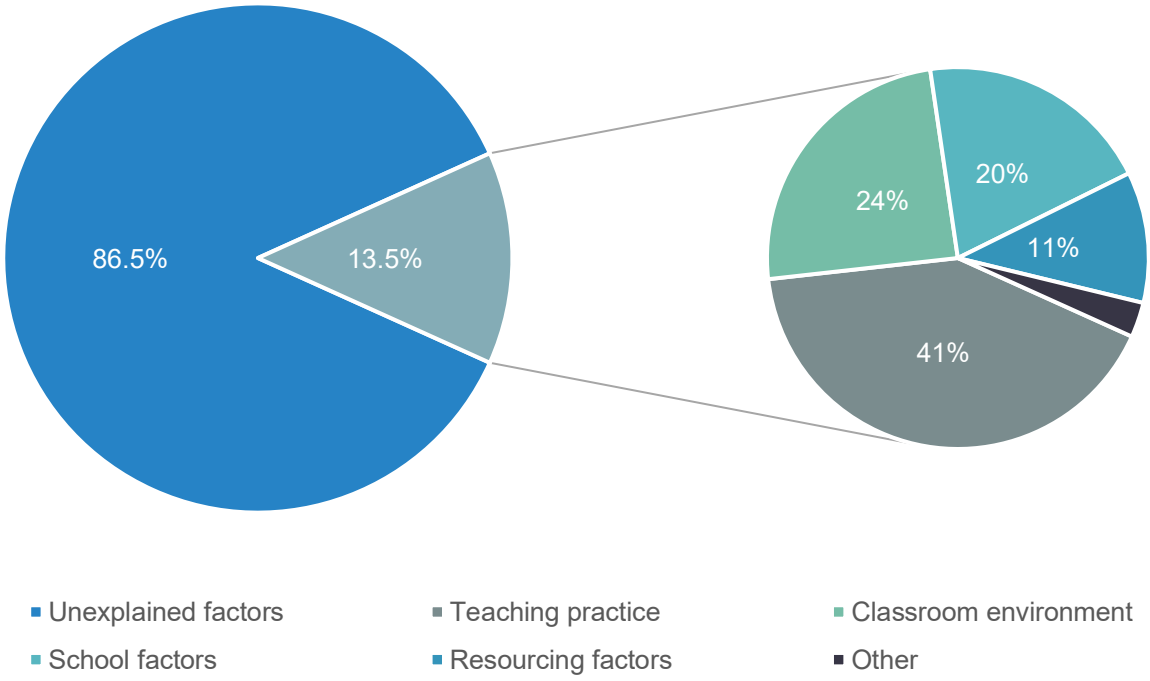
Individually computed proportion of variance in Australian student achievement averaged across Reading, Mathematics, and Science by teacher factors.



Source: OECD (2021). Positive, High-achieving Students? What Schools and Teachers Can Do.

Previous study by Deloitte Access Economics suggests that differences in school quality explains between 8 and 29 per cent of variations in student mathematics achievement.[44] Among various school quality drivers, teaching efficacy was identified as the most influential driver —accounting for one third of the explained variation in student achievement. Here, teaching efficacy refers to the effectiveness of teaching practices in the classroom, which differs from teacher attributes such as level of qualification and years of experience.

Relative importance of school quality drivers (averaged over PISA and TIMSS)



Source: Deloitte Access Economics (2019).

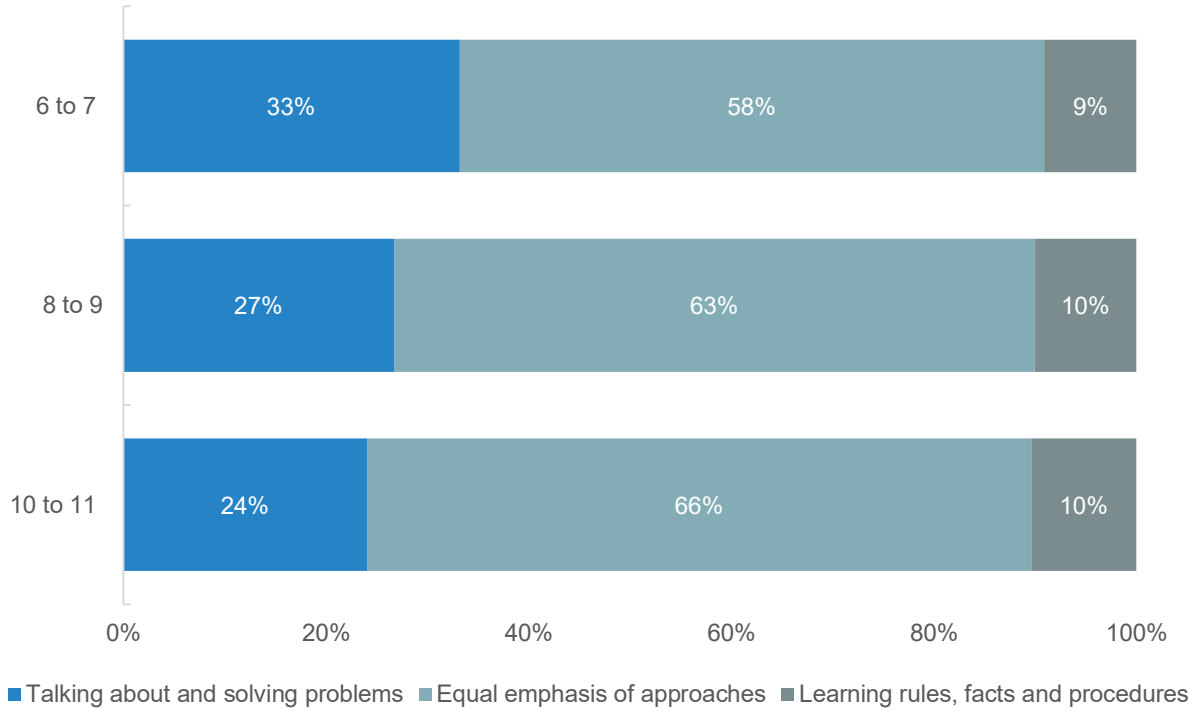
Evidence shows that some teaching practices are generally more effective than others.

A greater emphasis on explicit instruction is associated with higher student achievement, corresponding to as much as an additional 24 months of learning gain when employed in every lesson.[45] On the other hand, the use of inquiry-based teaching in every lesson was associated with being up to 18 months behind peers not exposed to such practice.[46] Prior work has also estimated that students who receive inquiry-based teaching in every lesson achieve around 61 points lower in PISA.[47]

Australian mathematics classrooms are more likely to employ inquiry-based teaching rather than explicit instruction. The vast majority of Australian teachers report that they employ a mixed emphasis of approaches in teaching mathematics. However, at the age of 6 to 7, more than three times more students receive mostly inquiry-based instruction in comparison to explicit instruction.

CIS estimates that average PISA scores would increase by the equivalent of around 10 months of schooling, by the age of 15, if students received explicit instruction in most classes with some inquiry-based learning.[48] There is significant room for improvement by ensuring students receive greater exposure to explicit instruction in most lessons.

Teachers' reported emphasis in teaching mathematics, students aged 6-7, 8-9, 10-11.



Source: Longitudinal Study of Australian Children (LSAC)

There are some specific practices that are regularly found to be among the most effective for all learners:

- Clear teacher demonstrations that recognise implications of cognitive load;
- Guided, scaffolded practice opportunities that allow students to verbalise;
- Immediate corrective feedback to clarify and confirm students' progress; and
- Spaced and interleaved practice to facilitate cumulative review of content.

Effective teaching doesn't necessarily imply employing explicit instruction alone, but a great deal of explicit instruction is often necessary before students are ready for alternative teaching approaches to be introduced.

Inconsistent and ineffective teaching practices appear to be the result of insufficient and improper preparation of trainee teachers during university-based Initial Teacher Education (ITE).[49] [50]

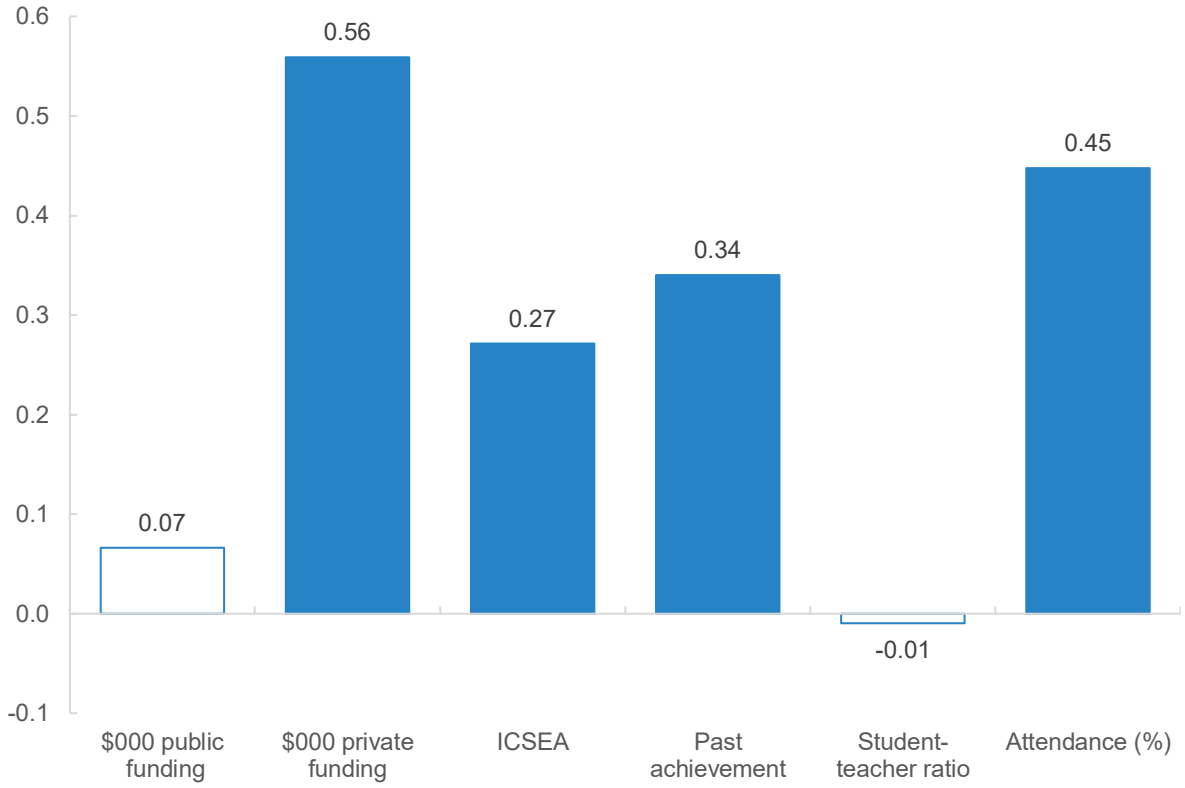
School resourcing and student outcomes

By international standards, Australia has among the highest levels of school funding, and the levels have been increasing more steeply than most similar countries.[51]

At a system-level, additional public funding has not produced improved educational outcomes. This is consistent with decades of educational economics research have similarly found little or no association between overall resourcing and student outcomes.[52]

In addition to no evidence of system-wide increases in inputs translating to outcomes, CIS research also finds the same to be true when considering school-level comparisons.[53] This analysis found no association between more public funding and improvements in student achievement at the school level. For this reason, policymakers should not look to resourcing alone as a likely lever to raise Australian student achievement.

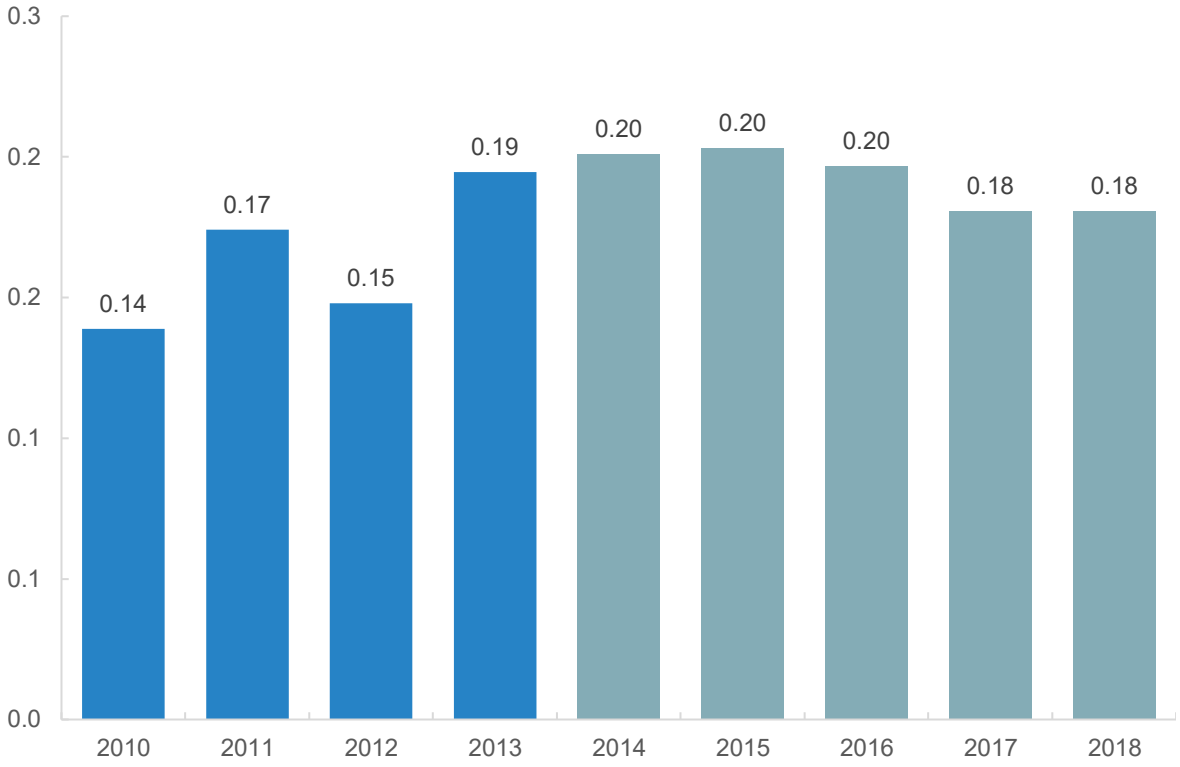
Statistical association between key variables and student achievement in Year 5 NAPLAN, government schools, 2010-2018.



Source: Fahey, G. (2020). Dollars and Sense: Time for smart reform of Australian school funding, Centre for Independent Studies, Research Report No 40.

Among the policy objectives of Gonski school funding reform has been to reduce the impact of socio-educational advantage in explaining student outcomes. Analysis of ACARA school-level would suggest that this has not occurred to date. The statistical association between school ICSEA has generally been the same magnitude or greater since Gonski reforms were introduced to the school funding formula in 2014.

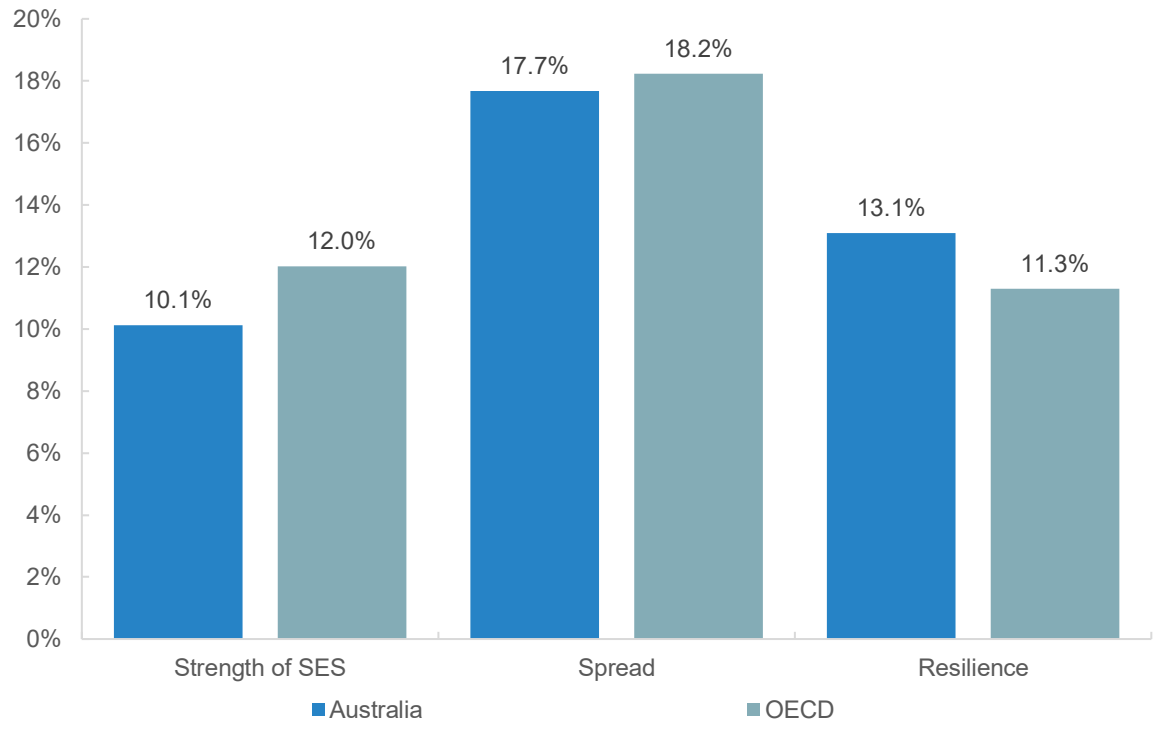
Statistical association between school Index of Community. Socio-Educational Advantage (ICSEA) and average student achievement, 2010 to 2018.



Source: Authors' analysis of ACARA school-record data.

In any case, Australia compares relatively well to OECD countries in measures of educational equity. The strength of association between socio-educational status and achievement is weaker than the OECD average, the spread in achievement between socioeconomically advantaged and disadvantaged is smaller than the OECD average, and the likelihood of socioeconomically disadvantaged students to record high achievement (academic resilience) is relatively high.

PISA measures of school system inequity.



Source: OECD (2019). Programme for International Student Assessment 2018.

Assessing appropriateness and effectiveness of the National Policy Initiatives

There have been varying levels of progress toward NPIs through the current NSRA.

While some stakeholders may make the case for relatively few, narrowly targeted NPIs, it is our view that this is insufficient to appropriately meet current area of demand and already established intergovernmental cooperation.

In the section that follows, a broad assessment is made on the progress toward the reform directions, followed by a series of recommended actions that should inform future NPIs and/or the NMF.

A general note to be stressed is that Education Ministers should resolve to improve the transparency and reporting of progress made against current and future NPIs, as the Education Ministers Meeting forum currently lacks a suitable level of public accountability.

Supporting students, student learning, and student achievement

In recent times, Australian Education Ministers have made considerable progress against the NPIs in this reform direction.

While there is implementation work to go on with, and additional sections still under examination, significant progress has been made in reviewing of the Australian Curriculum.

The outputs from the Online Formative Assessment Initiative are understood to be at an advanced stage.

The findings from the Senior Secondary Pathways Review are largely with jurisdictions to act upon. It is not recommended that all recommendations — such as the proposed Learner Profile — are implemented across all jurisdictions and should not be a focus of the Australian Government in forward NPIs.

The new NSRA should both advance the progress from the previous round, formalise additional areas of intergovernmental commitment that have increased over recent years, and pursue more ambitious outcomes.

Set an explicit, medium term national student achievement improvement target

The Australian Government has previously indicated the aspiration to improve the ranking of Australian students in the OECD-run Programme for International Student Assessment (PISA) by 2030.[54]

Given the scale of the sustained achievement decline observed in PISA, it would be appropriate for Education Ministers to undertake toward a shared commitment to raise student achievement into the medium term. This will make more tangible and explicit the aspirations of "improving educational outcomes" laid out in the Alice Springs Declaration.

Monitor progress against NAPLAN proficiency standards

The NMF currently monitors progress against the NMS, however its very low threshold for achievement limits the role that it plays as a barometer of overall outcomes across the wider student population in literacy and numeracy.

It is expected that Education Ministers will proceed with national proficiency standards in NAPLAN in 2022. This would put NAPLAN's measurement into alignment with reporting in sample assessments, such as PISA, PIRLS, TIMSS, and NAP.

A proficiency standard will be a much more informative indicator of national progress. Education Ministers should not only support the reporting of progress against national proficiency, but also its ongoing monitoring within the NMF.

Gain commitment to address poor literacy rates among male students

There are significant and widening achievement and attainment gaps between young males and young females.

Boys are over-represented in virtually all educational risk categories from even the earliest stages of their interaction with early childhood education. The alarming rates of underachievement — especially very low writing proficiency — among secondary school boys is observed across all jurisdictions.

Given the correlation between writing proficiency, school-leaving destination, and post-school educational attainment, boys are at a heightened risk of poor attainment and labour market outcomes.

Some commitments within the Senior Secondary Pathways Review will help to promote retention of boys toward school completion, but this attainment alone may not be sufficient in improving post-school outcomes, in lieu of raising overall literacy standards.

Monitor early competency and school readiness of children

In recent years, the federal government and various jurisdictions have significantly increased the investment and regulation of early childhood education and care. The additional impetus to integrate these sectors with formal schooling will further amplify the need for intergovernmental collaboration and greater monitoring of progress.

The National Quality Standard (NQS) may potentially be a suitable tool to support regulators of providers, but it is not necessarily an appropriate indicator of school preparedness of Australian children. Understandably, the NQS is weighted toward regulatory compliance and child safety standards, rather than explicitly and directly monitoring the educational preparation of children. Research shows that there is only a modest correlation between the highest categories of NQS ratings and the quality of services, and that there is no observed quality difference between providers rated as 'meeting' and 'working towards' the standard.[55]

The Australian Early Development Census (AEDC) provides some indicative measures of appropriate factors. The AEDC measures of proportion of children on track developmentally should be reflected in

the NMF. However not all indicators contained in the AEDC are necessarily predictive of academic preparedness — in part because some developmental vulnerabilities may reflect another underlying unidentified educational risk factor. Moreover, it is not clear what expectation is currently placed upon educators to intervene and act upon the collection provided for the AEDC.

The existing data collections, despite growing considerably in recent years, could be better aligned with school readiness and integrated with expected school practice. Over the course of the next NRSA, Education Ministers should undertake to determine clear expectations to define what 'school readiness' looks like for Australian children and how progress can be better monitored against these outcomes.

Ensure all students receive a phonics screening check

The federal government has previously supported implementation of the voluntary Year 1 Phonics Screening Check. Many school systems have also introduced similar screening checks over recent years.

While some jurisdictions are at various stages of implementation and consideration of such initiatives, the federal government should encourage all Education Ministers to commit to implementing the screening check over the life of the next NSRA.

Make suitable outcomes for students with disability visible in national measurement

There is very limited monitoring of educational outcomes for students with disability, despite increased attention from educators and policymakers over recent years.

The significant progress in adopting and implementing the Nationally Consistent Collection of Data on School Students with Disability (NCCD) means that there is much more visibility to school systems regarding the *inputs* related to students with disability. However, it is not necessarily clear to what extent schools' adjustments and other practices are contributing to greater outcomes for students, their carers, their peers, and families.

There have also been important developments from the Royal Commission into Violence, Abuse, Neglect and Exploitation of People with Disability, specifically its hearing and deliberations on 'Education and Learning', as well as the review of the Disability Standards for Education. A consistent theme is a need for education progress to be realised — so that the emphasis is not just on the provision of services alone, but to helping demonstrate the meaningful improvements being made in the educational lives of students.

Updated standards and expectations regarding education for students with disability should be made present in the NSRA, given the intergovernmental governance of these matters.

Monitor youth proficiency in literacy and numeracy, not just attainment

The NMF provides several appropriate measures for considering the post-school attainment of youth. However, this does not necessarily translate to overall skill acquisition alone.

The OECD's Programme for International Assessment of Adult Competencies (PIAAC) provides a reliable indicator of adult levels of literacy and numeracy proficiency. Education Ministers should monitor the results for Australian youth in the upcoming round of PIAAC in future revisions to the NMF.

Supporting teaching, school leadership, and school improvement

Progress of NPIs against this reform direction has been mixed.

There remains limited national coordination to support teacher workforce strategies, despite some consideration by Education Ministers through the previous Education Council forum. Ongoing developments impacting on the teacher workforce — such as subject-specific and geographic shortages of teachers; demand for special educators, early childhood educators and school principals; and pressures on teacher working hours — are evident across several jurisdictions and may require greater coordination of efforts to improve outcomes.

The quality of initial teacher education remains a source of concern.

Clarity in the upcoming NPIs toward national quality assurance activities should be informed by the new Initial Teacher Education Quality Assessment Expert Panel — most substantively standards for ensuring that ITE providers sufficiently promote evidence-based teaching practices. The NPIs should also include commitment to implement recommendations from the Quality Initial Teacher Education Review.

While the introduction of Teaching Performance Assessments (TPAs) over recent years is an important reform, there remain some standard setting and moderation issues that require resolution. In addition, not all providers have yet to have an endorsed TPA.

Ensure there is a flexible, diverse, and capable teacher workforce

It is increasingly clear that the composition and preferences of the teacher workforce are changing. In common with other macro labour markets, teaching is not necessarily a career for life for many. Instead, it is likely to be a profession that sees various pathways.

Analysis contained in the Quality Initial Teacher Education Review shows that teaching is considered as a highly attractive pathway for many mid-career professionals — with 4 in 10 considering becoming a teacher, if there were few barriers to enter the profession.

This points to future supply of the teacher workforce not being limited to school-leavers, but increasingly to a wider pool of new entrants. Facilitating this additional pipeline is key to a sustainable teacher workforce.

In addition, there are many who may be considered in ‘potential teacher supply’ — those who have acquired necessary credentials, qualifications, and registration — who are not currently teaching. Helping these individuals transition to teaching roles will help to improve overall teacher supply.

Education Ministers should commit to an understanding in the NSRA to promote teacher supply strategies that reflect greater flexibility and diversity.

Facilitating interstate mobility through mutual recognition of credentials should form part of the NSRA, so that regulatory barriers do not unnecessarily prevent the matching of potential teachers with school systems’ needs. This is especially important in the current context because some shocks to teacher supply

in NSW could potentially be mitigated by additional supply from school systems in which there is a teacher surplus.

Ensure teacher remuneration is better aligned with performance

While there is national guidance over the Professional Standards and the certification process toward High Accomplished and Lead Teacher (HALT) status, this has not met expectations to date. While there is qualitative evidence to indicate some potential barriers to capable teachers not seeking out HALT certification, this may require closer examination over the life of the next NSRA.

Education Ministers should commit to not only evaluating the HALT certification, but also to openly considering potential alternative approaches — such as NSW Productivity Commission's proposed Instructional Lead — which might contribute to a greater nexus between teachers' performance and remuneration.

Develop a nationally consistent training pathway to transition paraprofessionals to teaching

By international standards, Australia has an exceedingly large supply of non-teaching staff in schools. Assisting more of these staff to provide support to teachers could help address workload and other issues faced by the sector.

Developing a recognised training pathway for these paraprofessionals will require national collaboration for the purposes of accreditation, certification, and approval to work within schools.

Enhancing the national evidence base

The establishment of the Australian Education Research Organisation (AERO) was a key accomplishment over the life of the current NSRA — albeit at a relatively slow pace. Over the life of the next NSRA, Education Ministers will need to evaluate the extent to which AERO is meeting the expectations of policymakers, educators, and the broader community. Establishing appropriate indicators of engagement and impact would assist stakeholders to ensure AERO meets its potential and broad strategic objectives. It will be important that as AERO continues to grow in the years ahead, it supports and helps to enable external research (such as those from the independent research community), and does not crowd it out or monopolise the wider evidence environment.

The Australian Teacher Workforce Data (ATWD) has been relatively slow and modest in its benefits to the research community to date. Outputs to date have been very descriptive, rather than analytical — which, while useful, has not substantially added to the evidence base above and beyond existing data. That said, recent improvements to the ATWD — including the new Key Metrics Dashboard — are promising developments. The ambition in the next NSRA should be to see that the ATWD helps inform suitable metrics for teacher workforce performance monitoring.

It is expected that all schools will have a Unique Student Identifier (USI) by 2023. Progress toward this initiative has been very slow over many years and is well behind international standards of data collect.

While not directly related to the NSRA, it is noteworthy that the Australian Government's passage of Data Availability and Transparency Act 2022 has implications for further developing the national

education evidence base. Over the life of the coming NSRA, Education Ministers should collaborate to ensure that priority data collections reflect the best possible use of shared and integrated data that can be supported by the new Office of the National Data Commissioner.

Ensure there is timely and reliable macro and micro teacher workforce data

There remain significant obstacles to timely and reliable teacher workforce data— both in terms of macro reporting and micro teacher-record levels.

Priorities for macro data reporting include matching of teacher supply and demand (including forecasts), including by discipline and geography. In addition, data collection should ensure that there is a nationally consistent and reliable measure of teacher attrition as well as potential teacher supply. Education Ministers are advised to consult the teacher workforce monitoring that is currently being employed in Colorado as an example of best practice macro monitoring of the teacher workforce.

Micro data would be suitable to advance research projects to further build the evidence base related to teacher effectiveness, especially the contribution of ITE toward this. Education Ministers should support the integration of ITE, TPA, and school data to provide better understanding about ITE effectiveness and preservice teacher preparation.

Improve the collection, coordination, and communication of early years data

There is a vacuum of quality data to inform educators, administrators, and researchers between early years data collections and school-based data. Given that this is also the most formative opportunity for educational intervention, this presents a gap in assessing and remediating educational vulnerabilities.

Over the life of the next NSRA, Education Ministers would benefit from not only being able to correlate the educational achievement of children who start school with different vulnerabilities based on AEDC, but also have developed resources for use of educators and providers to guide intervention practice.

To further the relevant data pertaining to early childhood education and care, further NPIs should seek to integrate data collection from ECEC providers (including matched provider details, and child attendance patterns, not just hours attended) and those obtained at school entry.

Create a National Behaviour Survey to better monitor student engagement

The Australian Government has previously indicated that classroom management was among the priority areas for education reform. AERO has been tasked with producing and sharing resources to support educators and school leaders, the work could be supplemented with a supporting data collection to inform future practice and monitor outcomes.

Education Ministers could monitor the implementation of the soon-to-be introduced English school system's National Behaviour Survey, focussed on low-level disruption, bullying and other incidents of challenging behaviour. Over the next NSRA, Education Minister should assess the suitability of an equivalent database for Australia's context.

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