Programme for International Student Assessment (PISA)

PISA 2015: Reporting Australia's results

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Contents

List of Figures

List of Tables

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The undertaking of PISA 2015 was a collaborative effort. A national assessment such as PISA could not be successful without the cooperation of school systems, principals, teachers, students and parents. A high participation rate of the randomly selected schools and students is essential for obtaining high-quality data. It is thanks to this level of cooperation that Australia was able to fully satisfy the internationally set response criteria for PISA 2015. ACER gratefully acknowledges the assistance of education system officials Australia-wide, and the principals, teachers and students in the participating schools who so generously gave their time and support to the project.

Executive Summary

The Programme for International Student Assessment (PISA) is an international comparative study of student achievement directed by the Organisation for Economic Co-operation and Development (OECD). PISA measures how well 15-year-olds, who are nearing the end of their compulsory schooling in most participating educational systems, are prepared to use the knowledge and skills in particular areas to meet real-life opportunities and challenges.

PISA 2015 is the sixth cycle of PISA since it was first conducted in 2000. Seventy-two OECD countries or partner economies participated in PISA 2015. In Australia, PISA is managed by the Australian Council for Educational Research (ACER) and is jointly funded by the Australian Government and the state and territory governments.

This report presents the results for Australia as a whole, for the Australian jurisdictions and (where relevant) for the other participants in PISA 2015, so that Australia's results can be viewed in an international context, and student performance can be monitored over time. The relationship of socioeconomic background to scientific literacy achievement and the influence of other student- and school-level factors are also examined in this report.

What are the main goals of PISA?

PISA tries to answer several important questions related to education, such as:

- How well are young adults prepared to meet the challenges of the future? Can they analyse, reason and communicate their ideas effectively? Will their skills enable them to adapt to rapid societal change?
- Are some ways of organising schools and school learning more effective than others?
- What influence does the quality of school resources have on student outcomes?
- What educational structures and practices maximise the opportunities of students from disadvantaged backgrounds?
- How equitable is the provision of education within a country and across countries?

Who is assessed?

PISA assesses a random sample of 15-year-old students, drawn from a nationally representative sample of schools. In 2015, 72 countries and economies (all 35 OECD countries and 32 partner countries and economies) and around half-a-million students (representing 29 million 15-year-old students) participated in the PISA assessment.

In Australia, 758 schools and a total of 14 530 students participated in PISA 2015. Australia took a larger sample than the one required by PISA in order to oversample smaller jurisdictions and Indigenous students to ensure that reliable estimates could be inferred for those populations.

What is assessed?

The PISA assessment focuses on young people's ability to apply their knowledge and skills to real-life problems and situations. The term *literacy* is attached to the domains of science, reading and mathematics to reflect the focus on these broader skills and as a concept it is used in a much broader sense than simply being able to read and write. The OECD considers that science and mathematics are so pervasive in modern life that it is important for students to be literate in these areas as well.

Assessment tasks typically contain some stimulus text describing a real-life situation and a series of two or more questions (items) for students to answer about the text. For the mathematical and scientific components, the text typically presents situations in which mathematical or scientific problems are posed, or mathematical or scientific concepts need to be understood. Some of the PISA 2015 items were multiple-choice items, and others required students to construct and write their own answers.

A different domain is the focus of each PISA assessment cycle. Scientific literacy was the major domain in PISA 2015 and in 2006; reading literacy was the major domain in PISA 2000 and 2009, and mathematical literacy in PISA 2003 and 2012. In addition to these core literacy domains, PISA also assesses additional domains in each cycle. In PISA 2015, collaborative problem solving and financial literacy were also assessed.

What did participants need to do?

In PISA 2015, the main mode of assessment changed from a paper-based delivery to a computer-based delivery. Students who participated in PISA 2015 completed a two-hour cognitive assessment. All students completed items from scientific literacy (the major domain), and from one or more of the other domains (reading literacy, mathematical literacy, or collaborative problem solving). Students also completed a student questionnaire about their family background, aspects of their lives such as their motivation and engagement towards learning, and learning and instruction in science.

School principals completed a short web-based questionnaire that focused on information about their schools, including resources, the school environment and the qualifications of staff. Australia also participated in the teacher questionnaire. Sampled teachers completed a web-based questionnaire that sought information about their educational background and training, and teaching practices.

How are results reported?

International comparative studies have provided an arena to observe the similarities and differences between educational policies and practices. They enable researchers and others to observe what is possible for students to achieve and what environment is most likely to facilitate their learning. PISA provides regular information on educational outcomes within and across countries by providing insight into the range of skills and knowledge in in different assessment domains.

Results are reported for scientific, reading and mathematical literacy overall, as well as for the scientific literacy subscales. Each literacy domain has a defined average score across OECD countries: 493 points for scientific literacy; 493 points for reading literacy; and 490 points for mathematical literacy.

This report presents results as average scores, as distributions of scores and as percentages of students who attain each of a set of defined proficiency levels. Each of the literacy proficiency scales (and subscales) contain descriptions of the skills typically shown by students achieving at each level, as defined by international experts. In PISA 2015, there were seven levels of scientific and reading literacy proficiency and six levels of mathematical literacy. Students who are proficient at Level 5 or Level 6 are considered to be highly proficient in the assessment domain and are considered to be high performers, while students who have performed below Level 2 proficiency (the PISA baseline proficiency level) have such limited proficiencies that they will likely not be able to actively participate in real-life situations and are considered low performers.

PISA 2015 in Australia

- Approximately 14 500 students from about 760 schools participated, from all jurisdictions and all sectors of schooling.
- Data were gathered between late July and early September 2015.

- Test administrators were trained in PISA procedures and then administered the assessment sessions, in order to ensure that testing occurred in a standard and consistent manner.
- A group of teachers was trained to code students' answers to items that required a written response.
- Students' results were sent to their schools. Apart from this, all information in PISA at student and school levels is kept in strict confidence.
- PISA is a key part of the Australia's National Assessment Program.

Australia's performance in PISA 2015: Results from an international perspective

This section summarises the findings detailed in this report. Differences are only mentioned if tests of statistical significance showed that these were likely to be real differences.

Results from an international perspective

In scientific literacy

- Australian students achieved an average score of 510 points in the PISA 2015 scientific literacy assessment, which was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than that of 9 countries (Singapore, Japan, Estonia, Chinese Taipei, Finland, Macao (China), Canada, Vietnam, and Hong Kong (China)).
- Australia's performance was not significantly different from that of 8 countries (B-S-J-G (China), Korea, New Zealand, Slovenia, the United Kingdom, Germany, the Netherlands and Switzerland).
- Australia's performance was significantly higher than 51 countries, which included 23 OECD countries.
- Australia's proportion of high performers (Level 5 or 6; 11%) was higher than the OECD average (8%).
- Australia's proportion of low performers (below Level 2; 18%) was lower than the OECD average (21%).
- In Australia, the nationally agreed proficient standard is Level 3; 61% of Australian students achieved the National Proficient Standard in scientific literacy.
- Australia and 12 other countries showed a significant decline in their scientific literacy performance between PISA 2006 and 2015. Australia's performance declined significantly by 17 points.

On the science competency subscales

- Australian students achieved an average score on each of the science competency subscales that was significantly higher than the OECD average. Australia's average score was 510 points on the *explain phenomenon scientifically* subscale; 512 points on the *evaluate and design scientific enquiry* subscale; and 508 points on the *interpret data and evidence scientifically* subscale.
- Australia's performance was significantly lower than 9 countries on the *explain phenomenon scientifically* subscale; lower than 8 countries on the *evaluate and design scientific enquiry* subscale; and lower than 9 countries on the *interpret data and evidence scientifically* subscale.

On the science knowledge subscales

- Australian students achieved an average score on each of the science knowledge subscales that were significantly higher than the OECD average. Australia's average score was 508 points on the *content knowledge* subscale and 511 points on the *procedural and epistemic knowledge* subscale.

- Australia’s performance was significantly lower than 10 countries on the *content knowledge* subscale and lower than 9 countries on the *procedural and epistemic knowledge* subscale.

On the science content subscales

- Australian students achieved an average score on each of the science knowledge subscales that were significantly higher than the OECD average. Australia’s average score was 510 points on the *living systems* subscale; 511 points on the *physical systems* subscale; and 509 points on the *Earth and space systems* subscale.
- Australia’s performance was significantly lower than 8 countries on the *living systems* subscale; lower than 8 countries on the *physical systems* subscale; and lower than 9 countries on the *Earth and space systems* subscale.

In reading literacy

- Australian students achieved an average score of 503 points in reading literacy, which was significantly higher than the OECD average of 493 points.
- Australia’s performance was significantly lower than 11 countries (Singapore, Hong Kong (China), Canada, Finland, Ireland, Estonia, Korea, Japan, Norway, New Zealand and Macao (China)).
- Australia’s performance was not significantly different from that of 13 countries (Germany, Poland, Slovenia, the Netherlands, Sweden, Denmark, France, Belgium, Portugal, the United Kingdom, Chinese Taipei, the United States and B-S-J-G (China)).
- Australia’s performance was significantly higher than 44 countries, which included 15 OECD countries.
- Australia’s proportion of high performers (11%) was higher than the OECD average (8%).
- Australia’s proportion of low performers (18%) was lower than the OECD average (20%).
- 61% of Australian students achieved the National Proficient Standard in reading literacy.
- The reading literacy performance for Australia and eight other countries declined significantly between 2009 and 2015. Australia's performance declined by 12 points.

In mathematical literacy

- Australian students achieved an average score of 494 points in mathematical literacy, which was significantly higher than the OECD average of 490 points.
- Australia’s performance was significantly lower than 19 countries (Singapore, Hong Kong (China), Macao (China), Chinese Taipei, Japan, B-S-J-G (China), Korea, Switzerland, Estonia, Canada, the Netherlands, Denmark, Finland, Slovenia, Belgium, Germany, Poland, Ireland and Norway).
- Australia’s performance was not significantly different from that of 10 countries (Austria, New Zealand, Vietnam, the Russian Federation, Sweden, France, the United Kingdom, the Czech Republic, Portugal and Italy).
- Australia’s performance was significantly higher than 39 countries, which included 12 OECD countries.
- Australia’s proportion of high performers (11%) was consistent with the OECD average (10%).
- Australia’s proportion of low performers (22%) was similar to the OECD average (23%).
- 55% of Australian students achieved the National Proficient Standard (Level 3) in mathematical literacy.
- Australia was one of 13 countries whose performance declined significantly between 2003 and 2015. Australia’s performance declined by 30 points.

Results for the Australian jurisdictions

In scientific literacy

- The Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland performed at a significantly higher level than the OECD average (493 points), while the Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.
- The Australian Capital Territory and Western Australia performed at a significantly similar level but performed significantly higher than New South Wales, South Australia, Queensland, the Northern Territory and Tasmania. The Australian Capital Territory performed significantly higher than Victoria; Western Australia also performed at a statistically similar level to Victoria. Victoria, New South Wales, South Australia and Queensland performed at a level not significantly different to one another. All jurisdictions performed significantly higher than the Northern Territory and Tasmania.
- The proportion of students who achieved the National Proficient Standard in scientific literacy was 48% in Tasmania; 51% in the Northern Territory; 59% in New South Wales; 60% in Queensland and South Australia; 63% in Victoria; 65% in Western Australia; and 68% in the Australian Capital Territory.
- In Victoria and the Northern Territory, there was no decline in scientific literacy scores between 2006 and 2015. All other jurisdictions experienced a significant decline. Queensland had the smallest decline (by 15 points), followed by the Australian Capital Territory and Western Australia (by 22 points each), Tasmania (by 23 points) and South Australia (by 24 points). New South Wales had the largest decline (by 27 points).

In reading literacy

- All jurisdictions performed significantly higher than the OECD average, except for Tasmania and the Northern Territory, whose performances were significantly lower than the OECD average.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, Tasmania and the Northern Territory. Western Australia, Victoria, South Australia, New South Wales and Queensland performed not significantly different to one another, and significantly higher than Tasmania and the Northern Territory. The average scores in reading literacy for Tasmania and the Northern Territory were not significantly different to one another.
- The proportion of students who reached the National Proficient Standard in reading literacy was 48% in Tasmania and the Northern Territory; 59% in New South Wales; 60% in Queensland; 61% in South Australia; 63% in Victoria and Western Australia; and 65% in the Australian Capital Territory.
- In Victoria, Queensland and the Northern Territory, there was no decline in reading literacy scores between 2000 and 2015. All other jurisdictions experienced a significant decline. Western Australia had the smallest decline (by 31 points), followed by South Australia (by 34 points) and New South Wales (by 36 points). The Australian Capital Territory had the largest decline (by 37 points).

In mathematical literacy

- The Australian Capital Territory, Western Australia and Victoria performed at a significantly higher level than the OECD average. New South Wales, South Australia, Queensland and the Northern Territory performed not significantly different to the OECD average. Tasmania performed significantly lower than the OECD average.
- The Australian Capital Territory, Western Australia and Victoria performed at a statistically similar level; however, the Australian Capital Territory outperformed all other jurisdictions. The Northern Territory's performance was not significantly different to that of Tasmania.

- The proportion of students who reached the National Proficient Standard in mathematical literacy was 44% in Tasmania; 47% in the Northern Territory; 53% in Queensland; 54% in South Australia; 55% in New South Wales; 58% in Victoria; 60% in Western Australia; and 61% in the Australian Capital Territory.
- In Victoria and the Northern Territory, there was no decline in mathematical literacy scores between 2003 and 2015. All other jurisdictions experienced a significant decline. New South Wales had the smallest decline (by 32 points), followed by Queensland (by 33 points), Tasmania (by 38 points), the Australian Capital Territory (by 42 points) and Western Australia (by 44 points). South Australia had the largest decline (by 46 points).

Results for Australian school sectors

Results of student performance across the three school sectors (government, Catholic and independent) were compared using the unadjusted average scores, and adjusted scores, after adjusting for student- and school-level socioeconomic background.

- Comparing the unadjusted average literacy scores for these three groups of students reveals that, on average, students in the independent school sector achieved significantly higher than students in Catholic schools or government schools, and students in Catholic schools scored significantly higher than students in government schools. These findings apply to scientific literacy and reading literacy.
- When student-level socioeconomic background is taken into account, significant differences in performance between the school sectors still remain, although the differences are reduced.
- When school-level socioeconomic background is also taken into account, the differences between students in government schools and students in Catholic schools, and the differences between students in government schools and students in independent schools were not significant. However, the differences between students in Catholic schools and students in independent schools remain significant. Students in independent schools have a performance advantage over students in Catholic schools that is not attributable to student- or school-level socioeconomic background.

In scientific literacy

- Students in government schools achieved an average score of 492 points, which was lower than students in Catholic schools (521 points) and students in independent schools (552 points).
- There were similar proportions of high-performing students in government schools (9%) and Catholic schools (11%), which were both lower than the porportion in independent schools (18%).
- 23% of students in government schools were low performers in scientific literacy compared to 13% of low-performing students in Catholic schools and 7% of low-performing students in independent schools.
- 53% of students in government schools achieved the National Proficient Standard in scientific literacy compared to 66% of students in Catholic schools and 78% of students in independent schools.

In reading literacy

- Students in government schools achieved an average score of 484 points, which was lower than for students in Catholic schools (517 points) and students in independent schools (544 points).
- 8% of students in government schools were high performers in reading literacy compared to 12% of high-performing students in Catholic schools and 18% of high-performing students in independent schools.

- 24% of students in government schools were low performers in reading literacy compared to 13% of low-performing students in Catholic schools and 7% of low-performing students in independent schools.
- 53% of students in government schools achieved the National Proficient Standard in reading literacy compared to 67% of students in Catholic schools and 77% of students in independent schools.

In mathematical literacy

- Students in government schools achieved an average score of 477 points, which was lower than for students in Catholic schools (503 points) and students in independent schools (532 points).
- 9% of students in government schools were high performers in mathematical literacy compared to 12% of high-performing students in Catholic schools and 19% of high-performing students in independent schools.
- 28% of students in government schools were low performers in mathematical literacy compared to 17% of low-performing students in Catholic schools and 10% of low-performing students in independent schools.
- 48% of students in government schools achieved the National Proficient Standard in mathematical literacy compared to 60% of students in Catholic schools and 73% of students in independent schools.

Results for Indigenous students

In PISA 2015, Australian Indigenous students were identified from information provided by their schools. Altogether, 2807 Indigenous students were assessed in PISA 2015.

- Indigenous students achieved significantly lower scores than non-Indigenous students in the scientific, reading and mathematical literacy domains.
- There was an under-representation of Indigenous students at the higher end of the proficiency scale and an over-representation of Indigenous students at the lower end of the proficiency scale.

In scientific literacy

- Indigenous students achieved an average score of 437 points, which was 76 points (or around two-and-a-half years of schooling) lower than the average score of 513 points achieved by non-Indigenous students.
- 3% of Indigenous students were high performers in scientific literacy compared to 12% of high-performing non-Indigenous students.
- 42% of Indigenous students were low performers in scientific literacy compared to 17% of low-performing non-Indigenous students.
- 31% of Indigenous students achieved the National Proficient Standard in scientific literacy compared to 62% of non-Indigenous students.
- Between PISA 2006 and 2015, the scientific literacy performance of Indigenous students has not changed significantly, while there was a significant decline (by 16 points) in the performance of non-Indigenous students.

In reading literacy

- Indigenous students achieved an average score of 435 points, which was 71 points (or around two-and-a-third years of schooling) lower than the average score of 506 points achieved by non-Indigenous students.
- 3% of Indigenous students were high performers in reading literacy compared to 11% of high-performing non-Indigenous students.

- 40% of Indigenous students were low performers in reading literacy compared to 17% of low-performing non-Indigenous students.
- 32% of Indigenous students achieved the National Proficient Standard in reading literacy compared to 62% of non-Indigenous students.
- Between PISA 2000 and 2015, the reading literacy performance of Indigenous students has not changed significantly, while there was a significant decline (by 25 points) in the performance of non-Indigenous students.

In mathematical literacy

- Indigenous students achieved an average score of 427 points, which was 70 points (or around two-and-a-third years of schooling) lower than the average score of 497 points achieved by non-Indigenous students.
- 3% of Indigenous students were high performers in mathematical literacy compared to 12% of high-performing non-Indigenous students.
- 49% of Indigenous students were low performers in mathematical literacy compared to 21% of low-performing non-Indigenous students.
- 25% of Indigenous students achieved the National Proficient Standard in mathematical literacy compared to 57% of non-Indigenous students.
- Between PISA 2003 and 2015, the mathematical literacy performance of Indigenous students has not changed significantly, while there was a significant decline (by 29 points) in the performance of non-Indigenous students.

Results for geographic location of schools

The locations of schools in PISA were classified using the MCEETYA Schools Geographic Location Classification.[1] Almost three-quarters (74%) of the PISA participants attended schools in metropolitan areas, one-quarter were from provincial areas and the remaining 1% of participants attended schools in remote areas.

- Students in metropolitan schools performed significantly higher than students from provincial schools or remote schools, while students from provincial schools performed at a statistically similar level to students from remote schools.
- There was a higher proportion of high performers from metropolitan schools compared to students from provincial or remote schools. Similarly, there was a lower proportion of low performers from metropolitan schools compared to students from provincial or remote schools.

In scientific literacy

- Students from metropolitan schools achieved an average score of 517 points, which was 26 points (or around one year of schooling) higher than the average score of 491 points achieved by students from provincial schools and 44 points (or around one-and-a-half year of schooling) higher than the average score of 473 points achieved by students from remote schools.
- 13% of students from metropolitan schools were high performers in scientific literacy compared to 7% of high-performing students from provincial schools and remote schools.
- 16% of students from metropolitan schools were low performers in scientific literacy compared to 23% of low-performing students from provincial schools and 28% of low-performing students from remote schools.

1 The Reader's Guide provides more information about the MCEETYA Schools Geographic Location Classification.

- 64% of students from metropolitan schools achieved the National Proficient Standard compared to 53% of students from provincial schools and 47% of students from remote schools.
- Between PISA 2006 and 2015, the scientific literacy performance of students from remote schools has not changed significantly, while there was a significant decline (by 13 points) in the performance of students from metropolitan schools and a significant decline (by 30 points) in the performance of students from provincial schools.

In reading literacy

- Students from metropolitan schools achieved an average score of 511 points, which was 31 points (or around one year of schooling) higher than the average score of 480 points achieved by students from provincial schools and 46 points (or around one-and-a-half year of schooling) higher than the average score of 465 points achieved by students from remote schools.
- 12% of students from metropolitan schools were high performers in reading literacy compared to 7% of high-performing students from provincial schools and 6% of high-performing students from remote schools.
- 16% of students from metropolitan schools were low performers in reading literacy compared to 24% of low-performing students from provincial schools and 28% of low-performing students from remote schools.
- 64% of students from metropolitan schools achieved the National Proficient Standard compared to 51% of students from provincial schools and 44% of students from remote schools.
- Between 2000 and 2015, the reading literacy performance of students from remote schools has not changed significantly, while there was a significant decline (by 23 points) in the performance of students from metropolitan schools and a significant decline (by 38 points) in the performance of students from provincial schools.

In mathematical literacy

- Students from metropolitan schools achieved an average score of 502 points, which was 29 points (or around one year of schooling) higher than the average score of 473 points achieved by students from provincial schools and 42 points (or around one-and-a-half year of schooling) higher than the average score of 460 points achieved by students from remote schools.
- 13% of students from metropolitan schools were high performers in mathematical literacy compared to 7% of high-performing students from provincial schools and 5% of high-performing students from remote schools.
- 19% of students from metropolitan schools were low performers in mathematical literacy compared to 29% of low-performing students from provincial schools and 33% of low-performing students from remote schools.
- 59% of students from metropolitan schools achieved the National Proficient Standard compared to 46% of students from provincial schools and 40% of students from remote schools.

Between 2003 and 2015, mathematical literacy performance declined significantly for students from all geographic locations. There was a 27-point decline for students from metropolitan schools, a 42-point decline for students from provincial schools, and a 33-score points decline for students from remote schools.

Results for socioeconomic background

Information about socioeconomic background is based on a measure of socioeconomic background: the economic, social and cultural status index (ESCS)[2]. Using this index, participating students were distributed into quartiles of socioeconomic background.

- On average, students from higher socioeconomic backgrounds performed at a significantly higher level than students from lower socioeconomic backgrounds.
- The proportion of high performers increased and the proportion of low performers decreased with each increase in socioeconomic background quartile.

In scientific literacy

- Students in the highest socioeconomic quartile achieved an average score of 559 points, which was 91 points (or around three years of schooling) higher than the average score of 468 points for students in the lowest socioeconomic quartile.
- 4% of students in the lowest socioeconomic quartile were high performers in scientific literacy compared to 8% of high-performing students in the second socioeconomic quartile, 12% in the third socioeconomic quartile and 22% in the highest socioeconomic quartile.
- 29% of students in the lowest socioeconomic quartile were low performers in scientific literacy compared to 19% of low-performing students in the second socioeconomic quartile, 13% in the third socioeconomic quartile and 7% in the highest socioeconomic quartile.
- 43% of students in the lowest socioeconomic quartile achieved the National Proficient Standard in scientific literacy compared to 80% of students in the highest socioeconomic quartile.
- Between PISA 2006 and 2015, scientific literacy performance has declined significantly for students in three of the socioeconomic quartiles. There was a 22-point decline in the lowest and highest socioeconomic quartiles, and an 18-point decline in the third socioeconomic quartile.

In reading literacy

- Students in the highest socioeconomic quartile achieved an average score of 551 points, which was 89 points (or around three years of schooling) higher than the average score of 462 points for students in the lowest socioeconomic quartile.
- 5% of students in the lowest socioeconomic quartile were high performers in reading literacy compared to 8% of high-performing students in the second socioeconomic quartile, 12% in the third socioeconomic quartile and 21% in the highest socioeconomic quartile.
- 30% of students in the lowest socioeconomic quartile were low performers in reading literacy compared to 20% of low-performing students in the second socioeconomic quartile, 13% in the third socioeconomic quartile and 7% in the highest socioeconomic quartile.
- 44% of students in the highest socioeconomic quartile achieved the National Proficient Standard in reading literacy compared to 79% of students in the highest socioeconomic quartile.
- Between PISA 2000 and 2015, reading literacy performance has declined significantly for students all of the socioeconomic quartiles. There was a 22-point decline in the lowest and third socioeconomic quartiles, a 23-point decline in the second socioeconomic quartile, and a 36-point decline in the highest socioeconomic quartile.

In mathematical literacy

- Students in the highest socioeconomic quartile achieved an average score of 541 points, which was 86 points (or around three years of schooling) higher than the average score of 455 points for students in the lowest socioeconomic quartile.

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2 The Reader's Guide provides more information about socioeconomic background and the ESCS index.

- 4% of students in the lowest socioeconomic quartile were high performers in mathematical literacy compared to 7% of high-performing students in the second socioeconomic quartile, 12% in the third socioeconomic quartile and 23% in the highest socioeconomic quartile.
- 35% of students in the lowest socioeconomic quartile were low performers in mathematical literacy compared to 24% of low-performing students in the second socioeconomic quartile, 16% in the third socioeconomic quartile and 9% in the highest socioeconomic quartile.
- 37% of students in the highest socioeconomic quartile achieved the National Proficient Standard in mathematical literacy compared to 76% of students in the highest socioeconomic quartile.
- Between PISA 2003 and 2015, mathematical literacy performance declined significantly for students in all socioeconomic quartiles. There was a 24-point decline in the lowest socioeconomic quartile, a 28-point decline in the second socioeconomic quartile, a 32-point decline in the third socioeconomic quartile, and a 31-point decline in the highest socioeconomic quartile.

Results for immigrant background

In PISA, immigrant background consists of three categories: Australian-born, first-generation and foreign-born.[3] Approximately 50% of the students to sit PISA 2015 were Australian-born, 30% were first-generation and 12% of students were foreign-born.

- Australian-born students performed at a level significantly lower than first-generation students and statistically similar to foreign-born students across all assessment domains. Foreign-born students performed at a level significantly lower than first-generation students in scientific literacy and reading literacy and not significantly different in mathematical literacy.
- The proportion of low-performing Australian-born and foreign-born students was higher than the proportion of low-performing first-generation students. The proportion of high-performing Australian-born students was lower than for first-generation students or foreign-born students.

In scientific literacy

- Australian-born students achieved an average score of 510 points, which was 10 points (or about one-third of a year of schooling) lower than the average score of 520 points achieved by first-generation students. Foreign-born students achieved an average score of 505 points which was 15 points (or about half a year of schooling) lower than the average score achieved by first-generation students.
- 10% of Australian-born students were high performers in scientific literacy compared to 13% of high-performing first-generation students and 12% of high-performing foreign-born students.
- 17% of Australian-born students were low performers in scientific literacy compared to 15% of low-performing first-generation students and 20% of low-performing foreign-born students.
- 61% of Australian-born students achieved the National Proficient Standard compared to 64% of first-generation students and 58% of foreign-born students.
- Between PISA 2006 and 2015, the scientific literacy performance of first-generation students has not changed significantly, while there was a significant decline (by 18 points) in the performance of Australian-born students and a significant decline (by 21 points) in the performance of foreign-born students.

In reading literacy

- Australian-born students achieved an average score of 501 points, which was 16 points (or around half a year of schooling) lower than the average score of 517 points achieved by first-generation students. Foreign-born students achieved an average score of 500 points which was 17 points

3 The Reader's Guide provides more information about immigrant status.

(or around half a year of schooling) lower than the average score achieved by first-generation students.

- 10% of Australian-born students were high performers in reading literacy compared to 14% of high-performing first-generation students and 12% of high-performing foreign-born students.
- 18% of Australian-born students were low performers in reading literacy compared to 14% of low-performing first-generation students and 21% of low-performing foreign-born students.
- 60% of Australian-born students reached the National Proficient Standard compared to 66% of first-generation students and 59% of foreign-born students.
- Between PISA 2000 and 2015, the reading literacy performance of foreign-born students has not changed significantly, while there was a significant decline (by 29 points) in the performance of Australian-born students and a significant decline (by 20 points) in the performance of first-generation students.

In mathematical literacy

- Australian-born students achieved an average score of 491 points, which was 14 points (or around half a year of schooling) lower than the average score of 505 points achieved by first-generation students.
- 10% of Australian-born students were high performers in mathematical literacy compared to 14% of high-performing first-generation students and 14% of high-performing foreign-born students.
- 22% of Australian-born students and foreign-born students were low performers in mathematical literacy compared to 18% of low-performing first-generation students.
- 55% of Australian-born students achieved the National Proficient Standard compared to 60% of first-generation students and 56% of foreign-born students.
- Between 2003 and 2015, mathematical literacy performance declined significantly for students in all immigrant background groups. There was a 35-point decline for Australian-born students, a 17-point decline for first-generation students and a 28-point decline for foreign-born students.

Results for language background

In PISA, 87% of students indicated that English was spoken at home most of the time and 11% of students indicated they spoke a language other than English at home most of the time.

- Students who spoke English at home most of the time performed significantly higher in scientific literacy and reading literacy than students who spoke a language other than English at home most of the time, while students who spoke English at home most of the time performed not significantly different in mathematical literacy to students who spoke a language other than English at home most of the time.
- The proportion of low-performing students who spoke English at home most of the time was lower than the proportion of low-performing students who spoke a language other than English most of the time, while the proportions of high performers for both language background groups were similar.

In scientific literacy

- Students who spoke English at home achieved an average score of 515 points, which was 27 points (or about one year of schooling) higher than the average score of 488 points achieved by students who spoke a language other than English at home.
- 12% of students who spoke English at home were high performers in scientific literacy compared to 10% of high-performing students who spoke a language other than English at home.
- 16% of students who spoke English at home were low performers in scientific literacy compared to 27% of low-performing students who spoke a language other than English at home.

- 63% of students who spoke English at home achieved the National Proficient Standard in scientific literacy compared to 51% of students who spoke a language other than English at home.
- Between PISA 2006 and 2015, the scientific literacy performance of students who spoke a language other than English at home has not changed significantly, while there was a significant decline (by 16 points) in the performance of students who spoke English at home.

In reading literacy

- Students who spoke English at home achieved an average score of 507 points, which was 20 points (or around two-thirds of a year of schooling) higher than the average score of 487 points achieved by students who spoke a language other than English at home.
- 11% of students in each of the language background groups were high performers in reading literacy.
- 17% of students who spoke English at home were low performers in reading literacy compared to 26% of low-performing students who spoke a language other than English at home.
- 62% of students who spoke English at home achieved the National Proficient Standard in reading literacy compared to 53% of students who spoke a language other than English at home.
- Between PISA 2009[4] and 2015, the reading literacy performance of students who spoke a language other than English at home has not changed significantly, while there was a significant decline (by 12 points) in the performance of students who spoke English at home.

In mathematical literacy

- Students who spoke English at home achieved an average score of 496 points, which was statistically similar to the average score of 487 points achieved by students who spoke a language other than English at home.
- 11% of students who spoke English at home were high performers in mathematical literacy compared to 13% of high-performing students who spoke a language other than English at home.
- 21% of students who spoke English at home were low performers in mathematical literacy compared to 27% of low-performing students who spoke a language other than English at home.
- 57% of students who spoke English at home achieved the National Proficient Standard in mathematical literacy compared to 52% of students who spoke a language other than English at home.
- Between PISA 2003 and 2015, the mathematical literacy performance declined significantly for students in both language background groups. There was a 31-point decline for students who spoke English at home and a 28-point decline for students who spoke a language other than English at home.

Results for females and males

In scientific literacy

- Across OECD countries, the average score for females was 491 points and for males was 495 points, a significant difference of 4 points.
- Females significantly outperformed males in 16 countries, while males performed significantly higher than females in 20 countries.
- In Australia, females scored 509 points on average, which was not significantly different to the average score of 511 for males.

4 The comparison of language background performance is based on the last PISA cycle when reading literacy was a major domain, PISA 2009, as data collected on language background in PISA 2000 is not comparable to other cycles.

- 10% of Australian females and 13% of Australian males were high performers in scientific literacy.
- 17% of Australian females and 19% of Australian males were low performers in scientific literacy.
- 61% each of Australian females and Australian males achieved the National Proficiency Standard in scientific literacy.
- Between PISA 2006 and PISA 2015, scientific literacy performance of females declined significantly (by 18 points) and the performance of males declined significantly (by 16 points).

In reading literacy

- Across OECD countries, the average score for females was 506 points and for males was 479 points, a significant difference of 27 points.
- In all participating countries, females performed significantly higher than males in reading literacy.
- In Australia, females scored 519 points on average, which was significantly higher than the average score of 487 points for males. This difference represents about one year of schooling.
- 13% of Australian females and 9% of Australian males were high performers in reading literacy.
- 13% of Australian females and 23% of Australian males were low performers in reading literacy.
- 67% of Australian females and 55% of Australian males achieved the National Proficient Standard in reading literacy.
- Between PISA 2000 and PISA 2015, reading literacy performance of females declined significantly (by 27 points) and the performance of males declined significantly (by 25 points).

In mathematical literacy

- Across OECD countries, the average score for females was 486 points and for males was 494 points, a significant difference of 8 points.
- Females significantly outperformed males in 4 countries, while males significantly outperformed females in 20 countries.
- In Australia, females scored 491 points on average, which was not significantly different to the average score of 497 points for males.
- 10% of Australian females and 13% of Australian males were high performers in mathematical literacy.
- 22% each of Australian females and Australian males were low performers in mathematical literacy.
- 54% of Australian females and 56% of Australian males achieved the National Proficient Standard in mathematical literacy.
- Between PISA 2003 and PISA 2015, mathematical literacy performance of females declined significantly (by 31 points) and the performance of males declined significantly (by 30 points).

Equity in Australian schools

- The overall socioeconomic gradient for Australia broadly follows that of all other countries: each increment of the PISA scale of economic, social and cultural status (ESCS) was associated with an increase in performance in scientific literacy.
- The key proxy for equity in PISA is the strength of the relationship between socioeconomic background and performance – that is the degree to which variance in scientific literacy performance scores was explained by students' socioeconomic background. On this measure, the strength of the relationship in Australia was similar to that on average across OECD countries.
- The slope of the socioeconomic gradient was steeper in Australia than on average across the OECD. In Australia, the effect of socioeconomic background on performance in scientific literacy was higher than on average across the OECD.

- Victoria was the only jurisdiction in which the strength of the relationship between socioeconomic background and performance was weaker than on average across the OECD, placing it as high-equity. Victoria also had the flattest slope, indicating there was less of a relationship between ESCS and performance in Victoria than in other jurisdictions or on average across Australia.
- The difference between advantaged and disadvantaged students was 88 score points, on average, across the OECD and 92 score points in Australia. This is equal to around three years of schooling or one full proficiency level.
- The amount of variance in performance between Australian schools was lower than the OECD average; however, the amount of variance within Australian schools was greater. With 25% of the variation being between schools though, it still matters which school a child attends.
- Regardless of their own socioeconomic background, students enrolled in a school with a high average socioeconomic background tended to perform at a higher level than students enrolled in a school with a low average socioeconomic background.
- Tasmanian schools had a larger proportion of disadvantaged students (those in the lowest quartile of ESCS) than any other jurisdiction, closely followed by Queensland. The Australian Capital Territory had a much greater proportion of high socioeconomic background students than any other jurisdiction.
- Independent schools had a proportionally greater number of high socioeconomic background students than Catholic schools, who in turn had a far greater proportion than government schools. Conversely, government schools had a far greater proportion of low socioeconomic background students than either Catholic schools or independent schools.

Australian students' motivation and beliefs in science

- High-performing countries in PISA tend to display high levels of motivation and self-efficacy in science, with students who are in the highest quartile across many of the indices outperforming those in the lowest quartile, on average, by the equivalent of two to three years of schooling.
- On average, Australian students demonstrated higher levels of instrumental motivation to learn science and higher levels in their enjoyment of learning science compared to the OECD average. Australian students also demonstrated higher levels of interest in broad science topics compared to students across the OECD. Overall, within Australia, students reported higher levels of motivation and enjoyment in learning science than an interest in broad science topics.
- Singapore, Hong Kong (China) and Canada consistently exceeded the OECD average in relation to motivation to learn science, self-efficacy in science, environmental awareness and optimism and value beliefs about science.
- Within Australian schools, students in Western Australia had a higher motivation to learn science and self-efficacy in science, while students in Queensland and Tasmania tended to be lower in motivation and self-efficacy.
- On average, across OECD countries, nearly 25% of students reported that they expect to work in an occupation that requires further science training beyond compulsory school education. Nearly 30% of Australian students reported expecting to work in a science-related career by age 30.
- Overall, nearly one-third of students in Victoria and Western Australia expected to work in a science-related career by age 30 compared to just over one-fifth of students from the Australian Capital Territory and Tasmania.
- In Australia, males tended to be more interested in science, to enjoy science and to have higher self-efficacy in science compared to females. This was reflected in males being four times more likely to expect to work in science and engineering or ICT professions than their female peers. New South Wales reported the highest level of students aspiring to work in non-science related careers (50%); however, just over one–quarter of students in the Australian Capital Territory reported the highest proportion of vague, missing or indecisive career expectations suggesting they were undecided about their future career aspirations.

The school learning environment

- School leaders may need to show more active leadership when the learning environment deteriorates and student problems arise. Many of the top-performing PISA countries reported levels of educational leadership lower than the OECD average, whereas levels for Australia were, on average, substantially higher than across the OECD.
- Within Australia, levels of educational leadership were highest for Tasmania and the Northern Territory and lowest for the Australian Capital Territory. Educational leadership levels were also significantly higher for low socioeconomic background (disadvantaged) schools.
- Principals judged student-related behaviours, such as truancy and skipping classes, to occupy their time and hinder instruction, particularly in the Northern Territory and in disadvantaged schools.
- Teacher-related behaviours such as absenteeism, not being prepared for class and not meeting individual students' needs were also seen by a significant proportion of principals to hinder instruction, and this was again most apparent in disadvantaged schools.
- While staffing was not perceived to be a problem for principals in general, around two-thirds of principals in the Northern Territory reported that a lack of, or inadequate or poorly qualified teaching staff hindered instruction. Socioeconomic differences were also apparent, with a much greater proportion of principals of disadvantaged schools identifying these issues compared to advantaged schools.
- Many principals reported that inadequate or poor quality physical infrastructure hindered their capacity to provide instruction, 34% of principals of students from disadvantaged schools compared with 12% of principals of students from advantaged schools identified this as an issue.
- Australian students were generally positive about how much support their science teachers provided; however, while the differences were small, a significantly lower percentage of students at disadvantaged schools than advantaged schools reported the teacher showing interest in every student's learning, teacher providing extra help, and the teacher helping students with their learning.
- Student reports indicated that many Australian schools have a poor climate of classroom discipline. Australia scored significantly lower than the OECD average on this index, indicating a more problematic situation than across the OECD. About one-third of the students in advantaged schools, and about half of those in disadvantaged schools, reported that in most or every class there was noise and disorder, students didn't listen to what the teacher said, and that students found it difficult to learn. This was particularly an issue in Tasmania and New South Wales.

Reader's Guide

Target population for PISA

This report uses '15-year-olds' as shorthand for the PISA target population. In practice, the target population was students aged between 15 years and 3 (complete) months and 16 years and 2 (complete) months at the beginning of the assessment period, and who were enrolled and attending an educational institution full-time or part-time. Since the majority of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

Rounding of figures

Because of rounding, some numbers in tables may not exactly add to the totals reported. Totals, differences and averages are always calculated on the basis of exact numbers and are rounded only after calculation. When standard errors have been rounded to one or two decimal places and the value 0.0 or 0.00 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05 or 0.005 respectively.

Confidence intervals and standard errors

In this and other reports, student achievement is often described by an average score. For PISA, each average score is calculated from the sample of students who undertook PISA 2015 and is referred to as the sample average. The sample average is an approximation of the actual average score (known as the population average) that would have been obtained had all students in a country actually sat the assessment.

Since the sample average is just one point along the range of student achievement scores, more information is needed to gauge whether the sample average is an underestimation or overestimation of the population average. The calculation of confidence intervals can indicate the precision of a sample average as a population average. Confidence intervals provide a range of scores within which we are confident that the population average actually lies.

In this report, each sample average is presented with an associated standard error. The confidence interval, which can be calculated using the standard error, indicates that there is a 95% chance that the actual population average lies within plus or minus 1.96 standard errors of the sample average.

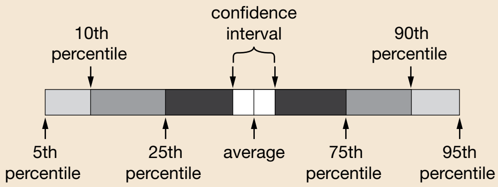
Statistical significance

The term 'significantly' is used throughout the report to describe a difference that meets the requirements of statistical significance at the 0.05 level, indicating that the difference is real, and would be found in at least 95 analyses out of 100 if the comparisons were to be repeated. It is not to be confused with the term 'substantial', which is qualitative and based on judgement rather than statistical comparisons. A difference may appear substantial but not statistically significant (due to factors that affect the size of the standard errors around the estimate, for example) while another difference may seem small but reach statistical significance because the estimate was more accurate.

Average performance and distribution of scores

Average scores provide a summary of student performance and allow comparisons of the relative standing between different countries and different subgroups. In addition, the distribution of scores (reported at the 5th, 10th, 25th, 75th, 90th and 95th percentiles) are reported in graphical format. The following box gives details on how to read these graphs.

Each country's results are represented in horizontal bars with various colours. On the left end of the bar is the 5th percentile—this is the score below which 5% of the students have scored. The next two lines indicate the 10th percentile and the 25th percentile. The next line at the left of the white band is the lower limit of the confidence interval for the mean—i.e., there is 95% confidence that the mean will lie in this white band. The line in the centre of the white band is the mean. The lines to the right of the white band indicate the 75th, 90th and 95th percentiles.



OECD average

An OECD average was calculated for most indicators in this report and is presented for comparative purposes. The OECD average corresponds to the arithmetic average of the respective country estimates, and can be used to compare a country on a given indicator with a typical OECD country.

Proficiency levels

To summarise data from responses to PISA 2015, performance scales were constructed for each assessment domain. The scales are used to describe the performance of students in different countries, including in terms of described proficiency levels.

This report uses the following categories to describe students' levels of proficiency in PISA.

High performers: Students who are proficient at Level 5 or Level 6 are considered to demonstrate high levels of skills and knowledge and are highly proficient in the assessment domain.

Middle performers: Students who are proficient at Level 2, Level 3 or Level 4.

Low performers: Students who are below Level 2 proficiency are considered to demonstrate low levels of skills and knowledge in the assessment domain. Their proficiency is too low to enable them to participate effectively and productively in life.

PISA baseline proficiency level: In PISA, Level 2 is considered the international baseline proficiency level and defines the level of achievement on the PISA scale at which students begin to demonstrate the competencies that will enable them to actively and effectively participate in life situations.

National Proficient Standard in PISA: In Australia, the key performance measure in PISA has been set at the boundary between Level 2 and Level 3 on the PISA proficiency scales (as agreed in the *Measurement Framework for Schooling in Australia*). This level has been identified as the proficient standard because it represents 'a "challenging but reasonable" expectation of student achievement at a year level with students needing to demonstrate more than elementary skills expected at that year level' (ACARA, 2015, p. 5). Students performing at or above Level 3 have met or exceeded the National Proficient Standard.

Interpreting differences in the PISA scores

It is possible to estimate the score point difference that is associated with one year of schooling. This difference can be estimated for Australia because the Australian PISA 2015 sample included a sizeable number of students from different school year levels. Analyses of these data indicate that the difference between two year levels is, on average, 30 score points on the PISA scale.

Reporting of trends

Each cycle of PISA includes a number of items from previous cycles (referred to as trend items). This allows for comparisons with previous cycles to be made and trends (changes over time) to be measured.

The most reliable way to establish a trend for an assessment domain is to compare results between cycles when that assessment domain was the major domain.

The first full assessment of each domain (the major domain) sets the scale and provides a starting point for future comparisons. Reading literacy was the major domain for the first time in 2000, and again in 2009. Mathematical literacy was first assessed as a major domain in 2003, and again in 2012. Scientific literacy was the major domain for the first time in 2006, and again in 2015. Thus, it is possible to measure changes in reading literacy between PISA 2000 and 2015, changes in mathematical literacy between PISA 2003 and 2015, and changes in scientific literacy between PISA 2006 and 2015.

PISA indices

The measures that are presented as indices summarise student responses to a series of related items constructed on the basis of previous research. In describing students in terms of each characteristic (e.g. self-efficacy in science, enjoyment of learning science), scales were originally constructed on which the OECD average was given an index value of 0,[5] and about two-thirds of the OECD population were given values between –1 and +1 (the index has a mean of 0 and a standard deviation of 1). Negative values on an index do not necessarily imply that students responded negatively to the underlying items. Rather, a student with a negative score responded less positively than students on average across OECD countries.

The indices are based on all categories for each item, whereas the reported percentages are collapsed into fewer categories. Due to this and the weighting of responses, a ranking based on the value of the indices will sometimes not exactly correspond to one based, say, on the average of the percentages.

Information about school characteristics was collected through the school questionnaire, which was completed by the principal. In this report, responses from principals were weighted so that they are proportionate to the number of 15-year-olds enrolled in the school.

5 However, in instances where a scale has been used in a previous PISA assessment, the OECD average in PISA 2015 may not be equal to 0. This may be due to the increase in the number of OECD countries and/or changes in the responses to the items over time.

Definition of background characteristics

There are a number of definitions used in this report that are particular to the Australian context, as well as many that are relevant to the international context. This section provides an explanation for those that are not self-evident.

Indigenous background

Indigenous background is derived from information provided by the school, which was taken from school records. Students were identified as being of Australian Aboriginal or Torres Strait Islander descent. For the purposes of this report, data for the two groups are presented together under the term ‘Indigenous students’.

Socioeconomic background

Two measures are used by the OECD to represent elements of socioeconomic background. One is the highest level of the father’s and mother’s occupation (known as the highest international social and economic index – HISEI), which is coded in accordance with the International Labour Organization’s International Standard Classification of Occupations. The other measure is the index of economic, social and cultural status (ESCS), which was created to capture the wider aspects of a student’s family and home background. The ESCS is based on three indices: the highest occupational status of parents (HISEI); the highest educational level of parents in years of education (PARED); and home possessions (HOMEPOS). The index of home possessions (HOMEPOS) comprises all items on the indices of family wealth (WEALTH), cultural resources (CULTPOSS), access to home educational and cultural resources and books in the home (HEDRES). It must be noted that there have been some adjustments to the computation of ESCS over the PISA cycles.

ESCS Trend

While an ESCS index was included in all past PISA databases, the components of ESCS and the scaling model have changed over cycles, meaning that the ESCS scores are not comparable across cycles directly. An ESCS-trend index variable has been computed using similar methodology for the current cycle and for previous cycles in order to enable a trend study.

Geographic location

In Australia, participating schools were coded with respect to the Ministerial Council on Education, Employment, Training and Youth Affairs’ Schools Geographic Location Classification (Jones, 2004).

For the analysis in this report, only the broadest categories are used:

- metropolitan – including mainland capital cities or major urban districts with a population of 100 000 or more (e.g. Queanbeyan, Cairns, Geelong, Hobart)
- provincial – including provincial cities and other non-remote provincial areas (e.g. Darwin, Ballarat, Bundaberg, Geraldton, Tamworth)
- remote – including areas with very restricted or very little accessibility to goods, services and opportunities for social interaction (e.g. Coolabah, Mallacoota, Capella, Mount Isa, Port Lincoln, Port Hedland, Swansea, Alice Springs, Bourke, Thursday Island, Yalata, Condingup, Nhulunbuy).

Immigrant background

Immigrant background is derived from students' self-report of the country in which they and their parents were born. For the analysis in this report, immigrant background is defined by the following categories:

- Australian-born students – students born in Australia with both parents born in Australia
- first-generation students – students born in Australia with at least one parent born overseas
- foreign-born students – students born overseas with both parents also born overseas.

Language background

Language background is derived from students' self-report of the language they speak at home most of the time. For the analysis in this report, language background has been defined as:

- students who speak English at home
- students who speak a language other than English at home.

Sample surveys

PISA is a sample survey and is designed and conducted so that the sample provides reliable estimates about the population of 15-year-old students. The PISA 2015 sample was a two-stage stratified sample. The first stage involved the sampling of schools in which 15-year-old students could be enrolled. The second stage of the selection process randomly sampled students within the sampled schools. The following variables were used in the stratification of the school sample: jurisdiction; school sector; geographic location; sex of students at the school; and a socioeconomic background variable (based on the Australian Bureau of Statistics' Socio-economic Indexes for Areas, which consists of four indexes that rank geographic areas across Australia in terms of their relative socioeconomic advantage and disadvantage).

Reporting of country results

This report does not include results for Argentina, Malaysia and Kazakhstan, because their coverage was too small to ensure comparability.

This report does not include results for countries that achieved an average score lower than Mexico, the lowest performing OECD country. As a result, this report does *not* include:

- *scientific literacy results* for Algeria, Brazil, the Dominican Republic, the Former Yugoslav Republic of Macedonia, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Montenegro, Peru and Tunisia
- *reading literacy results* for Albania, Algeria, Brazil, the Dominican Republic, the Former Yugoslav Republic of Macedonia, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Moldova, Qatar, Thailand and Tunisia
- *mathematical literacy results* for Algeria, Brazil, Costa Rica, Colombia, the Dominican Republic, the Former Yugoslav Republic of Macedonia, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Peru, Qatar and Tunisia.

CHAPTER 1

Introduction

What is PISA?

The Programme for International Student Assessment (PISA) is an international study that measures how well 15-year-olds,[6] who are nearing the end of their compulsory schooling in most participating education systems, are prepared to use their knowledge and skills in particular areas to meet real-life opportunities and challenges. This is in contrast to assessments that seek to measure the extent to which students have mastered a specific curriculum. PISA's orientation reflects a change in the goals and objectives of curricula, which increasingly address how well students are able to apply what they learn at school.

What are the main goals of PISA?

PISA looks to answer several important questions related to education, such as:

- How well are young adults prepared to meet the challenges of the future? Can they analyse, reason and communicate their ideas effectively? Will their skills enable them to adapt to rapid societal change?
- Are some ways of organising schools and school learning more effective than others?
- What influence does the quality of school resources have on student outcomes?
- What educational structures and practices maximise the opportunities of students from disadvantaged backgrounds?
- How equitable is the provision of education within a country and across countries?

What does PISA assess?

The core assessment domains of scientific literacy, reading literacy and mathematical literacy are measured in PISA. The PISA 2015 cognitive assessment also included the additional domain of collaborative problem solving.

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6 Refer to the Reader's Guide for more information about the target population for PISA.

In the PISA context, the three assessment domains are defined as following.

> **Scientific literacy** *is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically.*
>
> **Reading literacy** *is an individual's capacity to understand, use, reflect on and engage with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society.*
>
> **Mathematical literacy** *is an individual's capacity to formulate, employ and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens.*
>
> OECD, 2016a, p. 13

How often is PISA administered?

Since 2000, PISA has been conducted every three years. In each cycle, the three assessment domains are rotated so that one domain is the major focus (the major domain), with a larger amount of the assessment time being devoted to this domain compared to the other two assessment domains (the minor domains).

PISA 2015 was the sixth cycle of PISA and scientific literacy was the major domain, which allowed an in-depth analysis and the reporting of results by subscale to be undertaken. The assessment of scientific literacy as a major domain in PISA 2015 also allows for changes in performance to be reported over a nine-year period, from PISA 2006 when scientific literacy was first assessed as a major domain (Table 1.1).

TABLE 1.1 Summary of the assessment domains in PISA

PISA 2000	PISA 2003	PISA 2006	PISA 2009	PISA 2012	PISA 2015
Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy
Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy
Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy

Major domain Minor domain

PISA also assesses additional domains in each cycle. In PISA 2015, collaborative problem solving was assessed. The same students who sat PISA 2015 also sat an assessment of financial literacy. Results on the performance of Australian students in these additional domains will be released in two separate reports in 2017.

How are results reported in PISA?

International comparative studies have provided an arena to observe the similarities and differences between educational policies and practices. They enable researchers and others to observe what is possible for students to achieve and what environment is most likely to facilitate their learning. PISA provides regular information on educational outcomes within and across countries by providing insight into the range of skills and competencies, in different assessment domains, that are considered to be essential to an individual's ability to participate in and contribute to society.

PISA results are reported on a set of scales. Each scale was developed when an assessment domain was first assessed as a major domain (in 2000 for reading literacy, in 2003 for mathematical literacy and in 2006 for scientific literacy). Each scale was originally constructed to have an average score of 500 and a standard deviation of 100 among OECD countries.

Averages and standard errors

Similar to other international studies, PISA results are reported as average scores, which provide a summary of student performance and allow for comparisons of the relative standing between different countries and different subgroups. The OECD average[7] is the average of the data values across all OECD countries, and can be used to compare a country on a given indicator with a typical OECD country.

Proficiency levels

PISA also provides a profile of students' scientific, reading and mathematical performance using proficiency levels – categories that summarise the skills and knowledge that students are able to display. The performance scale is divided into levels of difficulty, referred to as proficiency levels. Students at a particular level not only typically demonstrate the knowledge and skills associated with that level, but also the proficiencies required at lower levels. In the 2015 cycle of PISA, the proficiency levels for scientific literacy were expanded to include seven levels. A difference of 75 score points represents one proficiency level on the PISA scientific literacy scale. Seven levels of proficiency have been defined for the domain of reading literacy and six levels of proficiency have been defined for the domain of mathematical literacy. A difference of 73 score points represents one proficiency level on the PISA reading literacy scale, while a difference of 62 score points represents one proficiency level on the PISA mathematical literacy scale. Further details on the proficiency levels for each literacy domain can be found in Chapters 2, 4 and 5.

What has changed for PISA 2015?

A number of changes were introduced to the test administration and scaling for PISA 2015. The changes relate to the assessment mode, scaling model, treatment of non-reached items, treatment of differential item functioning, and construct coverage across domains.[8]

Assessment mode

In PISA 2015, the main mode of assessment moved from a paper-based delivery to a computer-based delivery. The computer-based assessment included trend items (that were originally developed for delivery as a paper-based assessment and were adapted for delivery on computer)[9] and new scientific literacy items. The computer-based assessment allowed for a greater variety of contexts to be included in the scientific literacy assessment. Approximately 13% of new scientific literacy items were developed to incorporate interactive presentations, where students' actions determined what they saw on the screen.

Out of 72 countries, 57 countries, including all OECD countries, administered PISA as a computer-based assessment. The remaining 15 countries and economies that administered PISA as a paper-based assessment completed only trend items (which represent about half of all the items used in the computer-based assessments). Results for both the computer- and paper-based assessments are reported on the same scale.

7 Although the OECD average is comparable between cycles, changes in the average not only reflect the change in the performance of OECD countries over time, but may also reflect the addition of new member countries to the OECD.

8 For more information about the changes in PISA 2015, please refer to the *PISA 2015 Technical Report* (OECD, forthcoming).

9 A mode study was undertaken in the field trial to assess the equivalence between the paper- and computer-based versions of trend items.

The computer-based delivery facilitated an improved test design. Students may perceive items as being of varying difficulty, or students may apply varying degrees of effort, depending on the position of the item in the test booklet. Rotating the positions of items across different versions of test booklets mitigates this effect. In previous cycles of PISA, there were 13 different test booklets; in PISA 2015, computer-based delivery allowed for 66 different test forms.

The computer-based software uses a 'lock-step' design, which prevents students from returning to a unit that has been previously completed. At the end of the unit, students are advised that they will be unable to return to the unit, and consequently once students reach the end of the test they are unable to review their answers.

Scaling model

In previous cycles, a one-parameter model was used to scale the items. In PISA 2015, a hybrid model was used, which incorporates the one-parameter model for the trend items as well as a two-parameter model on which new items were scaled.

Treatment of non-reached items

Items at the end of the assessment that students did not answer are referred to as 'not reached'. In this cycle of PISA, the not-reached items were treated as not administered, whereas in previous cycles they were treated as incorrect (when estimating student proficiency) and as not administered (when estimating the item parameters).

Treatment of differential item functioning

Some items function differently in one country compared to the majority of countries. In PISA 2015, the calibration allowed for unique item parameters to be applied to these items whereas in previous cycles, these items were treated as not administered.

Construct coverage across domains

In PISA 2015, the number of trend items was increased for all domains to improve the coverage of items between minor and major domains.

The results from PISA enable performance over time to be monitored. However, given the number of changes that have occurred in PISA 2015, comparisons between the results for this cycle and previous cycles should be interpreted with due caution.

What did participants do?

Students

Students completed a two-hour cognitive assessment. Students were also allowed up to 45 minutes to complete the student questionnaires, which they responded to after the completion of the PISA cognitive assessment. Students then undertook the financial literacy assessment.

Students were randomly assigned to a test form that comprised four 30-minute clusters of cognitive materials (scientific literacy, reading literacy, mathematical literacy, and collaborative problem solving), with each cluster consisting of units that required them to construct responses to a stimulus and a series of questions. The stimulus material was typically a short written passage or text accompanying a table, chart, graph, photograph or diagram. A range of item-response formats, such as multiple-choice questions and questions requiring students to construct their own responses, was used to cover the full range of cognitive abilities and knowledge identified in the Assessment Framework.[10]

Students were assigned three student questionnaires. These consisted of the internationally standardised student questionnaire, and two additional student questionnaires that were offered as international options: an information and communications technology (ICT) questionnaire and an educational career questionnaire. The student questionnaire sought information on students and their family background, aspects of students' lives, such as their attitudes towards learning, their habits and life in and outside of school, aspects of students' interest, motivation and engagement, and learning and instruction in science, including instructional time and class size. The ICT questionnaire collected information on the availability and use of ICT, students' perceptions of their competence in completing tasks and their attitudes towards computer use. The educational career questionnaire gathered information about whether students had experienced interruptions of schooling and their preparation for their future career.

School principals

Principals from participating schools were asked to complete a school questionnaire, which collected descriptive information about the school, including the quality of the school's human and material resources, decision-making processes, instructional practices and school and classroom climate.

Teachers

A teacher questionnaire was also offered as an international option for the first time in PISA 2015, and Australia was one of the 19 countries that participated in this option. There were two questionnaire options: one which had a focus for science teachers and the other for non-science teachers. The questionnaires collected information about teachers' educational background and training, teaching practices, teacher-directed teaching and learning activities in science lessons.

Administration of PISA

Students completed the cognitive assessment and questionnaires using computers and USB drives. The school principals and teachers completed their questionnaires online using logins to a secure website. In Australia, PISA 2015 took place during a six-week period from late July to early September 2015. For most countries in the Northern Hemisphere, the testing period took place between March and May 2015. Together with appropriate application of the student age definition, this resulted in the students in Australia being at both a comparable age and a comparable stage in the school year to those in the Northern Hemisphere who had been tested earlier in 2015.[11]

Who participates in PISA?

PISA aims to be as inclusive as possible of the population of 15-year-old students in each country and strict guidelines are enforced with regard to the percentage of schools and of students that could be excluded (which could not exceed 5% of the nationally desired target population).[12]

There are strict criteria on population coverage, response rates and sampling procedures. For initially selected schools, a minimum response rate of 85% (weighted and unweighted) was required, as well as a minimum rate of 80% (weighted and unweighted) of selected students. Countries that

10 The Assessment Framework explains the guiding principles behind the PISA 2015 assessment. Refer to the *PISA 2015 assessment and analytical framework* (OECD, 2016a).

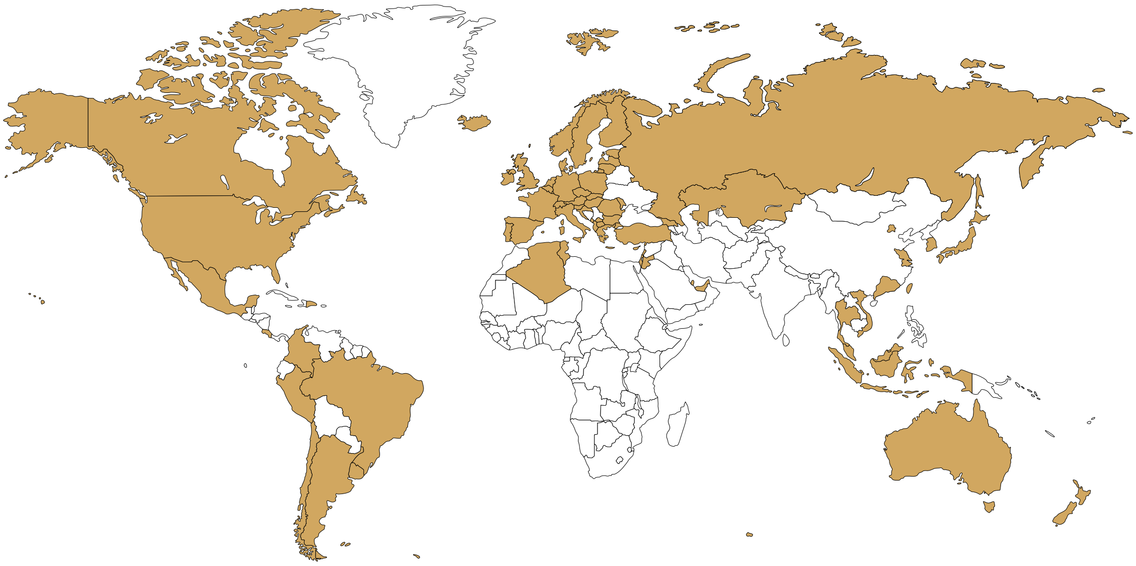
11 Further information on the PISA procedures can be found in Appendix A.

12 Further information on sampling can be found in Appendix B.

obtained an initial school response rate between 65% and 85% could still obtain an acceptable school response by the use of replacement schools. Schools with a student participation response rate lower than 50% were not regarded as participating schools. Australia successfully achieved the required response rates.

Countries

Although PISA was originally an OECD assessment created by the governments of OECD countries, it has become a major assessment in many regions and countries around the world. There were 72 countries and economies that participated in PISA 2015, including 35 OECD countries and 37 partner countries or economies (Figure 1.1).[13]



OECD countries		
Australia	Hungary	Norway
Austria	Iceland	Poland
Belgium	Ireland	Portugal
Canada	Israel	Slovak Republic
Chile	Italy	Slovenia
Czech Republic	Japan	Spain
Denmark	Korea	Sweden
Estonia	Latvia	Switzerland
Finland	Luxembourg	Turkey
France	Mexico	United Kingdom
Germany	The Netherlands	United States
Greece	New Zealand	

Partner countries/economies		
Albania	Former Yugoslav Republic of Macedonia	Moldova
Algeria	Georgia	Montenegro
Argentina†	Hong Kong (China)	Peru
Brazil	Indonesia	Qatar
B-S-J-G (China)*	Jordan	Romania
Bulgaria	Kazakhstan†	Russian Federation
Chinese Taipei	Kosovo	Singapore
Colombia	Lebanon	Thailand
Costa Rica	Lithuania	Trinidad and Tobago
Croatia	Macao (China)	Tunisia
Cyprus	Malta	United Arab Emirates
Dominican Republic	Malaysia†	Uruguay
		Vietnam

* B-S-J-G (China) refers to the four PISA participating provinces: Beijing, Shanghai, Jiangsu and Guangdong.

† Results for Argentina, Malaysia and Kazakhstan have not been reported in this report because their coverage was too small to ensure comparability.

Note: 15 countries (Albania, Algeria, Argentina, Georgia, Indonesia, Jordan, Kazakhstan, Kosovo, Lebanon, the Former Yugoslav Republic of Macedonia, Malta, Moldova, Romania, Trinidad and Tobago, and Vietnam) administered PISA as a paper-based assessment.

Although 72 countries and economies participated in PISA 2015, only those countries with an average score higher than the lowest scoring OECD country, Mexico, have been reported in this publication. Further details are provided in the Reader's Guide.

FIGURE 1.1 Countries and economies participating in PISA 2015

13 PISA 2015 assessed the economic regions of Beijing, Shanghai, Jiangsu and Guangdong [B-S-J-G (China)], Chinese Taipei, Hong Kong (China) and Macao (China). Economic regions are required to meet the same PISA technical standards as other participating countries. Results for an economic region are only representative of the region assessed and are not representative of the country. For convenience, this report refers to these economic regions as countries.

Schools

In most countries, 150 schools and 42 students within each school were randomly selected to participate in PISA. In some countries, including Australia, a larger sample of schools and students participated. This allowed countries to carry out specific national options at the same time as the PISA assessment and for meaningful comparisons to be made between different sectors of the population.

In Australia, a larger sample of schools and students participated in PISA to produce reliable estimates that would be representative of each of the Australian jurisdictions[14] and of Indigenous students. In order for comparisons to be made between jurisdictions, it was necessary to oversample the smaller jurisdictions, because a random sample proportionate to jurisdiction populations would not yield sufficient students in the smaller jurisdictions to give a result that would be sufficiently precise. Further, a sufficiently large sample of Australia's Indigenous students was required so that valid and reliable separate analyses could be conducted.

The Australian PISA 2015 school sample consisted of 758 schools (Table 1.2). The sample was designed so that schools were selected with a probability proportional to the enrolment of 15-year-olds in each school. Stratification of the sample ensured that the PISA sample was representative of the Australian population of 15-year-olds. Several variables were used in the stratification of the school sample including jurisdiction, school sector, geographic location, sex of students at the school and a socioeconomic background variable.[15]

TABLE 1.2 Number of Australian PISA 2015 schools, by jurisdiction and school sector

Jurisdiction	Sector			Total
	Government	Catholic	Independent	
ACT	25	8	9	42
NSW	105	44	28	177
VIC	75	30	25	130
QLD	81	27	25	133
SA	55	22	21	98
WA	57	20	21	98
TAS	33	12	8	53
NT	15	5	7	27
Australia	**446**	**168**	**144**	**758**

Note: These numbers are based on unweighted data.

Of the Australian PISA schools, 87% were coeducational. Seven per cent of schools catered for all female students, while 6% catered for all-male students. Two per cent (15 schools) of the PISA 2015 schools were single-sex schools from the government school sector, 8% (58 schools) were from the Catholic school sector, and 3% (26 schools) were from the independent school sector.

Students

The target population for PISA is students who are aged between 15 years and 3 months and 16 years and 2 months at the beginning of the testing period and are enrolled in an educational institution, either full- or part-time. Since the largest part (but not all) of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

14 Throughout this report, the Australian states and territories will be collectively referred to as jurisdictions.

15 Based on the Australian Bureau of Statistic's Socio-Economic Indexes for Areas.

In each country, a random sample of 42 students was selected with equal probability from each of the randomly selected schools using a list of all 15-year-old students submitted by the school. Approximately 540 000 students took part in PISA 2015, representing about 29 million 15-year-old students internationally.

PISA 2015 students across the jurisdictions

In most Australian jurisdictions, 20 students and all age-eligible Indigenous students were sampled per school. In the Australian Capital Territory, 30 students and all age-eligible Indigenous students were sampled per school, and in the Northern Territory, 27 students and all age-eligible Indigenous students were sampled per school. The Australian PISA 2015 sample of 14 530 students, whose results feature in the national and international reports, was drawn from all jurisdictions and school sectors according to the distributions shown in Table 1.3.

TABLE 1.3 Number of Australian PISA 2015 students, by jurisdiction and school sector

Sector		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Government	N students	496	2053	1253	1905	922	1104	654	275	8662
	Weighted N	2304	46660	36144	31221	10273	16236	3710	1377	147925
Catholic	N students	210	849	530	579	391	355	248	115	3277
	Weighted N	1406	20634	14810	10784	4039	5635	1296	259	58863
Independent	N students	211	471	403	456	367	410	133	140	2591
	Weighted N	822	12906	13252	10903	3887	6356	944	472	49542
Australia	**N students**	**917**	**3373**	**2186**	**2940**	**1680**	**1869**	**1035**	**530**	**14530**
	Weighted N	**4532**	**80200**	**64206**	**52908**	**18199**	**28227**	**5950**	**2108**	**256330**

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

As the sample is age-based in PISA, the students come from various year levels but they are mostly from Years 9, 10 and 11. There are some variations to the year-level composition of the sample in the different jurisdictions as shown in Table 1.4, because of differing school starting ages in different jurisdictions.

TABLE 1.4 Percentage of Australian PISA 2015 students, by jurisdiction and year level

Jurisdiction	Year level					
	7	8	9	10	11	12
ACT			12	81	7	
NSW	^	^	12	81	6	
VIC	^	^	23	75	1	^
QLD		^	2	51	47	^
SA		^	8	87	5	^
WA			1	86	13	
TAS			32	68	^	
NT	^	^	8	79	13	
Australia	**^**	**^**	**11**	**75**	**14**	**^**

^ denotes percentages ≤ 1

Note: These percentages are based on unweighted data; the jurisdiction totals are reported as whole numbers without rounding off decimal places.

Table 1.5 shows the number of Australian female and male students who participated in PISA by jurisdiction. There were equal proportions of females and males in four jurisdictions (the Australian Capital Territory, New South Wales, Victoria and Western Australia), while the proportion of males was higher than the proportion of females in:

- Queensland: 49% female; 51% male
- South Australia: 49% female; 51% male
- Tasmania: 48% female; 52% male
- Northern Territory: 49% female; 51% male.

TABLE 1.5 Percentage of Australian PISA 2015 students, by jurisdiction and sex

Sex		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Females	N students	441	1686	1102	1430	798	928	513	265	7163
	Weighted N	2254	40118	32163	25851	8828	14061	2835	1041	127151
Males	N students	476	1687	1084	1510	882	941	522	265	7367
	Weighted N	2278	40081	32043	27057	9370	14165	3116	1067	129177

PISA 2015 students and geographic location of schools

The locations of schools in PISA were classified using the MCEETYA Schools Geographic Location Classification (Jones, 2004).[16] Table 1.6 shows about 75% of PISA 2015 participants attended schools in metropolitan areas, 25% were from provincial areas and the remaining 1% of participants attended schools in remote areas.

TABLE 1.6 Number and percentage of Australian PISA 2015 students, by geographic location

Geographic location	N students	Weighted N	Weighted (%)
Metropolitan	9947	188606	74
Provincial	4065	64073	25
Remote	518	3650	1

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

PISA 2015 students and Indigenous background

In PISA 2015, Australian Indigenous students were identified from information provided by their schools. Every student from a participating school who identified as Indigenous was sampled for Australia's PISA. Four per cent of the PISA sample was of Indigenous background. Table 1.7 shows the number of Australian Indigenous and non-Indigenous students who participated in PISA.

TABLE 1.7 Number and percentage of Australian PISA 2015 students, by Indigenous background

Indigenous background	N Students	Weighted N	Weighted (%)
Indigenous	2807	10659	4
Non-Indigenous	11723	245670	96

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

16 The Reader's Guide provides more information about the MCEETYA Schools Geographic Location Classification.

The distribution of non-Indigenous students by geographic location was similar to the data reported in Table 1.6. Table 1.8 shows that 75% of non-Indigenous students were from metropolitan schools, 24% from provincial schools and 1% from remote schools. However, a different distribution was found for participating Indigenous students: 46% of students were from metropolitan schools, 47% from provincial schools and 8% from remote schools.

TABLE 1.8 Number and percentage of Australian PISA 2015 students, by geographic location and Indigenous background

Geographic location	Indigenous students			Non-Indigenous students		
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)
Metropolitan	1534	4874	46	8413	183732	75
Provincial	1085	4981	47	2980	59092	24
Remote	188	804	8	330	2846	1

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

PISA 2015 students and socioeconomic background

Information about students' socioeconomic background was collected in the student questionnaire. Students were asked several questions about their family and home background. This information was used to construct a measure of socioeconomic background: the economic, social and cultural status index (ESCS). Using this index, participating students were distributed into quartiles of socioeconomic background.

The distribution of Australian students by school sector is provide in Table 1.9, and shows there were higher proportions of students from lower socioeconomic backgrounds who attended government schools (34%) compared to the proportions of students who attended Catholic schools (16%) or independent schools (10%). Conversely, there were lower proportions of students from higher socioeconomic backgrounds who attended government schools (17%) compared to the proportions of students who attended Catholic schools (29%) or independent schools (44%).

TABLE 1.9 Number and percentage of Australian PISA 2015 students, by socioeconomic background quartiles and school sector

Socioconomic background	Government			Catholic		
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)
Lowest quartile	3122	48261	34	577	9043	16
Second quartile	2212	38663	27	833	14671	25
Third quartile	1696	31483	22	927	17366	30
Highest quartile	1192	23596	17	888	16927	29

Socioconomic background	Independent			Total weighted % of PISA population
	N students	Weighted N	Weighted (%)	
Lowest quartile	283	4828	10	25
Second quartile	486	8812	18	25
Third quartile	728	13366	28	25
Highest quartile	1045	21585	44	25

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

The distribution of Australian Indigenous and non-Indigenous students by overall socioeconomic quartiles is provided in Table 1.10. Half of the Indigenous students sampled were classified in the lowest socioeconomic quartile, while just 8% were found to be in the highest socioeconomic quartile.

TABLE 1.10 Number and percentage of Australian PISA 2015 students, by socioeconomic background quartiles and Indigenous background

Socioeconomic background	Indigenous students			Non-Indigenous students			Total weighted % of PISA population
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)	
Lowest quartile	1252	4975	50	2730	57159	24	25
Second quartile	691	2642	26	2840	59503	25	25
Third quartile	442	1582	16	2909	60633	25	25
Highest quartile	235	835	8	2890	61274	26	25

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

In metropolitan schools, which had the bulk of enrolments, there were roughly similar proportions of students across the socioeconomic background quartiles—less than half in the two lowest quartiles (45%) and nearly one-third (29%) in the highest quartile. In contrast, in provincial schools, 63% of students were in the two lowest quartiles and 15% of students were in the highest quartile. Remote schools were even more skewed in terms of socioeconomic background, with 69% of students in the two lowest quartiles and just 11% of students in the highest socioeconomic quartile. The distribution of students in schools from different geographic locations by socioeconomic background quartiles is provided in Table 1.11.

TABLE 1.11 Number and percentage of Australian PISA 2015 students, by socioeconomic background quartiles and geographic location

Socioeconomic background	Metropolitan			Provincial		
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)
Lowest quartile	2304	39346	21	1503	21495	35
Second quartile	2308	43673	24	1074	17382	28
Third quartile	2468	48220	26	777	13301	22
Highest quartile	2541	52412	29	527	9310	15

Socioeconomic background	Remote			Total weighted % of PISA population
	N students	Weighted N	Weighted (%)	
Lowest quartile	175	1292	37	25
Second quartile	149	1091	32	25
Third quartile	106	693	20	25
Highest quartile	57	387	11	25

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

PISA 2015 students and immigrant status

The student questionnaire collected information about the country of birth of students and their parents. This data was used to create a measure of immigrant status, with three categories: Australian-born, first-generation and foreign-born.[17]

Table 1.12 shows that just over 50% of students to sit PISA 2015 were Australian-born, 30% were first-generation and 12% of students were foreign-born.

TABLE 1.12 Number and percentage of Australian PISA 2015 students, by immigrant background

Immigrant background	N students	Weighted N	Weighted (%)
Australian-born	8483	137006	53
First-generation	3795	76985	30
Foreign-born	1465	31468	12

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample. The weighted % doesn't sum to 100% as 4% of students didn't provide these details.

PISA 2015 students and language spoken at home

The student questionnaire asked students which language was spoken in their homes most of the time. A measure of language spoken at home was derived to identify students who spoke English at home and students who spoke a language other than English at home.

In Australia, 87% of PISA 2015 participants indicated that English was spoken at home most of the time; 11% of students indicated they spoke a language other than English at home most of the time (Table 1.13).

TABLE 1.13 Number and percentage of Australian PISA 2015 students, by language background

Language background	N students	Weighted N	Weighted (%)
English spoken at home	12626	221894	87
Language other than English spoken at home	1477	28648	11

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample. The weighted % doesn't sum to 100% as 2% of students didn't provide these details.

PISA in Australia

PISA is a key part of the National Assessment Program (NAP). Components of NAP include the National Assessment Program – Literacy and Numeracy (NAPLAN), which is conducted annually for every student in Years 3, 5, 7 and 9; the national sample assessments of civics and citizenship, information and communication technology (ICT) literacy, and science literacy; and the international assessments, which comprise – in addition to PISA – the IEA's Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS).

Unlike NAPLAN, PISA is not a curriculum-based assessment and assesses a nationally representative sample of 15-year-olds (rather than a year-level based sample), providing national and group estimates rather than providing individual student results.

17 The Reader's Guide provides more information about immigrant status.

The results collected from these assessments allow for nationally comparable reporting of progress towards the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008), which set goals for high-quality schooling in Australia designed to secure students the necessary knowledge, understanding, skills and values for a productive and rewarding life.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) reports on these assessments annually in its *National Report on Schooling in Australia*, which is the main vehicle for reporting against nationally agreed key performance measures defined in the *Measurement Framework for Schooling in Australia 2015* (Australian Curriculum, Assessment and Reporting Authority, 2015).

The *Measurement Framework for Schooling in Australia 2015* outlines national standards for each of the elements of the NAP, including PISA. The national standard for PISA is a *proficient standard*, which represents a 'challenging but reasonable' expectation of student achievement. This National Proficient Standard for PISA has been set at Level 3 on the PISA proficiency scales for each domain.

Organisation of the report

This report focuses on Australian students' performance in PISA 2015. Chapter 2 provides a brief overview of the PISA scientific literacy framework and presents results on the performance of Australian students in scientific literacy. Results are compared to other participating countries, across jurisdictions and for different demographic groups of interest. Changes in scientific literacy performance are also examined. Chapter 3 presents results for Australian students' performance on the scientific literacy subscales. Chapters 4 and 5 are devoted to student performance in reading literacy and mathematical literacy. Chapter 6 focuses on the relationship between socioeconomic background and performance. Chapter 7 explores students' motivation and beliefs in science and Chapter 8 examines the learning environment at the school, classroom and student level.

Further information

Further information about PISA in Australia is available from the national PISA website: www.acer.org/ozpisa/.

CHAPTER 2

Australian students' performance in scientific literacy

Key findings

- Australian students achieved an average score of 510 points in scientific literacy, which was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than that of 9 countries (Singapore, Japan, Estonia, Chinese Taipei, Finland, Macao (China), Canada, Vietnam, and Hong Kong (China)).
- Australia's performance was not significantly different from that of 8 countries (B-S-J-G (China), Korea, New Zealand, Slovenia, the United Kingdom, Germany, the Netherlands and Switzerland).
- Australia's performance was significantly higher than 51 countries, which included 23 OECD countries.
- Australia's proportion of high performers (11%) was higher than the OECD average (8%).
- Australia's proportion of low performers (18%) was lower than the OECD average (21%).
- 61% of Australian students achieved the National Proficient Standard (Level 3) in scientific literacy.
- Australia and 12 other countries showed a significant decline in their scientific literacy performance between 2006 and 2015. Australia's performance declined by 17 points.
- The Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland performed at a significantly higher level than the OECD average (493 points), while the Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.
- The proportion of students who reached the National Proficient Standard in scientific literacy was 48% in Tasmania; 51% in the Northern Territory; 59% in New South Wales; 60% in Queensland and South Australia; 63% in Victoria; 65% in Western Australia; and 68% in the Australian Capital Territory.
- In Victoria and the Northern Territory, there was no significant decline in scientific literacy scores between 2006 and 2015. All other jurisdictions experienced a significant decline. Queensland had the smallest decline (15 points), followed by the Australian Capital Territory and Western Australia (22 points each), Tasmania (23 points), South Australia (24 points) and New South Wales had the largest decline (27 points).

- Indigenous students achieved significantly lower than non-Indigenous students in scientific literacy, with a difference of 76 points, which equates to around two-and-a-half years of schooling.
- Students from metropolitan schools scored, on average, 26 points higher in scientific literacy (average difference representing around one year of schooling) than students from provincial schools, and scored 46 points on average higher than students from remote schools (the average difference representing around two years of schooling).
- Students in the highest socioeconomic background quartile achieved an average score of 559 points, which was significantly higher than students in the lowest socioeconomic background quartile, who achieved 468 points. This difference of 89 points represents around three years of schooling.
- Australian-born students achieved an average score that was significantly lower than first-generation students and statistically similar to foreign-born students.
- Students who spoke English at home achieved an average scientific literacy score that was significantly higher than students who spoke a language other than English at home.
- Females scored 509 points on average, which was not significantly different to the average score of 511 for males.

In PISA, the rotation of the assessment domains in each cycle allows for one domain to be assessed in greater detail every nine years. Scientific literacy was first assessed as a major domain in PISA 2006 and was the major domain in 2015. Revisiting scientific literacy as a major domain provides an opportunity for the assessment framework to be updated, to integrate new developments in theory and practice, as well as recognising the changes in the world in which students learn and live. It also allows for reporting on the overall scientific literacy scale and on the scientific literacy subscales.

This first section of this chapter begins with a summary of the PISA scientific literacy assessment domain, which includes a definition of scientific literacy, an overview of the assessment framework and a description of how scientific literacy is measured and reported in PISA.[18] The next section presents the results of student performance in scientific literacy for the PISA 2015 assessment in terms of average scores and proficiency levels. The performance of Australian PISA students is compared to the performance of PISA students from other countries. The performance of students within Australia, by jurisdiction and by other subgroups is also compared. The last section discusses the changes in scientific literacy performance over time.

How is scientific literacy defined in PISA?

The PISA concept of scientific literacy emphasises the ability to apply scientific knowledge of and about science, and recognises there is an affective element relating to students' attitudes or dispositions towards science. PISA defines scientific literacy as follows:

> Scientific literacy is the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to explain phenomena scientifically, evaluate and design scientific enquiry, and interpret data and evidence scientifically.
>
> OECD, 2016a, p. 20

18 Details about the scientific literacy framework, structure of the assessment and proficiency scale have been assembled from the PISA 2015 Assessment and Analytical Framework (OECD, 2016a).

How is scientific literacy assessed in PISA?

The scientific literacy assessment framework consists of four interrelated aspects. The central aspect comprises three competencies that students need to apply. Figure 2.1 lists the competencies, which students need to use in specific contexts and the application of these competencies is influenced by their knowledge of science and their attitudes towards science.

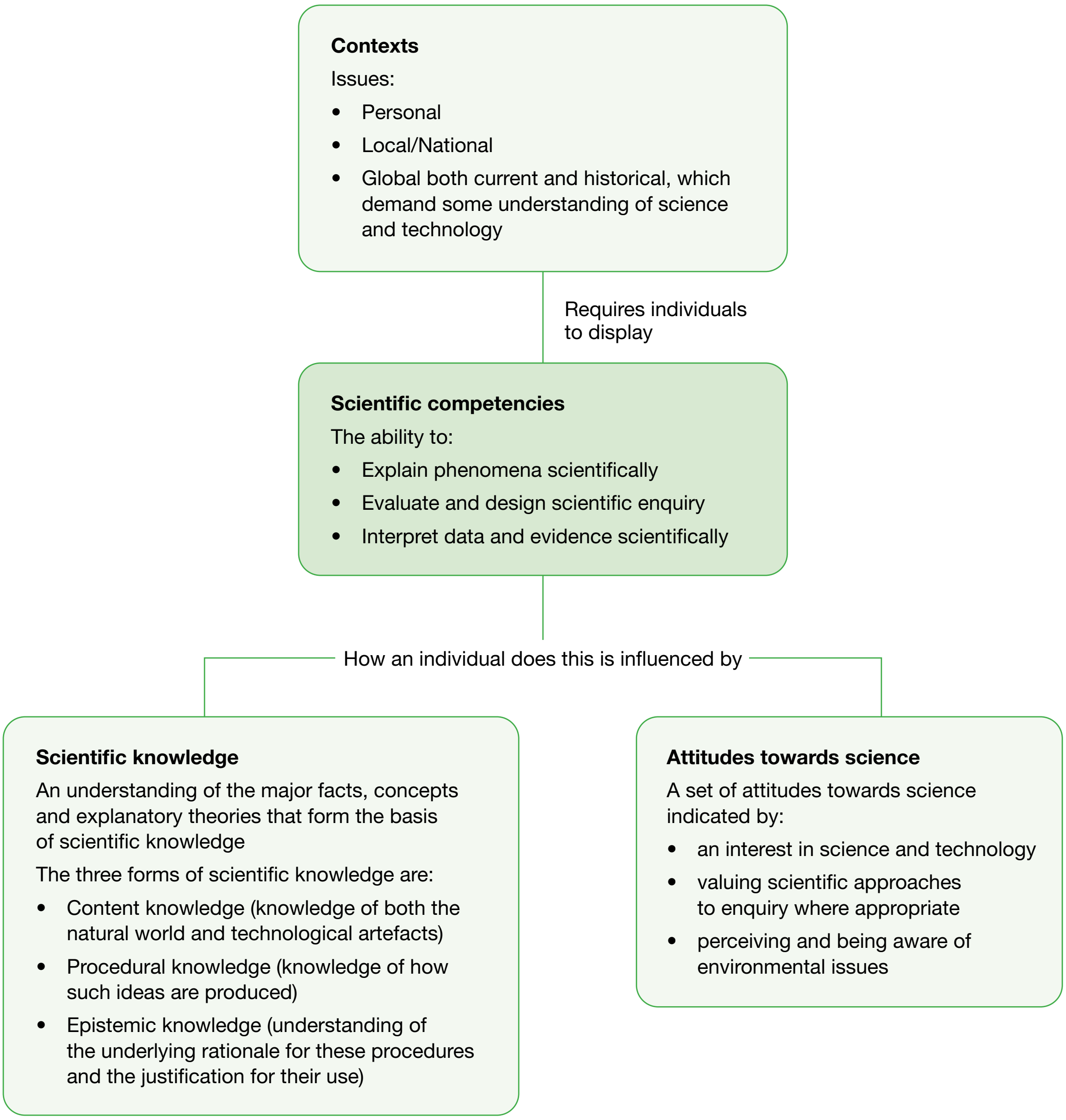


FIGURE 2.1 Aspects of the scientific literacy assessment framework

Scientific competencies

The scientific literacy assessment framework defines three competencies that are grounded in logic, reasoning and critical analysis. These are the ability to:

- explain phenomena scientifically
- evaluate and design scientific enquiry
- interpret data and evidence scientifically.

Figure 2.2 lists the skills within each competency that would be demonstrated by a scientifically literate person.

Explain phenomena scientifically

Recognise, offer and evaluate explanations for a range of natural and technological phenomena demonstrating the ability to:

- Recall and apply appropriate scientific knowledge.
- Identify, use and generate explanatory models and representations.
- Make and justify appropriate predictions.
- Offer explanatory hypotheses.
- Explain the potential implications of scientific knowledge for society.

Evaluate and design scientific enquiry

Describe and appraise scientific investigations and propose ways of addressing questions scientifically demonstrating the ability to:

- Identify the question explored in a given scientific study.
- Distinguish questions that could be investigated scientifically.
- Propose a way of exploring a given question scientifically.
- Evaluate ways of exploring a given question scientifically.
- Describe and evaluate how scientists ensure the reliability of data, and the objectivity and generalisability of explanations.

Interpret data and evidence scientifically

Analyse and evaluate scientific data, claims and arguments in a variety of representations and draw appropriate conclusions, demonstrating the ability to:

- Transform data from one representation to another.
- Analyse and interpret data and draw appropriate conclusions.
- Identify the assumptions, evidence and reasoning in science-related texts.
- Distinguish between arguments that are based on scientific evidence and theory and those based on other considerations.
- Evaluate scientific arguments and evidence from different sources (e.g. newspapers, the internet, journals).

FIGURE 2.2 The three competencies in the scientific literacy assessment framework

Contexts

The items for the PISA 2015 scientific literacy assessment are set within real-life contexts and are not limited to life in the classroom and school. They focus on situations relating to self: family and peer groups (personal); to the community (local/national); and to life across the globe (global). Some of the items may also be framed within a historical situation in order to assess an understanding of the processes and practices in the advances in scientific knowledge.

Table 2.1 shows how science and technology issues (the areas of application) are applied within the personal, local/national and global settings The PISA scientific literacy assessment is not an assessment of contexts, but an assessment of competencies and knowledge in specific contexts that will be relevant and familiar to 15-year-old students.

TABLE 2.1 Contexts in the scientific literacy assessment

Areas of application	Personal	Local/National	Global
Health and disease	Maintenance of health, accidents, nutrition	Control of disease, social transmission, food choices, community health	Epidemics, spread of infectious diseases
Natural resources	Personal consumption of materials and energy	Maintenance of human populations, quality of life, security, production and distribution of food, energy supply	Renewable and non-renewable natural systems, population growth, sustainable use of species
Environmental quality	Environmentally friendly actions, use and disposal of materials and devices	Population distribution, disposal of waste, environmental impact	Biodiversity, ecological sustainability, control of pollution, production and loss of soil/biomass
Hazards	Risk assessments of lifestyle choices	Rapid changes (earthquakes, severe weather), slow and progressive changes (coastal erosion, sedimentation), risk assessment	Climate change, impact of modern communication
Frontiers of science and technology		New materials, devices and processes, genetic modifications, health technology, transport	Extinction of species, exploration of space, and origin and structure of the universe

Scientific knowledge

All of the scientific competencies require knowledge. While the competency *explaining scientific and technological phenomena* requires a knowledge of the content of science (content knowledge), the other competencies *evaluating and designing scientific enquiry*, and *interpreting data and evidence scientifically*, requires a knowledge about science (procedural and epistemic knowledge).

Content knowledge refers to an understanding of the major facts, ideas and theories from the disciplines of biology, chemistry, physics, earth and space sciences. In PISA, the assessment items have been classified into three areas (living systems, physical systems, and earth and space sciences), and require that the knowledge has relevance to real-life situations, represents important scientific concepts or major explanatory theories, and is appropriate to the development level of 15-year-olds. Figure 2.3 shows a range of examples from the three areas that require content knowledge.

Living systems

- Cells (e.g. structures and function, DNA, plant and animal).
- The concept of an organism (e.g. unicellular and multicellular).
- Humans (e.g. health, nutrition, subsystems such as digestion, respiration, circulation, excretion, reproduction and their relationship).
- Populations (e.g. species, evolution, biodiversity, genetic variation).
- Ecosystems (e.g. food chains, matter and energy flow).
- Biosphere (e.g. ecosystem services, sustainability).

Physical systems

- Properties of matter (e.g. changes of state, thermal and electrical conductivity).
- Chemical changes of matter (e.g. chemical reactions, energy transfer, acids/bases).
- Motion and forces (e.g. velocity, friction) and action at a distance (e.g. magnetic, gravitational and electrostatic forces).
- Energy and its transformation (e.g. conservation, dissipation, chemical reactions).
- Interactions between energy and matter (e.g. light and radio waves, sound and seismic waves).

Earth and space systems

- Structures of the Earth systems (e.g. lithosphere, atmosphere, hydrosphere).
- Energy in the Earth systems (e.g. sources, global climate).
- Change in Earth systems (e.g. plate tectonics, geochemical cycles, constructive and destructive forces).
- Earth's history (e.g. fossils, origin and evolution).
- Earth in space (e.g. gravity, solar systems, galaxies).
- The history and scale of the universe and its history (e.g. light year, Big Bang theory).

FIGURE 2.3 Examples of content knowledge by systems

Procedural knowledge refers to an understanding of how knowledge has been derived. In order to undertake scientific enquiry and engage in critical reviews of the evidence, a knowledge of the standard procedures scientists use to obtain reliable and valid data is required. Figure 2.4 provides examples that illustrate the general features of procedural knowledge.

Procedural knowledge

- The concept of variables, including dependent, independent and control variables.
- Concepts of measurement, e.g. quantitative (measurements), qualitative (observations), the use of a scale, categorical and continuous variables.
- Ways of assessing and minimising uncertainty, such as repeating and averaging measurements.
- Mechanisms to ensure the replicability (closeness of agreement between repeated measures of the same quantity) and accuracy of data (the closeness of agreement between a measured quantity and a true value of the measure).
- Common ways of abstracting and representing data using tables, graphs and charts, and using them appropriately.
- The control-of-variables strategy and its role in experimental design or the use of randomised controlled trials to avoid confounded findings and identify possible causal mechanisms.
- The nature of an appropriate design for a given scientific question, e.g. experimental, field-based or pattern-seeking.

FIGURE 2.4 Examples conveying general features of procedural knowledge

Epistemic knowledge refers to an understanding of the role of specific constructs and defining features essential to the process of knowledge-building in science. It provides a rationale for the procedures and practices in which scientists engage, a knowledge of the structures and defining features that guide scientific enquiry, and the foundation for the basis of belief in the claims that science makes about the natural world. Figure 2.5 shows the major features of epistemic knowledge necessary for scientific literacy.

Epistemic knowledge

The constructs and defining features of science. That is:

- The nature of scientific observations, facts, hypotheses, models and theories.
- The purpose and goals of science (to produce explanations of the natural world) as distinguished from technology (to produce an optimal solution to human need), and what constitutes a scientific or technological question and appropriate data.
- The values of science, e.g. a commitment to publication, objectivity and the elimination of bias.
- The nature of reasoning used in science, e.g. deductive, inductive, inference to the best explanation (abductive), analogical, and model-based.

The role of these constructs and features in justifying the knowledge produced by science. That is:

- How scientific claims are supported by data and reasoning in science.
- The function of different forms of empirical enquiry in establishing knowledge, their goal (to test explanatory hypotheses or identify patterns) and their design (observation, controlled experiments, correlational studies).
- How measurement error affects the degree of confidence in scientific knowledge.
- The use and role of physical, system and abstract models and their limits.
- The role of collaboration and critique, and how peer reviews helps to establish confidence in scientific claims.
- The role of scientific knowledge, along with other forms of knowledge, in identifying and addressing societal and technological issues.

FIGURE 2.5 Major features of epistemic knowledge

Attitudes towards science

The scientific literacy assessment framework recognises the role that individuals' attitudes play in the interest and response to science and technology in general and to issues that may affect them. In PISA 2015, students' attitudes towards science were measured through the Student Questionnaire and evaluated in three areas: interest in science and technology, environmental awareness, and valuing scientific approaches to enquiry.

The PISA 2015 scientific literacy assessment structure

The assessment framework serves as the conceptual basis for assessing students' proficiency in scientific literacy. The trend items and newly developed items for PISA 2015 covered the full range of cognitive abilities and knowledge identified in the assessment framework. The trend items that had previously been administered in the paper-based assessment (prior to PISA 2015) were transposed for the computer-based assessment. A number of new scientific literacy items were developed to take advantage of this new mode of assessment by expanding the assessment of scientific literacy, for example, assessing students' ability to conduct scientific enquiry by asking them to design (simulated) experiments and interpret the resulting evidence.

Scientific literacy items in the assessment

The PISA 2015 scientific literacy assessment included 184 scientific literacy items, which were assembled into clusters. The assessment design consisted of six trend scientific literacy clusters and six newly developed scientific literacy clusters. In all, this was the equivalent of six hours of scientific literacy assessment materials (as each cluster occupied 30 minutes of testing time). Two of the four clusters in each test form were scientific literacy items, so students spent half of their testing time (one hour) responding to between 12 and 37 scientific literacy items, depending on which test form they were randomly assigned from the test rotation design.

Item response formats

Scientific literacy was assessed through a range of item-response formats to cover the full range of cognitive abilities that were identified in the PISA 2015 assessment framework. These included:

- *multiple-choice items:* where students were asked to select one correct response from among four or five possible response options, or where students had to select an answer from a selectable element within a graphic or text.
- *complex multiple-choice items:* where students were asked to select the correct response to each of a number of statements or questions, select more than one response from a list, select choices from a drop-down menu to fill multiple blanks, or select and move elements to complete a task of matching, ordering or categorising.
- *open constructed-response items:* where students were asked to provide a written response that ranged from a phrase to a few sentences, or where students provided a response by drawing a graph or diagram.

Table 2.2 shows that of the 184 scientific literacy items in PISA 2015, around 30% were simple multiple-choice items, while there were higher proportions of complex multiple-choice items and constructed-response items (approximately 35%). All of the multiple-choice items and 3% of constructed-response items were computer scored. The remainder of the constructed-response items were coded by experienced trained coders.

TABLE 2.2 Type of item response formats in the scientific literacy assessment[19]

	Items	
Item format	No.	%
Simple multiple-choice	54	29
Complex multiple-choice	66	36
Constructed-response	64	35

Note: Due to rounding, some percentages may not match to totals in the text. This relates to all tables and graphs in this chapter. See the Reader's Guide for more information.

Distribution of items

The balance of items among the competencies, context and knowledge components are broadly consistent with the previous framework and reflect the consensus view of the experts who were consulted when the framework was being updated for PISA 2015. The number and proportion of items, by aspect, that were selected for the assessment are shown in Table 2.3.

TABLE 2.3 Distribution of items by aspects in the scientific literacy assessment[20]

	Items	
Aspects	No.	%
Scientific competencies		
Explain phenomena scientifically	89	48
Evaluate and design scientific enquiry	39	21
Interpret data and evidence scientifically	56	30
Context		
Personal	21	11
Local/National	108	59
Global	55	29
Scientific knowledge		
Content	98	53
Procedural	60	33
Epistemic	26	14
Content knowledge – Systems		
Living	74	40
Physical	61	33
Earth and science	49	27

Cognitive demand of items

The PISA 2015 scientific literacy assessment framework includes the definition of levels of cognitive demand. Cognitive demand refers to the type of mental processes required to complete an item. The PISA assessment assesses student performance not only through items of different difficulty but also by assessing students' abilities of different levels of cognitive demand.

Three levels of cognitive demand were identified to ensure a balanced scientific literacy assessment:

- *low cognitive demand:* items required students to carry out a one-step procedure, such as recalling a fact or locating a single point of information from a table or graph.
- *medium cognitive demand:* items required students to use and apply their conceptual knowledge to describe or explain phenomena, select appropriate procedures involving two or more steps, organise or display data, interpret or use simple data sets or graphs.
- *high cognitive demand:* items required students to analyse complex information or data, synthesise or evaluate evidence or justify, reason, or develop a plan or sequence of steps to approach a problem.

19 Information collated from data provided from Annex C2 in PISA 2015 Results (Volume I): Excellence and Equity in Education (OECD, 2016b).

20 Information collated from data provided from Annex C, in PISA 2015 Results (Volume I): Excellence and Equity in Education (OECD, 2016b).

In the PISA 2015 scientific literacy assessment, approximately 30% of the items required a low depth of knowledge, about 61% required a medium depth of knowledge and around 8% of the items required a high depth of knowledge.

Scaling of the scientific literacy items[21]

The assessment design, similar to those used in previous PISA assessments, allowed a single scale of proficiency in scientific literacy to be constructed. The scale of scientific literacy was constructed using item-response theory, with each item associated with a particular point on the scale indicating its difficulty, and each student's performance associated with a particular point on the same scale indicating their estimated scientific literacy proficiency. On this scale, the relative difficulty of items in an assessment can be estimated by considering the proportion of students getting each item correct. It is possible to estimate the location of individual students and to describe the degree of scientific literacy that they possess.

Figure 2.6 shows that the relationship between items and students on the scientific literacy scale is probabilistic. The estimate of student proficiency reflects the kinds of tasks they would be expected to successfully complete. A student whose ability places them at a certain point on the PISA scientific literacy scale would most likely be able to successfully complete tasks at or below that location, and they would increasingly be more likely to be able to complete tasks located at progressively lower points on the scale, but they would be less likely to be able to complete tasks above that point, and they would be increasingly less likely to be able to complete tasks located at progressively higher points on the scale.

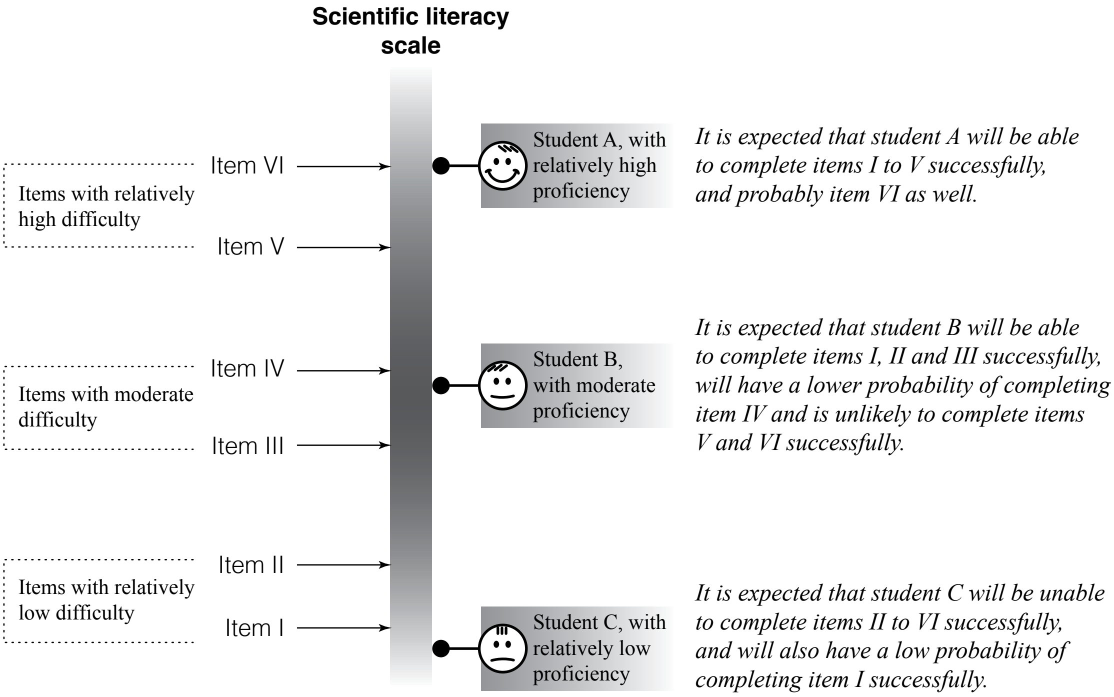


FIGURE 2.6 The probabilistic relationship between items and student performance on the PISA scientific literacy scale

The overall scientific literacy scale draws on all of the scientific literacy items in the PISA 2015 assessment as well as scales for the three scientific literacy competencies, the three content areas and two of the broad knowledge type categories.[22]

21 The scaling procedures used in PISA 2015 are described in greater detail in the PISA 2015 Technical Report (OECD, forthcoming).

22 A single scale for both procedural and epistemic knowledge was constructed because there were two few epistemic knowledge items to support the construction of an epistemic knowledge scale.

Examples of released items

As PISA is a recurring assessment, the majority of items remain secure in order for trend data to be reported over time. However, a small number of example items for scientific literacy have been made public, and can be found in previous National PISA reports or through the OECD website at http://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm. Some of the examples available online illustrate the interactive nature of the new scientific literacy items.

How is scientific literacy assessment reported in PISA?

Statistics such as average scores and measures of distribution of performance allow for comparisons against other countries and subgroups. Proficiency levels provide results in descriptive terms, where descriptions of the skills and knowledge students typically use are attached to achievement results.

Average scores and distribution of scores

Average scores provide a summary of student performance and allow comparisons of the relative standing between different countries and different subgroups. In PISA 2006, when scientific literacy was a major domain for the first time, the metric for the overall scientific literacy scale was based on an average score, across OECD countries, of 500 points and a standard deviation of 100 points. The average score on the PISA 2015 scientific literacy scale across participating OECD countries was 493 points, with a standard deviation of 94 points. The difference in the OECD average between PISA 2006 and 2015 occurs because of changes in students' scientific literacy performance over time as well as reflecting changes in the overall number of OECD countries.

The distribution of scores along the scientific literacy scale also provides further detail about students' performance. Results are reported at the 5th, 10th, 25th, 75th, 90th and 95th percentiles in graphical format to observe the variation in student performance within a country or subgroup.

Proficiency levels

While average scores provide a comparison of student performance on a numerical level, proficiency levels provide a description of the knowledge and skills that students are typically capable of displaying.

The PISA scientific literacy scale is divided into seven levels of proficiency, with 75 points representing one proficiency level. The scientific literacy proficiency scale spans from Level 1b (the lowest proficiency level) to Level 6 (the highest). Six of the proficiency levels, Level 1a (formerly known as Level 1) to Level 6 are comparable to those proficiency levels in PISA 2006, while Level 1b was newly created to describe some of the easiest tasks included in the assessment.

Descriptions of each of the proficiency levels are based on the framework-related cognitive demands imposed by items that are located within each level to describe the kinds of knowledge and skills needed to successfully complete those items, and which can then be used as characterisations of the substantive meaning of each level. The descriptions for all of scientific literacy proficiency levels have been updated to reflect the PISA 2015 assessment framework and the new items that have been developed for this cycle. Figure 2.7 provides descriptions of the scientific competencies, knowledge and understanding required at each level of the scientific literacy scale, and the cut-off points between the proficiency levels.

	Proficiency level	What students can typically do at each level
High performers	6	Students can draw on a range of interrelated scientific ideas and concepts from the physical, life and earth and space sciences and use content, procedural and epistemic knowledge in order to offer explanatory hypotheses of novel scientific phenomena, events and processes or to make predictions. In interpreting data and evidence, they are able to discriminate between relevant and irrelevant information and can draw on knowledge external to the normal school curriculum. They can distinguish between arguments that are based on scientific evidence and theory and those based on other considerations. Students at this level can evaluate competing designs of complex experiments, field studies or simulations and justify their choices.
	707.9 score points	
	5	Students can use abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and processes involving multiple causal links. They are able to apply more sophisticated epistemic knowledge to evaluate alternative experimental designs and justify their choices and use theoretical knowledge to interpret information or make predictions. Students at this level can evaluate ways of exploring a given question scientifically and identify limitations in interpretations of data sets including sources and the effects of uncertainty in scientific data.
	633.3 score points	
Middle performers	4	Students can use more complex or more abstract content knowledge, which is either provided or recalled, to construct explanations of more complex or less familiar events and processes. They can conduct experiments involving two or more independent variables in a constrained context. They are able to justify an experimental design, drawing on elements of procedural and epistemic knowledge. Students at this level can interpret data drawn from a moderately complex data set or less familiar context, draw appropriate conclusions that go beyond the data and provide justifications for their choices.
	558.7 score points	
	3	Students can draw upon moderately complex content knowledge to identify or construct explanations of familiar phenomena. In less familiar or more complex situations, they can construct explanations with relevant cueing or support. They can draw on elements of procedural or epistemic knowledge to carry out a simple experiment in a constrained context. Students at this level are able to distinguish between scientific and non-scientific issues and identify the evidence supporting a scientific claim.
	484.1 score points	
	2	Students are able to draw on everyday content knowledge and basic procedural knowledge to identify an appropriate scientific explanation, interpret data, and identify the question being addressed in a simple experimental design. They can use basic or everyday scientific knowledge to identify a valid conclusion from a simple data set. Students at this level can demonstrate basic epistemic knowledge by being able to identify questions that can be investigated scientifically.
	409.5 score points	
Low performers	1a	Students are able to use basic or everyday content and procedural knowledge to recognise or identify explanations of simple scientific phenomenon. With support, they can undertake structured scientific enquiries with no more than two variables. They are able to identify simple causal or correlational relationships and interpret graphical and visual data that require a low level of cognitive demand. Students at this level can select the best scientific explanation for given data in familiar personal, local and global contexts.
	334.9 score points	
	1b	Students can use basic or everyday scientific knowledge to recognise aspects of familiar or simple phenomenon. They are able to identify simple patterns in data, recognise basic scientific terms and follow explicit instructions to carry out a scientific procedure.
	260.5 score points	

FIGURE 2.7 Summaries of the seven proficiency levels on the scientific literacy scale

Students placed at Level 5 or 6 on the scientific literacy scale (scoring 633 points or higher) are considered high performers. These students are highly proficient and demonstrate high levels of skills and knowledge in scientific literacy. Students placed at the highest proficiency level, Level 6, are able to successfully complete challenging tasks that rely on their depth of science knowledge and competencies. Students who achieved at this level are likely to be able to complete tasks located at this level as well as all other tasks located in the lower levels on the scientific literacy scale.

In PISA, Level 2 is considered the international baseline proficiency level and defines the level of achievement on the scientific literacy scale at which students begin to demonstrate the scientific knowledge and skills that will enable them to participate actively in life situations related to science and technology.

Students who are placed below Level 2, scoring less than 410 points, are considered low performers. These students have low levels of cognitive ability in scientific literacy. They are only able to recognise or explain simple scientific phenomena and understand basic scientific terms. These lower levels of skills and knowledge in scientific literacy will reduce these individuals' capacity to be adequately equipped to make informed decisions about science-related issues. Students who performed at Level 1b or below are considered to be lacking the necessary scientific literacy skills to participate fully in society beyond school.

In Australia, the nationally agreed proficient standard (as agreed in *Measurement Framework for Schooling in Australia*) is Level 3 on the PISA proficiency scale. This level was chosen because it 'represents a "challenging but reasonable" expectation of student achievement at a year level with students needing to demonstrate more than elementary skills expected at that year level' (ACARA, 2015, p. 5). Students performing at or above Level 3 have achieved the National Proficient Standard.

Interpreting differences in PISA scores: how big is 'big'?

How do we go about understanding the difference in average scientific literacy scores between two groups of students? The following comparisons can help in judging the magnitude of score differences.

In terms of proficiency levels

A difference of about 75 points represents one proficiency level on the PISA scientific literacy scale. In substantive terms, this can be considered a comparatively large difference in student performance. For example, compare the skill sets for those students who are proficient at Level 2 and those students who are proficient at Level 3. Students who perform at Level 2 on the scientific literacy scale have adequate scientific knowledge to provide possible explanations in familiar contexts and are able to draw conclusions based on simple investigations. Students who reach Level 3 are proficient with the tasks at Level 2 and can also identify clearly described scientific issues in a range of contexts and can interpret and use scientific concepts from different disciplines and can apply them directly.

In terms of schooling

It is possible to estimate the score point difference that is associated with one year of schooling. This difference can be estimated for Australia because the Australian PISA 2015 sample included a sizeable number of students from different school year levels. Analyses of these data indicate that the difference between two year levels is, on average, around 30 points on the PISA scientific literacy scale.

Australia's scientific literacy results from an international perspective

Scientific literacy performance in PISA 2015

In PISA 2015, Australian students achieved an average score of 510 points in scientific literacy. This was significantly higher than for students across OECD countries, who achieved an average of 493 points.

Australia was one of 24 countries or economies[23] (18 OECD: Japan, Estonia, Finland, Canada, Korea, New Zealand, Slovenia, Australia, the United Kingdom, Germany, the Netherlands, Switzerland, Ireland, Belgium, Denmark, Poland, Portugal and Norway; 6 partner: Singapore, Chinese Taipei, Macao (China), Vietnam, Hong Kong (China) and B-S-J-G (China)) to achieve an average score that was significantly higher than the OECD average. Seven OECD countries (the United States, Austria, France, Sweden, the Czech Republic, Spain and Latvia) performed at a level not significantly different to the OECD average. All other countries, including 10 OECD countries (Luxembourg, Italy, Hungary, Iceland, Israel, the Slovak Republic, Greece, Chile, Turkey and Mexico) as well as a number of other partner countries performed significantly lower than the OECD average.

Singapore achieved the highest average score in scientific literacy with a score of 556 points, which was significantly higher than any other participating country. Singapore's score was almost one proficiency level higher than the OECD average, and equal to about two years of schooling. Japan, Estonia, Finland and Canada were the highest performing OECD countries with scores that were the equivalent of around one year of schooling higher than the OECD average.

Australian students' performance in scientific literacy was significantly below 9 countries (4 OECD: Japan, Estonia, Finland and Canada; 5 partner countries: Singapore, Chinese Taipei, Macao (China), Vietnam and Hong Kong (China)). Australia's score was equivalent to around one-and-a-half years of schooling lower compared to Singapore's. Australia's performance was not significantly different from that of 8 countries (7 OECD: Korea, New Zealand, Slovenia, the United Kingdom, Germany, the Netherlands and Switzerland; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 51 countries, including 23 OECD countries.

The difference in scientific literacy performance between the highest and lowest performing OECD countries was 122 points, which is equivalent to around four years of schooling, while the difference in performance among partner countries was even larger.

The gap between the 5th and 95th percentiles for the OECD countries was 309 points. However, the difference in scores between the lowest and highest achieving students varied considerably within the different countries. Among the OECD countries, students with the broadest range of abilities were from Israel (346 points), New Zealand (341 points), Sweden and Australia (each 336 points), while students with the narrowest range of abilities were from Mexico (234 points) and Turkey (258 points).

Among the high-performing partner countries, Singapore (340 points) and Chinese Taipei (326 points) had larger differences between their lowest and highest performers compared to Macao (China) (267 points), Hong Kong (China) (266 points), and Vietnam (251 points), which had smaller differences between their lowest and highest performers.

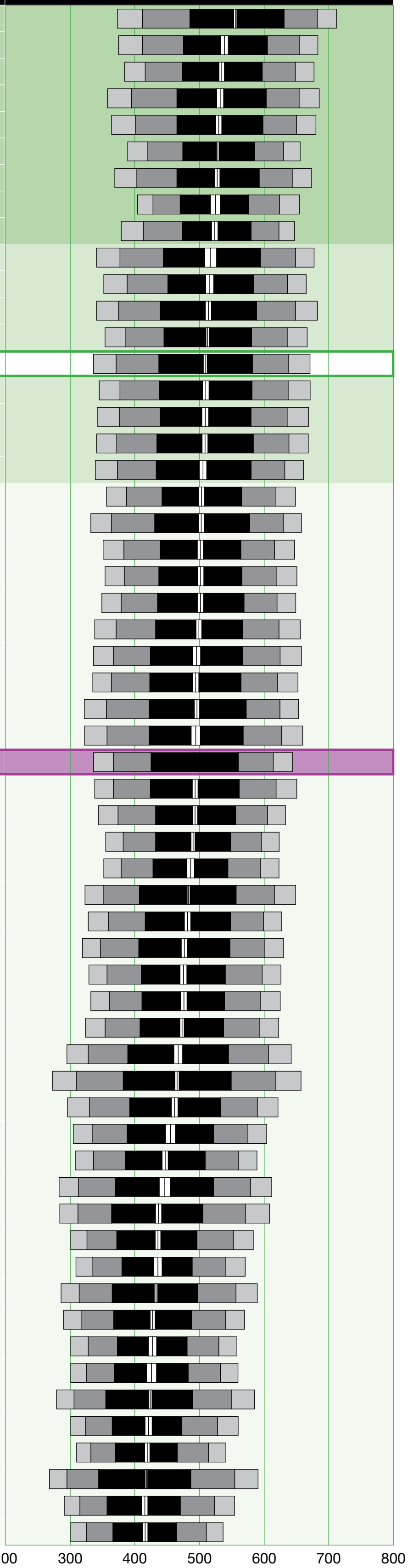
Figure 2.8 lists the average scientific literacy scores, along with the standard errors, confidence intervals around the average, and the difference between the 5th and 95th percentiles. It also shows the graphical distribution of student performance. Countries are shown in order from the highest to the lowest average scientific literacy score and the three colour bands indicate whether a particular country has performed at a significantly higher or lower level or whether they performed at a level not significantly different to Australia. Although there were 72 participating countries in PISA 2015, countries which achieved an average score lower than Mexico, the lowest performing OECD country, were not included.[24]

23 For ease of reading, economic regions such as B-S-J-G (China) are referred to as countries.

24 Results for countries that achieved an average score lower than Mexico (416 points) have not been included in this chapter. These countries are Montenegro, Georgia, Jordan, Indonesia, Brazil, Peru, Lebanon, Tunisia, the Former Yugoslav Republic of Macedonia, Kosovo, Algeria and the Dominican Republic. Results for Argentina, Malaysia and Kazakhstan have not been reported because their coverage was too small to ensure comparability.

	Country	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Significantly higher than Australia	Singapore	556	1.2	553–558	340
	Japan	538	3.0	533–544	308
	Estonia	534	2.1	530–538	293
	Chinese Taipei	532	2.7	527–538	327
	Finland	531	2.4	526–535	316
	Macao (China)	529	1.1	526–531	267
	Canada	528	2.1	524–532	305
	Vietnam	525	3.9	517–532	251
	Hong Kong (China)	523	2.5	518–528	266
Not significantly different from Australia	B-S-J-G (China)	518	4.6	509–527	336
	Korea	516	3.1	510–522	313
	New Zealand	513	2.4	509–518	341
	Slovenia	513	1.3	510–515	312
	Australia	**510**	**1.5**	**507–513**	**336**
	United Kingdom	509	2.6	504–514	326
	Germany	509	2.7	504–514	326
	Netherlands	509	2.3	504–513	327
	Switzerland	506	2.9	500–511	322
Significantly lower than Australia	Ireland	503	2.4	498–507	292
	Belgium	502	2.3	498–506	325
	Denmark	502	2.4	497–507	296
	Poland	501	2.5	497–506	296
	Portugal	501	2.4	496–506	299
	Norway	498	2.3	494–503	317
	United States	496	3.2	490–502	322
	Austria	495	2.4	490–500	317
	France	495	2.1	491–499	330
	Sweden	493	3.6	486–500	336
	OECD average	**493**	**0.4**	**492–494**	**309**
	Czech Republic	493	2.3	488–497	311
	Spain	493	2.1	489–497	289
	Latvia	490	1.6	487–493	269
	Russian Federation	487	2.9	481–492	271
	Luxembourg	483	1.1	481–485	326
	Italy	481	2.5	476–485	299
	Hungary	477	2.4	472–481	311
	Lithuania	475	2.7	470–481	297
	Croatia	475	2.5	471–480	292
	Iceland	473	1.7	470–477	298
	Israel	467	3.4	460–473	346
	Malta	465	1.6	462–468	384
	Slovak Republic	461	2.6	456–466	325
	Greece	455	3.9	447–463	299
	Chile	447	2.4	442–452	281
	Bulgaria	446	4.4	437–454	328
	United Arab Emirates	437	2.4	432–441	324
	Uruguay	435	2.2	431–440	282
	Romania	435	3.2	429–441	261
	Cyprus	433	1.4	430–435	304
	Moldova	428	2.0	424–432	280
	Albania	427	3.3	421–434	257
	Turkey	425	3.9	418–433	258
	Trinidad and Tobago	425	1.4	422–427	306
	Thailand	421	2.8	416–427	258
	Costa Rica	420	2.1	416–424	231
	Qatar	418	1.0	416–420	321
	Colombia	416	2.4	411–420	263
	Mexico	416	2.1	412–420	234

Distribution of scores



Note: refer to the Reader's Guide for the interpretation of this graph. This applies to all graphs with similar formatting in this chapter.

FIGURE 2.8 Average scores and distribution of students' performance on the scientific literacy scale, by country

Scientific literacy proficiency in PISA 2015

Proficiency levels provide further meaning about students' ability in scientific literacy. There are seven levels of described proficiency in the PISA 2015 scientific literacy assessment, which range from Level 6 (highest proficiency) to Level 1b (lowest proficiency).

Figure 2.9 shows the proportion of students at each scientific literacy level from below Level 1b to Level 6, by country. Countries have been ordered by the percentage of students performing below Level 2, which is the internationally assigned baseline benchmark. Countries with the lowest proportion of students below Level 2 are placed at the top of the figure and countries with the highest proportion of students below Level 2 are placed at the bottom.

High performers

The students who demonstrated the highest levels of proficiency – Level 5 or 6 – are referred to as high performers and are proficient learners of scientific literacy. On average, 8% of students across the OECD countries were high performers. Singapore was the highest performing country in scientific literacy with 24% of high performers, while there were 14 countries (Chinese Taipei, Japan, Finland, B-S-J-G (China), Estonia, New Zealand, Canada, Australia, the Netherlands, the United Kingdom, Korea, Slovenia, Germany and Switzerland) which had between 10% and 15% of high performers. All other countries had fewer than 10% of students who were high performers, with less than 1% of students in Thailand, Albania, Colombia, Turkey, Costa Rica and Mexico being high performers.

Students who achieved scores higher than 708 points were placed at proficiency Level 6. These students were highly proficient in scientific literacy, were capable of drawing on a range of interrelated scientific ideas and concepts from the sciences, and were able to use content, procedural and epistemic knowledge in order to offer explanatory hypotheses of novel scientific phenomena, events and processes or to make predictions. They were able to discriminate between relevant and irrelevant information and could draw on knowledge external to the normal school curriculum. They could distinguish between arguments that were based on scientific evidence and theory and those based on other considerations, and they could evaluate competing designs of complex experiments, field studies or simulations and justify their choices.

On average, 1% of students across OECD countries achieved Level 6. In Singapore, 6% of students achieved this highest level, and New Zealand and Chinese Taipei had the next highest proportion with 3% of students. Australia was among one of 11 countries with 2% of students who achieved Level 6. Over 40 countries had fewer than 1% of students who achieved Level 6. Hong Kong (China) and Macao (China) were two of these countries.

Students who were proficient at Level 5 were capable of using abstract scientific ideas or concepts to explain unfamiliar and more complex phenomena, events and processes involving multiple causal links. They applied more sophisticated epistemic knowledge to evaluate alternative experimental designs and justify their choices and use theoretical knowledge to interpret information or make predictions. They were also able to evaluate ways of exploring a given question scientifically and identify limitations of data sets, including sources and the effects of uncertainty in scientific data.

Low performers

In PISA, Level 2 is considered the baseline level of scientific literacy proficiency. Students who do not reach this level are considered to have limited skills that will prevent them from actively participating successfully in life situations related to science. Students who do not achieve Level 2 are considered low performers.

On average, 21% of students across OECD countries did not attain Level 2. In some of the lowest performing countries (Qatar, Colombia, Mexico, Thailand, Costa Rica, Trinidad and Tobago, Turkey, Moldova, Cyprus, the United Arab Emirates, Albania, and Uruguay), between 40% and 50% of their students were low performers. In Australia, 18% of students failed to reach Level 2; countries that performed significantly higher than Australia had between 6% and 12% of low performers.

The proficiency of low-performing students suggests that their capabilities would not extend beyond Level 1a. Students proficient at Level 1a were able to use basic or everyday content and procedural knowledge to recognise or identify explanations of simple scientific phenomenon. With support, they could undertake structured scientific enquiries with no more than two variables, and they were able to identify simple causal or correctional relationships and interpret graphical and visual data that required a low level of cognitive demand. They were capable of selecting the best scientific explanations for given data in familiar personal, local and global contexts.

On average, 16% of students across the OECD performed at Level 1a. In Australia, 13% of students achieved this level compared to between 6% and 9% of students in the countries who performed significantly higher than Australia. Costa Rica, Mexico, Thailand, Colombia, Turkey and Albania had the highest proportion of students placed at Level 1a, with between 30% and 36% of students.

Students proficient at Level 1b were only capable of using basic or everyday scientific knowledge to recognise familiar or simple phenomenon, and were able to identify simple patterns in data, recognise basic scientific terms and follow explicit instructions to carry out a scientific procedure.

On average, 5% of students across the OECD performed at this level. In Australia, this proportion was 4%, while the proportion of students from countries which performed significantly higher than Australia was 3% or lower.

The proficiency of students who performed below Level 1b cannot be described in terms of what tasks they were capable of performing; however, these students would have limited or very limited skills and knowledge in scientific literacy, and it would be unlikely that these students could correctly complete any of the scientific literacy items.

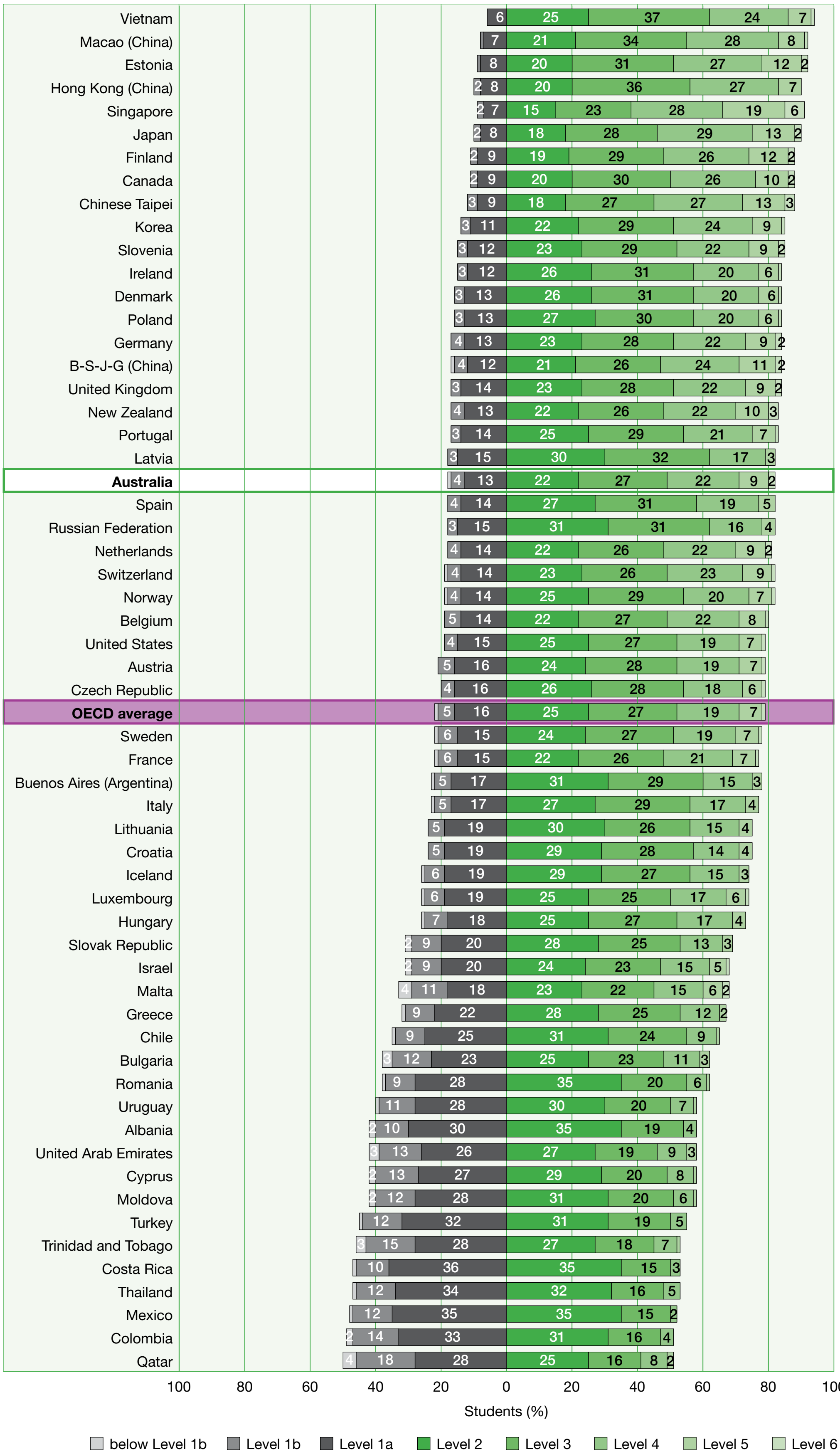
The proportion of students in Australia who placed below Level 1b was similar to the proportion of students across OECD counties (0.56% and 0.59% respectively). Almost 30 countries had fewer than 1% of students placed below Level 1b, while Qatar and Malta had 4%, the highest proportion of students at this level.

Middle performers

Students who were neither high nor low performers attained a proficiency of Level 2, 3 or 4, and are also referred to as middle performers. On average, around three-quarters (71%) of the students across OECD countries performed at these levels. The majority of students in Vietnam (86%) and in Hong Kong (China) and Macao (China) (83%) were middle performers, while 66% of students in Singapore and 71% of students in Australia attained these levels.

Students who achieved the National Proficient Standard

In Australia, the National Proficient Standard is set at Level 3 and represents a baseline proficiency that students are expected to demonstrate in scientific literacy. Sixty-one per cent of Australian students achieved the National Proficient Standard (Level 3 or above) in scientific literacy, which was higher than 54% of students across OECD countries. Countries that performed significantly higher than Australia had between 69% and 75% of students who reached Level 3 or above.



Note: If the proportion of students in a proficiency level is one per cent or less, the level still appears in the figure but the numeric label '1' does not. This convention has been used for all figures about proficiency levels in this chapter.

FIGURE 2.9 Percentage of students across the scientific literacy proficiency scale, by country

TABLE 2.4 Average scientific literacy performance over time, PISA 2006 to 2015, and differences between 2006 and 2015, and between 2012 and 2015, by country

Country	PISA 2006 Avg. score	PISA 2006 SE	PISA 2009 Avg. score	PISA 2009 SE	PISA 2012 Avg. score	PISA 2012 SE	PISA 2015 Avg. score	PISA 2015 SE	Average score difference between 2006 and 2015 (PISA 2015 – PISA 2006) Score dif.		SE	Average score difference between 2012 and 2015 (PISA 2015 – PISA 2012) Score dif.		SE
Albania	✧	✧	391	3.9	397	2.4	427	3.3	✧		✧	**30**	▲	5.7
Australia	527	2.3	527	2.5	521	1.8	510	1.5	**–17**	▼	5.2	**–12**	▼	4.6
Austria	511	3.9	✧	✧	506	2.7	495	2.4	**–16**	▼	6.4	**–11**	▼	5.4
Belgium	510	2.5	507	2.5	505	2.2	502	2.3	–8		5.6	–3		5.0
Bulgaria	434	6.1	439	5.9	446	4.8	446	4.4	12		8.7	–1		7.6
Canada	534	2.0	529	1.6	525	1.9	528	2.1	–7		5.3	2		4.8
Chile	438	4.3	447	2.9	445	2.9	447	2.4	9		6.7	2		5.4
Chinese Taipei	532	3.6	520	2.6	523	2.3	532	2.7	0		6.3	9		5.3
Colombia	388	3.4	402	3.6	399	3.1	416	2.4	**28**	▲	6.1	**17**	▲	5.5
Costa Rica	✧	✧	430	2.8	429	2.9	420	2.1	✧		✧	–10		5.3
Croatia	493	2.4	486	2.8	491	3.1	475	2.5	**–18**	▼	5.7	**–16**	▼	5.6
Cyprus	✧	✧	✧	✧	438	1.2	433	1.4	✧		✧	–5		4.3
Czech Republic	513	3.5	500	3.0	508	3.0	493	2.3	**–20**	▼	6.1	**–15**	▼	5.4
Denmark	496	3.1	499	2.5	498	2.7	502	2.4	6		5.9	3		5.3
Estonia	531	2.5	528	2.7	541	1.9	534	2.1	3		5.6	–7		4.9
Finland	563	2.0	554	2.3	545	2.2	531	2.4	**–33**	▼	5.5	**–15**	▼	5.1
France	495	3.4	498	3.6	499	2.6	495	2.1	0		6.0	–4		5.1
Germany	516	3.8	520	2.8	524	3.0	509	2.7	–7		6.5	**–15**	▼	5.6
Greece	473	3.2	470	4.0	467	3.1	455	3.9	**–19**	▼	6.8	–12		6.4
Hong Kong (China)	542	2.5	549	2.8	555	2.6	523	2.5	**–19**	▼	5.7	**–32**	▼	5.4
Hungary	504	2.7	503	3.1	494	2.9	477	2.4	**–27**	▼	5.8	**–18**	▼	5.5
Iceland	491	1.6	496	1.4	478	2.1	473	1.7	**–18**	▼	5.1	–5		4.8
Ireland	508	3.2	508	3.3	522	2.5	503	2.4	–6		6.0	**–19**	▼	5.2
Israel	454	3.7	455	3.1	470	5.0	467	3.4	13		6.8	–4		7.2
Italy	475	2.0	489	1.8	494	1.9	481	2.5	5		5.5	**–13**	▼	5.0
Japan	531	3.4	539	3.4	547	3.6	538	3.0	7		6.3	–8		6.1
Korea	522	3.4	538	3.4	538	3.7	516	3.1	–6		6.4	**–22**	▼	6.2
Latvia	490	3.0	494	3.1	502	2.8	490	1.6	1		5.6	**–12**	▼	5.0
Lithuania	488	2.8	491	2.9	496	2.6	475	2.7	**–13**	▼	5.9	**–20**	▼	5.4
Luxembourg	486	1.1	484	1.2	491	1.3	483	1.1	–4		4.7	**–8**	▼	4.3
Macao (China)	511	1.1	511	1.0	521	0.8	529	1.1	**18**	▲	4.7	8		4.2
Mexico	410	2.7	416	1.8	415	1.3	416	2.1	6		5.7	1		4.7
Netherlands	525	2.7	522	5.4	522	3.5	509	2.3	**–16**	▼	5.7	**–13**	▼	5.7
New Zealand	530	2.7	532	2.6	516	2.1	513	2.4	**–17**	▼	5.7	–2		5.1
Norway	487	3.1	500	2.6	495	3.1	498	2.3	**12**	▲	5.9	4		5.5
Poland	498	2.3	508	2.4	526	3.1	501	2.5	4		5.6	**–24**	▼	5.6
Portugal	474	3.0	493	2.9	489	3.7	501	2.4	**27**	▲	5.9	**12**	▲	5.9
Qatar	349	0.9	379	0.9	384	0.7	418	1.0	**68**	▲	4.7	**34**	▲	4.1
Romania	418	4.2	428	3.4	439	3.3	435	3.2	**16**	▲	6.9	–4		6.0
Russian Federation	479	3.7	478	3.3	486	2.9	487	2.9	7		6.5	0		5.7
Singapore	✧	✧	542	1.4	551	1.5	556	1.2	✧		✧	4		4.4
Slovak Republic	488	2.6	490	3.0	471	3.6	461	2.6	**–28**	▼	5.8	–10		5.9
Slovenia	519	1.1	512	1.1	514	1.3	513	1.3	–6		4.8	–1		4.3
Spain	488	2.6	488	2.1	496	1.8	493	2.1	4		5.6	–4		4.8
Sweden	503	2.4	495	2.7	485	3.0	493	3.6	–10		6.2	9		6.1
Switzerland	512	3.2	517	2.8	515	2.7	506	2.9	–6		6.2	–10		5.6
Thailand	421	2.1	425	3.0	444	2.9	421	2.8	0		5.7	**–23**	▼	5.7
Turkey	424	3.8	454	3.6	463	3.9	425	3.9	2		7.1	**–38**	▼	6.8
United Arab Emirates	✧	✧	✧	✧	448	2.8	437	2.4	✧		✧	**–12**	▼	5.4
United Kingdom	515	2.3	514	2.5	514	3.4	509	2.6	–6		5.6	–5		5.8
United States	489	4.2	502	3.6	497	3.8	496	3.2	7		6.9	–1		6.3
Uruguay	428	2.7	427	2.6	416	2.8	435	2.2	7		5.7	**20**	▲	5.3
Vietnam	✧	✧	✧	✧	528	4.3	525	3.9	✧		✧	–4		7.0
OECD average 2006	498	0.5	✧	✧	501	0.5	493	0.4	–5		4.5	**–8**	▼	4.0

Notes: The symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
✧ Did not participate in this cycle or comparisons cannot be made.
Countries that did not participate in PISA 2006 or 2012 have not been included.

Scientific literacy performance over time

Table 2.4 shows the average scores on scientific literacy performance for PISA 2006, 2009, 2012 and 2015, along with the differences in average scores between PISA 2006 and 2015, and between PISA 2012 and 2015.

In PISA 2015, the OECD average was 493 points, which was not significantly different from the OECD average in PISA 2006 (498 points). However, there was a significant decrease of 8 points in the OECD average from PISA 2012 (501 points) to PISA 2015.

Between PISA 2006 and 2015, 6 countries (Qatar, Colombia, Portugal, Macao (China), Romania and Norway) showed a significant improvement in their scientific literacy performance. Thirteen countries (Finland, Slovak Republic, Hungary, Czech Republic, Hong Kong (China), Greece, Croatia, Iceland, New Zealand, Australia, the Netherlands, Austria and Lithuania) showed a significant decline in their scientific literacy performance. Australia's average performance in 2006 was 527 points, which declined by 17 points to 510 points in 2015.

Between PISA 2012 and 2015, 5 countries (Qatar, Albania, Uruguay, Colombia and Portugal) showed a significant improvement in their scientific literacy performance and 19 countries (Luxembourg, Austria, Australia, the United Arab Emirates, Latvia, Italy, the Netherlands, Finland, Germany, the Czech Republic, Croatia, Hungary, Ireland, Lithuania, Korea, Thailand, Poland, Hong Kong (China) and Turkey) showed a significant decline in their scientific literacy performance. Australia's average performance in 2012 was 521 points, which declined by 12 points in 2015.

Table 2.5 shows the relative positions of participating countries to Australia's in scientific literacy performance from PISA 2006 to 2015. Countries are shown in order from the highest to the lowest performing country in scientific literacy in 2015.[25]

- There were 34 countries whose scientific literacy performance has been consistently significantly lower than Australia's performance across the PISA cycles (21 OECD: Austria, Belgium, Chile, the Czech Republic, Denmark, France, Greece, Hungary, Iceland, Israel, Italy, Latvia, Luxembourg, Mexico, Norway, Portugal, Slovak Republic, Spain, Sweden, Turkey, and the United States; 13 partner: Albania, Bulgaria, Colombia, Costa Rica, Croatia, Lithuania, Qatar, Romania, the Russian Federation, Serbia, Thailand, the United Arab Emirates, and Uruguay). Ireland's and Poland's performances have been significantly lower than Australia's performance across all cycles, except in PISA 2012, when both countries' performances were not significantly different to that of Australia.
- The performance of Finland, Hong Kong (China), Shanghai (China) and Singapore has been consistently significantly higher than Australia's, while the performances of the Netherlands and Liechtenstein have consistently been not significantly different to Australia's.
- The performances of a number of countries relative to Australia have changed over time.
  - Canada's performance was significantly higher than Australia's in 2006 and 2015; however, its performance was not significantly different to Australia's between 2009 and 2012.
  - There were 5 countries (Germany, Macao (China), Slovenia, Switzerland and the United Kingdom) whose performance was significantly lower than Australia's in 2006; however, in 2015 the performances of Germany, Slovenia, Switzerland and the United Kingdom were not significantly different to Australia's, while that of Macao (China) was significantly higher than Australia's.
  - The performances of Japan, Estonia and Chinese Taipei in 2006 were on par with that of Australia, but each country's performance was significantly higher in 2015.
  - The performances of Korea and New Zealand in 2006 and 2015 were not significantly different to that of Australia.

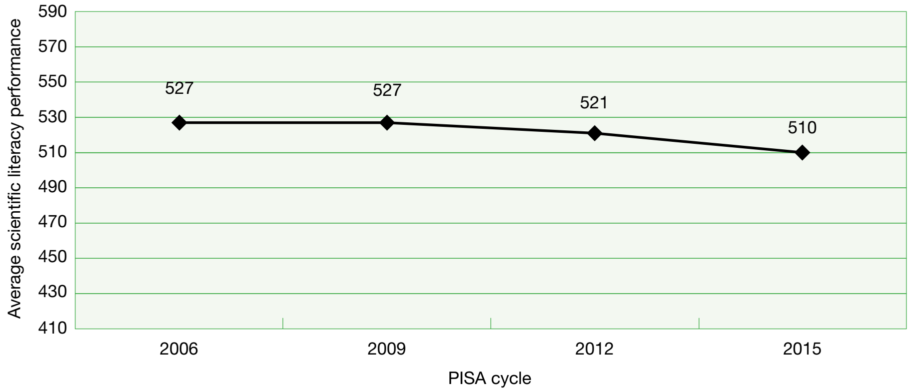
25 With the exceptions of Liechtenstein, Serbia and Shanghai (China), which are placed at the bottom of the table as they did not participate in PISA 2015, or did not participate in PISA 2015 as the same entity.

TABLE 2.5 Relative trends in scientific literacy performance, by country

	Position relative to Australia in			
Country	PISA 2015	PISA 2012	PISA 2009	PISA 2006
Singapore	▲	▲	▲	–
Japan	▲	▲	▲	●
Estonia	▲	▲	●	●
Chinese Taipei	▲	●	●	▲
Finland	▲	▲	▲	▲
Macao (China)	▲	●	▼	▼
Canada	▲	●	●	▲
Hong Kong (China)	▲	▲	▲	▲
Korea	●	▲	▲	●
New Zealand	●	▼	●	●
Slovenia	●	▼	▼	▼
Australia				
United Kingdom	●	●	▼	▼
Germany	●	●	●	▼
Netherlands	●	●	●	●
Switzerland	●	●	▼	▼
Ireland	▼	●	▼	▼
Belgium	▼	▼	▼	▼
Denmark	▼	▼	▼	▼
Poland	▼	●	▼	▼
Portugal	▼	▼	▼	▼
Norway	▼	▼	▼	▼
United States	▼	▼	▼	▼
Austria	▼	▼	–	▼
France	▼	▼	▼	▼
Sweden	▼	▼	▼	▼
Czech Republic	▼	▼	▼	▼
Spain	▼	▼	▼	▼
Latvia	▼	▼	▼	▼
Russian Federation	▼	▼	▼	▼
Luxembourg	▼	▼	▼	▼
Italy	▼	▼	▼	▼
Hungary	▼	▼	▼	▼
Lithuania	▼	▼	▼	▼
Croatia	▼	▼	▼	▼
Iceland	▼	▼	▼	▼
Israel	▼	▼	▼	▼
Slovak Republic	▼	▼	▼	▼
Greece	▼	▼	▼	▼
Chile	▼	▼	▼	▼
Bulgaria	▼	▼	▼	▼
United Arab Emirates	▼	▼	▼	–
Uruguay	▼	▼	▼	▼
Romania	▼	▼	▼	▼
Albania	▼	▼	▼	–
Turkey	▼	▼	▼	▼
Thailand	▼	▼	▼	▼
Costa Rica	▼	▼	▼	–
Qatar	▼	▼	▼	▼
Colombia	▼	▼	▼	▼
Mexico	▼	▼	▼	▼
Liechtenstein	–	●	●	●
Serbia	–	▼	▼	▼
Shanghai (China)	–	▲	▲	–

Notes: ▲ Score signficantly higher than Australia's
● Score not significantly different to that of Australia's
▼ Score signficantly lower than Australia's
– Did not participate in this cycle or comparisons cannot be made
B-S-J-G (China), Cyprus, Malta, Trinidad and Tobago, and Vietnam have not been included in this table

Figure 2.10 shows Australia's performance in scientific literacy across the four PISA cycles, from 2006 to 2015. Australia's average score in scientific literacy declined significantly by 17 points: from 527 points in PISA 2006 to 510 points in 2015. There was also a significant decline in scientific literacy performance between 2009 and 2015 (by 17 points), and between 2012 and 2015 (by 12 points).



	Difference between years					
	2012		2009		2006	
2015	–12	▼	–17	▼	–17	▼
2012			–6		–5	
2009					0	

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.10 Average scientific literacy performance and differences over time, PISA 2006 to 2015, for Australia

Figure 2.11 shows that there was little change in each of the percentiles between 2006 and 2012, meaning that Australia's performance remained constant; however, there was a significant decline in performance at the 10th, 25th and 90th percentiles between 2012 and 2015. There was a 19-point decline at the 10th percentile, a 15-point decline at the 25th percentile and a 10-point decline at the 90th percentile.

Between 2006 and 2015, performances at the 10th and 25th percentiles declined by approximately 20 points, and performances at the 75th and 90th percentiles declined by around 15 points. These results show that the performance of both the highest and the lowest performing students have declined over this period.

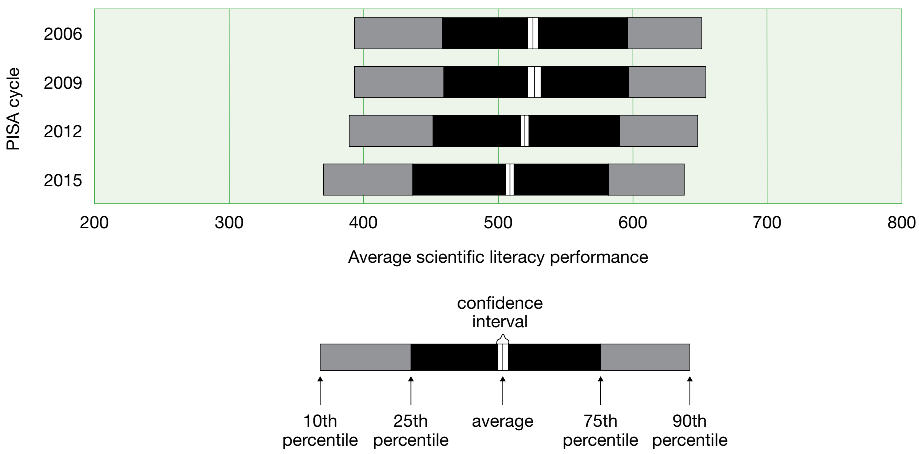


FIGURE 2.11 Distribution of students' performance on the scientific literacy scale over time, PISA 2006 to 2015, for Australia

Scientific literacy proficiency over time

Figure 2.12 shows the proportions of low and high performers for countries which participated in PISA 2006 and 2015. There were a number of countries in which the proportion of low performers and proportion of high performers changed significantly between 2006 and 2015.

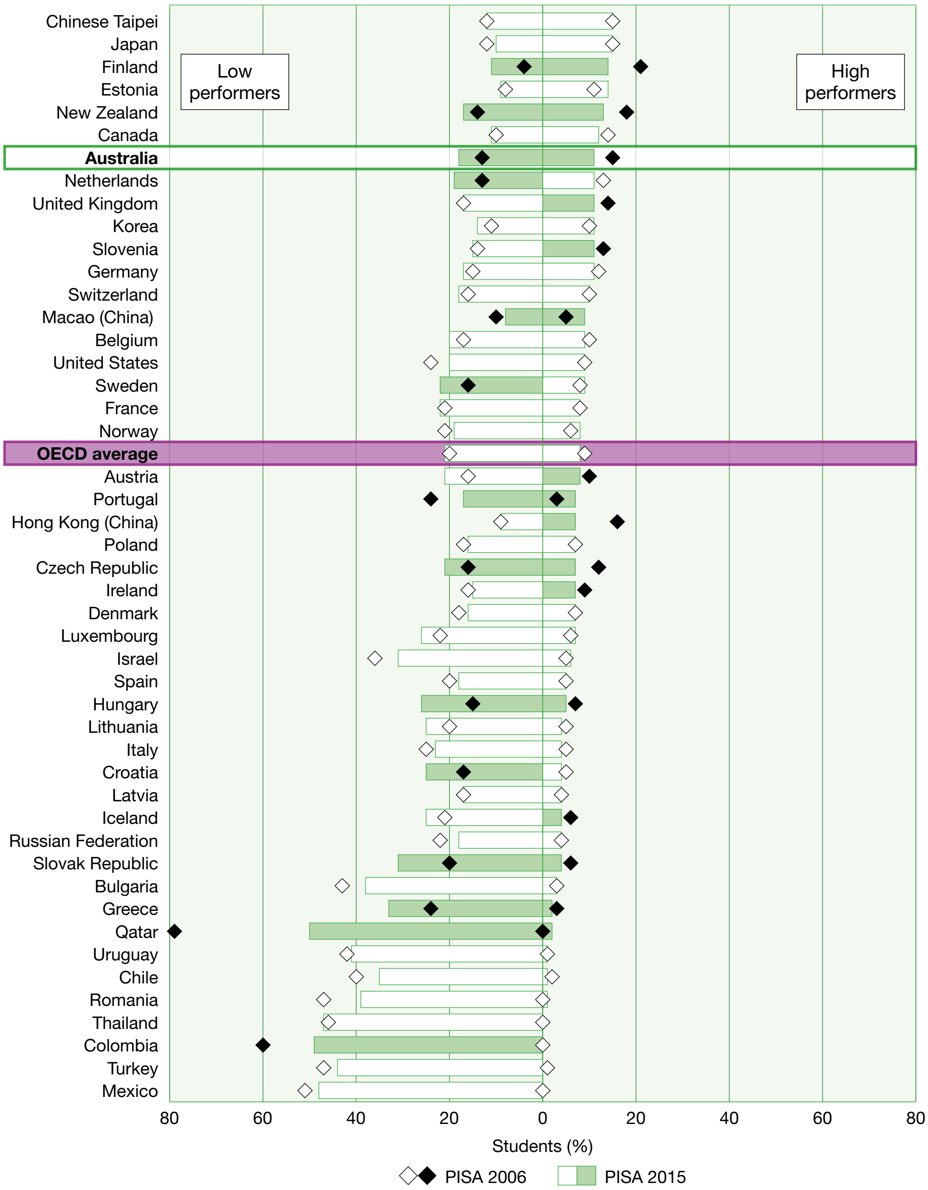
- In 7 countries (Australia, the Czech Republic, Finland, Greece, Hungary, New Zealand and the Slovak Republic), there were significantly higher proportions of low performers and significantly lower proportions of high performers in 2015 than in 2006. The increase in the proportion of low performers ranged from 4% in New Zealand to 11% in the Slovak Republic and Hungary. The decrease in the proportion of high performers ranged from 1% in Greece to 5% in New Zealand. In Australia in 2015, the proportion of low performers increased by 5% to 18%, and the proportion of high performers declined by 3% to 11%.
- In 3 countries (Macao (China), Portugal and Qatar), there were significantly lower proportions of lower performers and significantly higher proportions of high performers in 2015 than in 2006. The decrease for low performers ranged from 2% in Macao (China) to 29% in Qatar, while the increase for high performers was 1% in Qatar to 4% in Macao (China) and Portugal.

There were a number of countries whose proportions of low performers or proportions of high performers changed significantly between 2006 and 2015.

- In 6 countries (Austria, Hong Kong (China), Iceland, Ireland, Slovenia and the United Kingdom), there were significant decreases in the proportions of high performers between 2006 and 2015. The decrease of high performers ranged from 2% in Austria, Ireland and Slovenia to 9% in Hong Kong (China).
- In Croatia, the Netherlands and Sweden, there were significant increases in the proportion of low performers between 2006 and 2015, which ranged from 5% in Sweden to 8% in Croatia, while in Colombia, the proportion of low performers significantly decreased by 11%.

As previously noted, there was a decrease in the proportion of high performers in Australia, from 15% in 2006 to 11% in 2015, and an increase in the proportion of low performers from 13% in 2006 to 18% in 2015. Figure 2.13 provides more details about the proportion of students in each of the proficiency levels for the four PISA cycles. For 2006 and 2012, the proportion of students in each of the proficiency levels remained constant, while between 2015 and the previous cycles, there was a general downward shift of students from the top end to the lower end of the proficiency scale, that is, there were fewer high and middle performers and more low performers in scientific literacy.

In 2015, 61% of Australian students achieved the National Proficient Standard in scientific literacy compared to 67% in 2006.



Notes: Only countries that participated in both PISA 2006 and 2015 are shown. Countries are ordered in descending order of the percentage of high performers. A coloured bar and a black diamond indicate that the difference in the proportion of students between PISA 2006 and 2015 is significant.

FIGURE 2.12 Percentage of low and high performers in scientific literacy for PISA 2006 and 2015, by country

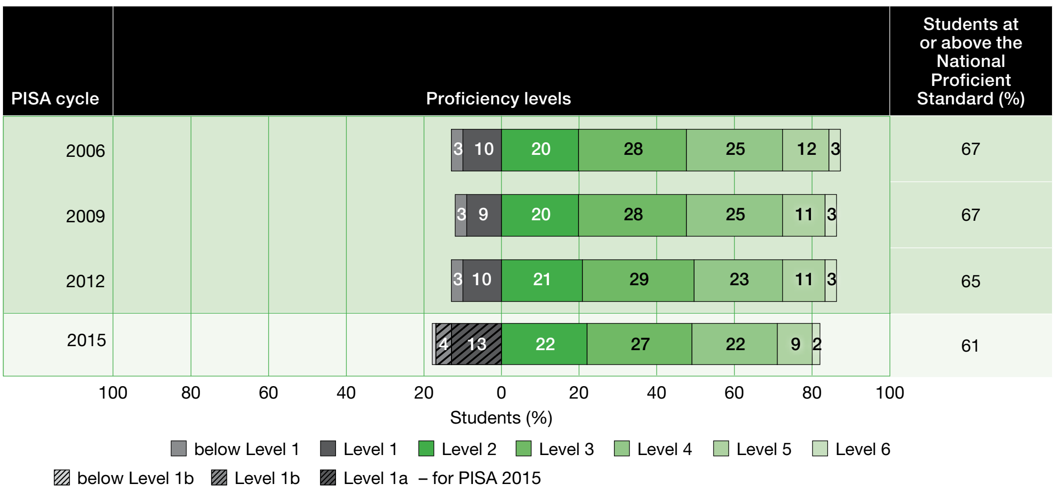


FIGURE 2.13 Percentage of students across the scientific literacy proficiency scale over time, PISA 2006 to 2015, for Australia

Australia's scientific literacy results in a national context

Scientific literacy results for PISA 2015 by jurisdiction

Scientific literacy performance

The scientific literacy performance for students in each of the Australian jurisdictions is shown in Figure 2.14 and Table 2.6. Figure 2.14 lists the average scores, together with the standard errors, confidence intervals around the average, the difference between the 5th and 95th percentiles, and shows the distribution of scientific literacy performance of each jurisdiction. The average scores and distributions for Australia, the OECD average and Singapore, the highest performing country in scientific literacy in PISA 2015, are included for comparison.

The average scores for scientific literacy in 2015 ranged from 527 points in the Australian Capital Territory to 483 points in Tasmania; the average score difference between these two jurisdictions was 44 points, which is around half a proficiency level or equal to around one-and-a-half years of schooling.

The Northern Territory displayed the widest distribution of scores, with a range of 365 points between the 5th and 95th percentiles. Western Australia and South Australia had the narrowest range, with 321 points and 322 points, respectively, separating the 5th and 95th percentiles.

Singapore performed significantly higher, by 29 points on average, than the highest performing jurisdiction, the Australian Capital Territory, and by 73 points on average compared to the lowest performing jurisdiction, Tasmania.

Jurisdiction	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
ACT	527	3.8	519–534	339
NSW	508	3.0	502–514	352
VIC	513	3.3	506–519	326
QLD	507	3.3	501–513	331
SA	508	3.9	500–516	322
WA	521	3.7	513–528	321
TAS	483	4.0	476–491	343
NT	489	5.9	478–501	365
Australia	**510**	**1.5**	**507–513**	**336**
OECD average	**493**	**0.4**	**492–494**	**309**
Singapore	556	1.2	553–558	340

FIGURE 2.14 Average scores and distribution of students' performance on the scientific literacy scale, by jurisdiction

Table 2.6 shows a pairwise comparison of average scientific literacy performance between any two jurisdictions.

- The Australian Capital Territory and Western Australia performed at a statistically similar level but performed significantly higher than New South Wales, South Australia, Queensland, the Northern Territory and Tasmania. The Australian Capital Territory performed significantly higher than Victoria; Western Australia also performed at a statistically similar level to Victoria.
- Victoria, New South Wales, South Australia and Queensland performed at a level not significantly different to one another.
- All jurisdictions performed significantly higher than the Northern Territory and Tasmania.
- The Northern Territory performed at a level that was statistically similar to Tasmania.
- Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia, and Queensland) performed at a significantly higher level than the OECD average (493 points). The Northern Territory's performance was not significantly different to the OECD average. Tasmania performed significantly lower than the OECD average.

TABLE 2.6 Multiple comparisons of average scientific literacy performance, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	527	3.8		●	▲	▲	▲	▲	▲	▲	▲
WA	521	3.7	●		●	▲	▲	▲	▲	▲	▲
VIC	513	3.3	▼	●		●	●	●	▲	▲	▲
NSW	508	3.0	▼	▼	●		●	●	▲	▲	▲
SA	508	3.9	▼	▼	●	●		●	▲	▲	▲
QLD	507	3.3	▼	▼	●	●	●		▲	▲	▲
NT	489	5.9	▼	▼	▼	▼	▼	▼		●	●
TAS	483	4.0	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.4**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Appendix C provides information about the scientific literacy performance of each jurisdiction compared to participating countries.

Scientific literacy proficiency

Figure 2.15 shows the proportion of students at each of the scientific literacy proficiency levels in each jurisdiction together with the percentages for Australia, Singapore and the OECD average.

High performers

- The Australian Capital Territory was the jurisdiction with the highest proportion of high performers (14%) compared to Singapore (24%).
- New South Wales, Western Australia, Queensland and the Northern Territory each had a proportion of around 12% of high performers; Victoria and South Australia each had 10%.
- Tasmania had a proportion of 9% of high performers, which was similar to the OECD average of 8%.

Around three per cent of students from the Australian Capital Territory, Queensland and New South Wales achieved Level 6, which is the highest scientific literacy proficiency level, compared to 6% in Singapore. Five jurisdictions (Victoria, South Australia, Western Australia and the Northern Territory) had 2% of students who had achieved Level 6. Only 1% of students from Tasmania achieved Level 6, which was the same proportion as the OECD average.

Low performers

- Tasmania (27%) and the Northern Territory (26%) had the highest proportions of low performers.
- The Australian Capital Territory had a proportion of 14% of low performers, Western Australian had 15%, Victoria had 16%, South Australia had 17%, Queensland had 18% and New South Wales had 19%. All were lower than the OECD average.
- The proportions of low performers in Tasmania and the Northern Territory were higher than the OECD average (21%).

Students who placed at Level 1b demonstrated basic skills in scientific literacy, and students who placed below Level 1b demonstrated very limited skills in skills in scientific literacy. Eight per cent of students in Tasmania and the Northern Territory and 6% in New South Wales performed at Level 1b or below, which was also the proportion of students across OECD countries. For the other jurisdictions, the proportions were 5% in Queensland, 4% in the Australian Capital Territory, South Australia and Victoria, and 3% in Western Australia.

Students who achieved the National Proficient Standard

The proportion of students in each jurisdiction who achieved the National Proficient Standard in scientific literacy ranged from 48% in Tasmania to 68% in the Australian Capital Territory.

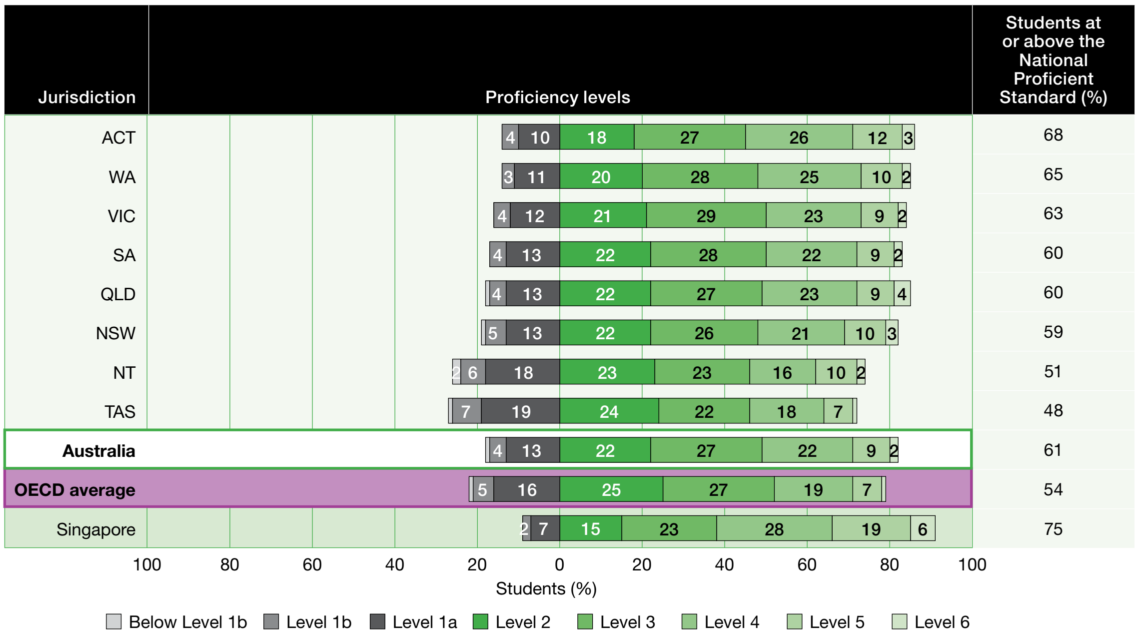


FIGURE 2.15 Percentage of students across the scientific literacy proficiency scale, by jurisdiction

Scientific literacy results over time by jurisdiction

Scientific literacy performance

Figure 2.16 shows the average performance in scientific literacy for each cycle since PISA 2006 by jurisdiction. In addition, it also shows the change in performance between two cycles, and indicates whether this change in performance is significant or not significant.

Comparing scientific literacy performance between one PISA cycle and the adjacent cycle, a period of 3 years, indicates that the changes in performance between 2006 and 2009, and between 2009 and 2012 in each jurisdiction were not significant.

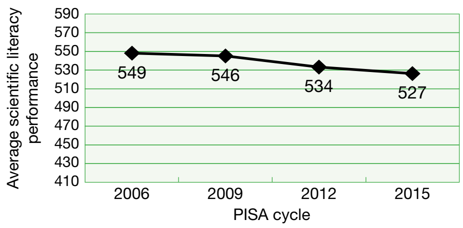
The average scientific literacy scores between PISA 2006 and 2015 show that, with the exception of Victoria and the Northern Territory, the other jurisdictions experienced a significant decline in scientific literacy performance in this period:

- Queensland's performance declined by 15 points (the smallest decline of any jurisdiction).
- the Australian Captain Territory's and Western Australia's performance each declined by 22 points.
- Tasmania's performance declined by 23 points.
- South Australia's performance declined by 24 points.
- New South Wales' performance declined by 27 points (the largest decline of any jurisdiction).

The changes in scientific literacy performance between 2012 and 2015 were significantly different in four jurisdictions:

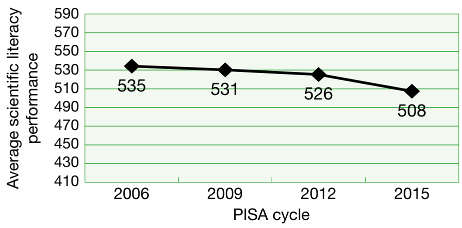
- Queensland's performance declined by 12 points.
- Western Australia's performance declined by 14 points.
- Tasmania's performance declined by 17 points.
- New South Wales' performance declined by 18 points.

Australian Capital Territory



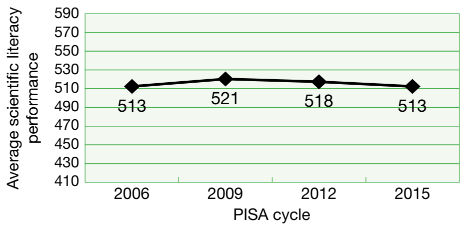
	Difference between years					
	2012		2009		2006	
2015	–7		–19	▼	–22	▼
2012			–12		–15	▼
2009					–3	

New South Wales



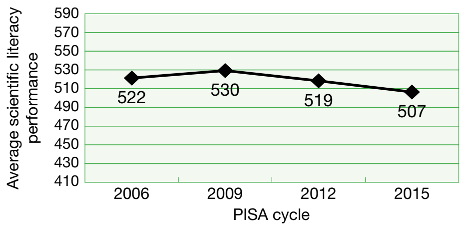
	Difference between years					
	2012		2009		2006	
2015	–18	▼	–23	▼	–27	▼
2012			–5		–9	
2009					–4	

Victoria



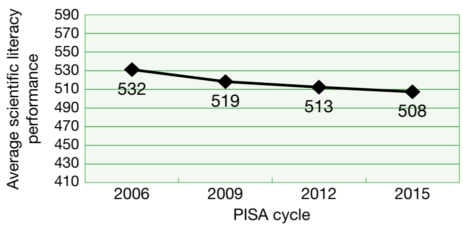
	Difference between years					
	2012		2009		2006	
2015	–5		–8		0	
2012			–3		5	
2009					8	

Queensland



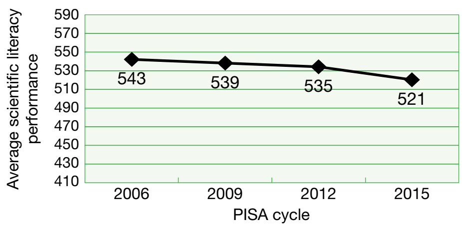
	Difference between years					
	2012		2009		2006	
2015	–12	▼	–23	▼	–15	▼
2012			–11		–3	
2009					7	

South Australia



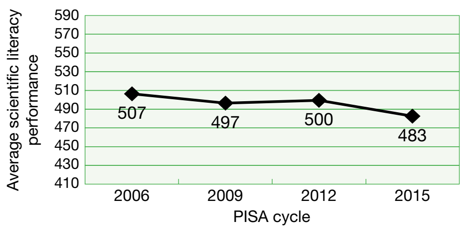
	Difference between years					
	2012		2009		2006	
2015	–5		–11		–24	▼
2012			–7		–19	▼
2009					–13	

Western Australia



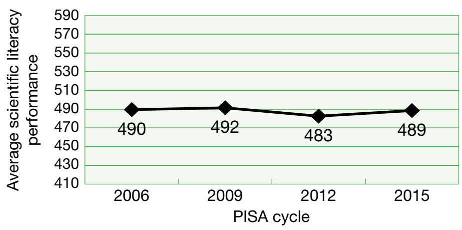
	Difference between years					
	2012		2009		2006	
2015	–14	▼	–18	▼	–22	▼
2012			–5		–8	
2009					–4	

Tasmania



	Difference between years					
	2012		2009		2006	
2015	–17	▼	–14		–23	▼
2012			3		–7	
2009					–9	

Northern Territory



	Difference between years					
	2012		2009		2006	
2015	6		–3		–1	
2012			–9		–7	
2009					2	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.16 Average scientific literacy performance over time, and differences from PISA 2006 to 2015, by jurisdiction

Scientific literacy proficiency

Figure 2.17 shows the proportions of low and high performers on the scientific literacy proficiency scale by jurisdiction from PISA 2006 to 2015.

High performers

Between 2006 and 2015, the proportions of high performers decreased across all jurisdictions by a minimum of 1% in Victoria and the Northern Territory up to a maximum of 7% in each of the Australian Capital Territory and Western Australia.

Between 2012 and 2015, the proportions of high performers decreased across all jurisdictions, except for the Northern Territory, where the proportion of high performers increased by 3%. For the other jurisdictions, the proportion of high performers decreased by 1% in South Australia, Victoria and Tasmania to 4% in Western Australia and New South Wales.

Low performers

Between PISA 2006 and 2015, the proportion of low performers remained constant in Victoria and the Northern Territory, while the proportions of low performers increased in the other jurisdictions by a minimum of 4% in the Australian Capital Territory to a maximum of 8% in New South Wales and Tasmania.

Between PISA 2012 and 2015, the proportion of low performers in the Northern Territory was unchanged, while the proportions of low performers increased in the other jurisdictions by 2% in each of the Australian Capital Territory and Victoria to 7% in Tasmania.

Students who achieved the National Proficient Standard

The proportion of students who achieved the National Proficient Standard is a key performance measure for PISA. Table 2.7 shows that while the proportion of students who achieved this standard in scientific literacy remained constant in Victoria between 2006 and 2015, the proportion of students in the other jurisdictions who achieved it decreased by a minimum of 3% in the Northern Territory to a maximum of 11% in Tasmania.

Between PISA 2012 and 2015, the proportion of students who achieved the National Proficient Standard decreased in all jurisdictions by a minimum of 1% in South Australia and Victoria to a maximum of 9% in Tasmania.

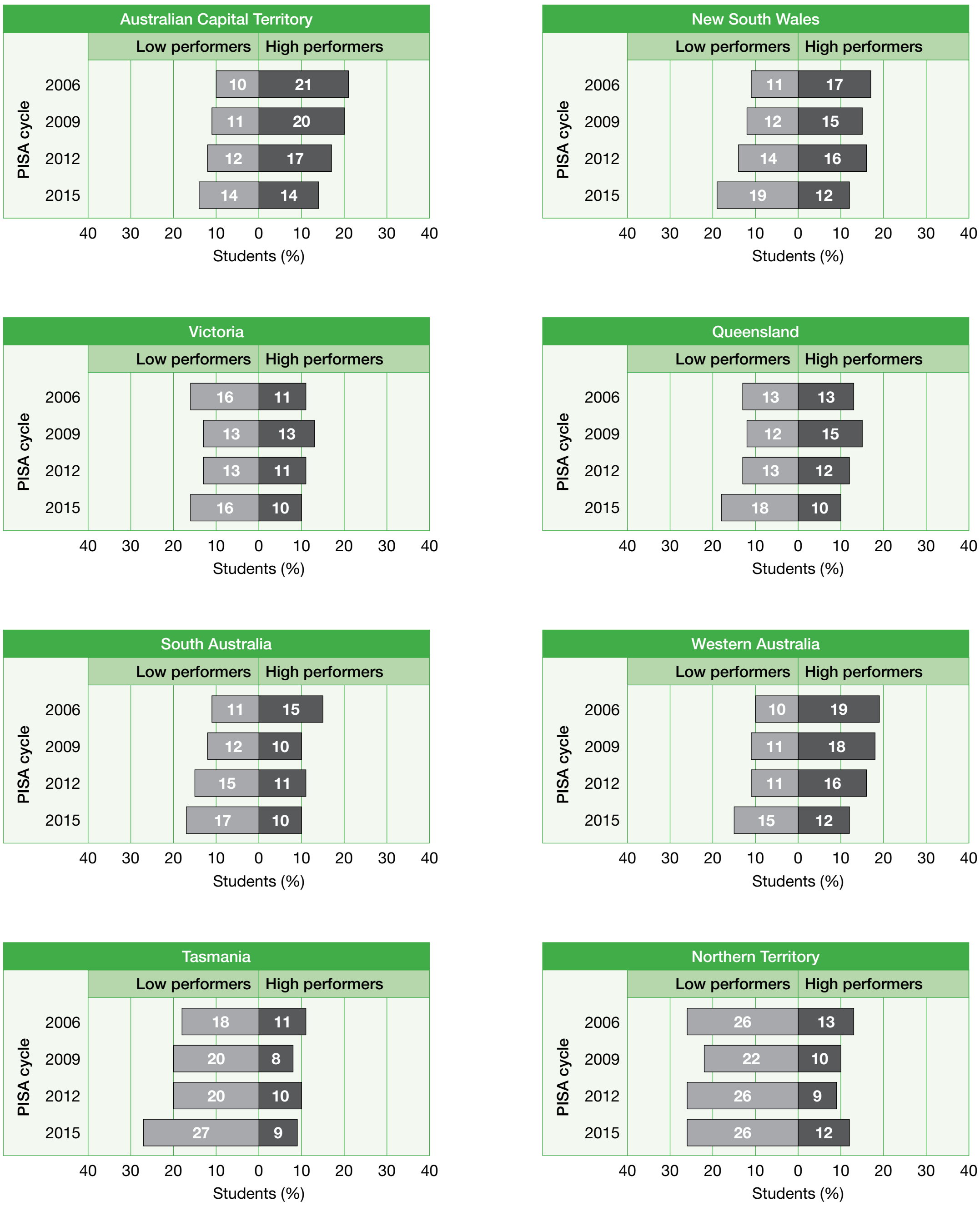


FIGURE 2.17 Percentage of low and high performers on the scientific literacy proficiency scale over time, PISA 2006 to 2015, by jurisdiction

TABLE 2.7 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by jurisdiction

	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	75	2.0	74	2.0	71	1.9	68	1.9
NSW	69	1.6	69	1.8	66	1.3	59	1.2
VIC	62	2.0	65	2.2	64	1.7	63	1.4
QLD	66	1.6	68	2.4	64	1.3	60	1.5
SA	69	2.0	66	2.2	61	1.6	60	2.0
WA	73	2.7	71	2.9	70	1.5	65	1.6
TAS	59	2.3	57	2.4	57	1.8	48	1.8
NT	53	2.2	57	3.1	55	3.9	51	2.8

Scientific literacy results for PISA 2015 across the school sectors

The results for student performance across the school sectors are reported using both unadjusted and adjusted average scores. Previous cycles of PISA have shown that when average performance between public and private schools is compared, without taking into account student and school socioeconomic background, ‘private schools tend to show better performance than public schools in 28 countries and economies’ (OECD, 2013, p.57). When student and school socioeconomic background is taken into account, ‘private schools outperform public schools in only 13 countries and economies, and public schools outperform private schools in eight countries and economies’ (OECD, 2013, p.57). The international report notes that: ‘students who attend private schools tend to be more socioeconomically advantaged than students who attend public schools’ (OECD, 2013, p.57).

In order for the findings of student performance across the school sectors to be interpreted accurately, it is necessary to include a discussion of the effect of an individual’s and school’s socioeconomic background in the reporting of sectoral data.

In addition, the school-sector results may be misconstrued because performance may be attributed to receiving an education in a particular school sector, when in fact the student may not have received all of their education in one school sector. For example, a student may attend a government school for their primary education and then move to a Catholic or an independent school for their secondary education. The PISA data does not take the mobility of students across school sectors into account.

Scientific literacy performance

Figure 2.18 shows the unadjusted average scores for scientific literacy by school sector and shows that students in independent schools performed significantly higher than students in Catholic schools and government schools, and students in Catholic schools scored significantly higher than students in government schools. The average score difference between students in government schools and students in Catholic schools, and between students in Catholic schools and students in independent schools was approximately 30 points, which is equal to around one year of schooling. The average score difference between students in government schools and students in independent schools was double that at 60 points, which is equivalent to around two years of schooling.

The average scientific literacy scores for Catholic and independent schools were significantly higher than the OECD average (28 and 59 points), while the score for government schools was not significantly different to the OECD average.

Catholic and independent schools had a narrower spread of students scoring between the 5th and 95th percentiles (around 308 points) compared to students in government schools (340 points). The wider spread of scores indicates that there is a broader range of abilities of students in government schools than in Catholic or independent schools.

School sector	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Government	492	2.0	488–495	340
Catholic	521	3.3	515–527	308
Independent	552	3.3	545–558	307

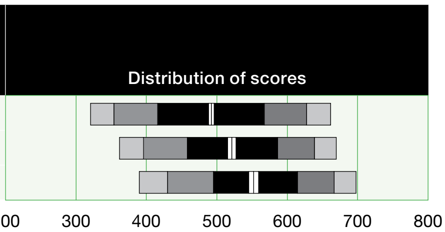


FIGURE 2.18 Average scores and distribution of students’ performance on the scientific literacy scale (unadjusted for student and school socioeconomic background) by school sector

When reporting results by school sector, it is misleading to provide results only using unadjusted average scores because, as Table 1.8 in Chapter 1 shows, there are higher proportions of students from lower socioeconomic backgrounds who attend government schools compared to the proportions of students who attend Catholic or independent schools. To ensure fair comparisons, results are adjusted for differences in an individual student's family background or socioeconomic background, as well as the school-level socioeconomic background. Table 2.8 shows the average difference in the unadjusted score as well as the average score differences in scientific literacy performance once student socioeconomic background, and student- and school-level socioeconomic background are accounted for.

When student-level socioeconomic background is taken into account, students in independent schools performed significantly higher than students in Catholic schools, and students in Catholic schools performed significantly higher than students in government schools, although the differences are reduced.

When school-level socioeconomic background is also taken into account, the differences between students in government schools and students in Catholic schools, and the differences between students in government schools and students in independent schools were not significant. However, the differences between students in Catholic schools and students in independent schools remain significant. Students in independent schools have a performance advantage over students in Catholic schools that is not attributable to student- and school-level socioeconomic background.

TABLE 2.8 Differences in average scientific literacy scores after adjusting for student- and school-level socioeconomic background

School sector comparison	Difference in raw score (score points)	Difference in scores after student socioeconomic background is accounted for	Difference in scores after student and school level socioeconomic background are accounted for
Catholic-Government	**30**	**13**	–6
Independent-Government	**60**	**35**	7
Independent-Catholic	**31**	**23**	**15**

Note: statistically significant values are shown in bold.

Scientific literacy proficiency

Figure 2.19 shows the proportions of students at each proficiency level on the scientific literacy scale by school sector and provides the following information:

- There were similar proportions of high performers in government and Catholic schools (9% and 11%), while there were approximately twice as many high performers in independent schools (18%).
- The proportion of low performers in government schools (23%) was higher than for Catholic (13%) and independent schools (7%).
- Around half the students in government schools reached the National Proficient Standard compared to two-thirds of students in Catholic schools and approximately three-quarters of students in independent schools.

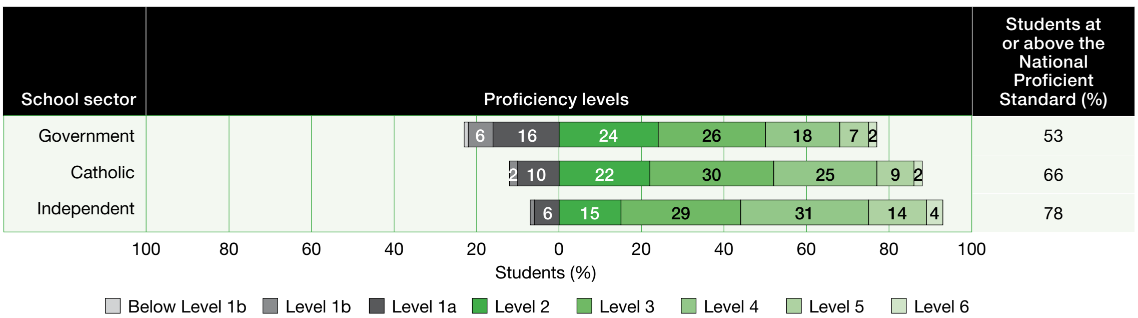


FIGURE 2.19 Percentage of students across the scientific literacy proficiency scale, by school sector

Scientific literacy results over time across the school sectors

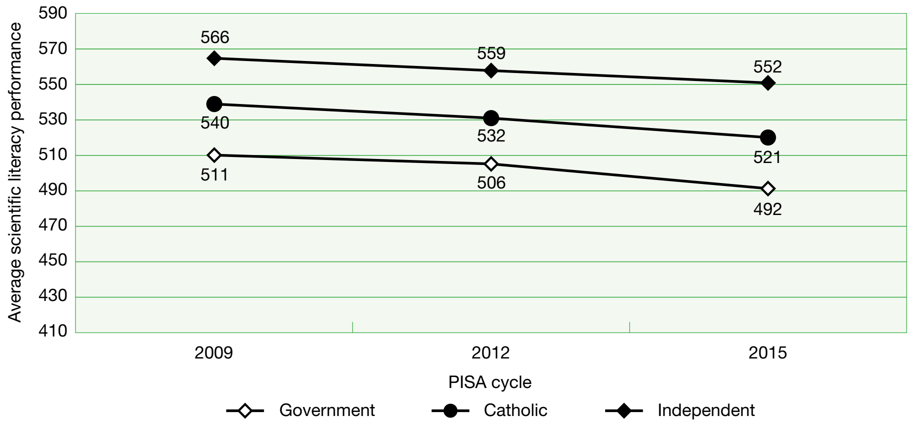
Scientific literacy performance

Figure 2.20 shows the average performance in scientific literacy from PISA 2009 (when results for school sector were first reported) to 2015. The figure also shows the change in performance between two cycles.

For each of the school sectors, the average scientific literacy performance declined significantly between 2009 and 2015.

- For government schools, the average scientific literacy performance declined (by 19 points), from 511 points in 2009 to 492 points in 2015.
- For Catholic schools, the average scientific literacy performance declined (by 19 points), from 540 points in 2009 to 521 points in 2015.
- For independent schools, the average scientific literary performance declined (by 14 points), from 566 points in 2009 to 552 points in 2015.

Between 2012 and 2015, the average scientific literacy performance in government schools declined significantly (by 14 points).



Government	Difference between years 2012		Difference between years 2009	
2015	−14	▼	−19	▼
2012			−5	
2009				

Catholic	Difference between years 2012		Difference between years 2009	
2015	−11		−19	▼
2012			−8	
2009				

Independent	Difference between years 2012		Difference between years 2009	
2015	−7		−14	▼
2012			−7	
2009				

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.20 Average scientific literacy performance and differences over time, PISA 2009 to 2015, by school sector

Between 2009 and 2012, no significant differences in scientific literacy performance between school sectors were found once student- and school-level socioeconomic background were taken into account. However in 2015, for the first time, differences between students in Catholic schools and students in independent schools remain significant once student- and school-level socioeconomic background were accounted for.

Scientific literacy proficiency

Table 2.9 shows the proportion of low and high performers in PISA 2009 and 2015 by school sector. Between 2009 and 2015, there was:

- a 6% increase in the proportion of low performers and a 3% decrease in the proportion of high performers in government schools
- a 5% increase in the proportion of low performers and a 3% decrease in the proportion of high performers in Catholic schools
- a 2% increase in the proportion of low performers and a 6% decrease in the proportion of high performers in independent schools.

TABLE 2.9 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2009 and 2015, by school sector

	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
School sector	%	SE	%	SE	%	SE	%	SE
Government	17	1.0	12	1.3	23	0.8	9	0.6
Catholic	7	1.0	14	1.1	13	1.0	11	1.0
Independent	6	0.8	24	1.6	7	0.8	18	1.1

Students who achieved the National Proficient Standard

Table 2.10 shows that between PISA 2009 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy decreased across the school sectors by 8% in government schools, 9% in Catholic schools and 3% in independent schools.

Between PISA 2009 and 2012, the proportion of students who achieved the National Proficient Standard in scientific literacy decreased across the school sectors: by 5% in each of the government and Catholic schools and 1% in independent schools.

TABLE 2.10 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2009 to 2015, by school sector

	PISA 2009		PISA 2012		PISA 2015	
School sector	%	SE	%	SE	%	SE
Government	60	1.4	58	1.1	53	0.8
Catholic	75	1.4	71	1.4	66	1.4
Independent	82	1.4	80	1.4	78	1.4

Australia's scientific literacy results for different demographic groups

Scientific literacy results for PISA 2015 by Indigenous background

In PISA 2015, Australian Indigenous students were identified from information provided by their schools.

Scientific literacy performance

Indigenous students performed at a significantly lower level than non-Indigenous students in scientific literacy with an average score of 437 points compared to an average score of 513 points for non-Indigenous students. This 76-point average score difference equates to one proficiency level or around two-and-a-half years of schooling. The performance in scientific literacy for Indigenous and non-Indigenous students is shown in Figure 2.21.

Indigenous students performed significantly lower than the OECD average (by 56 points), while non-Indigenous students performed significantly higher than the OECD average (by 20 points). Indigenous students' performance was not significantly different from students' performance in the United Arab Emirates, Uruguay, Romania and Cyprus; however, their performance was significantly higher than some countries such as Turkey, Thailand and Mexico.

The spread of scores between the 5th and 95th percentiles for Indigenous students was slightly narrower than for non-Indigenous students (by 14 points).

Indigenous background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Indigenous	437	2.9	432–443	319	
Non-Indigenous	513	1.6	510–516	333	

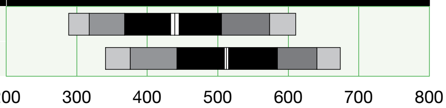


FIGURE 2.21 Average scores and distribution of students' performance on the scientific literacy scale, by Indigenous background

Scientific literacy proficiency

Figure 2.22 shows the under-representation of Indigenous students at the higher end of the scientific literacy proficiency scale and the over-representation of Indigenous students at the lower end of the proficiency scale.

- There were fewer high-performing Indigenous students than high-performing non-Indigenous students (3% compared to 12%).
- Only 0.3% of Indigenous students reached the highest proficiency level (Level 6) compared to 2% of non-Indigenous students.
- There were approximately twice as many low-performing Indigenous students in scientific literacy compared to their non-Indigenous counterparts (approximately 40% compared to almost 20%).
- Of the low performers, more than 12% of Indigenous students performed in the two lowest proficiency levels (below Level 1b and Level 1b) compared to the 4% of non-Indigenous students. Students performing at these levels have very limited skills and knowledge in scientific literacy.
- There was approximately an additional 30% of Indigenous students who demonstrated limited skills and knowledge in scientific literacy at Level 1a compared to around 10% of non-Indigenous students.
- The proportion of high-performing Indigenous students (3%) was about half that of high-performing students across the OECD (8%).
- There were twice as many low-performing Indigenous students (42%) compared to the low-performing students across the OECD (21%).
- There were twice as many non-Indigenous students (62%) who achieved the National Proficient Standard in scientific literacy than Indigenous students (31%).

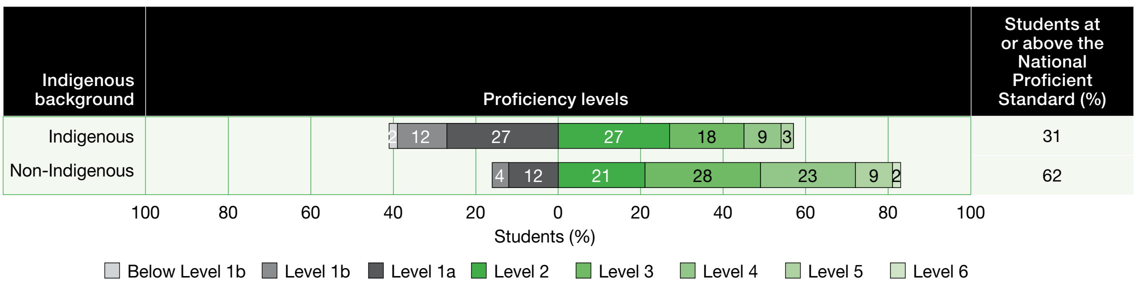


FIGURE 2.22 Percentage of students across the scientific literacy proficiency scale, by Indigenous background

Scientific literacy results over time by Indigenous background

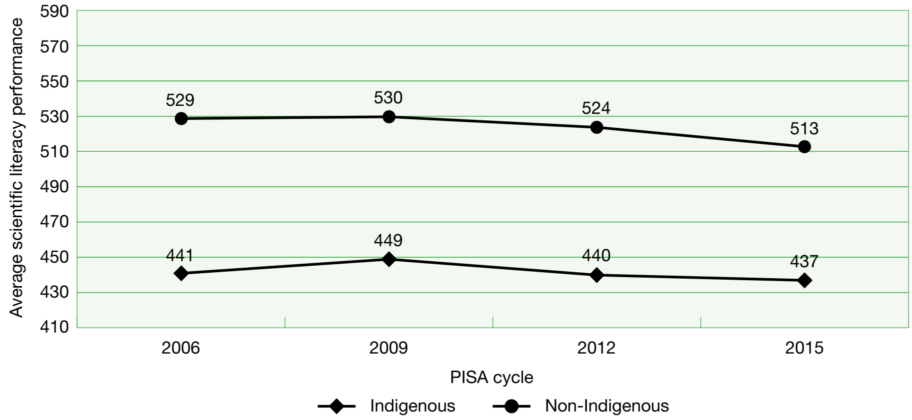
Scientific literary performance

Since PISA 2006, the scientific literacy performance of Indigenous students has not changed significantly. However, the following changes are noted for non-Indigenous students:

- Between PISA 2006 and 2015, there was a significant decline (by 16 points), from an average score of 529 points to 513 points.
- Between PISA 2012 and 2015, there was a significant decline (by 11 points).

Figure 2.23 shows the average scientific literacy performance, and change in performance, across the PISA cycles for Indigenous and non-Indigenous students.

The difference in performance between Indigenous and non-Indigenous students in 2006 was 88 points. The difference in performance between Indigenous and non-Indigenous students in 2015 was 76 points. This gap has not changed significantly between 2006 and 2015.



Indigenous						
	Difference between years					
	2012		2009		2006	
2015	−3		−12		−4	
2012			−9		−1	
2009					8	

Non-Indigenous						
	Difference between years					
	2012		2009		2006	
2015	−11	▼	−17	▼	−16	▼
2012			−5		−5	
2009					0	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.23 Average scientific literacy performance and differences over time, PISA 2006 to 2015, by Indigenous background

Scientific literacy proficiency

Table 2.11 shows that between 2006 and 2015, there was an increase in the proportion of low-performing Indigenous and non-Indigenous students, and a decrease in the proportion of high-performing Indigenous and non-Indigenous students:

- The proportion of low-performing Indigenous students increased by 2%, while the proportion of high-performing Indigenous students decreased by 1%.
- The proportion of low-performing non-Indigenous students increased by 5% and the proportion of high-performing non-Indigenous students decreased by 3%.

TABLE 2.11 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2006 and 2015, by Indigenous background

	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Indigenous background	%	SE	%	SE	%	SE	%	SE
Indigenous	39	3.5	4	1.1	42	1.5	3	0.5
Non-Indigenous	12	0.6	15	0.7	17	0.6	12	0.5

Students who achieved the National Proficient Standard

Table 2.12 shows that between PISA 2006 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy for Indigenous and non-Indigenous students decreased by 4% for Indigenous students and 6% for non-Indigenous students.

Between PISA 2012 and 2015, the proportion of students who achieved the National Proficient Standard decreased by 2% for Indigenous students and 4% for non-Indigenous students.

TABLE 2.12 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by Indigenous background

	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Indigenous background	%	SE	%	SE	%	SE	%	SE
Indigenous	34	2.8	38	2.7	33	1.7	31	1.3
Non-Indigenous	68	0.9	68	0.9	66	0.7	62	0.7

Scientific literacy results for PISA 2015 by geographic location of school

Using the MCEETYA *Schools Geographic Location Classification* (Jones, 2004),[26] data on schools were coded into three broad categories of geographic location: metropolitan, provincial and remote.

Scientific literacy performance

Students from metropolitan schools performed significantly higher than students from provincial schools and remote schools. Figure 2.24 shows that students in metropolitan schools achieved an average score of 517 points while students in provincial schools and remote schools achieved average scores of 491 and 473 points respectively. The results also showed that students in metropolitan schools scored significantly higher on average (by 26 points) than students who attended provincial schools, an average score difference that is equal to around one year of schooling. The average score difference between students in metropolitan schools and students in remote schools was even larger at 44 points, an average score difference that is equal to around one-and-a-half years of schooling. Students in provincial schools performed not significantly different to students in remote schools.

The average performance of students in metropolitan schools was significantly higher than the OECD average (by 24 points) but the average performance of students in remote schools was significantly lower than the OECD average (by 20 points). The performance of students in provincial schools was not significantly different to that of students across the OECD.

The spread of scores for students across the three geographic locations was similar, ranging from 327 points for students from provincial schools to 343 points for students from remote schools.

26 The Reader's Guide provides more information about the MCEETYA *Schools Geographic Location Classification*.

Geographic location	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Metropolitan	517	1.9	514–521	336
Provincial	491	2.9	485–496	327
Remote	473	14.7	444–502	343

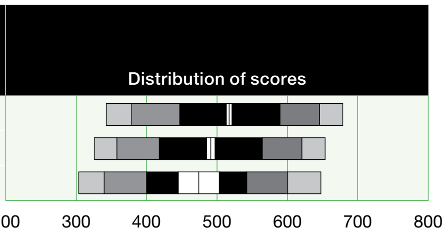


FIGURE 2.24 Average scores and distribution of students' performance on the scientific literacy scale, by geographic location

Scientific literacy proficiency

Figure 2.25 shows the proportion of students on the scientific literacy proficiency scale for the three geographic locations of schools and provides the following information:

- The proportion of high performers in metropolitan areas (13%) was twice the proportion of high performers in provincial and remote schools (7%).
- The proportion of low performers was 16% in metropolitan schools compared to 23% in provincial schools and 28% in remote schools.
- There was a higher proportion of high performers in metropolitan schools compared to high performers across the OECD (8%), while the proportion of high-performing students from provincial schools and remote schools (7%) was similar to the proportion of high performers across the OECD.
- There was a smaller proportion of low-performing students from metropolitan schools (16%) than low performers across the OECD (21%), whereas there was a higher proportion of low performers from provincial schools and remote schools than low performers across the OECD.
- Approximately two-thirds of students in metropolitan schools achieved the National Proficient Standard in scientific literacy compared to around half the students in provincial schools and remote schools.

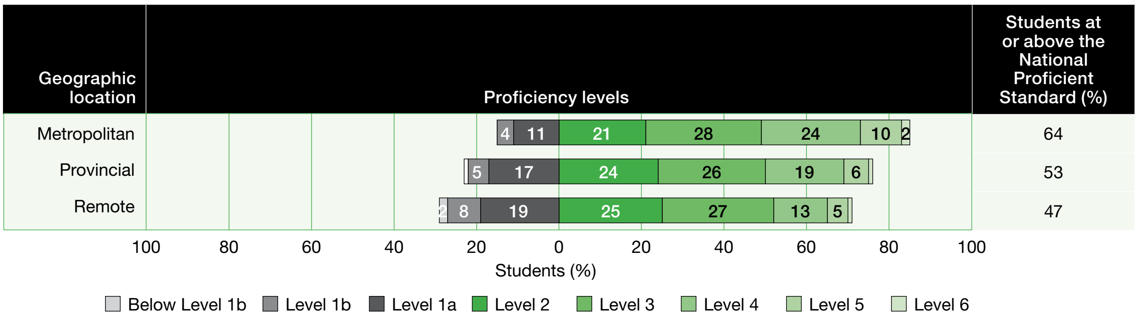


FIGURE 2.25 Percentage of students across the scientific literacy proficiency scale, by geographic location

Scientific literacy results over time by geographic location

Scientific literacy performance

Figure 2.26 shows that between PISA 2006 and 2015, the average scientific literacy performance for students in metropolitan schools and provincial schools has declined significantly, while the average performance of students in remote schools did not change significantly.

The results show that:

- the performance of students in metropolitan schools declined by 13 points, from an average score of 531 points in 2006 to 517 points in 2015

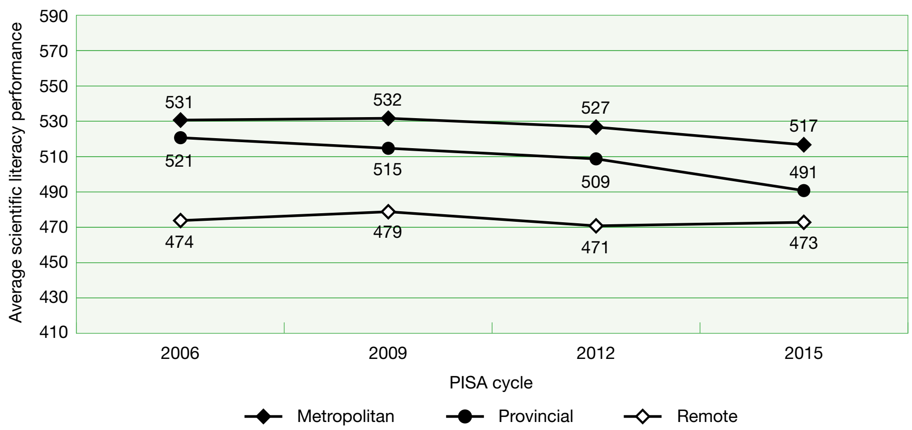
- the performance of students in provincial schools declined by 30 points, from an average score of 521 points in 2006 to 491 points in 2015
- the performance of students in remote schools did not change significantly.

Between 2012 and 2015, the average performance for students in provincial schools declined by 18 points, while the average performance for students in metropolitan schools and remote schools did not change significantly.

The difference in performance between students in metropolitan schools and students in provincial schools in 2006 was 10 points. The difference in performance between students in metropolitan schools and students in provincial schools in 2015 was 26 points. This gap has changed significantly, becoming wider, between 2006 and 2015.

The difference in performance between students in provincial schools and students in remote schools in 2006 was 47 points. The difference in performance between students in provincial schools and students in remote schools in 2015 was 18 points. This gap has not changed significantly between 2006 and 2015.

The difference in performance between students in metropolitan schools and students in remote schools in 2006 was 57 points. The difference in performance between students in metropolitan schools and students in remote schools in 2015 was 44 points. This gap has not changed significantly between 2006 and 2015.



Metropolitan	Difference between years		
	2012	2009	2006
2015	−9	−15 ▼	−13 ▼
2012		−5	−4
2009			1

Provincial	Difference between years		
	2012	2009	2006
2015	−18 ▼	−25 ▼	−30 ▼
2012		−7	−12 ▼
2009			−6

Remote	Difference between years		
	2012	2009	2006
2015	3	−6	−1
2012		−9	−3
2009			6

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.26 Average scientific literacy performance and differences over time, PISA 2006 to 2015, by geographic location

Scientific literacy proficiency

Table 2.13 shows the proportion of low and high performers in PISA 2006 and 2015 by geographic location. Between 2006 and 2015, there was:

- a 4% increase in the proportion of low performers and a 3% decrease in the proportion of high performers from metropolitan schools
- a 9% increase in the proportion of low performers and a 5% decrease in the proportion of high performers from provincial schools
- a 1% increase in the proportion of low performers and a 1% decrease in the proportion of high performers from remote schools.

TABLE 2.13 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2006 and 2015, by geographic location

	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Geographic location	%	SE	%	SE	%	SE	%	SE
Metropolitan	12	0.7	15	0.8	16	0.7	13	0.6
Provincial	14	1.1	13	1.0	23	1.1	7	0.8
Remote	28	6.7	8	2.0	28	5.2	7	3.2

Students who achieved the National Proficient Standard

Table 2.14 shows that between PISA 2006 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy decreased by 5% for students in metropolitan schools, 12% for students in provincial schools and 1% for students in remote schools.

Between PISA 2012 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy decreased by 3% for students in metropolitan schools, 8% for students in provincial schools and 1% for students in remote schools.

TABLE 2.14 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by geographic location

	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Geographic location	%	SE	%	SE	%	SE	%	SE
Metropolitan	68	1.1	69	1.1	67	0.8	64	0.8
Provincial	65	1.4	64	1.7	61	1.4	53	1.2
Remote	48	6.6	49	5.5	48	7.9	47	5.7

Scientific literacy results for PISA 2015 by socioeconomic background

In PISA, information about students' socioeconomic background was collected in the student questionnaire. Students were asked several questions about their family and home background. This information was used to construct a measure of socioeconomic background: economic, social and cultural status (ESCS).[27] Using this index, participating students were distributed into quartiles of ESCS.

Scientific literacy performance

Figure 2.27 shows the average scores for scientific literacy performance at each socioeconomic background (ESCS) quartile and illustrate that, on average, students from higher socioeconomic background perform at a significantly higher level than students from lower socioeconomic backgrounds.

Students in the highest quartile achieved an average score of 559 points, which was substantially and significantly higher than the average score of 468 points for students in the lowest quartile. This average difference of 91 points is equal to around three years of schooling or more than one proficiency level. The score difference between one quartile and the next was significant at approximately 30 points on average, which equates to about one-half of a proficiency level or about one year of schooling.

27 The Reader's Guide provides more information about socioeconomic background and the ESCS index.

The spread of scores between the highest and lowest performing students within each quartile was very similar (ranging from 314 points to 318 points).

The average score for students in the highest quartile was significantly higher than that of the OECD average (by 66 points), while the average score for students in the lowest quartile was significantly lower than for students across the OECD (by 25 points).

Socioeconomic background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Lowest quartile	468	2.3	463–472	318
Second quartile	498	2.1	493–502	316
Third quartile	524	2.2	520–529	316
Highest quartile	559	2.6	554–564	314

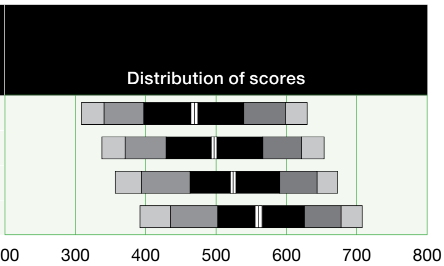


FIGURE 2.27 Average scores and distribution of students' performance on the scientific literacy scale, by socioeconomic background

Scientific literacy proficiency

Figure 2.28 shows that the percentage of high performers increased with each increase in quartile. There were only 4% of students in the lowest quartile, 8% of students in the second quartile, 12% of students in the third quartile and 22% of students in the highest quartile. Similarly, the percentage of low performers decreased with each increase in quartile. There were 29% of students in the lowest quartile, 19% of students in the second quartile, 13% of students in the third quartile and 7% of students in the highest quartile.

The proportion of high performers across the OECD (8%) was lower than the proportion of high performers in the third and highest quartile (12% and 22% respectively), the same proportion as high performers in the second quartile, and higher than the proportion of high performers in the lowest quartile (5%).

The proportion of low performers across the OECD (21%) was higher than the proportion of low performers in the second (19%), third (13%) and highest quartiles (7%) and lower than the proportion of low performers in the lowest quartile (29%).

Almost twice as many students in the highest quartile (80%) achieved the National Proficient Standard in scientific literacy compared to students in the lowest quartile (43%).

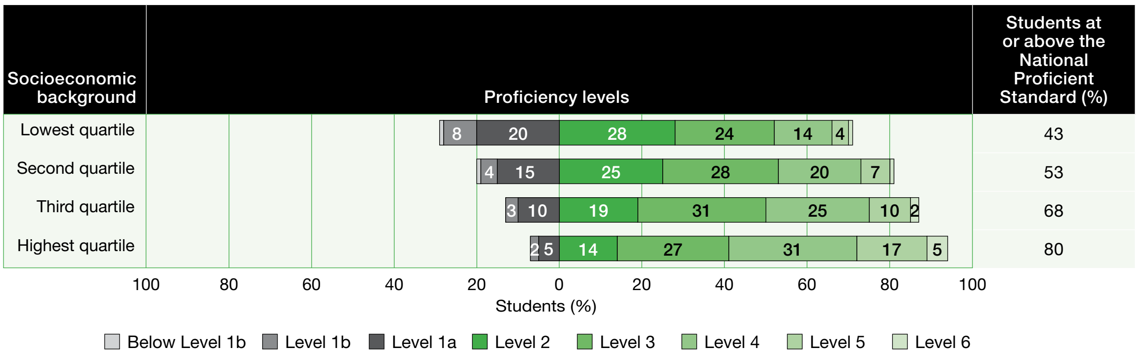


FIGURE 2.28 Percentage of students across the scientific literacy proficiency scale, by socioeconomic background

Scientific literacy results over time by socioeconomic background[28]

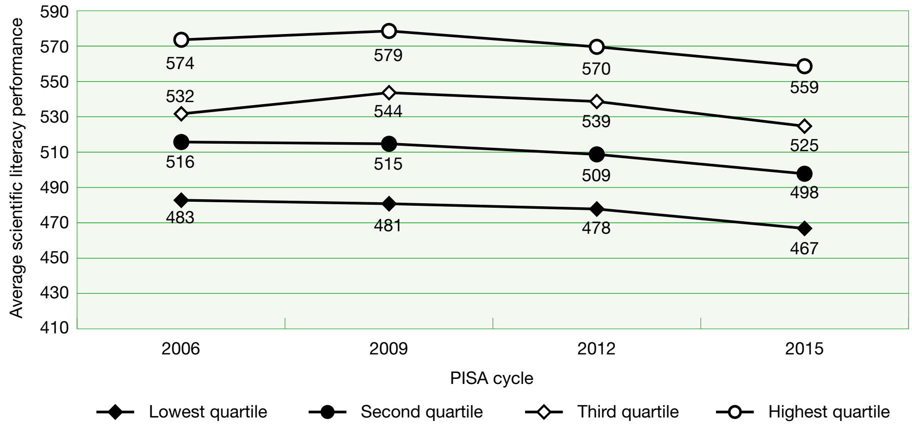
Scientific literacy performance

Figure 2.29 shows the average performance in scientific literacy for each quartile of socioeconomic background since PISA 2006, along with details about the change in performance, and significance, between two cycles.

Between PISA 2006 and 2015, there was a significant decline in average performance in three of the quartiles. There was a decline of 15 points in the lowest quartile and highest quartile, and a decline of 18 points in the second quartile.

Between 2012 and 2015, there were significant declines across the quartiles, with an 11-point decline in each of the lowest quartile, second and highest quartiles and a 14-point decline in the third quartile.

The difference in performance between students in the lowest quartile and students in the highest quartile in 2006 was 91 points. The difference in performance between students in the lowest quartile and students in the highest quartile in 2015 was 76 points. This gap has not changed significantly between 2006 and 2015.



Lowest quartile						
	Difference between years					
	2012		2009		2006	
2015	–11	▼	–13	▼	–15	▼
2012			–3		–5	
2009					–2	

Second quartile						
	Difference between years					
	2012		2009		2006	
2015	–11	▼	–17	▼	–18	▼
2012			–6		–8	
2009					–1	

Third quartile						
	Difference between years					
	2012		2009		2006	
2015	–14	▼	–19	▼	–7	
2012			–5		7	
2009					12	▲

Highest quartile						
	Difference between years					
	2012		2009		2006	
2015	–11	▼	–20	▼	–15	▼
2012			–9	▼	–5	
2009					5	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.29 Average scientific literacy performance and differences over time, PISA 2006 to 2015, by socioeconomic background

28 While an ESCS index was included in all past PISA databases, the components of ESCS and the scaling model has changed over cycles, meaning that the ESCS scores are not comparable across cycles directly. An ESCS-trend index variable has been computed using similar methodology for the current cycle and for previous cycles in order to enable a trend study.

Scientific literacy proficiency

Table 2.15 shows that between PISA 2006 and 2015, there was an increase in the proportion of low performers and a decrease in the proportion of high performers in scientific literacy proficiency.

For the high performers, there was:

- a 1% decrease in the lowest quartile
- a 3% decrease in the second quartile
- a 2% decrease in the third quartile
- a 6% decrease in the highest quartile.

For the low performers, there was:

- a 6% increase in the lowest quartile and second quartile
- a 2% increase in the third quartile and the highest quartile.

TABLE 2.15 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2006 and 2015, by socioeconomic background

Socioeconomic background	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	23	1.0	6	0.6	29	1.3	4	0.5
Second quartile	14	1.0	11	1.0	19	0.8	8	0.8
Third quartile	10	0.7	14	0.8	13	0.9	12	0.9
Highest quartile	5	0.5	27	1.3	7	0.6	22	1.1

Students who achieved the National Proficient Standard

Table 2.16 shows that between PISA 2006 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy by socioeconomic background quartiles decreased by 7% in each of the lowest and second quartiles, 1% in the third quartile and 4% in the highest quartile.

Between PISA 2012 and 2015, there was a decrease in the proportion of students who achieved the National Proficient Standard, with a 4% decrease in the lowest quartile, a 5% decrease in each of the second and third quartiles and a 2% decrease in the highest quartile.

TABLE 2.16 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by socioeconomic background

Socioeconomic background	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	50	1.1	49	1.3	47	1.2	43	1.1
Second quartile	63	1.4	63	1.1	61	1.0	56	1.1
Third quartile	70	1.2	75	1.1	73	1.2	68	1.1
Highest quartile	84	0.9	86	0.8	82	0.9	80	1.1

Scientific literacy results for PISA 2015 by immigrant background

Students self-reported their immigrant background by indicating where they and their parents had been born. The data was coded into three categories of immigrant background: Australian-born, first-generation and foreign born.[29]

29 The Reader's Guide provides more information about immigrant background.

Scientific literacy performance

Figure 2.30 shows that Australian-born students performed significantly lower than first-generation students and statistically similar to foreign-born students. Foreign-born students performed significantly lower than first-generation students. Australian-born students achieved an average score of 510 points, and performed equivalent to about one-third of a year of schooling lower than first-generation students, who achieved an average score of 520 points. Foreign-born students achieved an average score of 505 points and performed equivalent to about half a year of schooling lower than first-generation students.

The spread of scores was similar for Australian-born students (329 points) and first-generation students (333 points), which was narrower than the spread of scores for foreign-born students (349 points).

The average performance of all three immigrant background groups in scientific literacy was significantly higher than the OECD average (493 points).

Immigrant background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Australian-born	510	1.7	507–514	329	
First-generation	520	2.4	516–525	333	
Foreign-born	505	4.0	497–513	349	

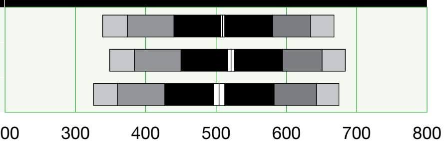


FIGURE 2.30 Average scores and distribution of students' performance on the scientific literacy scale, by immigrant background

Scientific literacy proficiency

Figure 2.31 shows the percentages of students by immigrant background at each proficiency level on the scientific literacy scale. The results show that:

- 10% of Australian-born students were high performers, compared to 13% of first-generation students and 12% of foreign-born students
- 17% per cent of Australian-born students were low performers, compared to 15% of first-generation students and 20% of foreign-born students
- the proportion of high performers across all three immigrant backgrounds was higher than the proportion of high performers across the OECD (8%)
- the proportions of low-performing Australian-born students and low-performing first-generation students were lower than the proportion of low-performing students across the OECD, while the proportion of low-performing foreign-born students was similar to the proportion of low-performing students across the OECD
- 61% of Australian-born students achieved the National Proficient Standard, compared to 64% of first-generation students and 58% of foreign-born students.

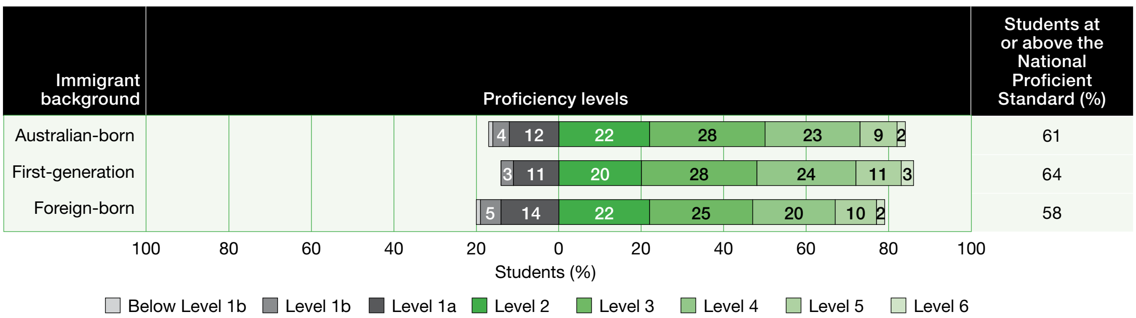


FIGURE 2.31 Percentage of students across the scientific literacy proficiency scale, by immigrant background

Scientific literacy results over time by immigrant background

Scientific literacy performance

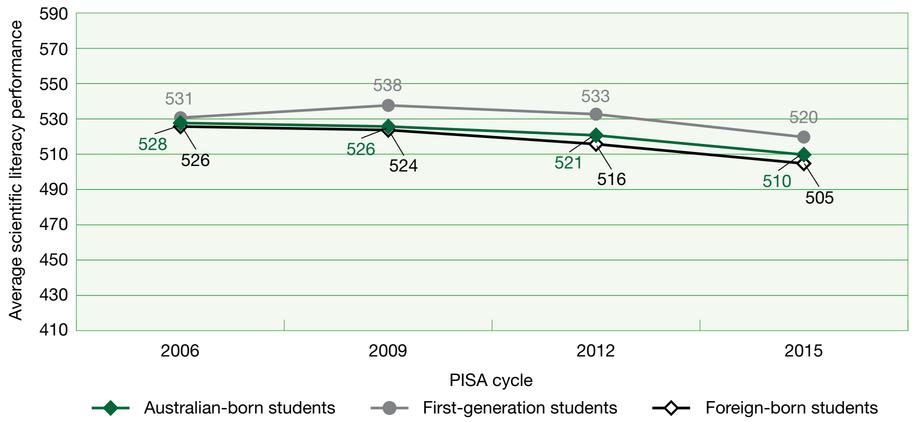
Figure 2.32 shows that between PISA 2006 and 2015, the scientific literacy performance for Australian-born and foreign-born students declined significantly, while the performance for first-generation students did not change significantly. For Australian-born students, the average score declined by 18 points to 510 points, and for foreign-born students the average score declined by 21 points to 505 points.

Between PISA 2012 and 2015, the scientific literacy performance for Australian-born and first-generation students declined significantly by 11 points and 13 points respectively.

The difference in performance between Australian-born students and first-generation students in 2006 was 3 points. The difference in performance between Australian-born students and first-generation students in 2015 was 10 points. This gap has not changed significantly between 2006 and 2015.

The difference in performance between Australian-born students and foreign-born students in 2006 was 2 points. The difference in performance between Australian-born students and foreign-born students in 2015 was 5 points. This gap has not changed significantly between 2006 and 2015.

The difference in performance between first-generation students and foreign-born students in 2006 was 5 points. The difference in performance between first-generation students and foreign-born students in 2015 was 15 points. This gap has not changed significantly between 2006 and 2015.



Australian-born						
	Difference between years					
	2012		2009		2006	
2015	–11	▼	–16	▼	–18	▼
2012			–5		–7	
2009					–2	

First-generation						
	Difference between years					
	2012		2009		2006	
2015	–13	▼	–17	▼	–11	
2012			–4		2	
2009					6	

Foreign-born						
	Difference between years					
	2012		2009		2006	
2015	–11		–19	▼	–21	▼
2012			–8		–10	
2009					–2	

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.32 Average scientific literacy performance and differences over time, PISA 2006 to 2015, by immigrant background

Scientific literacy proficiency

Table 2.17 shows that between PISA 2006 and 2015, the proportion of high performers for each of the immigrant backgrounds decreased. There was a 4% decrease for Australian-born students, 2% for first-generation students, and 5% for foreign-born students. In this same period, the proportion of low performers for each of the immigrant backgrounds increased. There was a 5% increase for Australian-born students, 4% for first-generation students and 5% for foreign-born students.

TABLE 2.17 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2006 and 2015, by immigrant background

Immigrant background	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Australian-born	12	0.7	14	0.7	17	0.6	10	0.5
First-generation	11	0.8	15	1.3	15	0.8	13	0.8
Foreign-born	16	1.5	17	2.1	20	1.5	12	1.2

Students who achieved the National Proficient Standard

Table 2.18 shows that between PISA 2006 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy in each of the immigrant background groups decreased by 6% for Australian-born students, 4% for first-generation students and 7% for foreign-born students.

Between PISA 2012 and 2015, there was a decrease in the proportion of students who achieved the National Proficient Standard, with a 4% decrease in each of the immigrant background groups.

TABLE 2.18 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by immigrant background

Immigrant background	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE
Australian-born	68	0.9	68	1.1	66	0.8	61	0.7
First-generation	68	1.4	71	1.1	68	1.2	64	1.1
Foreign-born	65	2.3	65	2.7	62	1.5	58	1.6

Scientific literacy results for PISA 2015 by language background

In the Student Questionnaire, students self-reported their language background by indicating the main language spoken in their home.[30] Students' language background was classified into two categories: students who spoke English at home and students who spoke a language other than English at home.

Scientific literacy performance

Figure 2.33 shows that students who spoke English at home performed significantly higher, by 27 points, than students who spoke a language other than English at home. This difference equates to almost half a proficiency level or about one year of schooling.

The spread of scores for students who spoke a language other than English at home is particularly wide compared to the spread of scores for students who spoke English at home. While the average score at the 5th percentile for students who spoke a language other than English at home was 38

30 The Reader's Guide provide more information about language background.

points lower than students who spoke English at home, the scores for the two groups were similar at the 95th percentile.

Students who spoke English at home performed significantly higher than the OECD average (by 22 points), whereas there was no significant difference in performance between students who spoke a language other than English and the OECD average.

Language background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
English spoken at home	515	1.5	512–517	330	
Language other than English spoken at home	488	5.0	478–498	363	

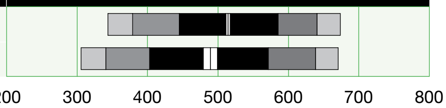


FIGURE 2.33 Average scores and distribution of students' performance on the scientific literacy scale, by language background

Scientific literacy proficiency

Figure 2.34 shows the similarity between the proportion of high performers in the two language background groups with 12% of students who spoke English at home and 10% of students who spoke a language other than English at home. However, there were almost twice as many low performers who spoke a language other than English at home (27%) than low performers who spoke English at home (16%).

The proportion of high performers, regardless of the language spoken at home, was higher than the proportion of high performers across the OECD, while the proportion of low performers who spoke English at home was lower than the proportion of low performers across the OECD, and the proportion of low performers who spoke a language other than English at home was higher than the low performers across the OECD.

Almost two-thirds (63%) of students who spoke English at home reached the National Proficient Standard in scientific literacy compared to half of the students who spoke a language other than English at home.

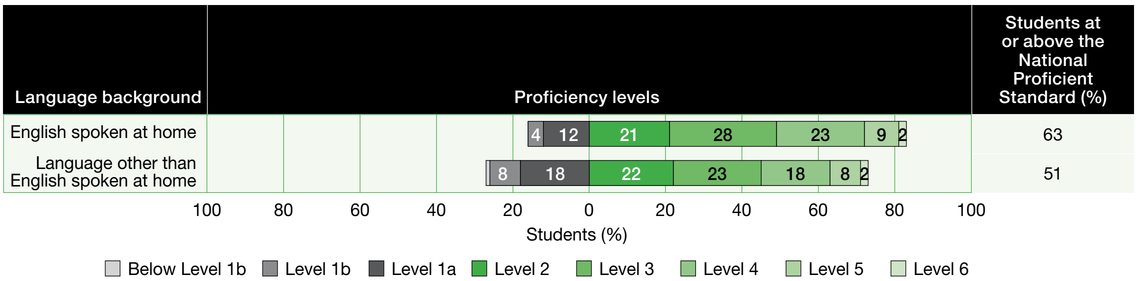


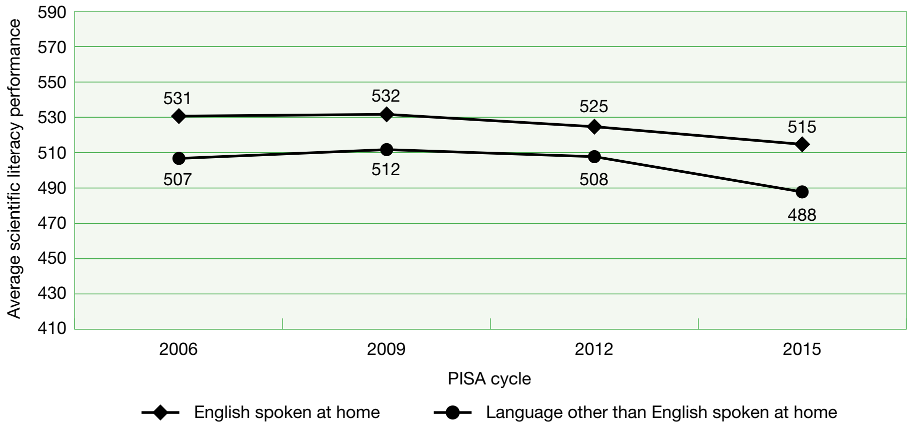
FIGURE 2.34 Percentage of students across the scientific literacy proficiency scale, by language background

Scientific literacy results over time by language background

Scientific literacy performance

Figure 2.35 shows that between PISA 2006 and 2015, the average performance for students who spoke English at home declined significantly (by 16 points), while the performance of students who spoke a language other than English at home did not change significantly. Between PISA 2012 and 2015, the performance declined significantly for students who spoke English at home (by 11 points), and for students who spoke a language other than English at home (by 21 points).

The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2006 was 24 points. The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2015 was 27 points. This gap has not changed significantly between 2006 and 2015.



English spoken at home	Difference between years		
	2012	2009	2006
2015	−11 ▼	−17 ▼	−16 ▼
2012		−7 ▼	−5
2009			1

Language other than English spoken at home	Difference between years		
	2012	2009	2006
2015	−21 ▼	−24 ▼	−19
2012		−4	1
2009			5

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.35 Average scientific literacy performance and differences over time, PISA 2006 to 2015, by language background

Scientific literacy proficiency

Table 2.19 shows the proportion of low and high performers in scientific literacy, for PISA 2006 and 2015 by language background.

- There was a 3% decrease in the proportion of high performers, regardless of language background.
- There was a 4% increase in the proportion of low performers who spoke English at home.
- There was a 7% increase in the proportion of low performers who spoke a language other than English.

TABLE 2.19 Percentage of low and high performers on the scientific literacy proficiency scale for PISA 2006 and 2015, by language background

Language background	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
English spoken at home	12	0.5	15	0.7	16	0.6	12	0.5
Language other than English spoken at home	20	1.9	13	2.4	27	1.9	10	1.3

Students who achieved the National Proficient Standard

Table 2.20 shows that between PISA 2006 and 2015, the proportion of students who achieved the National Proficient Standard in scientific literacy decreased by 6% in each of the language background groups, while between PISA 2012 and 2015, the proportion of students who spoke English at home decreased by 4% and the proportion of students who spoke a language other than English decreased by 7%.

TABLE 2.20 Percentage of students at or above the National Proficient Standard on the scientific literacy proficiency scale from PISA 2006 to 2015, by language background

Language background	PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE
English spoken at home	69	0.8	69	0.8	66	0.7	63	0.6
Language other than English spoken at home	57	2.9	60	3.0	58	2.0	51	2.1

Scientific literacy results by sex

Scientific literacy performance in PISA 2015 across countries by sex

Across the OECD countries, the average score for females was 491 points and for males was 495 points, a significant difference of 4 points. Females significantly outperformed males in 16 countries, with the largest differences found in the United Arab Emirates, Albania, Qatar and Trinidad and Tobago, where females scored, on average, 20 points or more higher than males.

Males performed significantly higher than females in 20 countries. The largest differences were found in Austria, Costa Rica, Italy and Chile, where males scored on average 15 points or more higher than females.

In Australia, females scored 509 points on average, which was not significantly different to the average score of 511 for males. Among the countries who performed significantly higher than Australia and which showed significant differences in performance by sex, females in Macao (China) and Finland scored significantly higher than males (by 8 and 20 points respectively), while males from Singapore and Japan scored significantly higher than females (by 6 and 12 points respectively).

Figure 2.36 shows the average scores and standard errors for females and males on the scientific literacy scale, graphs the difference by sex and indicates whether the difference is statistically significant.

Country	Females Avg. score	Females SE	Males Avg. score	Males SE
Austria	486	3.1	504	3.6
Costa Rica	411	2.2	429	2.5
Italy	472	3.6	489	3.1
Chile	440	2.7	454	3.1
Japan	532	2.9	545	4.1
Belgium	496	2.7	508	3.1
Ireland	497	2.6	508	3.2
Germany	504	2.8	514	3.2
Portugal	496	2.6	506	2.9
Colombia	411	2.4	421	3.1
B-S-J-G (China)	513	5.3	522	4.5
Czech Republic	488	2.5	497	3.3
Uruguay	431	2.2	440	3.1
Mexico	412	2.3	420	2.6
Luxembourg	479	1.5	487	1.7
United States	493	3.4	500	3.7
Spain	489	2.5	496	2.5
Singapore	552	1.7	559	1.8
Poland	498	2.8	504	2.9
Switzerland	502	3.5	508	3.1
Denmark	499	3.2	505	2.6
Croatia	473	2.8	478	3.2
New Zealand	511	2.7	516	3.2
Chinese Taipei	530	3.8	535	4.1
Russian Federation	485	3.1	489	3.6
Israel	464	4.1	469	4.7
Netherlands	507	2.5	511	2.9
OECD average	**491**	**0.5**	**495**	**0.5**
Estonia	533	2.3	536	2.7
Hungary	475	2.9	478	3.4
Norway	497	2.7	500	2.7
Australia	**509**	**1.7**	**511**	**2.1**
France	494	2.7	496	2.7
Canada	527	2.3	528	2.5
United Kingdom	509	3.3	510	2.9
Slovak Republic	461	3.3	460	3.0
Hong Kong (China)	524	3.4	523	3.1
Vietnam	526	4.2	523	4.0
Iceland	475	2.1	472	2.6
Sweden	496	3.7	491	4.1
Slovenia	516	1.9	510	1.9
Romania	438	3.4	432	3.7
Turkey	429	4.4	422	4.5
Moldova	431	2.4	425	2.4
Lithuania	479	2.8	472	3.3
Macao (China)	532	1.5	525	1.5
Greece	459	3.9	451	4.6
Thailand	425	2.9	416	3.6
Korea	521	3.3	511	4.6
Latvia	496	2.2	485	2.0
Malta	470	2.2	460	2.5
Bulgaria	454	4.4	438	5.3
Cyprus	441	1.9	424	1.7
Finland	541	2.6	521	2.7
Trinidad and Tobago	435	1.9	414	2.1
Qatar	429	1.3	406	1.4
Albania	439	3.0	415	4.0
United Arab Emirates	449	3.0	424	3.4

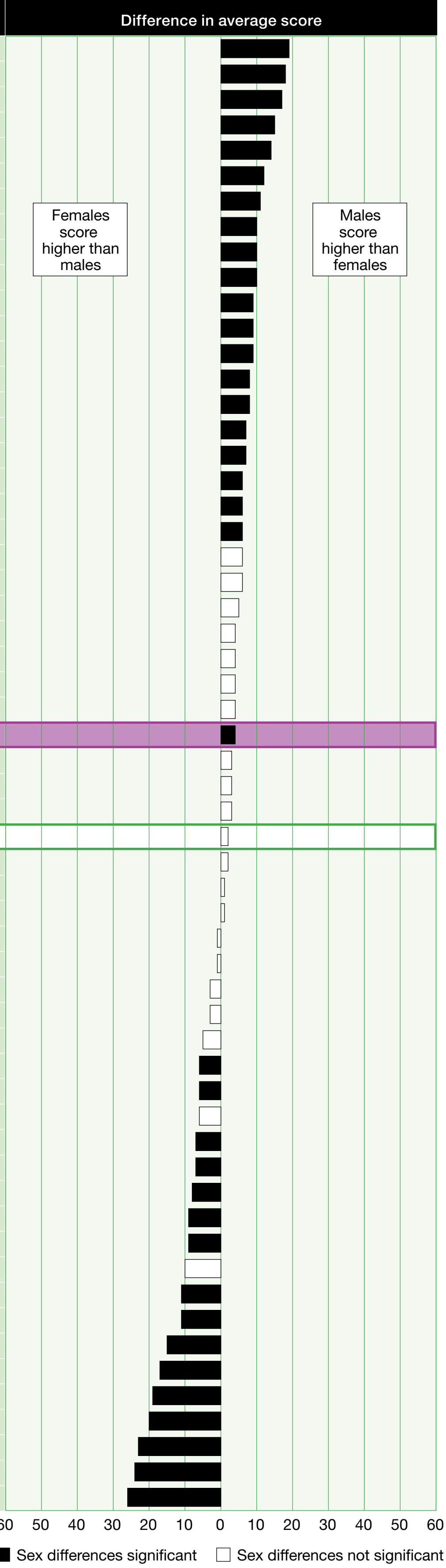


FIGURE 2.36 Average scores and differences in students' performance on the scientific literacy scale, by country and sex

Scientific literacy proficiency in PISA 2015 for Australia by sex

Figure 2.37 shows the proportion of females and males for Australia and the OECD average at each level of the scientific literacy proficiency scale.

The proportion of high-performing females and males was higher for Australia than for the OECD average. The results show that:

- 10% of Australian females and 13% of Australian males were high performers
- 7% of females and 9% of males across the OECD were high performers.

Conversely, the proportions of low-performing females and males were lower for Australia than for the OECD average. The results show that:

- 17% of Australian females and 19% of Australian males were low performers
- 21% of females and 22% of males across the OECD were low performers.

The same proportion of Australian females and males achieved the National Proficient Standard in scientific literacy (61%).

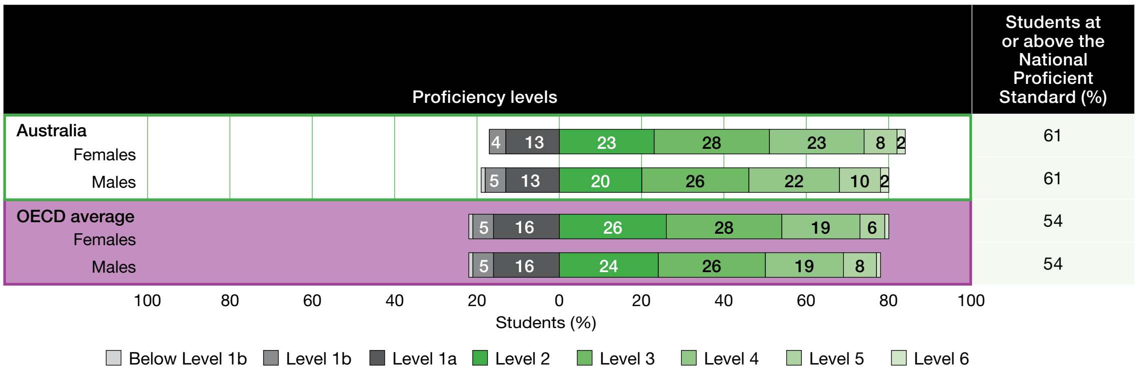


FIGURE 2.37 Percentage of students across the scientific literacy proficiency scale by sex, for Australia and the OECD average

Scientific literacy performance over time across countries by sex

Table 2.21 shows the average scientific literacy scores for females and males for PISA 2006 and 2015, along with the average differences. Over this period, the average performance in scientific literacy for both females and males across OECD countries significantly decreased by 6 and 4 points respectively. Table 2.21 also shows that:

- The performance of females and males declined significantly between PISA 2006 and 2015 in 12 countries (Australia, Croatia, the Czech Republic, Finland, Greece, Hong Kong (China), Hungary, Iceland, Lithuania, the Netherlands, New Zealand and the Slovak Republic). The change in performance for females ranged from 13 points in Lithuania to 25 points in Hungary, and the change for males ranged from 12 points in Lithuania to 40 points in Finland.
- The performance of both females and males significantly improved between PISA 2006 and 2015 in 6 countries (Colombia, Macao (China), Norway, Portugal, Qatar and Romania). The change in performance for females ranged from 8 points in Norway to 64 points in Qatar, and the change in performance of males ranged from 12 points in Macao (China) to 73 points in Qatar.
- There were 11 countries whose performance for females or males significantly changed between 2006 and 2015:
  - In Austria, Belgium, Ireland and Slovenia, the performance of females declined significantly (ranging from 7 points in Slovenia to 21 points in Austria).
  - In Israel and Chile, the average performance of females improved significantly (by 12 and 13 points respectively).

- In Canada, Sweden and the United Kingdom, male performance declined significantly (ranging from 8 points in Canada to 13 points in Sweden).
- In Italy and Uruguay, male performance improved significantly (by 12 and 13 points respectively).

TABLE 2.21 Average scientific literacy performance scores for PISA 2006 and 2015, and differences in performance between PISA 2006 and 2015, by country and sex

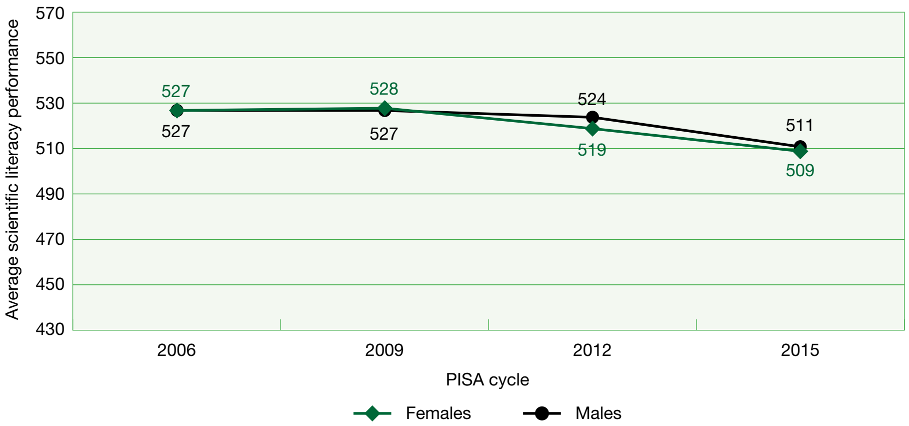
	PISA 2006				PISA 2015				Differences in average score between 2006 and 2015 (PISA 2015 – PISA 2006)					
	Females		Males		Females		Males		Females			Males		
Country	Avg. score	SE	Avg. score	SE	Avg. score	SE	Avg. score	SE	Score dif.		SE	Score dif.		SE
Australia	527	2.7	527	3.2	509	1.7	511	2.1	**–18**	▼	3.2	**–16**	▼	3.8
Austria	507	4.9	515	4.2	486	3.1	504	3.6	**–21**	▼	5.9	–10		5.5
Belgium	510	3.2	511	3.3	496	2.7	508	3.1	**–14**	▼	4.2	–3		4.5
Bulgaria	443	6.9	426	6.6	454	4.4	438	5.3	11		8.1	13		8.4
Canada	532	2.1	536	2.5	527	2.3	528	2.5	–5		3.1	**–8**	▼	3.5
Chile	426	4.4	448	5.4	440	2.7	454	3.1	**13**	▲	5.2	6		6.2
Chinese Taipei	529	5.1	536	4.3	530	3.8	535	4.1	1		6.3	–1		5.9
Colombia	384	4.1	393	4.1	411	2.4	421	3.1	**27**	▲	4.8	**28**	▲	5.2
Croatia	494	3.1	492	3.3	473	2.8	478	3.2	**–22**	▼	4.1	**–14**	▼	4.6
Czech Republic	510	4.8	515	4.2	488	2.5	497	3.3	**–22**	▼	5.4	**–18**	▼	5.3
Denmark	491	3.4	500	3.6	499	3.2	505	2.6	7		4.7	5		4.4
Estonia	533	2.9	530	3.1	533	2.3	536	2.7	–1		3.6	6		4.1
Finland	565	2.4	562	2.6	541	2.6	521	2.7	**–24**	▼	3.6	**–40**	▼	3.7
France	494	3.6	497	4.3	494	2.7	496	2.7	0		4.4	–1		5.1
Germany	512	3.8	519	4.6	504	2.8	514	3.2	–8		4.7	–5		5.6
Greece	479	3.4	468	4.5	459	3.9	451	4.6	**–20**	▼	5.1	**–17**	▼	6.4
Hong Kong (China)	539	3.5	546	3.5	524	3.4	523	3.1	**–15**	▼	4.9	**–23**	▼	4.7
Hungary	501	3.5	507	3.3	475	2.9	478	3.4	**–25**	▼	4.6	**–29**	▼	4.7
Iceland	494	2.1	488	2.6	475	2.1	472	2.6	**–19**	▼	3.0	**–16**	▼	3.7
Ireland	509	3.3	508	4.3	497	2.6	508	3.2	**–11**	▼	4.2	0		5.4
Israel	452	4.2	456	5.6	464	4.1	469	4.7	**12**	▲	5.8	13		7.3
Italy	474	2.5	477	2.8	472	3.6	489	3.1	–2		4.3	**12**	▲	4.2
Japan	530	5.1	533	4.9	532	2.9	545	4.1	2		5.9	12		6.4
Korea	523	3.9	521	4.8	521	3.3	511	4.6	–2		5.1	–10		6.6
Latvia	493	3.2	486	3.5	496	2.2	485	2.0	3		3.9	–1		4.0
Lithuania	493	3.1	483	3.1	479	2.8	472	3.3	**–13**	▼	4.2	**–12**	▼	4.5
Luxembourg	482	1.8	491	1.8	479	1.5	487	1.7	–3		2.4	–4		2.5
Macao (China)	509	1.6	513	1.8	532	1.5	525	1.5	**23**	▲	2.2	**12**	▲	2.4
Mexico	406	2.6	413	3.2	412	2.3	420	2.6	5		3.5	7		4.1
Netherlands	521	3.1	528	3.2	507	2.5	511	2.9	**–15**	▼	3.9	**–18**	▼	4.3
New Zealand	532	3.6	528	3.9	511	2.7	516	3.2	**–21**	▼	4.5	**–13**	▼	5.1
Norway	489	3.2	484	3.8	497	2.7	500	2.7	**8**	▲	4.2	**16**	▲	4.7
Poland	496	2.6	500	2.7	498	2.8	504	2.9	2		3.9	5		4.0
Portugal	472	3.2	477	3.7	496	2.6	506	2.9	**24**	▲	4.1	**29**	▲	4.7
Qatar	365	1.3	334	1.2	429	1.3	406	1.4	**64**	▲	1.8	**73**	▲	1.8
Romania	419	4.8	417	4.1	438	3.4	432	3.7	**18**	▲	5.9	**15**	▲	5.5
Russian Federation	478	3.7	481	4.1	485	3.1	489	3.6	6		4.8	8		5.4
Slovak Republic	485	3.0	491	3.9	461	3.3	460	3.0	**–24**	▼	4.5	**–31**	▼	4.9
Slovenia	523	1.9	515	2.0	516	1.9	510	1.9	**–7**	▼	2.7	–5		2.8
Spain	486	2.7	491	2.9	489	2.5	496	2.5	3		3.7	6		3.8
Sweden	503	2.9	504	2.7	496	3.7	491	4.1	–7		4.7	**–13**	▼	4.9
Switzerland	509	3.6	514	3.3	502	3.5	508	3.1	–6		5.0	–6		4.5
Thailand	428	2.5	411	3.4	425	2.9	416	3.6	–3		3.8	5		5.0
Tunisia	388	3.5	383	3.2	385	2.2	388	2.4	–3		4.2	5		4.0
Turkey	430	4.1	418	4.6	429	4.4	422	4.5	–2		6.0	4		6.4
United Kingdom	510	2.8	520	3.0	509	3.3	510	2.9	–1		4.3	**–10**	▼	4.1
United States	489	4.0	489	5.1	493	3.4	500	3.7	4		5.2	10		6.3
Uruguay	430	2.7	427	4.0	431	2.2	440	3.1	2		3.5	**13**	▲	5.0
OECD average	497	0.6	499	0.6	491	0.5	495	0.5	**–6**	▼	0.8	**–4**	▼	0.8

Notes: The symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
Only countries that participated in both PISA 2006 and 2015 are shown.

Figure 2.38 shows the average scores for Australian females and males from PISA 2006 to 2015 and illustrates the similarities in scientific literacy performance of females and males. The performance of females and males has declined significantly:

- Between 2006 and 2015, the performance of females declined by 18 points and the performance of males declined by 16 points.
- Between 2012 and 2015, the performance of females declined by 10 points and the performance of males declined by 13 points.

In 2006, there was no difference in performance between females and males. In 2015, there was a 2-point difference between females and males. This gap has not changed significantly between 2006 and 2015.



Females						
	Difference between years					
	2012		2009		2006	
2015	–10	▼	–19	▼	–18	▼
2012			–9	▼	–8	
2009					1	

Males						
	Difference between years					
	2012		2009		2006	
2015	–13	▼	–16	▼	–16	▼
2012			–3		–3	
2009					0	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 2.38 Average scientific literacy performance and differences over time, PISA 2006 to 2015, for Australia by sex

Scientific literacy proficiency over time for Australia by sex

Table 2.22 shows that between PISA 2006 and 2015, there was a 4% decrease in the proportion of high-performing females and a 3% decrease in the proportion of high-performing males, while there was a 5% increase in the proportion of both low-performing females and males.

TABLE 2.22 Percentage of low and high performers across the scientific literacy proficiency scale for PISA 2006 and 2015 by sex, for Australia

	PISA 2006				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Sex	%	SE	%	SE	%	SE	%	SE
Females	12	0.7	14	0.8	17	0.7	10	0.5
Males	14	0.8	16	1.0	19	0.7	13	0.7

Scientific literacy performance in PISA 2015 across jurisdictions by sex

Figure 2.39 shows males performed significantly higher than females in one jurisdiction, the Northern Territory. Males achieved an average score of 499 points, which was 20 points higher than females. This average score difference was equal to two-thirds of a year of schooling.

Jurisdiction	Females		Males	
	Avg. score	SE	Avg. score	SE
QLD	510	4.2	504	4.2
WA	521	3.7	520	5.4
NSW	508	3.7	508	4.0
TAS	482	5.8	485	6.5
ACT	525	5.2	529	5.2
SA	506	4.6	510	5.2
VIC	507	3.6	518	4.5
NT	479	7.1	499	9.4

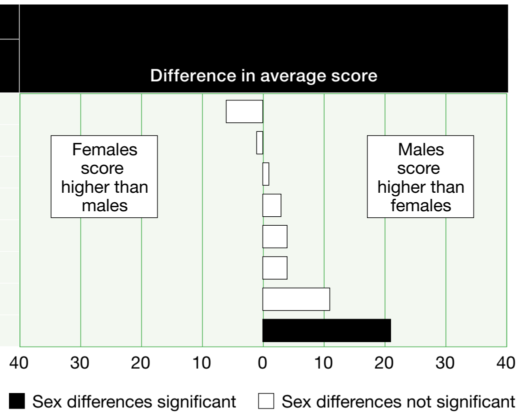


FIGURE 2.39 Average scores and differences in students' performance on the scientific literacy scale, by jurisdiction and sex

Scientific literacy proficiency in PISA 2015 across jurisdictions by sex

Figure 2.40 shows the proportion of females and males across the scientific literacy proficiency scale by jurisdiction.

High-performing males

The proportion of high-performing males in scientific literacy in Tasmania was the same as the proportion of high-performing males across the OECD (9%). In all other jurisdictions, the proportion of high-performing males was higher than their OECD counterparts. The proportions for the other jurisdictions ranged from 11% in Queensland and South Australia to 17% in the Australian Capital Territory.

High-performing females

All jurisdictions, except Victoria, had a higher proportion of high-performing females than high-performing females across OECD countries (7%). The proportions for the other jurisdictions ranged from 12% in the Australian Capital Territory to 8% in Tasmania and the Northern Territory.

Low-performing males

The proportions of low-performing males in scientific literacy in Tasmania (27%) and the Northern Territory (23%) were higher than the OECD average for low-performing males (22%), while the proportion of low-performing males in other jurisdictions was lower than the OECD average. The proportions for the other jurisdictions ranged from 20% in New South Wales and Queensland to 13% in the Australian Capital Territory.

Low-performing females

The proportions of low-performing females in the Northern Territory (29%) and Tasmania (27%) were higher than the average proportion of low-performing females across OECD countries (21%) while the proportion of low-performing females in other jurisdictions was lower than the OECD average.

There were higher proportions of high-performing males than high-performing females in all jurisdictions. The largest difference between the high-performing males and females was in the Northern Territory with 7%, followed by Victoria with 6% and the Australian Capital Territory with 5%.

The differences between low-performing males and females within each jurisdiction ranged from 1% in the Australian Capital Territory to 6% in the Northern Territory, and there were no differences in the proportions of low-performing males and low-performing females in Victoria.

The proportion of females who achieved the National Proficient Standard in scientific literacy ranged from 47% in Tasmania to 68% in the Australian Capital Territory, while the proportion of males who achieved the National Proficient Standard ranged from 50% in Tasmania to 68% in the Australian Capital Territory.

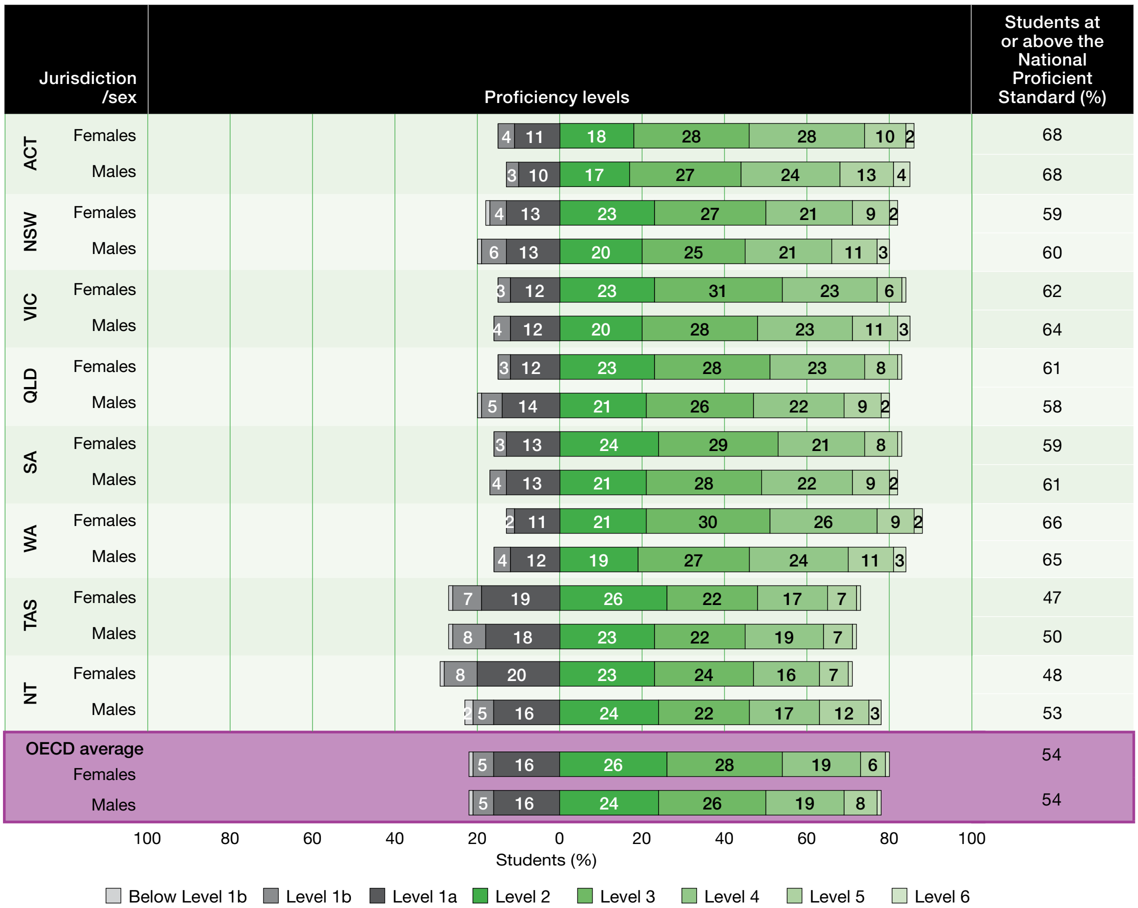


FIGURE 2.40 Percentage of students across the scientific literacy proficiency scale, by jurisdiction and sex

Scientific literacy performance in PISA 2015 across the school sectors by sex

Figure 2.41 shows there were no significant differences between the performance of females and males in scientific literacy across the school sectors.

School sector	Females Avg. score	Females SE	Males Avg. score	Males SE
Government	491	2.4	492	2.6
Catholic	520	3.6	522	4.3
Independent	547	3.8	556	4.2

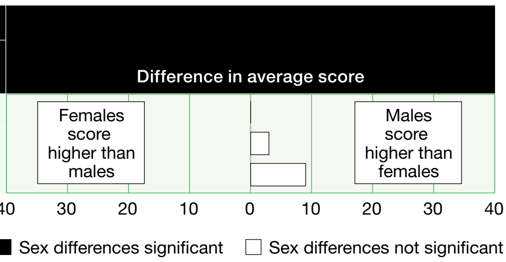


FIGURE 2.41 Average scores and differences in students' performance on the scientific literacy scale, by school sector and sex

Scientific literacy proficiency in PISA 2015 across the school sectors by sex

In addition to the average performance of females and males by school sector, Figure 2.42 provides further detail about their proficiencies on the scientific literacy assessment. Eight per cent of females in government schools were high performers, which was similar to the proportion of high-performing females in Catholic schools, and about half the proportion of high-performing females in independent schools (15%). Around 10% of males in government schools were high performers, compared to 13% in Catholic schools and 21% in independent schools.

Twenty-two per cent of the females in government schools were low performers, which was double the proportion of low-performing females in Catholic schools (11%) and around three times the proportion of those in independent schools (7%). The findings were similar for males, with 24% of the males in government schools, 14% of those in Catholic schools and 7% of those in independent schools classed as low performers.

Each school sector had similar proportions of females and males achieving the National Proficient Standard in scientific literacy.

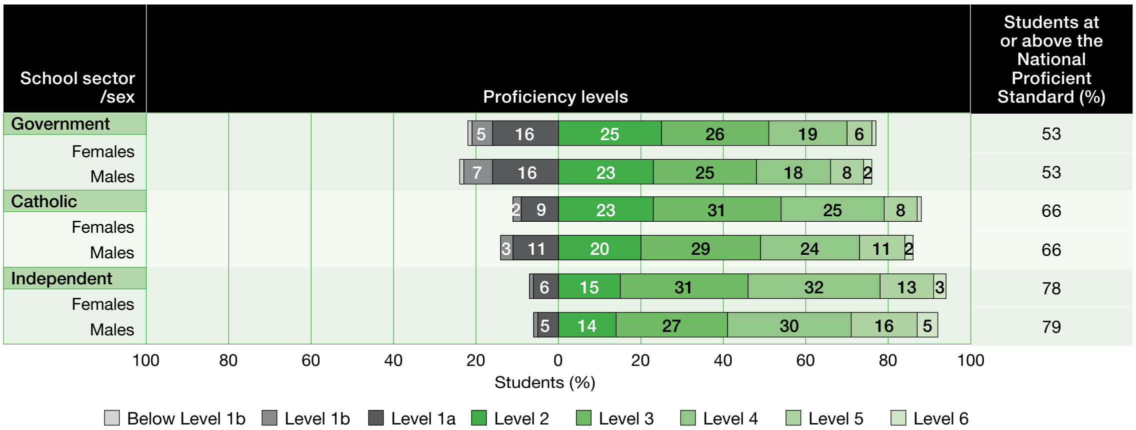


FIGURE 2.42 Percentage of students across the scientific literacy proficiency scale, by school sector and sex

Scientific literacy performance in PISA 2015 by Indigenous background and sex

Figure 2.43 shows there were no significant differences between the performance of Indigenous females and males in scientific literacy. This was also the case for non-Indigenous females and males.

Indigenous background	Females Avg. score	Females SE	Males Avg. score	Males SE
Indigenous	436	3.8	439	3.9
Non-Indigenous	512	1.7	514	2.2

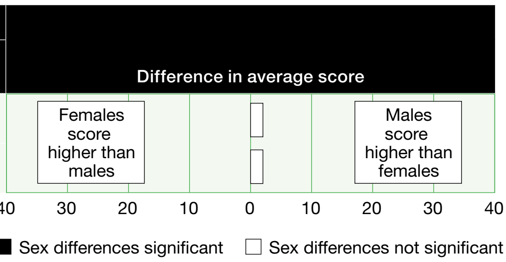


FIGURE 2.43 Average scores and differences in students' performance on the scientific literacy scale, by Indigenous background and sex

Scientific literacy proficiency in PISA 2015 by Indigenous background and sex

Figure 2.44 shows that there were similar proportions of high-performing Indigenous females (2%) compared to high-performing Indigenous males (4%). The proportions of low-performing Indigenous females and males were also similar (41% and 43%).

The proportion of high-performing non-Indigenous females was 10% and the proportion of high-performing non-Indigenous males was 13%. The proportion of low-performing non-Indigenous females was 16%, which was also similar to low-performing males with 18%.

There were similar proportions of Indigenous females and males (30% and 32%) and non-Indigenous females and males (62% each) who achieved the National Proficient Standard in scientific literacy.

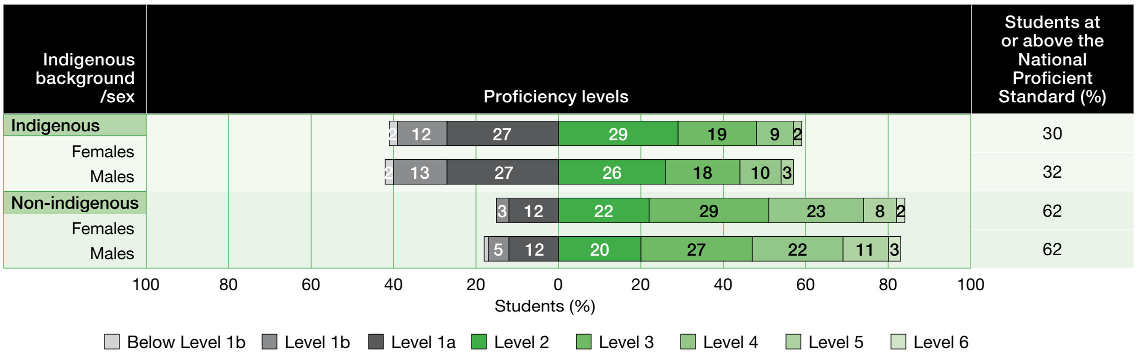


FIGURE 2.44 Percentage of students across the scientific literacy proficiency scale, by Indigenous background and sex

Australian students' performance on the scientific literacy subscales

CHAPTER 3

The previous chapter summarised the scientific literacy performance of students in PISA 2015 on the overall scientific literacy scale. In PISA 2015, there were 184 scientific literacy items, and each item was assigned to a science competency, science knowledge and science content category, which then enabled reporting by scientific literacy subscale. This chapter provides further detail about students' performance on the different aspects of scientific literacy. It examines students' performance on the three science competency subscales, the two science knowledge subscales and the three science content subscales.[31,32]

Key findings: science competency subscales

Explain phenomenon scientifically

- Australia's average score on the *explain phenomenon scientifically* subscale was 510 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 9 countries (Singapore, Japan, Chinese Taipei, Finland, Estonia, Canada, Macao (China), Hong Kong (China) and Slovenia).
- Australia's performance was not significantly different from that of 8 countries (B-S-J-G (China), New Zealand, Germany, Korea, the United Kingdom, the Netherlands, Ireland and Switzerland).
- Australia's performance was significantly higher than 51 countries, including 22 OECD countries.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and significantly higher than all other jurisdictions.

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31 Results for the scientific literacy subscales are only available for countries that administered PISA as a computer-based assessment.

32 Only results for those countries whose scores on the overall scientific literacy scale were higher than Mexico (416 points) are included in this chapter. Results for Argentina, Malaysia and Kazakhstan have not been reported because their coverage was too small to ensure comparability.

Evaluate and design scientific enquiry

- Australia's average score on the *evaluate and design scientific enquiry* subscale was 512 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 8 countries (Singapore, Japan, Estonia, Canada, Finland, Macao (China), Chinese Taipei and Hong Kong (China)).
- Australia's performance was not significantly different from that of 9 countries (B-S-J-G (China), New Zealand, Korea, Slovenia, the Netherlands, the United Kingdom, Belgium, Switzerland and Germany).
- Australia's performance was significantly higher than 51 countries, which included 22 OECD countries.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than Queensland, New South Wales, South Australia, the Northern Territory and Tasmania.

Interpret data and evidence scientifically

- Australia's average score on the *interpret data and evidence scientifically* subscale was 508 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 9 countries (Singapore, Japan, Estonia, Chinese Taipei, Macao (China), Finland, Canada, Korea and Hong Kong (China)).
- Australia's performance was not significantly different from that of 9 countries (B-S-J-G (China), New Zealand, Slovenia, the United Kingdom, Germany, the Netherlands, Switzerland, Belgium and Portugal).
- Australia's performance was significantly higher than 50 countries, which included 21 OECD countries.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, the Northern Territory and Tasmania.

Key findings: science knowledge subscales

Content knowledge

- Australia's average score on the *content knowledge* subscale was 508 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 10 countries (Singapore, Japan, Chinese Taipei, Finland, Estonia, Canada, Macao (China), Hong Kong (China), B-S-J-G (China) and Slovenia).
- Australia's performance was not significantly different from that of 9 countries (Korea, Germany, New Zealand, the United Kingdom, the Netherlands, Switzerland, Ireland, Denmark and Norway).
- Australia's performance was significantly higher than 49 countries, which included 20 OECD countries.
- The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Procedural and epistemic knowledge

- Australia's average score on the *procedural and epistemic knowledge* subscale was 511 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 9 countries (Singapore, Japan, Estonia, Macao (China), Chinese Taipei, Finland, Canada, Hong Kong (China) and Korea).
- Australia's performance was not significantly different from that of 8 countries (B-S-J-G (China), New Zealand, Slovenia, the United Kingdom, the Netherlands, Germany, Belgium and Switzerland).
- Australia's performance was significantly higher than 51 countries, which included 22 OECD countries.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, the Northern Territory and Tasmania.

Key findings: science content subscales

Living systems

- Australia's average score on the *living systems* subscale was 510 points. This was significantly higher than the OECD average of 492 points.
- Australia was significantly lower than 8 countries (Singapore, Japan, Chinese Taipei, Estonia, Canada, Finland, Macao (China) and Hong Kong (China)).
- Australia's performance was not significantly different from that of 7 countries (B-S-J-G (China), New Zealand, Slovenia, Korea, Germany, the United Kingdom and Switzerland).
- Australia's performance was significantly higher than 53 countries, which included 24 OECD countries.
- The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, Queensland, South Australia, the Northern Territory and Tasmania.

Physical systems

- Australia's average score on the *physical systems* subscale was 511 points. This was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 8 countries (Singapore, Japan, Estonia, Finland, Macao (China), Chinese Taipei, Canada and Hong Kong (China)).
- Australia's performance was not significantly different from that of 9 countries (B-S-J-G (China), Korea, New Zealand, Slovenia, the Netherlands, the United Kingdom, Denmark, Ireland and Germany).
- Australia's performance was significantly higher than 51 countries, which included 22 OECD countries.
- The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Earth and space systems

- Australia's average score on the *Earth and space systems* subscale was 509 points. This was significantly higher than the OECD average of 494 points.
- Australia's performance was significantly lower than 9 countries (Singapore, Japan, Estonia, Finland, Chinese Taipei, Macao (China), Canada, Hong Kong (China) and Korea). Australia's performance was not significantly different from that of 9 countries (B-S-J-G (China), Slovenia, New Zealand, the Netherlands, Germany, the United Kingdom, Switzerland, Denmark and Belgium).
- Australia's performance was significantly higher than 51 countries, which included 21 OECD countries.
- The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Australia's results on the science competency subscales from an international perspective

Each scientific literacy item in PISA 2015 was classified into one of the three science competency categories:

- approximately 50% of the items required the competency *explain phenomenon scientifically*
- about 20% of the items required the competency *evaluate and design scientific enquiry*
- 30% of the items required the competency *interpret data and evidence scientifically*.

Table 3.1 provides the average scores and standard errors for the three science competency subscales (*explain phenomenon scientifically*, *evaluate and design scientific enquiry* and *interpret data and evidence scientifically*), as well as the average scores and standard errors for the overall scientific literacy scale for comparison. Countries are shown in order from the highest to the lowest average scientific literacy subscale score and the three colour bands indicate whether a particular country performed at a level significantly higher, lower or not different to Australia.

Students' performance across countries on the *explain phenomenon scientifically* subscale

Twenty-four countries (19 OECD, including Australia, and 5 partner) achieved significantly higher on the *explain phenomenon scientifically* subscale than the OECD average of 493 score points. Four OECD countries had average scores that were not statistically different from the OECD average, while 23 countries (12 OECD; 34 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 510 points on *explain phenomenon scientifically*, which was significantly lower than the performance of 9 countries (5 OECD: Japan, Finland, Estonia, Canada and Slovenia; 4 partner: Singapore, Chinese Taipei, Macao (China) and Hong Kong (China)). Australia's performance was not significantly different from that of 8 countries (7 OECD: New Zealand, Germany, Korea, the United Kingdom, the Netherlands, Ireland and Switzerland; 1 partner: B-S-J-G (China)), while it was significantly higher than 51 countries, (22 OECD; 29 partner).

Students' performance across countries on the *evaluate and design scientific enquiry* subscale

Twenty-three countries (18 OECD, including Australia, and 5 partner) achieved significantly higher on the *evaluate and design scientific enquiry* subscale than the OECD average of 493 score points. Six OECD countries had average scores that were not statistically different from the OECD average, while 40 countries (11 OECD; 29 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 512 points on *evaluate and design scientific enquiry*, which was significantly lower than 8 countries (4 OECD: Japan, Estonia, Canada and Finland; 4 partner: Singapore, Macao (China), Chinese Taipei and Hong Kong (China)). Australia's performance was not significantly different from that of 9 countries (8 OECD: New Zealand, Korea, Slovenia, the Netherlands, the United Kingdom, Belgium, Switzerland and Germany; 1 partner: B-S-J-G (China)), while it was significantly higher than 51 countries (22 OECD; 29 partner).

Students' performance across countries on the *interpret data and evidence scientifically* subscale

Twenty-three countries (18 OECD, including Australia, and 5 partner) achieved significantly higher on the *interpret data and evidence scientifically* subscale than the OECD average of 493 score points. Eight countries (7 OECD; 1 partner) had average scores that were not statistically different from the OECD average, while 38 countries (10 OECD; 28 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 508 points on *interpret data and evidence scientifically*, which was significantly lower than 9 countries (5 OECD: Japan, Estonia, Finland, Canada and Korea; 4 partner: Singapore, Chinese Taipei, Macao (China) and Hong Kong (China)). Australia's performance was not significantly different from that of 9 countries (8 OECD: New Zealand, Slovenia, the United Kingdom, Germany, the Netherlands, Switzerland, Belgium and Portugal; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 50 countries (21 OECD; 29 partner).

TABLE 3.1 Average scores in students' performance on the science competency subscales, by country

Scientific literacy (overall)			
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	556	1.2
	Japan	538	3.0
	Estonia	534	2.1
	Chinese Taipei	532	2.7
	Finland	531	2.4
	Macao (China)	529	1.1
	Canada	528	2.1
	Hong Kong (China)	523	2.5
Not significantly different from Australia	B-S-J-G (China)	518	4.6
	Korea	516	3.1
	New Zealand	513	2.4
	Slovenia	513	1.3
	Australia	**510**	**1.5**
	United Kingdom	509	2.6
	Germany	509	2.7
	Netherlands	509	2.3
	Switzerland	506	2.9
Significantly lower than Australia	Ireland	503	2.4
	Belgium	502	2.3
	Denmark	502	2.4
	Poland	501	2.5
	Portugal	501	2.4
	Norway	498	2.3
	United States	496	3.2
	Austria	495	2.4
	France	495	2.1
	Sweden	493	3.6
	OECD average	**493**	**0.4**
	Czech Republic	493	2.3
	Spain	493	2.1
	Latvia	490	1.6
	Russian Federation	487	2.9
	Luxembourg	483	1.1
	Italy	481	2.5
	Hungary	477	2.4
	Lithuania	475	2.7
	Croatia	475	2.5
	Iceland	473	1.7
	Israel	467	3.4
	Slovak Republic	461	2.6
	Greece	455	3.9
	Chile	447	2.4
	Bulgaria	446	4.4
	United Arab Emirates	437	2.4
	Uruguay	435	2.2
	Cyprus	433	1.4
	Turkey	425	3.9
	Thailand	421	2.8
	Costa Rica	420	2.1
	Qatar	418	1.0
	Colombia	416	2.4
	Mexico	416	2.1

Explain phenomena scientifically			
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	553	1.5
	Japan	539	3.3
	Chinese Taipei	536	2.8
	Finland	534	2.4
	Estonia	533	2.0
	Canada	530	2.1
	Macao (China)	528	1.4
	Hong Kong (China)	524	2.6
Not significantly different from Australia	B-S-J-G (China)	520	4.7
Significantly higher than Australia	Slovenia	515	1.5
Not significantly different from Australia	New Zealand	511	2.6
	Germany	511	2.8
	Australia	**510**	**1.6**
	Korea	510	3.4
	United Kingdom	509	2.7
	Netherlands	509	2.5
	Ireland	505	2.5
	Switzerland	505	3.1
Significantly lower than Australia	Norway	502	2.3
	Denmark	502	2.7
	Poland	501	2.8
	Austria	499	2.7
	Belgium	499	2.4
	Sweden	498	3.7
	Portugal	498	2.5
	Czech Republic	496	2.5
	Spain	494	2.2
	OECD average	**493**	**0.5**
	United States	492	3.4
	France	488	2.2
	Latvia	488	1.8
	Russian Federation	486	3.2
	Luxembourg	482	1.1
	Italy	481	2.7
	Hungary	478	2.5
	Lithuania	478	2.7
	Croatia	476	2.4
	Iceland	468	2.0
	Slovak Republic	464	2.7
	Israel	463	3.5
	Greece	454	3.9
	Bulgaria	449	4.5
	Chile	446	2.6
	United Arab Emirates	437	2.5
	Uruguay	434	2.3
	Cyprus	432	1.4
	Turkey	426	4.2
	Costa Rica	420	2.3
	Thailand	419	2.9
	Qatar	417	1.2
	Mexico	414	2.3
	Colombia	412	2.6

TABLE 3.1 (continued)

	Evaluate and design scientific enquiry		
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	560	1.4
	Japan	536	3.3
	Estonia	535	2.6
	Canada	530	2.7
	Finland	529	2.9
	Macao (China)	525	1.9
	Chinese Taipei	525	3.1
	Hong Kong (China)	524	3.0
Not significantly different from Australia	B-S-J-G (China)	517	5.1
	New Zealand	517	3.1
	Korea	515	3.3
	Australia	**512**	**2.0**
	Slovenia	511	2.0
	Netherlands	511	2.5
	United Kingdom	508	2.8
	Belgium	507	2.5
	Switzerland	507	3.5
	Germany	506	2.9
Significantly lower than Australia	Denmark	504	2.6
	United States	503	3.6
	Portugal	502	2.7
	Poland	502	3.0
	Ireland	500	2.6
	France	498	2.5
	Norway	493	2.6
	OECD average	**493**	**0.5**
	Sweden	491	4.0
	Latvia	489	2.0
	Spain	489	2.7
	Austria	488	2.6
	Czech Republic	486	2.8
	Russian Federation	484	3.3
	Luxembourg	479	1.7
	Lithuania	478	2.9
	Italy	477	2.7
	Iceland	476	2.5
	Hungary	474	2.8
	Croatia	473	2.9
	Israel	471	3.8
	Slovak Republic	457	3.2
	Greece	453	4.2
	Chile	443	2.9
	Bulgaria	440	4.8
	Uruguay	433	2.9
	United Arab Emirates	431	2.7
	Cyprus	430	1.9
	Turkey	428	4.0
	Thailand	423	3.5
	Costa Rica	422	2.7
	Colombia	420	2.9
	Mexico	415	2.9
	Qatar	414	1.5

	Interpret data and evidence scientifically		
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	556	1.4
	Japan	541	3.3
	Estonia	537	2.6
	Chinese Taipei	533	2.7
	Macao (China)	532	2.9
	Finland	529	1.9
	Canada	525	3.1
	Korea	523	3.0
	Hong Kong (China)	521	5.1
Not significantly different from Australia	B-S-J-G (China)	516	3.1
	New Zealand	512	3.3
	Slovenia	512	2.0
	United Kingdom	509	2.0
	Germany	509	2.5
	Australia	**508**	**2.8**
	Netherlands	506	2.5
	Switzerland	506	3.5
	Belgium	503	2.9
	Portugal	503	2.6
Significantly lower than Australia	Poland	501	3.6
	France	501	2.7
	Ireland	500	3.0
	Denmark	500	2.6
	Norway	498	2.5
	United States	497	2.6
	Latvia	494	0.5
	OECD average	**493**	**4.0**
	Czech Republic	493	2.0
	Spain	493	2.7
	Austria	493	2.6
	Sweden	490	2.8
	Russian Federation	489	3.3
	Luxembourg	486	1.7
	Italy	482	2.9
	Iceland	478	2.7
	Hungary	476	2.5
	Croatia	476	2.8
	Lithuania	471	2.9
	Israel	467	3.8
	Slovak Republic	459	3.2
	Greece	454	4.2
	Chile	447	2.9
	Bulgaria	445	4.8
	United Arab Emirates	437	2.9
	Uruguay	436	2.7
	Cyprus	434	1.9
	Turkey	423	4.0
	Thailand	422	3.5
	Qatar	418	2.7
	Colombia	416	2.9
	Costa Rica	415	2.9
	Mexico	415	1.5

Students' relative strength and weakness on the science competency subscales

There are a number of countries whose performance varied across the different science competency subscales, which indicates a country's strength and weakness on the subscales. The results on the science competency subscales show:

- Australia, B-S-J-G (China), Croatia, Denmark, Estonia, Greece, Hong Kong (China), Hungary, Mexico, Poland, Switzerland, Thailand, the United Kingdom and Uruguay performed similarly, with no significant differences in the average scores across the competency subscales.
- Bulgaria, Ireland, the Slovak Republic and Sweden had significantly higher average scores on *explain phenomenon scientifically* than on *evaluate and design scientific enquiry* and *interpret data and evidence scientifically*. These countries demonstrated a relative strength on *explain phenomenon scientifically*.
- France, Iceland and Portugal had significantly lower average scores on *explain phenomenon scientifically* than on *evaluate and design scientific enquiry* and *interpret data and evidence scientifically*. These countries demonstrated a relative weakness on *explain phenomenon scientifically*.
- New Zealand and Singapore performed relatively stronger on *evaluate and design scientific enquiry* than on the other two competency subscales.
- Chinese Taipei, the Czech Republic, Germany, Spain and the United Arab Emirates performed relatively weaker on *evaluate and design scientific enquiry* than on the other two competency subscales.
- Latvia and Macao (China) performed relatively stronger on *interpret data and evidence scientifically* than on the other two competency subscales.
- Canada, Costa Rica, Lithuania and the Netherlands performed relatively weaker on *interpret data and evidence scientifically* than on the other two competency subscales.

Across the OECD, no single competency subscale showed a relative strength or weakness; however, students performed significantly higher on *interpret data and evidence scientifically* than on *evaluate and design scientific enquiry*.

Australia's results on the science knowledge subscales from an international perspective

Scientific literacy requires an understanding of major scientific facts, ideas and theories (*content knowledge*), an understanding of how knowledge has been derived (*procedural knowledge*) and an understanding of the role of specific constructs and the defining features essential to the process of knowledge-building in science (*epistemic knowledge*). All scientific literacy items in PISA 2015 were classified within one of the science knowledge categories:

- 53% of the items required *content knowledge*
- 33% of items required *procedural knowledge*
- 14% of items required *epistemic knowledge*.

As there were too few items assessing epistemic knowledge to support a separate subscale, for the purposes of reporting science knowledge by subscale, *procedural knowledge* and *epistemic knowledge* were combined to form a *procedural and epistemic knowledge* subscale, in addition to the *content knowledge* subscale.

Table 3.2 provides the average scores and standard errors for the two science knowledge subscales (*content knowledge* and *procedural and epistemic knowledge*), as well as the average scores and standard errors for the overall scientific literacy scale for comparison. Countries are shown in order from the highest to the lowest average scientific literacy subscale score and the three colour bands indicate whether a particular country has performed at a level significantly higher, lower or not significantly different to Australia.

Students' performance across countries on the *content knowledge* subscale

Twenty-four countries (19 OECD, including Australia, and 5 partner) achieved significantly higher on the *content knowledge* subscale than the OECD average of 493 score points. Five countries (4 OECD; 1 partner) had average scores that were not statistically different from the OECD average, while 40 countries (12 OECD; 28 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 508 points on *content knowledge*, which was significantly lower than 10 countries (5 OECD: Japan, Finland, Estonia, Canada and Slovenia; 5 partner: Singapore, Chinese Taipei, Macao (China), Hong Kong (China) and B-S-J-G (China)). Australia's performance was not significantly different from that of 9 OECD countries (Korea, Germany, New Zealand, the United Kingdom, the Netherlands, Switzerland, Ireland, Denmark and Norway), while it was significantly higher than 49 countries (20 OECD; 29 partner).

Students' performance across countries on the *procedural and epistemic knowledge* subscale

Twenty-four countries (19 OECD, including Australia, and 5 partner) achieved significantly higher on the *procedural and epistemic knowledge* subscale than the OECD average of 493 score points. Five OECD countries had average scores that were not statistically different from the OECD average, while 40 countries (11 OECD; 29 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 511 points on *procedural and epistemic knowledge*, which was significantly lower than 9 countries (5 OECD: Japan, Estonia, Finland, Canada and Korea; 4 partner: Singapore, Macao (China), Chinese Taipei and Hong Kong (China). Australia's performance was not significantly different from that of 8 countries (7 OECD: New Zealand, Slovenia, the United Kingdom, the Netherlands, Germany, Belgium and Switzerland; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 51 countries (22 OECD; 29 partner).

TABLE 3.2 Average scores in students' performance on the science knowledge subscales, by country

Scientific literacy (overall)

	Country	Avg. score	SE
Significantly higher than Australia	Singapore	556	1.2
	Japan	538	3.0
	Estonia	534	2.1
	Chinese Taipei	532	2.7
	Finland	531	2.4
	Macao (China)	529	1.1
	Canada	528	2.1
	Hong Kong (China)	523	2.5
Not significantly different from Australia	B-S-J-G (China)	518	4.6
	Korea	516	3.1
	New Zealand	513	2.4
	Slovenia	513	1.3
	Australia	**510**	**1.5**
	United Kingdom	509	2.6
	Germany	509	2.7
	Netherlands	509	2.3
	Switzerland	506	2.9
Significantly lower than Australia	Ireland	503	2.4
	Belgium	502	2.3
	Denmark	502	2.4
	Poland	501	2.5
	Portugal	501	2.4
	Norway	498	2.3
	United States	496	3.2
	Austria	495	2.4
	France	495	2.1
	Sweden	493	3.6
	OECD average	**493**	**0.4**
	Czech Republic	493	2.3
	Spain	493	2.1
	Latvia	490	1.6
	Russian Federation	487	2.9
	Luxembourg	483	1.1
	Italy	481	2.5
	Hungary	477	2.4
	Lithuania	475	2.7
	Croatia	475	2.5
	Iceland	473	1.7
	Israel	467	3.4
	Slovak Republic	461	2.6
	Greece	455	3.9
	Chile	447	2.4
	Bulgaria	446	4.4
	United Arab Emirates	437	2.4
	Uruguay	435	2.2
	Cyprus	433	1.4
	Turkey	425	3.9
	Thailand	421	2.8
	Costa Rica	420	2.1
	Qatar	418	1.0
	Colombia	416	2.4
	Mexico	416	2.1

Content knowledge

	Country	Avg. score	SE
Significantly higher than Australia	Singapore	553	1.6
	Japan	539	3.2
	Chinese Taipei	538	2.9
	Finland	534	2.4
	Estonia	534	2.1
	Canada	528	2.2
	Macao (China)	527	1.2
	Hong Kong (China)	526	2.6
	B-S-J-G (China)	520	4.6
	Slovenia	515	1.5
Not significantly different from Australia	Korea	513	3.3
	Germany	512	2.9
	New Zealand	512	2.6
	United Kingdom	508	2.8
	Australia	**508**	**1.8**
	Netherlands	507	2.4
	Switzerland	506	3.0
	Ireland	504	2.3
	Denmark	502	2.7
	Norway	502	2.4
Significantly lower than Australia	Poland	502	2.7
	Austria	501	2.8
	Portugal	500	2.6
	Czech Republic	499	2.5
	Belgium	498	2.4
	Sweden	498	3.6
	Spain	494	2.2
	OECD average	**493**	**0.5**
	United States	490	3.4
	Latvia	489	1.7
	France	489	2.2
	Russian Federation	488	3.3
	Luxembourg	483	1.3
	Italy	483	2.7
	Hungary	480	2.5
	Lithuania	478	2.7
	Croatia	476	2.5
	Iceland	468	1.8
	Slovak Republic	463	2.6
	Israel	462	3.6
	Greece	455	3.9
	Chile	448	2.6
	Bulgaria	447	4.5
	United Arab Emirates	437	2.5
	Uruguay	434	2.3
	Cyprus	430	1.8
	Turkey	425	4.1
	Costa Rica	421	2.5
	Thailand	420	2.8
	Qatar	416	1.2
	Mexico	414	2.1
	Colombia	413	2.5

Procedural and epistemic knowledge

	Country	Avg. score	SE
Significantly higher than Australia	Singapore	558	1.2
	Japan	538	3.0
	Estonia	535	2.2
	Macao (China)	531	1.2
	Chinese Taipei	528	2.8
	Finland	528	2.6
	Canada	528	2.4
	Hong Kong (China)	521	2.6
	Korea	519	3.1
Not significantly different from Australia	B-S-J-G (China)	516	4.8
	New Zealand	514	2.5
	Slovenia	512	1.5
	Australia	**511**	**1.7**
	United Kingdom	510	2.5
	Netherlands	509	2.3
	Germany	507	2.8
	Belgium	506	2.4
	Switzerland	505	3.0
Significantly lower than Australia	Portugal	502	2.6
	Denmark	502	2.4
	Poland	501	2.5
	United States	501	3.3
	Ireland	501	2.4
	France	499	2.2
	Norway	496	2.5
	OECD average	**493**	**0.4**
	Latvia	492	1.8
	Spain	492	2.2
	Sweden	491	3.6
	Austria	490	2.4
	Czech Republic	488	2.4
	Russian Federation	485	3.0
	Luxembourg	482	1.0
	Italy	479	2.6
	Iceland	477	2.0
	Croatia	475	2.7
	Lithuania	474	2.7
	Hungary	474	2.7
	Israel	470	3.5
	Slovak Republic	458	2.8
	Greece	454	4.0
	Chile	446	2.6
	Bulgaria	445	4.4
	Uruguay	436	2.5
	United Arab Emirates	435	2.6
	Cyprus	434	1.5
	Turkey	425	4.0
	Thailand	422	3.2
	Qatar	418	1.2
	Colombia	417	2.5
	Costa Rica	417	2.3
	Mexico	416	2.4

Students' relative strength and weakness on the *science knowledge* subscales

Students from Belgium, Colombia, Cyprus, France, Iceland, Israel, Korea, Latvia, Macao (China), Singapore and the United States all performed relatively stronger on the *procedural and epistemic knowledge* subscale than on the *content knowledge* subscale. In these countries, the average scores on *procedural and epistemic knowledge* were significantly higher than on *content knowledge*.

Students from Austria, B-S-J-G (China), Chinese Taipei, Costa Rica, the Czech Republic, Finland, Germany, Hong Kong (China), Hungary, Ireland, Italy, Lithuania, Norway, the Slovak Republic, Slovenia and Sweden all performed relatively stronger on *content knowledge* than on the *procedural and epistemic knowledge*. In these countries, the average scores on *content knowledge* were significantly higher than on *procedural and epistemic knowledge*.

In Australia, there was no significant difference between students' performance on *content knowledge* and *procedural and epistemic knowledge*. This was also the case across the OECD.

Australia's results on the science content subscales from an international perspective

All scientific literacy items were classified into one of the three content areas: *living systems*, *physical systems* and *Earth and space systems*:

- 40% of items were classified in the *living systems* category
- 33% of items were classified in the *physical systems* category
- 27% of items were classified in the *Earth and space systems* category.

Table 3.3 provides the average scores and standard errors for the three science content subscales (*living systems*, *physical systems* and *Earth and space systems*), as well as the average scores and standard errors for the overall scientific literacy scale for comparison. Countries are shown in order from the highest to the lowest average scientific literacy subscale score and the three colour bands indicate whether a particular country has performed at a level significantly higher, lower or not different to Australia.

Students' performance across countries on the *living systems* subscale

Twenty-one countries (16 OECD, including Australia, and 5 partner) achieved significantly higher on the *living systems* subscale than the OECD average of 492 score points. Eight OECD countries had average scores that were not statistically different from the OECD average, while 40 countries (11 OECD; 29 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 510 points on *living systems*, which was significantly lower than 8 countries (4 OECD: Japan, Estonia, Canada and Finland; 4 partner: Singapore, Chinese Taipei, Macao (China) and Hong Kong (China)). Australia's performance was not significantly different from that of 7 countries (6 OECD: New Zealand, Slovenia, Korea, Germany, the United Kingdom and Switzerland; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 53 countries (24 OECD and 29 partner).

Students' performance across countries on the *physical systems* subscale

Twenty-three countries (18 OECD, including Australia, and 5 partner) achieved significantly higher on the *physical systems* subscale than the OECD average of 493 score points. Seven countries (6 OECD; 1 partner) had average scores that were not statistically different from the OECD average, while 39 countries (11 OECD; 28 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 511 points on *physical systems*, which was significantly lower than 8 countries (4 OECD: Japan, Estonia, Finland and Canada; 4 partner: Singapore, Macao (China), Chinese Taipei and Hong Kong (China)). Australia's performance was not significantly different from that of 9 countries (8 OECD: Korea, New Zealand, Slovenia, the Netherlands, the United Kingdom, Denmark, Ireland and Germany; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 51 countries (22 OECD; 29 partner).

Students' performance across countries on the *Earth and space systems* subscale

Twenty-two countries (17 OECD, including Australia, and 5 partner) achieved significantly higher on the *Earth and space systems* subscale than the OECD average of 494 score points. Nine countries (8 OECD; 1 partner) had average scores that were not statistically different from the OECD average, while 38 countries (10 OECD; 28 partner) had average scores that were significantly lower than the OECD average.

Australian students achieved an average score of 509 points on *Earth and space systems*, which was significantly lower than 9 countries (5 OECD: Japan, Estonia, Finland, Canada and Korea; 4 partner: Singapore, Chinese Taipei, Macao (China) and Hong Kong (China)). Australia's performance was not significantly different from that of 9 countries (8 OECD: Slovenia, New Zealand, the Netherlands, Germany, the United Kingdom, Switzerland, Denmark and Belgium; 1 partner: B-S-J-G (China)), while Australia's performance was significantly higher than 50 countries (21 OECD; 29 partner).

TABLE 3.3 Average scores in students' performance on the science content subscales, by country

	Scientific literacy (overall)		
	Country	**Avg. score**	**SE**
Significantly higher than Australia	Singapore	556	1.2
	Japan	538	3.0
	Estonia	534	2.1
	Chinese Taipei	532	2.7
	Finland	531	2.4
	Macao (China)	529	1.1
	Canada	528	2.1
	Hong Kong (China)	523	2.5
Not significantly different from Australia	B-S-J-G (China)	518	4.6
	Korea	516	3.1
	New Zealand	513	2.4
	Slovenia	513	1.3
	Australia	**510**	**1.5**
	United Kingdom	509	2.6
	Germany	509	2.7
	Netherlands	509	2.3
	Switzerland	506	2.9
Significantly lower than Australia	Ireland	503	2.4
	Belgium	502	2.3
	Denmark	502	2.4
	Poland	501	2.5
	Portugal	501	2.4
	Norway	498	2.3
	United States	496	3.2
	Austria	495	2.4
	France	495	2.1
	Sweden	493	3.6
	OECD average	**493**	**0.4**
	Czech Republic	493	2.3
	Spain	493	2.1
	Latvia	490	1.6
	Russian Federation	487	2.9
	Luxembourg	483	1.1
	Italy	481	2.5
	Hungary	477	2.4
	Lithuania	475	2.7
	Croatia	475	2.5
	Iceland	473	1.7
	Israel	467	3.4
	Slovak Republic	461	2.6
	Greece	455	3.9
	Chile	447	2.4
	Bulgaria	446	4.4
	United Arab Emirates	437	2.4
	Uruguay	435	2.2
	Cyprus	433	1.4
	Turkey	425	3.9
	Thailand	421	2.8
	Costa Rica	420	2.1
	Qatar	418	1.0
	Colombia	416	2.4
	Mexico	416	2.1

	Living systems		
	Country	**Avg. score**	**SE**
Significantly higher than Australia	Singapore	558	1.4
	Japan	538	3.2
	Chinese Taipei	532	2.7
	Estonia	532	2.1
	Canada	528	2.4
	Finland	527	2.5
	Macao (China)	524	1.4
	Hong Kong (China)	523	2.7
Not significantly different from Australia	B-S-J-G (China)	517	4.5
	New Zealand	512	2.8
	Slovenia	512	1.6
	Korea	511	3.2
	Australia	**510**	**1.8**
	Germany	509	2.9
	United Kingdom	509	2.6
	Switzerland	506	3.2
Significantly lower than Australia	Netherlands	503	2.4
	Belgium	503	2.4
	Portugal	503	2.5
	Poland	501	2.8
	Ireland	500	2.5
	United States	498	3.4
	Denmark	496	2.6
	France	496	2.3
	Norway	494	2.5
	Spain	493	2.3
	Czech Republic	493	2.4
	OECD average	**492**	**0.5**
	Austria	492	2.6
	Latvia	489	1.7
	Sweden	488	3.7
	Luxembourg	485	1.2
	Russian Federation	483	2.8
	Italy	479	2.7
	Croatia	476	2.6
	Iceland	476	2.0
	Lithuania	476	2.7
	Hungary	473	2.6
	Israel	469	3.5
	Slovak Republic	458	2.8
	Greece	456	4.0
	Chile	452	2.7
	Bulgaria	443	4.5
	Uruguay	438	2.5
	United Arab Emirates	438	2.6
	Cyprus	433	1.5
	Turkey	424	3.9
	Qatar	423	1.1
	Thailand	422	3.2
	Costa Rica	420	2.4
	Colombia	419	2.5
	Mexico	415	2.4

TABLE 3.3 (continued)

Physical systems			
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	555	1.6
	Japan	538	3.2
	Estonia	535	2.3
	Finland	534	2.6
	Macao (China)	533	1.4
	Chinese Taipei	531	3.0
	Canada	527	2.4
	Hong Kong (China)	523	2.9
Not significantly different from Australia	B-S-J-G (China)	520	5.3
	Korea	517	3.6
	New Zealand	515	2.7
	Slovenia	514	1.6
	Netherlands	511	2.6
	Australia	**511**	**1.8**
	United Kingdom	509	2.9
	Denmark	508	2.7
	Ireland	507	2.8
	Germany	505	2.8
Significantly lower than Australia	Switzerland	503	3.1
	Poland	503	2.7
	Norway	503	2.5
	Sweden	500	3.8
	Belgium	499	2.4
	Portugal	499	2.7
	Austria	497	2.7
	United States	494	3.5
	OECD average	**493**	**0.5**
	France	492	2.4
	Czech Republic	492	2.5
	Latvia	490	1.7
	Russian Federation	488	3.4
	Spain	487	2.3
	Hungary	481	2.9
	Italy	479	2.8
	Luxembourg	478	1.4
	Lithuania	478	2.8
	Iceland	472	1.9
	Croatia	472	2.6
	Israel	469	3.8
	Slovak Republic	466	2.9
	Greece	452	4.0
	Bulgaria	445	4.4
	Chile	439	3.0
	United Arab Emirates	434	2.8
	Cyprus	433	1.6
	Uruguay	432	2.6
	Turkey	429	4.3
	Thailand	423	3.2
	Costa Rica	417	2.4
	Qatar	415	1.5
	Colombia	414	2.7
	Mexico	411	2.2

Earth and space systems			
	Country	Avg. score	SE
Significantly higher than Australia	Singapore	554	1.6
	Japan	541	3.3
	Estonia	539	2.3
	Finland	534	3.0
	Chinese Taipei	534	3.1
	Macao (China)	533	1.2
	Canada	529	2.5
	Hong Kong (China)	523	2.5
	Korea	521	3.3
Not significantly different from Australia	B-S-J-G (China)	516	4.9
	Slovenia	514	1.8
	New Zealand	513	2.7
	Netherlands	513	2.8
	Germany	512	2.9
	United Kingdom	510	2.8
	Australia	**509**	**2.1**
	Switzerland	508	3.1
	Denmark	505	2.7
	Belgium	503	2.6
Significantly lower than Australia	Ireland	502	2.6
	Poland	501	2.8
	Portugal	500	2.9
	Norway	499	2.6
	Austria	497	2.9
	Spain	496	2.3
	United States	496	3.4
	France	496	2.5
	Sweden	495	4.1
	OECD average	**494**	**0.5**
	Czech Republic	493	2.6
	Latvia	493	1.9
	Russian Federation	489	3.3
	Italy	485	2.7
	Luxembourg	483	1.6
	Croatia	477	2.7
	Hungary	477	2.8
	Lithuania	471	3.0
	Iceland	469	1.9
	Slovak Republic	458	2.8
	Israel	457	3.8
	Greece	453	4.3
	Bulgaria	448	4.8
	Chile	446	2.5
	United Arab Emirates	435	2.8
	Uruguay	434	2.6
	Cyprus	430	1.6
	Turkey	421	4.3
	Mexico	419	2.4
	Costa Rica	418	2.4
	Thailand	416	3.2
	Colombia	411	2.7
	Qatar	409	1.2

Students' relative strength and weakness on the science content subscales

There are a number of countries whose performance varied across the different science content subscales, which indicates a country's strength and weakness on the subscales. These differences in performance may be attributable to varying emphases placed on different topics in the curriculum. The results on the science content subscales show:

- Australia, B-S-J-G (China), Canada, Chinese Taipei, the Czech Republic, Hong Kong (China), Japan, New Zealand, Poland, Slovenia, the United Arab Emirates and the United Kingdom performed similarly, with no significant differences in the average scores across the content subscales.
- Colombia, Greece and Singapore had significantly higher average scores on *living systems* than on *physical systems* and *Earth and space*. These countries demonstrated a relative strength on *living systems*.
- Austria, Denmark, Finland, Macao (China), the Netherlands, Norway and the Russian Federation had significantly lower average scores on *living systems* than on *physical systems* and *Earth and space.* These countries demonstrated a relative weakness on *living systems*.
- Ireland, the Slovak Republic and Turkey performed relatively stronger on *physical systems* than on *living systems* and *Earth and space*.
- Belgium, Croatia, France, Germany, Luxembourg, Mexico and Spain performed relatively weaker on *physical systems* than on the other two content subscales.
- Italy and Latvia performed relatively stronger on *Earth and space systems* than on the other two content subscales. Israel, Lithuania and Thailand performed relatively weaker on *Earth and space systems* than on the other two content subscales.

Across the OECD, students were relatively weaker on *living systems* than on *physical systems* and *Earth and space systems*.

Australia's results on the science competency subscale from a national context

Students' performance on the *explain phenomenon scientifically* subscale

Table 3.4 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *explain phenomenon scientifically* subscale. The average scores on this subscale ranged from 530 points in the Australian Capital Territory to 485 points in Tasmania. The Australian Capital Territory performed at a level not significantly different to Western Australia and achieved significantly higher than all other jurisdictions.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory and Tasmania performed not significantly different to the OECD average.

TABLE 3.4 Average scores and multiple comparisons on the *explain phenomenon scientifically* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	530	4.1		●	▲	▲	▲	▲	▲	▲	▲
WA	525	4.6	●		▲	▲	▲	▲	▲	▲	▲
VIC	511	3.3	▼	▼		●	●	●	▲	▲	▲
NSW	510	3.2	▼	▼	●		●	●	▲	▲	▲
SA	507	4.3	▼	▼	●	●		●	●	▲	▲
QLD	506	3.3	▼	▼	●	●	●		●	▲	▲
NT	493	6.4	▼	▼	▼	▼	●	●		●	●
TAS	485	4.6	▼	▼	▼	▼	▼	▼	●		●
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	●	●	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' performance on the *evaluate and design scientific enquiry* subscale

Table 3.5 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *evaluate and design scientific enquiry* subscale. The average scores on this subscale ranged from 527 points in the Australian Capital Territory to 484 points in Tasmania. The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than Queensland, New South Wales, South Australia, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, Queensland, New South Wales and South Australia) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory performed not significantly different to the OECD average while Tasmania performed significantly lower than the OECD average.

TABLE 3.5 Average scores and multiple comparisons on the *evaluate and design scientific enquiry* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	QLD	NSW	SA	NT	TAS	OECD average
ACT	527	4.8		●	●	▲	▲	▲	▲	▲	▲
WA	520	4.3	●		●	●	●	●	▲	▲	▲
VIC	517	4.3	●	●		●	●	●	▲	▲	▲
QLD	510	4.4	▼	●	●		●	●	●	▲	▲
NSW	510	3.6	▼	●	●	●		●	●	▲	▲
SA	508	4.4	▼	●	●	●	●		●	▲	▲
NT	495	10.1	▼	▼	▼	●	●	●		●	●
TAS	484	4.4	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' performance on the *interpret data and evidence scientifically* subscale

Table 3.6 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *interpret data and evidence scientifically* subscale. The average scores on this subscale ranged from 522 points in the Australian Capital Territory to 481 points in Tasmania. The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, South Australia, New South Wales and Queensland) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory performed not significantly different to the OECD average. Tasmania performed significantly lower than OECD average.

TABLE 3.6 Average scores and multiple comparisons on the *interpret data and evidence scientifically* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	SA	NSW	QLD	NT	TAS	OECD average
ACT	522	4.1		●	●	▲	▲	▲	▲	▲	▲
WA	518	4.0	●		●	●	▲	▲	▲	▲	▲
VIC	513	3.4	●	●		●	●	●	▲	▲	▲
SA	508	4.3	▼	●	●		●	●	▲	▲	▲
NSW	506	3.5	▼	▼	●	●		●	▲	▲	▲
QLD	506	3.5	▼	▼	●	●	●		▲	▲	▲
NT	483	8.1	▼	▼	▼	▼	▼	▼		●	●
TAS	481	4.1	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' relative strength and weakness on the science competency subscales

There were no differences among the science competency subscale averages that were significant within any of the jurisdictions.

Australia's results on the science knowledge subscale from a national context

Students' performance on the *content knowledge* subscale

Table 3.7 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *content knowledge* subscale. The average scores on this subscale ranged from 526 points in the Australian Capital Territory to 483 points in Tasmania. The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.

TABLE 3.7 Average scores and multiple comparisons on the *content knowledge* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	526	4.4		●	▲	▲	▲	▲	▲	▲	▲
WA	522	4.3	●		▲	▲	▲	▲	▲	▲	▲
VIC	508	3.3	▼	▼		●	●	●	▲	▲	▲
NSW	508	3.5	▼	▼	●		●	●	▲	▲	▲
SA	505	4.4	▼	▼	●	●		●	●	▲	▲
QLD	504	3.2	▼	▼	●	●	●		●	▲	▲
NT	490	7.6	▼	▼	▼	▼	●	●		●	●
TAS	483	4.2	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' performance on the *procedural and epistemic knowledge* subscale

Table 3.8 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *procedural and epistemic knowledge* subscale. The average scores on this subscale ranged from 524 points in the Australian Capital Territory to 483 points in Tasmania. The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, South Australia, New South Wales and Queensland) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.

TABLE 3.8 Average scores and multiple comparisons on the *procedural and epistemic knowledge* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	SA	NSW	QLD	NT	TAS	OECD average
ACT	524	4.2		●	●	▲	▲	▲	▲	▲	▲
WA	520	4.1	●		●	●	▲	▲	▲	▲	▲
VIC	516	3.4	●	●		●	●	●	▲	▲	▲
SA	509	4.0	▼	●	●		●	●	▲	▲	▲
NSW	509	3.2	▼	▼	●	●		●	▲	▲	▲
QLD	508	3.6	▼	▼	●	●	●		▲	▲	▲
NT	490	8.2	▼	▼	▼	▼	▼	▼		●	●
TAS	483	4.5	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.4**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' relative strength and weakness on the *science knowledge* subscales

There were no differences among the science knowledge subscale averages that were significant within any of the jurisdictions.

Australia's results on the science content subscale from a national context

Students' performance on the *living systems* subscale

Table 3.9 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *living systems* subscale. The average scores on this subscale ranged from 526 points in the Australian Capital Territory to 483 points in Tasmania. The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, Queensland, South Australia, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, Queensland and South Australia) all performed at a significantly higher level than the OECD average (492 points). The Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.

TABLE 3.9 Average scores and multiple comparisons on the *living systems* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	QLD	SA	NT	TAS	OECD average
ACT	526	4.2		●	▲	▲	▲	▲	▲	▲	▲
WA	521	4.2	●		●	▲	▲	▲	▲	▲	▲
VIC	513	3.7	▼	●		●	●	●	▲	▲	▲
NSW	508	3.5	▼	▼	●		●	●	▲	▲	▲
QLD	507	3.5	▼	▼	●	●		●	●	▲	▲
SA	506	4.3	▼	▼	●	●	●		●	▲	▲
NT	493	6.8	▼	▼	▼	▼	●	●		●	●
TAS	483	4.6	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**492**	**0.5**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' performance on the *physical systems* subscale

Table 3.10 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *physical systems* subscale. The average scores on this subscale ranged from 526 points in the Australian Capital Territory to 485 points in Tasmania. The Australian Capital Territory and Western Australia performed at a level not significantly different to one another and performed significantly higher than Victoria, New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland) all performed at a significantly higher level than the OECD average (493 points). The Northern Territory and Tasmania performed not significantly different to the OECD average.

TABLE 3.10 Average scores and multiple comparisons on the *physical systems* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	526	4.6		●	▲	▲	▲	▲	▲	▲	▲
WA	523	4.1	●		●	▲	▲	▲	▲	▲	▲
VIC	513	3.5	▼	●		●	●	●	▲	▲	▲
NSW	509	3.3	▼	▼	●		●	●	●	▲	▲
SA	509	4.3	▼	▼	●	●		●	●	▲	▲
QLD	507	3.9	▼	▼	●	●	●		●	▲	▲
NT	494	8.6	▼	▼	▼	●	●	●		●	●
TAS	485	4.5	▼	▼	▼	▼	▼	▼	●		●
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	●	●	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' performance on the *Earth and space systems* subscale

Table 3.11 shows the average scores for the Australian jurisdictions and a pairwise comparison between jurisdictions on the *Earth and space systems* subscale. The average scores on this subscale ranged from 521 points in the Australian Capital Territory to 482 points in Tasmania. The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than New South Wales, South Australia, Queensland, the Northern Territory and Tasmania.

Six jurisdictions (the Australian Capital Territory, Western Australia, Victoria, New South Wales, South Australia and Queensland) all performed at a significantly higher level than the OECD average (494 points). The Northern Territory performed not significantly different to the OECD average and Tasmania performed significantly lower than the OECD average.

TABLE 3.11 Average scores and multiple comparisons on the *Earth and space systems* subscale, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	521	4.8		●	●	▲	▲	▲	▲	▲	▲
WA	518	4.4	●		●	●	●	▲	▲	▲	▲
VIC	511	3.6	●	●		●	●	●	▲	▲	▲
NSW	508	3.9	▼	●	●		●	●	▲	▲	▲
SA	507	4.2	▼	●	●	●		●	▲	▲	▲
QLD	506	3.5	▼	▼	●	●	●		▲	▲	▲
NT	488	7.9	▼	▼	▼	▼	▼	▼		●	●
TAS	482	4.5	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**494**	**0.5**	▼	▼	▼	▼	▼	▼	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Students' relative strength and weakness on the science content subscales

There were no differences among the science content subscale averages that were significant within any of the jurisdictions.

CHAPTER 4

Australian students' performance in reading literacy

Key findings

- Australian students achieved an average score of 503 points in reading literacy, which was significantly higher than the OECD average of 493 points.
- Australia's performance was significantly lower than 11 countries (Singapore, Hong Kong (China), Canada, Finland, Ireland, Estonia, Korea, Japan, Norway, New Zealand and Macao (China)).
- Australia's performance was not significantly different from that of 13 countries (Germany, Poland, Slovenia, the Netherlands, Sweden, Denmark, France, Belgium, Portugal, the United Kingdom, Chinese Taipei, the United States and B-S-J-G (China)).
- Australia's performance was significantly higher than 44 countries, which included 15 OECD countries.
- Australia's proportion of high performers (11%) was higher than the OECD average (8%).
- Australia's proportion of low performers (18%) was lower than the OECD average (20%).
- 61% of Australian students achieved the National Proficient Standard in reading literacy.
- The reading literacy performance for Australia and eight other countries declined significantly between 2009 and 2015. Australia's performance declined by 12 points.
- All jurisdictions performed significantly higher than the OECD average, except for Tasmania and the Northern Territory, whose performances were significantly lower than the OECD average.
- The proportion of students who reached the National Proficient Standard (Level 3) in reading literacy was 48% in Tasmania and the Northern Territory; 59% in New South Wales; 60% in Queensland; 61% in South Australia; 63% in Victoria and Western Australia; and 65% in the Australian Capital Territory.
- Western Australia, South Australia, New South Wales, the Australian Capital Territory and Tasmania had significant declines in performance between 2000 and 2015.

- Indigenous students achieved significantly lower than non-Indigenous students in reading literacy, with a difference of 71 score points on average, which equates to around two-and-a-third years of schooling.
- Students from metropolitan schools scored, on average, 31 points higher in reading literacy (the average difference representing around one year of schooling) than students from provincial schools, and scored 46 points on average higher than students from remote schools (the average difference representing around one-and-a-half years of schooling).
- Students in the highest socioeconomic background quartile achieved an average score of 551 points, which was significantly higher than students in the lowest socioeconomic background quartile, who achieved 462 points. This difference of 89 points represents around three years of schooling.
- Australian-born students achieved an average score that was significantly lower than first-generation students and not statistically different to that of foreign-born students.
- Students who spoke English at home achieved an average reading literacy score that was significantly higher than students who spoke a language other than English at home.
- Females scored 519 points on average and males scored 487 points. This difference of 32 points represents around one year of schooling.

Reading literacy was assessed as a major assessment domain in PISA 2000 and 2009. In PISA 2015, reading literacy was assessed as a minor domain so students' reading literacy performance is reported on an overall scale rather than given as an in-depth analysis of skills and knowledge. Reading literacy will next be assessed as a major domain in 2018.

This chapter begins with a summary of the PISA reading literacy assessment domain, which includes a definition of reading literacy, an overview of the assessment framework and a description of how PISA measures and reports reading literacy.[33] The next section presents the results of student performance in reading literacy for the PISA 2015 assessment in terms of average scores and proficiency levels. The performance of Australian PISA students is compared to the performance of PISA students from other participating countries. Results are also presented by jurisdiction and by different demographic groups. A discussion about the changes in reading literacy performance between PISA 2009 and 2015, and between 2012 and 2015 is also provided.

How is reading literacy defined in PISA?

The PISA concept of reading literacy emphasises students' ability to use written information in situations that they may encounter in their life at and beyond school. PISA defines reading literacy as:

> … understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society.
>
> OECD, 2016a, p. 49

The definition of reading literacy is broader and deeper than solely decoding information. It implies that reading literacy involves understanding, using and reflecting on written information in a range of situations and in the different ways written texts are presented through different media (print and digital). Further, it recognises students' awareness of and the ability to use a variety of appropriate strategies when processing texts.

33 Details about the reading literacy framework, structure of the assessment and proficiency scale have been assembled from the *PISA 2015 Assessment and Analytical Framework* (OECD, 2016).

How is reading literacy assessed in PISA?

The PISA reading literacy assessment assesses student performance through three major task characteristics:

1. *aspect* (the type of reading task or reading process involved)
2. *text* (the range and format of the reading material)
3. *situation* (the range of contexts for which the text was constructed).

The task characteristics and categories of the reading literacy framework are shown in Figure 4.1.

ASPECT
What reading tasks must students perform?

- **Access and retrieve:** information in the text
- **Integrate and interpret:** what they read
- **Reflect and evaluate:** standing back from a text and relating it to their own experience

TEXT
What kind of text must students read?

- **Medium:** in what form does the text appear?
  - Print
  - Digital
- **Environment:** can the reader change digital texts?
  - Authored (reader is receptive)
  - Message based (reader can change)
- **Text format:** how is the text presented?
  - Continuous texts (in sentences)
  - Non-continuous texts (in lists)
  - Mixed texts (combining these)
  - Multiple texts (brought together from more than one source)
- **Text type:** what the text is trying to do?
  - Description (typically answering what questions)
  - Narration (typically when)
  - Exposition (typically how)
  - Argumentation (typically why)
  - Instruction (providing directions)
  - Transaction (exchanging information)

SITUATION
What kinds of texts must students read in terms of their intended use?

- **Personal:** to satisfy one's own interests
- **Public:** relating to wider society
- **Educational:** used in instruction
- **Occupational:** related to the world of work

FIGURE 4.1 The task characteristics of the reading literacy framework (OECD, 2010)

These task characteristics define the PISA reading literacy framework and the test developers used these as the foundation from which to construct the items in the reading literacy assessment. Some of the elements in the three task characteristics were used as the basis for constructing scales and subscales, and for reporting, whereas other elements ensured that reading literacy was adequately covered.

Aspect

Aspects are the cognitive strategies, approaches or purposes that readers use to negotiate their way into, around and between texts. It is expected that all readers will be able to demonstrate some level of competency in each of these aspects, irrespective of their overall proficiency. In PISA 2009, when reading literacy was the major domain, these aspects were reported on three subscales:

1. *Access and retrieve*: tasks involve using skills associated with finding, selecting and collecting relevant information, for example, from a page of continuous text, a table or a list of information.
2. *Integrate and interpret*: tasks involve processing what is read to make internal sense of a text. Integrating focuses on demonstrating an understanding of the relations between different parts of a text. Interpreting refers to the process of making meaning from something that is not stated.
3. *Reflect and evaluate*: tasks involve reflecting and evaluating skills that use knowledge, ideas or attitudes beyond the text in order to relate the information provided within the text to one's own conceptual and experiential frames of reference. In reflecting on a text, readers relate their own experience or knowledge to compare, contrast or hypothesise. In evaluating a text, readers make a judgement about it, drawing on personal experience or on knowledge of the world that may be formal or content-based.

These three aspects are interrelated and interdependent; however, in PISA the tasks are designed to emphasise one or another of the aspects.

Situation

The situation variables used in PISA refer to the contexts and uses for which the author constructed the text. In PISA, texts are assigned to one of four situations according to their supposed audience and purpose, rather than situated on the place where the reading activity may be carried out. The four situations are:

1. *Personal*: texts that are intended to satisfy an individual's personal interests (e.g. letters, fiction, biography, emails, diary-style blogs).
2. *Public*: texts that relate to activities and concerns of the larger society (e.g. public notices, news websites, forum-style blogs).
3. *Educational*: texts that are designed specifically for the purpose of instruction and imparting knowledge (e.g. printed textbooks, interactive learning software).
4. *Occupational*: texts associated with the workplace that support the accomplishment of an immediate task (e.g. job advertisement, manuals).

Text

Texts refer to the range of materials that are read. Digital reading was added to the framework in PISA 2009 and 2012, which meant that there were four main classifications in the PISA reading literacy framework:

1 *Medium*: the form texts are presented in: print (paper) or digital (hypertext). Print medium texts appear in many different forms, such as single sheets, brochures, magazines and books. Due to its static nature, printed text is usually read in a particular sequence and the amount of text is visible to the reader. In contrast, digital medium texts are dynamic and can be read in a non-sequential manner with only a fraction of the available text seen at any one time. To access text digitally, readers use navigation tools and features such as scroll bars, buttons, menus and tabs.

2 *Environment*: can be authored or message-based, and in PISA, only applies to digital medium texts. An authored environment is one in which the content cannot be modified (e.g. home pages, government information sites and news sites). A message-based environment is one where the reader has the opportunity to contribute by adapting the content (e.g. emails, blogs, chat rooms and web forums).

3 *Text format*: classifies a text as continuous, non-continuous, mixed or multiple. The categories are explained as follows.

- *Continuous* texts are formed by sentences that are, in turn, organised into paragraphs.
- *Non-continuous* texts are organised in matrix format, based on combinations of lists (e.g. lists, tables, diagrams, advertisements, catalogues, indexes and forms).
- *Mixed* texts consist of both continuous and non-continuous formats, where the author has used a variety of presentations to communicate information.
- *Multiple* texts are defined as collections of independently generated texts that are not necessarily presented in the same context in which they were originally authored (e.g. a collection of websites from different companies that provide travel advice may or may not provide similar directions to tourists).

4 *Text type*: is another way of classifying texts. This ensures the assessment includes a range of texts that represent different types of reading. The text type is not conceived of as a variable that influences the difficulty of a task and is subdivided into the following six categories.

- *Description*: in which the information refers to properties of objects in space and typically provides answers to 'What?' questions (e.g. catalogues, geographical maps, online flight schedules).
- *Narration*: in which the information refers to properties of objects in time and typically answers 'When?' or 'In what sequence?' questions (e.g. novels, short stories, plays, comic strips).
- *Exposition*: in which the information is presented as composite concepts or mental constructs and often answers 'How?' questions (e.g. scholarly essays, diagrams showing a model of memory, graphs of population trends).
- *Argumentation*: presents the relationship among concepts or propositions, typically answering 'Why?' questions (e.g. letters to the editor, poster advertisements, web-based reviews of a book or film).
- *Instruction*: provides directions on what to do. Instructions present directions for certain behaviours in order to complete a task (e.g. recipes, series of diagrams showing a procedure for giving first aid, guidelines for operating digital software).
- *Transaction*: refers to the exchange of information in an interaction with a reader (e.g. personal letters to share family news, email exchanges to plan holidays, text messages to arrange a meeting).

In PISA 2015, no items were assessed from the digital reading assessment. The computer-based assessment in PISA 2015 consisted of only items from the paper-based assessment that were delivered on computer, and so there are only two text classifications: text format and text type.

The PISA 2015 reading literacy assessment structure

The assessment framework serves as the conceptual basis for assessing students' proficiency in reading literacy. In addition to the framework, the difficulty of the items and the item format types need to be considered. The difficulty of the reading literacy items depends on the interaction of the aspects and text formats. For example, the difficulty of items in the aspect task, access and retrieve, depends on the number of pieces of information that the reader needs to locate, the amount of inference required, the amount and prominence of competing information, and the length and complexity of the text.

Reading literacy items in the assessment

As reading literacy was a minor assessment domain in PISA 2015, new reading literacy materials were not developed. The PISA 2015 assessment design incorporated six clusters of trend items, with a total of 103 items. This was equivalent to three hours of reading literacy materials. Table 4.1 shows the number and proportion of items selected for the PISA 2015 reading literacy assessment by task characteristic and category (OECD, 2016b).

TABLE 4.1 Distribution of items by task characteristic and categories in the reading literacy assessment[34]

Task characteristic and categories	Items	
	No.	%
Aspect		
Access and retrieve	26	25
Integrate and interpret	53	51
Reflect and evaluate	24	23
Situation		
Personal	29	28
Public	24	23
Educational	30	29
Occupational	20	19
Text (text format)		
Continuous	62	60
Non-continuous	31	30
Mixed	7	7
Multiple	3	3

Note: Due to rounding, some percentages may not match to totals in the text. This relates to all tables and graphs in this chapter. See the Reader's Guide for more information.

Item response formats

Reading literacy was assessed through a range of item responses to cover the full range of cognitive abilities and knowledge identified in the framework. These included:

- *multiple-choice items:* students were required to select one correct response among four or five possible response options
- *complex multiple-choice items:* students were required to select the correct response to each of a number of statements or questions
- *closed constructed-response items:* students provided their own responses with a limited range of acceptable answers

34 Information collated from data provided from Annex C2 in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016b).

- *open constructed-response items:* students were either required to provide a brief answer, similar to the closed constructed-response items, but with a wider range of possible answers, or where they were required to write a short explanation in response to a question, show the method and thought processes they used in constructing their response.

As shown in Table 4.2, simple multiple-choice items and open constructed-response items were the most common item formats (OECD, 2016b). The closed constructed-response items were coded automatically, while the open constructed-response items were coded by a trained expert coder, who selected the code that best captured the response provided by a student to an item. Each code was then converted to a score for that item.

TABLE 4.2 Distribution of items by item response format in the reading literacy assessment[35]

	Items	
Item format	No.	%
Simple multiple-choice	36	35
Complex multiple-choice	12	12
Open constructed-response	48	47
Closed constructed-response	7	7

Examples of released items

All reading literacy items that were included in the PISA 2015 assessment were used in previous assessments, that is, as trend items, and no reading literacy items were released after the assessment. However, a number of example items were made public and can be found in previous National PISA reports or through the OECD website at http://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm.

How is reading literacy reported in PISA?

PISA uses average scores and proficiency levels to provide a summary of student performance and to compare the relative standing between countries and different groups. As reading literacy was assessed as a minor domain in PISA 2015, fewer reading literacy items were administered to students and student performance is reported on a single overall reading literacy scale.

Average scores and distribution of scores

The average score on the PISA 2015 reading literacy scale across participating OECD countries was 493 points, with a standard deviation of 98 points. This is the benchmark against which each country's reading literacy performance in PISA 2015 can be compared.

Proficiency levels

The PISA 2015 reading literacy scale is based on the PISA 2009 reading literacy scale, when reading was the major assessment domain. The reading literacy scale is divided into seven proficiency levels, with Level 6 as the highest and Level 1b as the lowest. Figure 4.2 details the levels in terms of the nature of the reading skills, knowledge and understanding required at each level of the reading literacy scale. The cut-off points for each of the proficiency levels are also shown.

35 Information collated from data provided from Annex C2 in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016b).

	Proficiency level	What students can typically do at each level
High performers	6	Tasks at this level typically require the reader to make multiple inferences, comparisons and contrasts that are both detailed and precise. They require demonstration of a full and detailed understanding of one or more texts and may involve integrating information from more than one text. Tasks may require the reader to deal with unfamiliar ideas, in the presence of prominent competing information, and to generate abstract categories for interpretations. Reflect and evaluate tasks may require the reader to hypothesise about or critically evaluate a complex text on an unfamiliar topic, taking into account multiple criteria or perspectives, and applying sophisticated understandings from beyond the text. A salient condition for access and retrieve tasks at this level is precision of analysis and fine attention to detail that is inconspicuous in the texts.
	698.3 score points	
	5	Tasks at this level that involve retrieving information require the reader to locate and organise several pieces of deeply embedded information, inferring which information in the text is relevant. Reflective tasks require critical evaluation or hypothesis, drawing on specialised knowledge. Both interpretative and reflective tasks require a full and detailed understanding of a text whose content or form is unfamiliar. For all aspects of reading, tasks at this level typically involve dealing with concepts that are contrary to expectations.
	625.6 score points	
Middle performers	4	Tasks at this level that involve retrieving information require the reader to locate and organise several pieces of embedded information. Some tasks at this level require interpreting the meaning of nuances of language in a section of text by taking into account the text as a whole. Other interpretative tasks require understanding and applying categories in an unfamiliar context. Reflective tasks at this level require readers to use formal or public knowledge to hypothesise about or critically evaluate a text. Readers must demonstrate an accurate understanding of long or complex texts whose content or form may be unfamiliar.
	552.9 score points	
	3	Tasks at this level require the reader to locate, and in some cases recognise the relationship between, several pieces of information that must meet multiple conditions. Interpretative tasks at this level require the reader to integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. They need to take into account many features in comparing, contrasting or categorising. Often the required information is not prominent or there is much competing information; or there are other text obstacles, such as ideas that are contrary to expectation or negatively worded. Reflective tasks at this level may require connections, comparisons and explanations, or they may require the reader to evaluate a feature of the text. Some reflective tasks require readers to demonstrate a fine understanding of the text in relation to familiar, everyday knowledge. Other tasks do not require detailed text comprehension but require the reader to draw on less common knowledge.
	480.2 score points	
	2	Some tasks at this level require the reader to locate one or more pieces of information, which may need to be inferred and may need to meet several conditions. Other tasks require recognising the main idea in a text, understanding relationships or construing meaning within a limited part of the text when the information is not prominent and the reader must make low-level inferences. Tasks at this level may involve comparisons or contrasts based on a single feature in the text. Typical reflective tasks at this level require readers to make a comparison or several connections between the text and outside knowledge, by drawing on personal experience and attitudes.
	407.5 score points	
Low performers	1a	Tasks at this level require the reader to locate one or more independent pieces of explicitly stated information, to recognise the main theme or author's purpose in a text about a familiar topic or to make a simple connection between information in the text and common everyday knowledge. Typically, the required information in the text is prominent and there is little, if any, competing information. The reader is explicitly directed to consider relevant factors in the task and in the text.
	334.8 score points	
	1b	Tasks at this level require the reader to locate a single piece of explicitly stated information in a prominent position in a short, syntactically simple text with a familiar context and text type, such as a narrative or a simple list. The text typically provides support to the reader, such as repetition of information, pictures or familiar symbols. There is minimal competing information. In tasks requiring interpretation, the reader may need to make simple connections between adjacent pieces of information.
	262.0 score points	

FIGURE 4.2 Summaries of the seven proficiency levels on the reading literacy scale

Students who score between 626 and 698 points are placed at Level 5 and students who score higher than 698 points are placed at Level 6. Students who perform at Level 5 or 6 are considered highly proficient in reading literacy and are considered high performers in this domain. Students who are placed at Level 6 are able to make multiple inferences, comparisons and contrasts, demonstrate a full and detailed understanding of one or more texts, integrate information from more than one text, and deal with unfamiliar ideas in the presence of prominent competing information.

In PISA, Level 2 is considered the international baseline proficiency level and defines the level of achievement on the PISA scale at which students begin to demonstrate the reading literacy competencies that will enable them to actively participate in life situations. Students who score below Level 2 (i.e. below 408 points) are considered low performers and their low levels of reading literacy skills and knowledge will limit them in participating fully in society. The skills and knowledge of students who performed below the lower boundary of Level 1b (262 points) could not be reliably described because there were too few items at this level. However, students who performed at this level demonstrated limited reading skills that will likely negatively impact their lives.

In Australia, the nationally agreed proficient standard (as agreed in the *Measurement Framework for Schooling in Australia*) is Level 3. This level was chosen because it 'represents a "challenging but reasonable" expectation of student achievement at a year level with students needing to demonstrate more than elementary skills expected at that year level' (ACARA, 2015, p. 5). Students performing at or above Level 3 have met the National Proficient Standard.

Interpreting differences in PISA scores: how big is 'big'?

How do we go about understanding the difference in average reading literacy scores between two groups of students? The following comparisons can help in judging the magnitude of score differences.

In terms of proficiency levels

A difference of 73 points represents one proficiency level on the PISA reading literacy scale. This can be considered a comparatively large difference in student performance in substantive terms. For example, compare the skill sets for those students who are proficient at Level 2 and those who are proficient at Level 3. Students who reach Level 2 on the reading literacy scale are able to locate information that meets several conditions, make comparisons or contrasts around a single feature, work out what a well-defined part of a text means, even when the information is not prominent, and make connections between the text and personal experience. However, students who reach Level 3 are proficient with the tasks at Level 2 and in addition can also locate multiple pieces of information, link different parts of a text and relate a text to previously acquired knowledge.

In terms of schooling

It is possible to estimate the score point difference that is associated with one year of schooling. This difference can be estimated for Australia because the Australian PISA 2015 sample included a sizeable number of students from different school year levels. Analyses of these data indicate that the difference between two year levels is, on average, around 30 points on the PISA reading literacy scale.

Australia's reading literacy results from an international perspective

Reading literacy performance in PISA 2015

Australia achieved an average score of 503 points in the PISA 2015 reading literacy assessment, which was significantly higher than the OECD average of 493 points. Australia was one of 22 countries or economies[36] (19 OECD and 3 partner) to achieve an average score that was significantly higher than the OECD average. The OECD countries were Canada, Finland, Ireland, Estonia, Korea, Japan, Norway, New Zealand, Germany, Poland, Slovenia, the Netherlands, Australia, Sweden, Denmark, France, Belgium, Portugal, and the United Kingdom), and the partner countries were Singapore, Hong Kong (China), and Macao (China). Seven countries (3 OECD: the United States, Spain and Switzerland; 4 partner: Chinese Taipei, the Russian Federation, B-S-J-G (China) and Vietnam) performed not significantly different from the OECD average. All other countries, including 13 OECD countries (Latvia, the Czech Republic, Austria, Italy, Iceland, Luxembourg, Israel, Hungary, Greece, Chile, the Slovak Republic, Turkey and Mexico) performed significantly below the OECD average.

Singapore achieved the highest average score on the reading literacy assessment with a score of 535 points, which was 32 points or equivalent to around one year of schooling higher than the Australian average and 42 points higher than the OECD average.

Australia's performance in reading literacy was significantly lower than 11 countries (8 OECD: Canada, Finland, Ireland, Estonia, Korea, Japan, Norway and New Zealand; 3 partner: Singapore, Hong Kong (China) and Macao (China)). Australia's performance was not significantly different from that of 13 countries (11 OECD: Germany, Poland, Slovenia, the Netherlands, Sweden, Denmark, France, Belgium, Portugal, the United Kingdom and the United States; 2 partner: Chinese Taipei and B-S-J-G (China)). Australia's performance was significantly higher than 44 countries, which included 15 OECD countries.

The distribution of scores between the lowest and highest performing students within each country varied considerably, and seemed to be unrelated to the achieved average score for that country. The narrowest spread of scores between the lowest and highest performing students was found in Vietnam (239 points), while the widest spread of scores was found in Malta (395 points). In Australia, the difference between the lowest and highest performing students was 338 points, which was similar to Austria, Sweden, Cyprus, the Slovak Republic and wider than the OECD average (315 points). Of the countries that significantly outperformed Australia, the range of scores was narrower for Macao (China), Ireland, Hong Kong (China) and Estonia (between 270 and 290 points) compared to the OECD average, and wider for New Zealand (347 points).

Figure 4.3 lists the average reading literacy scores, along with the standard errors, confidence intervals around the average, and the difference between the 5th and 95th percentiles. It also shows the graphical distribution of student performance. Countries are shown in order from the highest to the lowest reading literacy average and the colour bands indicate whether a particular country has performed at a significantly higher or lower level or whether they performed at a level not significantly different to Australia's. Although 72 countries participated in PISA 2015, only those countries whose average score was higher than Mexico's (the lowest performing OECD country) have been included in this figure.[37]

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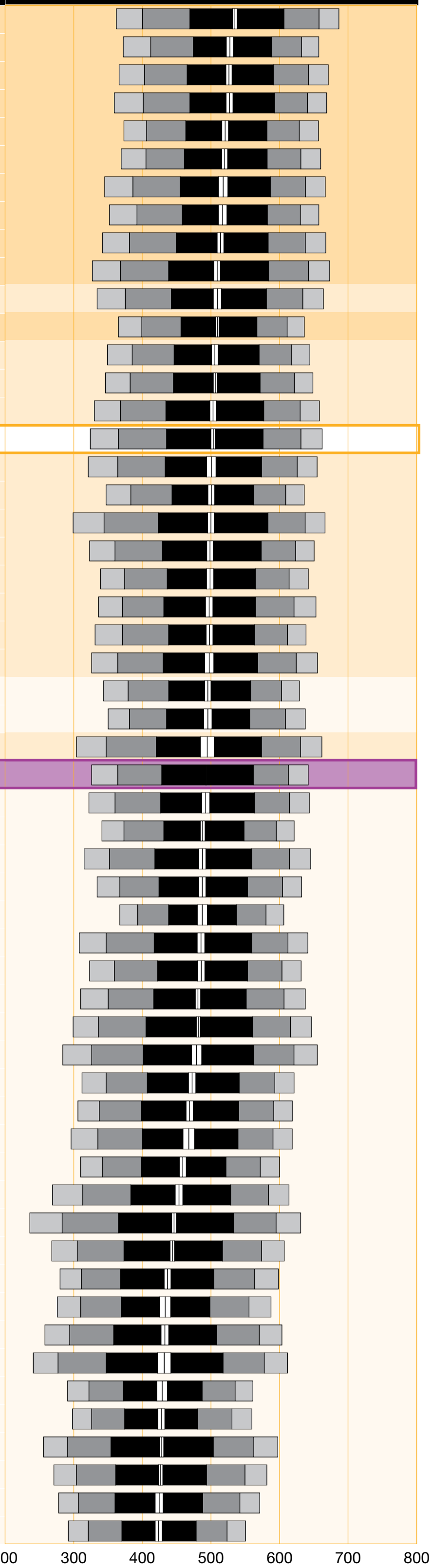
36 For ease of reading, economic regions such as B-S-J-G (China) are referred to as countries.

37 For brevity, results for countries that achieved an average score lower than Mexico's (423 points) have not been included in this chapter. These countries were Albania, Algeria, Brazil, the Dominican Republic, the Former Yugoslav Republic of Macedonia, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Moldova, Peru, Qatar, Thailand, and Tunisia.
Results for Argentina, Malaysia and Kazakhstan have not been reported because their coverage was too small to ensure comparability.

Group	Country	Avg. score	SE	Confidence interval	Difference between 5th & 95th percentiles	Proficiency levels
Significantly higher than Australia	Singapore	535	1.6	532–538	325	
	Hong Kong (China)	527	2.7	521–532	284	
	Canada	527	2.3	522–531	305	
	Finland	526	2.5	521–531	309	
	Ireland	521	2.5	516–526	284	
	Estonia	519	2.2	515–523	290	
	Korea	517	3.5	511–524	320	
	Japan	516	3.2	510–522	304	
	Norway	513	2.5	508–518	325	
	New Zealand	509	2.4	505–514	347	
	Germany	509	3.0	503–515	330	
	Macao (China)	509	1.3	506–511	270	
Not significantly different from Australia	Poland	506	2.5	501–511	295	
	Slovenia	505	1.5	502–508	302	
	Netherlands	503	2.4	498–508	328	
	Australia	**503**	**1.7**	**500–506**	**338**	
	Sweden	500	3.5	493–507	334	
	Denmark	500	2.5	495–505	288	
	France	499	2.5	494–504	367	
	Belgium	499	2.4	494–503	327	
	Portugal	498	2.7	493–503	302	
	United Kingdom	498	2.8	493–503	317	
	Chinese Taipei	497	2.5	492–502	307	
	United States	497	3.4	490–504	329	
	Spain	496	2.4	491–500	286	
	Russian Federation	495	3.1	489–501	287	
	B-S-J-G (China)	494	5.1	484–504	357	
	OECD average	**493**	**0.5**	**492–493**	**315**	
Significantly lower than Australia	Switzerland	492	3.0	486–498	321	
	Latvia	488	1.8	484–491	280	
	Czech Republic	487	2.6	482–492	330	
	Croatia	487	2.7	482–492	298	
	Vietnam	487	3.7	479–494	239	
	Austria	485	2.8	479–490	333	
	Italy	485	2.7	480–490	308	
	Iceland	482	2.0	478–485	328	
	Luxembourg	481	1.4	479–484	347	
	Israel	479	3.8	472–486	371	
	Lithuania	472	2.7	467–478	309	
	Hungary	470	2.7	464–475	313	
	Greece	467	4.3	459–476	322	
	Chile	459	2.6	454–464	289	
	Slovak Republic	453	2.8	447–458	344	
	Malta	447	1.8	443–450	395	
	Cyprus	443	1.7	440–446	339	
	Uruguay	437	2.5	432–442	318	
	Romania	434	4.1	426–442	312	
	United Arab Emirates	434	2.9	428–439	346	
	Bulgaria	432	5.0	422–442	370	
	Turkey	428	4.0	421–436	270	
	Costa Rica	427	2.6	422–433	262	
	Trinidad and Tobago	427	1.5	424–430	340	
	Montenegro	427	1.6	424–430	310	
	Colombia	425	2.9	419–431	294	
	Mexico	423	2.6	418–428	257	



Note: refer to the Reader's Guide for the interpretation of this graph. This relates to all graphs with similar formatting in this chapter.

FIGURE 4.3 Average scores and distribution of students' performance on the reading literacy scale, by country

Reading literacy proficiency in PISA 2015

Proficiency levels provide further meaning about students' ability in reading literacy. There are seven levels of described proficiency in the PISA 2015 reading literacy assessment, which range from Level 6 (highest proficiency) to Level 1b (lowest proficiency).

Proficiencies across the reading literacy scale

The proportion of students at each reading literacy proficiency level from below Level 1b to Level 6 by country is shown in Figure 4.4. Countries have been ordered by the percentage of students classified as below Level 2, the low performers, which is the internationally assigned baseline benchmark. Countries with the lowest proportion of students below Level 2 are placed at the top of the figure and countries with the highest proportion of students below Level 2 are placed at the bottom.

High performers

On average across the OECD countries, 8% of students were high performers, achieving Level 5 or 6. Singapore had 18% of high performers; 14% in Canada, Finland, and New Zealand; 13% in Korea and France; and 12% in Norway, Germany and Hong Kong (China). Australia, along with Estonia, Japan, Ireland, the Netherlands and B-S-J-G (China) had 11% of high performers. Sweden and the United States had 10% of high performers. Around 40 countries had fewer than 10% of high performers, and of these countries, around half had fewer than 5% of high performers in reading literacy. Mexico, Turkey, Costa Rica, Colombia and Montenegro had very few high performers (1% or less).

On average, 1% of students across OECD countries achieved Level 6. In Singapore, 4% of students achieved this level, while 3% of students in New Zealand and 2% of students in Australia, Canada, Norway, France, Finland, Germany, Korea and B-S-JG (China) were very high performers.

Low performers

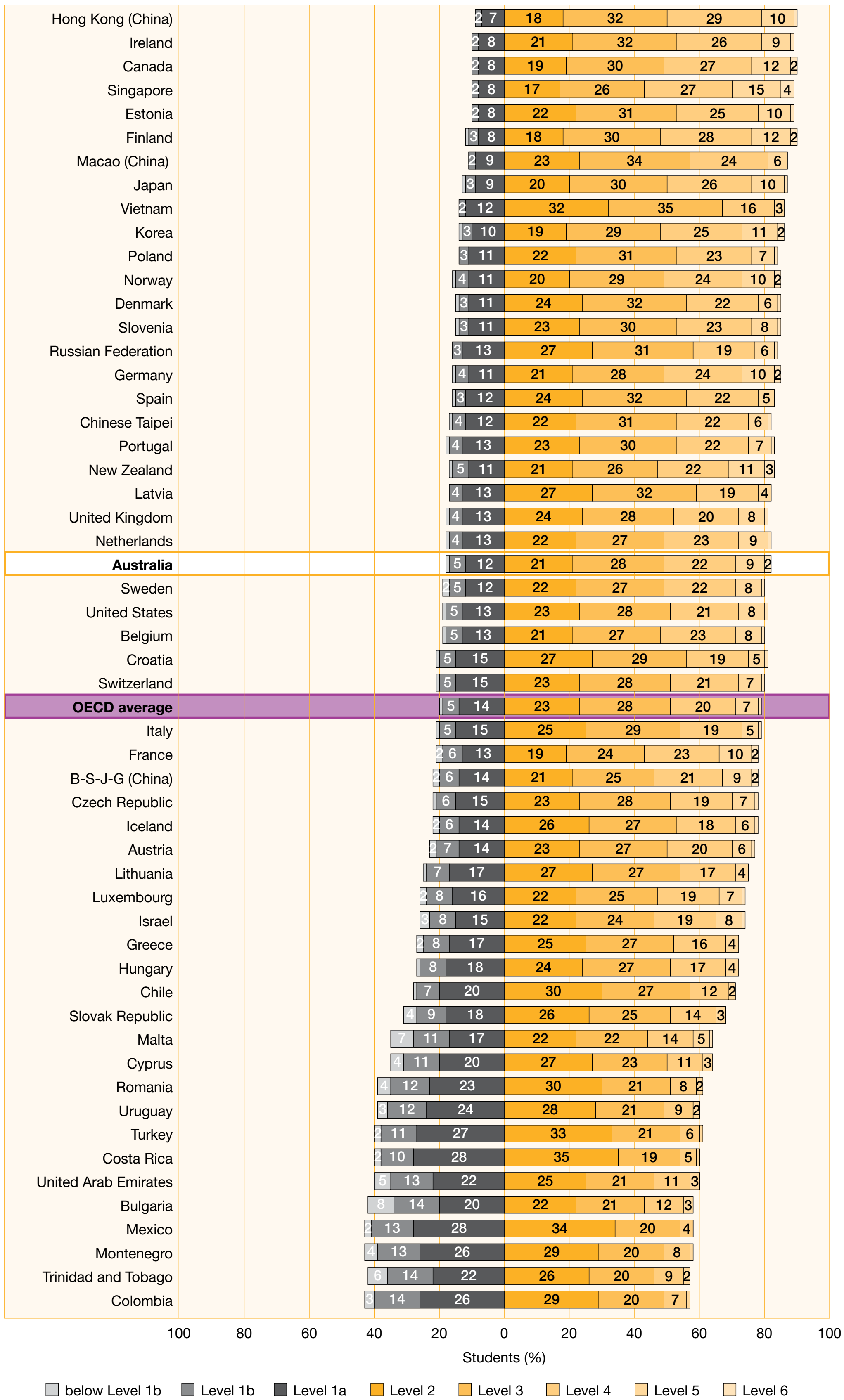
In PISA, Level 2 is considered the baseline level of reading literacy proficiency. Students who perform below Level 2 are considered low performers and are at risk of having inadequate reading literacy competencies to be able to participate effectively and productively in life. On average, 20% of students across OECD countries were low performers in reading literacy. Hong Kong (China) and Ireland had 9% and 10% of low performers respectively. Estonia, Canada, Finland, and Singapore had 11% of low performers and Japan, Korea, Norway and New Zealand had between 13% and 17% of low performers. In Australia, 18% of students were low performers, which was also the case for Latvia, the United Kingdom, the Netherlands, and Sweden.

Middle performers

Students who were neither high nor low performers were placed at Levels 2, 3 or 4, and are also referred to as middle performers. On average, 72% of students across the OECD achieved at these levels. The majority of students in Vietnam (83%) and in Macao (China) (82%) were middle performers, while 70% of students in Singapore and 71% of students in Australia were middle performers.

Students who achieved the National Proficient Standard

In Australia, Level 3 is the agreed National Proficient Standard in PISA, and represents a baseline proficiency that students are expected to demonstrate in reading literacy. In PISA 2015, 61% of Australian students achieved the National Proficient Standard in reading literacy, which was higher than the proportion of students across the OECD countries (57%). In Hong Kong (China), Singapore, and Finland, over 70% of students achieved a proficiency of Level 3 or above in reading literacy.



Note: if the proportion of students in a proficiency level is one per cent or less, the level still appears in the figure but the numeric label '1' does not. This convention has been used for all figures about proficiency levels in this chapter.

FIGURE 4.4 Percentage of students across the reading literacy proficiency scale, by country

Reading literacy performance over time

PISA is designed to compare performance between cycles and monitor the skills and knowledge of 15-year-old students over time. Reading literacy was first assessed as a major domain in PISA 2000, and again in PISA 2009.

Table 4.3 compares country performance in reading literacy since it was last assessed as a major assessment domain. The average scores on reading literacy performance are shown for PISA 2009, 2012 and 2015, along with the differences in average scores between PISA 2009 and 2015, and between PISA 2012 and 2015.

The OECD average in PISA 2015 (493 points) was not significantly different from the OECD average in 2009 (494 points), or the OECD average in 2012 (496 points).

Between 2009 and 2015, 14 countries showed a significant improvement in their reading literacy performance (the Russian Federation, Ireland, Macao (China), Slovenia, Montenegro, Estonia, Spain, Colombia, Germany, Croatia, Uruguay, Norway, Singapore and Luxembourg). The improvement in performance ranged from 35 points in the Russian Federation to 9 points in Singapore and Luxembourg. Australia and eight other countries (Turkey, the Slovak Republic, Hungary, Korea, Iceland, Greece, Costa Rica and New Zealand) showed a significant decline in their reading literacy performance between PISA 2009 and 2015. The decline ranged from 36 points in Turkey to 12 points in Australia and New Zealand. Australia's average performance in PISA 2009 was 515 points, which declined by 12 points to 503 points in 2015.

Between PISA 2012 and 2015, 6 countries (Uruguay, Slovenia, Colombia, the Russian Federation, Chile and Sweden) showed a significant improvement in their reading literacy performance. The improvement in performance ranged from 25 points in Uruguay to 17 points in Sweden. Eight countries showed a significant decline in their reading literacy performance between PISA 2012 and 2015 (Turkey, Chinese Taipei, Japan, Vietnam, Hungary, Korea, Hong Kong (China) and Switzerland). The decline in performance ranged from 47 points in Turkey to 17 points in Switzerland. Australia's average performance in PISA 2012 (512 points) was not significantly different to their average performance in 2015.

TABLE 4.3 Average reading literacy performance over time, PISA 2009 to 2015, and differences between 2009 and 2015, and between 2012 and PISA 2015, by country

Country	PISA 2009 Avg. score	PISA 2009 SE	PISA 2012 Avg. score	PISA 2012 SE	PISA 2015 Avg. score	PISA 2015 SE	Average score difference between 2009 and 2015 (PISA 2015 – PISA 2009) Score dif.		SE	Average score difference between 2012 and 2015 (PISA 2015 – PISA 2012) Score dif.		SE
Australia	515	2.3	512	1.6	503	1.7	**–12**	▼	4.5	–9		5.7
Austria	✧	✧	490	2.8	485	2.8	✧		✧	–5		6.6
Belgium	506	2.3	509	2.3	499	2.4	–7		4.8	–10		6.2
Bulgaria	429	6.7	436	6.0	432	5.0	3		9.0	–4		9.4
Canada	524	1.5	523	1.9	527	2.3	2		4.4	4		6.1
Chile	449	3.1	441	2.9	459	2.6	9		5.3	**17**	▲	6.5
Chinese Taipei	495	2.6	523	3.0	497	2.5	2		5.0	**–26**	▼	6.6
Colombia	413	3.7	403	3.4	425	2.9	**12**	▲	5.9	**22**	▲	6.9
Costa Rica	443	3.2	441	3.5	427	2.6	**–15**	▼	5.4	–13		6.8
Croatia	476	2.9	485	3.3	487	2.7	**11**	▲	5.2	2		6.8
Cyprus	✧	✧	449	1.2	443	1.7	✧		✧	–6		5.6
Czech Republic	478	2.9	493	2.9	487	2.6	9		5.2	–6		6.5
Denmark	495	2.1	496	2.6	500	2.5	5		4.7	4		6.4
Estonia	501	2.6	516	2.0	519	2.2	**18**	▲	4.9	3		6.1
Finland	536	2.3	524	2.4	526	2.5	–9		4.8	2		6.3
France	496	3.4	505	2.8	499	2.5	4		5.5	–6		6.5
Germany	497	2.7	508	2.8	509	3.0	**12**	▲	5.3	1		6.7
Greece	483	4.3	477	3.3	467	4.3	**–16**	▼	7.0	–10		7.6
Hong Kong (China)	533	2.1	545	2.8	527	2.7	–6		4.8	**–18**	▼	6.5
Hungary	494	3.2	488	3.2	470	2.7	**–25**	▼	5.4	**–19**	▼	6.7
Iceland	500	1.4	483	1.8	482	2.0	**–19**	▼	4.2	–1		5.9
Ireland	496	3.0	523	2.6	521	2.5	**25**	▲	5.2	–2		6.3
Israel	474	3.6	486	5.0	479	3.8	5		6.3	–7		8.2
Italy	486	1.6	490	2.0	485	2.7	–1		4.6	–5		6.2
Japan	520	3.5	538	3.7	516	3.2	–4		5.8	**–22**	▼	7.2
Korea	539	3.5	536	3.9	517	3.5	**–22**	▼	6.0	**–18**	▼	7.4
Latvia	484	3.0	489	2.4	488	1.8	4		4.9	–1		6.0
Lithuania	468	2.4	477	2.5	472	2.7	4		5.0	–5		6.4
Luxembourg	472	1.3	488	1.5	481	1.4	**9**	▲	3.9	–6		5.7
Macao (China)	487	0.9	509	0.9	509	1.3	**22**	▲	3.8	0		5.5
Mexico	425	2.0	424	1.5	423	2.6	–2		4.7	0		6.0
Montenegro	408	1.7	422	1.2	427	1.6	**19**	▲	4.1	5		5.6
Netherlands	508	5.1	511	3.5	503	2.4	–5		6.6	–8		6.7
New Zealand	521	2.4	512	2.4	509	2.4	**–12**	▼	4.8	–3		6.3
Norway	503	2.6	504	3.2	513	2.5	**10**	▲	5.0	9		6.7
Poland	500	2.6	518	3.1	506	2.5	5		5.0	–12		6.6
Portugal	489	3.1	488	3.8	498	2.7	9		5.3	10		7.0
Romania	424	4.1	438	4.0	434	4.1	9		6.7	–4		7.7
Russian Federation	459	3.3	475	3.0	495	3.1	**35**	▲	5.7	**19**	▲	6.8
Singapore	526	1.1	542	1.4	535	1.6	**9**	▲	3.9	–7		5.7
Slovak Republic	477	2.5	463	4.2	453	2.8	**–25**	▼	5.1	–10		7.3
Slovenia	483	1.0	481	1.2	505	1.5	**22**	▲	3.9	**24**	▲	5.6
Spain	481	2.0	488	1.9	496	2.4	**15**	▲	4.6	8		6.1
Sweden	497	2.9	483	3.0	500	3.5	3		5.7	**17**	▲	7.0
Switzerland	501	2.4	509	2.6	492	3.0	–8		5.2	**–17**	▼	6.6
Turkey	464	3.5	475	4.2	428	4.0	**–36**	▼	6.3	**–47**	▼	7.8
United Arab Emirates	✧	✧	442	2.5	434	2.9	✧		✧	–8		6.5
United Kingdom	494	2.3	499	3.5	498	2.8	4		5.0	–1		6.9
United States	500	3.7	498	3.7	497	3.4	–3		6.1	–1		7.3
Uruguay	426	2.6	411	3.2	437	2.5	**11**	▲	5.0	**25**	▲	6.6
Vietnam	✧	✧	508	4.4	487	3.7	✧		✧	**–21**	▼	7.8
OECD average 2009	494	0.5	496	0.5	493	0.5	–1		3.5	–4		5.3

Notes: the symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
✧ Did not participate in this cycle or comparisons cannot be made.
Countries that did not participate in PISA 2009 and 2015 have not been included.

Table 4.4 shows the relative position of a participating country to Australia's in reading literacy performance from PISA 2000 to 2015. Countries are shown in order of the highest to the lowest performing country in reading literacy in 2015.[38]

- Across the PISA cycles, there are 25 countries for which reading literacy performances over time have been consistently significantly lower than Australia's (17 OECD: Austria, Bulgaria, Chile, Colombia, Israel, Italy, Latvia, Lithuania, Luxembourg, Mexico, Montenegro, Romania, the Russian Federation, Serbia, the Slovak Republic, Spain and Turkey; 9 partner: Costa Rica, Croatia, the Czech Republic, Greece, Hungary, Iceland, the United Arab Emirates and Uruguay).
- Finland, Shanghai (China) and Singapore have all performed consistently significantly higher than Australia in PISA.
- There were a number of countries whose relative performance to Australia's has changed over the PISA assessments:
  - In 2000, Canada, Hong Kong (China), Ireland Japan, Korea, and New Zealand performed not significantly different to Australia; however, in 2015 their performances were significantly higher than Australia's.
  - Estonia, Macao (China), and Norway's performances in their first PISA cycle were significantly lower than Australia's; however, in 2015, their performances were significantly higher than Australia's.
  - 13 countries' (11 OECD: Belgium, Denmark, France, Germany, the Netherlands, Poland, Portugal, Slovenia, Sweden, the United Kingdom and the United States; 2 partner: Chinese Taipei and Liechtenstein) performances in reading literacy were initially significantly lower than Australia's; however, in their last participation in PISA, their performances were not significantly different to Australia's.

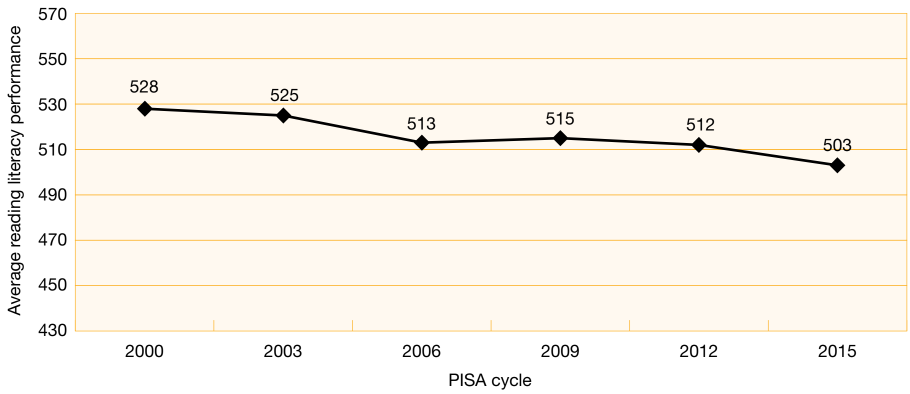
38 With the exceptions of Liechtenstein, Serbia and Shanghai (China) which have been placed at the bottom of the table as they did not participate in PISA 2015, or did not participate in PISA 2015 as the same entity.

TABLE 4.4 Relative trends in reading literacy performance, by country

	Position relative to Australia in					
Country	PISA 2015	PISA 2012	PISA 2009	PISA 2006	PISA 2003	PISA 2000
Singapore	▲	▲	▲	–	–	–
Hong Kong (China)	▲	▲	▲	▲	▼	●
Canada	▲	▲	▲	▲	●	●
Finland	▲	▲	▲	▲	▲	▲
Ireland	▲	▲	▼	●	▼	●
Estonia	▲	●	▼	▼	–	–
Korea	▲	▲	▲	▲	▲	●
Japan	▲	▲	●	▼	▼	●
Norway	▲	▼	▼	▼	▼	▼
New Zealand	▲	●	●	▲	●	●
Germany	●	●	▼	▼	▼	▼
Macao (China)	▲	●	▼	▼	▼	–
Poland	●	●	▼	●	▼	▼
Slovenia	●	▼	▼	▼	–	–
Netherlands	●	●	●	●	▼	–
Australia						
Sweden	●	▼	▼	●	▼	▼
Denmark	●	▼	▼	▼	▼	▼
France	●	●	▼	▼	▼	▼
Belgium	●	●	▼	▼	▼	▼
Portugal	●	▼	▼	▼	▼	▼
United Kingdom	●	▼	▼	▼	–	–
Chinese Taipei	●	▲	▼	▼	–	–
United States	●	▼	▼	–	▼	▼
Spain	▼	▼	▼	▼	▼	▼
Russian Federation	▼	▼	▼	▼	▼	▼
Switzerland	▼	●	▼	▼	▼	▼
Latvia	▼	▼	▼	▼	▼	▼
Czech Republic	▼	▼	▼	▼	▼	▼
Croatia	▼	▼	▼	▼	–	–
Austria	▼	▼	–	▼	▼	▼
Italy	▼	▼	▼	▼	▼	▼
Iceland	▼	▼	▼	▼	▼	▼
Luxembourg	▼	▼	▼	▼	▼	–
Israel	▼	▼	▼	▼	–	▼
Lithuania	▼	▼	▼	▼	–	–
Hungary	▼	▼	▼	▼	▼	▼
Greece	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	–	▼
Slovak Republic	▼	▼	▼	▼	▼	–
Uruguay	▼	▼	▼	▼	▼	–
Romania	▼	▼	▼	▼	–	▼
United Arab Emirates	▼	▼	▼	–	–	–
Bulgaria	▼	▼	▼	▼	–	▼
Turkey	▼	▼	▼	▼	▼	–
Costa Rica	▼	▼	▼	–	–	–
Montenegro	▼	▼	▼	▼	–	–
Colombia	▼	▼	▼	▼	–	–
Mexico	▼	▼	▼	▼	▼	▼
Liechtenstein	–	●	▼	●	●	▼
Serbia	–	▼	▼	▼	–	–
Shanghai (China)	–	▲	▲	–	–	–

Note: ▲ Score signficantly higher than Australia's
● Score not significantly different to Australia's
▼ Score signficantly lower than Australia's
– Did not participate in this cycle or comparisons cannot be made
B-S-J-G (China), Cyprus, Malta, Trinidad and Tobago, and Vietnam are not included in this table.

Figure 4.5 shows Australia's performance in reading literacy across six PISA assessments, from PISA 2000 to 2015. In 2000, when the majority of the assessment time was devoted to reading literacy, Australia achieved an average score of 528 points. In 2009, when reading literacy was next assessed as a major domain, Australia's performance had significantly declined by 13 points to an average of 515 points. In 2015, Australia achieved an average score of 503 points, which was significantly lower (by 12 points) than the average score achieved in 2009 (515 points), and significantly lower (by 25 points) than the average score achieved in 2000 (528 points).



	Difference between years									
	2012		2009		2006		2003		2000	
2015	–9		–12	▼	–10		–23	▼	–25	▼
2012			–3		–1		–14	▼	–16	▼
2009					2		–11	▼	–13	▼
2006							–13	▼	–15	▼
2003									–3	

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.5 Average reading literacy performance and differences over time, PISA 2000 to 2015, for Australia

Figure 4.6 shows the decline in reading literacy performance has occurred gradually over time.

- Between 2000 and 2012, there were significant declines at the 75th and 90th percentiles, by 23 and 21 points, while for students at the 10th and 25th percentiles, no significant differences were found.
- Between PISA 2003 and 2006, the scores at the 50th, 75th and 90th percentiles declined significantly, by about 15 points at each percentile.
- Between PISA 2003 and 2009, performance at the 25th and 50th percentiles declined significantly, by 16 and 18 points.
- Between 2009 and 2015, there were significant declines at the 10th (by 19 points) and 25th percentiles (by 16 points).
- Between 2012 and 2015, there were significant declines at the 10th (by 21 points) and 25th percentiles (by 14 points).

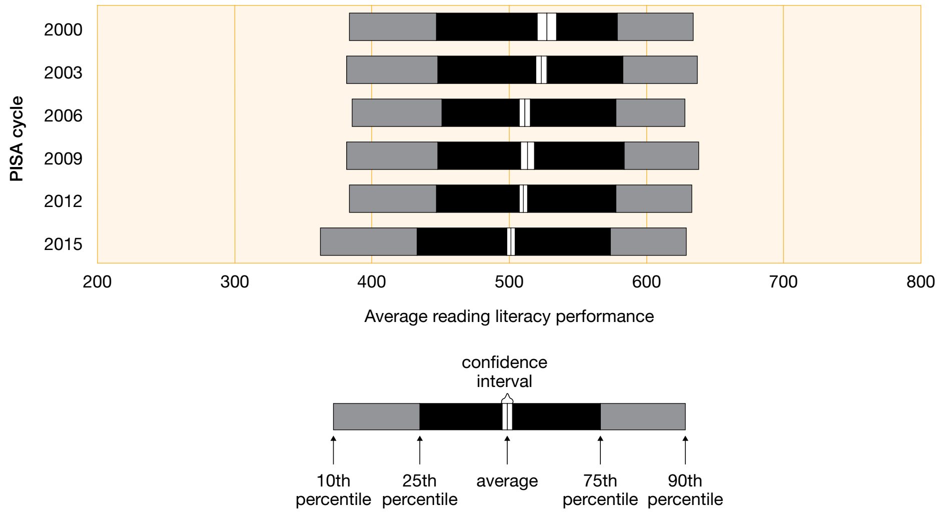


FIGURE 4.6 Distribution of students' performance on the reading literacy scale over time, PISA 2000 to 2015, for Australia

Reading literacy proficiency over time

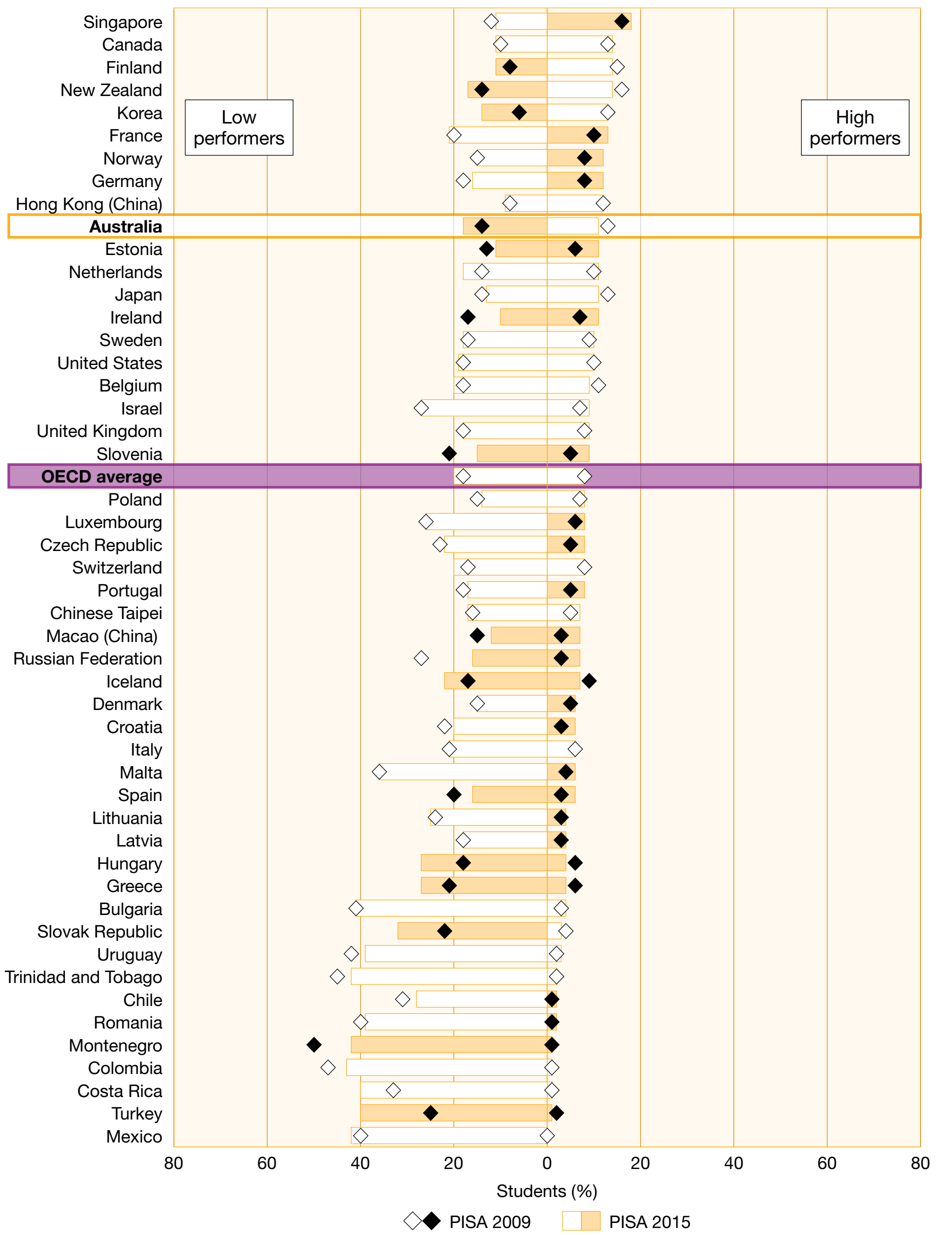
Figure 4.7 shows the proportions of low and high performers for PISA 2009 and 2015 in reading literacy. There were a number of countries whose proportions of low performers and proportions of high performers changed in this period.

In 7 countries (Estonia, Ireland, Macao (China), Montenegro, the Russian Federation, Slovenia and Spain), the proportions of low performers decreased significantly and the proportions of high performers increased significantly, that is, there were fewer low performers and more high performers in 2015 than in 2009. The improvement in the proportions of low performers ranged from 3% in Estonia, Macao (China) and Spain to 11% in the Russian Federation, while the decline in the proportions of high performers ranged from 1% in Montenegro to 5% in Estonia.

In Greece, Hungary, Iceland and Turkey, the proportions of low performers significantly increased and the proportions of high performers significantly decreased, that is, there were more low performers and fewer high performers in 2015 than in 2009. The decline in the proportions of low performers ranged from 5% in Iceland to 15% in Turkey, whereas the decline in the proportions of high performers ranged from 1% in Turkey to 2% in Greece, Hungary and Iceland.

There were a number of countries whose proportions of low performers and proportions of high performers changed significantly between 2009 and 2015.

- In 5 countries (Australia, Finland, Korea, New Zealand and the Slovak Republic), there were significantly higher proportions of low performers in 2015 than in 2009. The increase in the proportions of low performers ranged from 3% in New Zealand and Finland to 10% in the Slovak Republic. In Australia, there was a 4% increase in the proportion of low performers, from 14% in 2009 to 18% in 2015.
- In 14 countries (Chile, Croatia, the Czech Republic, Denmark, France, Germany, Latvia, Lithuania, Luxembourg, Malta, Norway, Portugal, Romania and Singapore) the proportions of high performers significantly increased between 2009 and 2015. The increase in the proportions of high performers ranged from 1% in Chile, Malta, Romania and Latvia to 4% in Germany and Norway.



Notes: Only countries that participated in both PISA 2009 and 2015 are shown. Countries are ordered in descending order of the percentage of high performers. A coloured bar and a black diamond indicate that the difference in the proportion of students between PISA 2009 and 2015 is significant.

FIGURE 4.7 Percentage of low and high performers in reading literacy for PISA 2009 and PISA 2015, by country

Figure 4.8 shows the average proportion of students performing at each reading literacy proficiency level from PISA 2000 to 2015. The results show that over time there has been a downward shift, with fewer high performers and more low performers. Between 2000 and 2009, the proportion of high performers declined by 4% and the proportion of low performers increased by 2%. Between 2009 and 2015, a similar pattern was observed with a decline in the proportion of high performers (by 2%) and an increase in the proportion of low performers (by 4%). Between 2012 and 2015, the proportion of high performers declined by 1% and the proportion of low performers increased by 4%.

In 2000, 69% of students achieved the National Proficient Standard in reading literacy, which in 2009 declinded by 4%. By 2015, this had further declined by 4% to 61% of students.

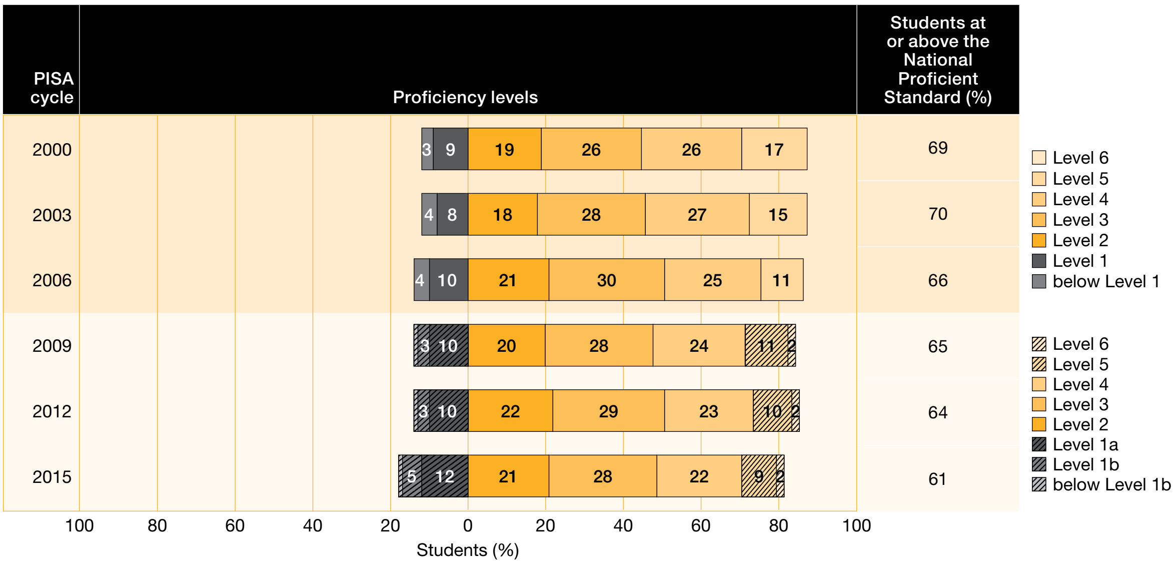


FIGURE 4.8 Percentage of students across the reading literacy proficiency scale over time, PISA 2000 to 2015, for Australia

Australia's reading literacy results in a national context

Reading literacy results for PISA 2015 by jurisdiction

Reading literacy performance

Figure 4.9 shows the reading literacy performances for students in each of the Australian jurisdictions. It lists the average scores, together with the standard error, confidence intervals around the average, the difference between the 5th and 95th percentiles, and shows the distribution of reading literacy scores of each jurisdiction. The average scores and distributions for Australia, the OECD average and Singapore, the highest performing country in reading literacy in PISA 2015, are included for comparison.

The average scores for reading literacy in 2015 ranged from 516 points in the Australian Capital Territory to 474 points in the Northern Territory. The average score difference between these two jurisdictions was 42 points, which is around half a proficiency level or equivalent to around one and-a-half years of schooling.

New South Wales had the widest spread of scores, with 357 points between the students at the 5th and 95th percentiles, while Victoria and Western Australia had the narrowest spread of scores with 323 and 324 points respectively.

Singapore performed significantly higher, by 19 points on average, than the highest performing jurisdiction, the Australian Capital Territory, and by 61 points on average higher than the lowest performing jurisdiction, the Northern Territory.

Jurisdiction	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
ACT	516	4.5	507–524	344	
NSW	502	3.0	496–508	357	
VIC	507	3.7	500–514	323	
QLD	500	3.7	493–507	338	
SA	503	3.8	495–510	327	
WA	507	4.2	499–515	324	
TAS	476	4.4	468–485	339	
NT	474	9.0	456–491	343	
Australia	**503**	**1.7**	**500–506**	**338**	
OECD average	**493**	**0.5**	**492–493**	**315**	
Singapore	535	1.6	532–538	325	

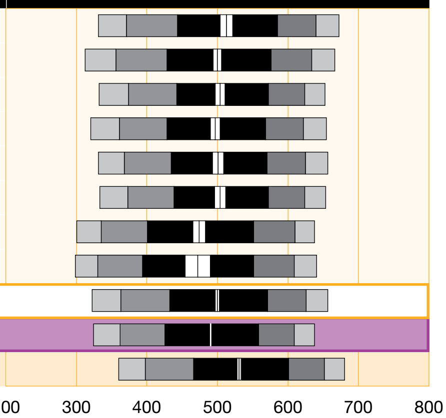


FIGURE 4.9 Average scores and distribution of students' performance on the reading literacy scale, by jurisdiction

Table 4.5 shows a pairwise comparison of average reading literacy performance between any two jurisdictions.

The Australian Capital Territory performed at a level not significantly different to Western Australia and Victoria, and performed significantly higher than South Australia, New South Wales, Queensland, Tasmania and the Northern Territory.

Western Australia, Victoria, South Australia, New South Wales and Queensland performed not significantly different to one another, and significantly higher than Tasmania and the Northern Territory.

The average scores in reading literacy for Tasmania and the Northern Territory were not significantly different to one another.

All jurisdictions performed significantly higher than the OECD average, except for Tasmania and the Northern Territory, whose performances were significantly lower than the OECD average.

TABLE 4.5 Multiple comparisons of average reading literacy performance, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	SA	NSW	QLD	TAS	NT	OECD average
ACT	516	4.5		●	●	▲	▲	▲	▲	▲	▲
WA	507	4.2	●		●	●	●	●	▲	▲	▲
VIC	507	3.7	●	●		●	●	●	▲	▲	▲
SA	503	3.8	▼	●	●		●	●	▲	▲	▲
NSW	502	3.0	▼	●	●	●		●	▲	▲	▲
QLD	500	3.7	▼	●	●	●	●		▲	▲	▲
TAS	476	4.4	▼	▼	▼	▼	▼	▼		●	▼
NT	474	9.0	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**493**	**0.5**	▼	▼	▼	▼	▼	▼	▲	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.
▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Appendix C provides information about the reading literacy performance of each jurisdiction compared to participating countries.

Reading literacy proficiency

Figure 4.10 shows the average proportion of students at each of the reading literacy proficiency levels in each jurisdiction, together with the percentages for Australia, Singapore and the OECD average.

High performers

As mentioned in earlier chapters, students who achieved Level 5 or Level 6 were considered high performers.

- The Australian Capital Territory was the jurisdiction with the highest proportion of high performers (14%) (Singapore had 18%).
- New South Wales had a proportion of 12% of high performers, Western Australia had 11%, Victoria, Queensland and South Australia each had 10%.
- Tasmania and the Northern Territory had the lowest proportions of high performers with 7% and 8% respectively, which were similar to the OECD average of 8%.

Three per cent of students from the Australian Capital Territory and New South Wales achieved the highest reading literacy proficiency level, Level 6, which was lower than the proportion of students in Singapore (4%). Queensland, South Australia and Western Australia had 2% of students placed at this level, while Victoria, Tasmania and the Northern Territory each had 1% of students at Level 6, which was also the same proportion as the OECD average.

Low performers

Students who were low performers (performing below Level 2) have not demonstrated the reading and literacy competencies that will enable them to participate actively in society.

- Tasmania and the Northern Territory had the highest proportions of low performers (26% and 28% respectively), which were higher than the OECD average of 20%.
- New South Wales and Queensland had proportions of 19% of low performers, South Australia had 18% and Western Australia had 17% .
- The Australian Capital Territory and Victoria each had proportions of 16% of low performers (Singapore had 11%).
- The proportions of low performers for six jurisdictions (the Australian Capital Territory, New South Wales, Victoria, Queensland, South Australia and Western Australia) were lower than the OECD average.

The students who placed at Level 1b and below Level 1b are of concern because they have demonstrated very limited skills in reading literacy. There were 10% of students in each of Tasmania and the Northern Territory, 7% of students from New South Wales, 6% of students from Queensland, and 5% of students from the Australian Capital Territory, Victoria, South Australia and Western Australia who were placed at Level 1b or below Level 1b.

Students who achieved the National Proficient Standard

Figure 4.10 shows the proportion of students in each jurisdiction who achieved the National Proficient Standard in reading literacy ranged from 48% in Tasmania and the Northern Territory to 65% in the Australian Capital Territory.

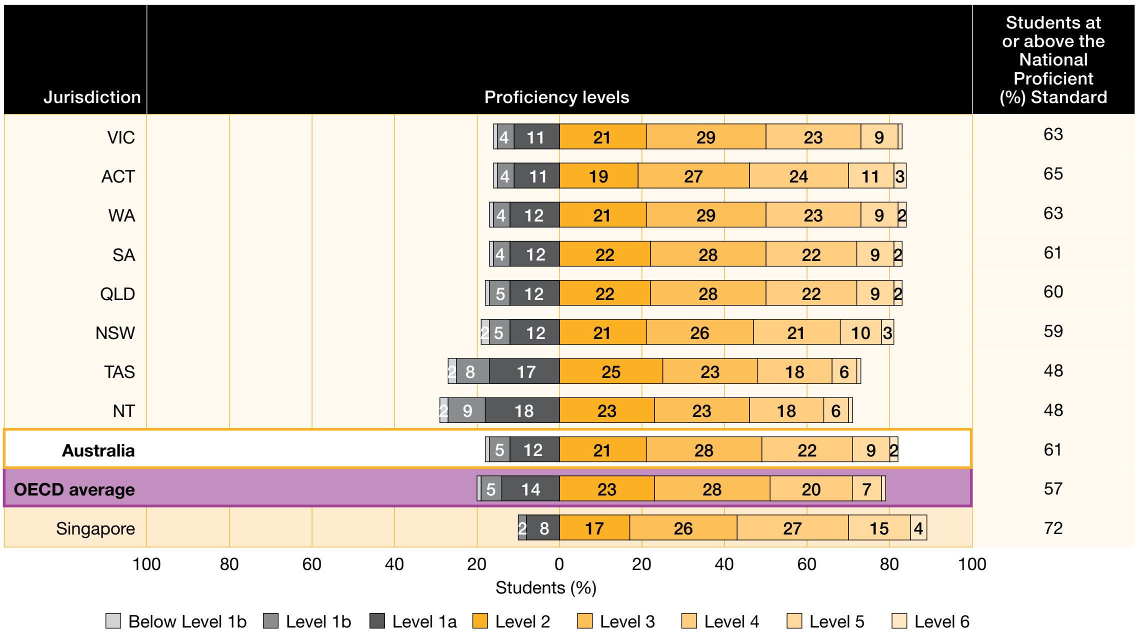


FIGURE 4.10 Percentage of students across the reading literacy proficiency scale, by jurisdiction

Reading literacy results over time by jurisdiction

Reading literacy performance

Figure 4.11 shows the average reading literacy performance for PISA 2000 to 2015, along with the change in performance between two cycles, and indicates whether this change is significant or not.

Between 2000 and 2015, the average reading literacy scores declined significantly in five jurisdictions:

- Western Australia's performance declined by 31 points (the smallest significant decline of any jurisdiction)
- South Australia's performance declined by 34 points
- New South Wales's performance declined by 36 points
- the Australian Capital Territory's performance declined by 37 points
- Tasmania's performance declined by 38 points (the largest significant decline of any jurisdiction).

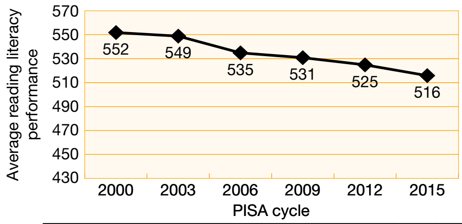
Between 2000 and 2009, the average reading literacy scores of four jurisdictions showed a significant decline in performance:

- the Australian Capital Territory declined by 21 points (the smallest significant decline of any jurisdiction)
- New South Wales declined by 23 points
- South Australia and Tasmania each declined by 31 points (the largest significant decline of any jurisdiction)
- Changes in performance in the other jurisdictions (Victoria, Queensland, Western Australia and the Northern Territory) were not significant.

Between 2009 and 2015, Queensland was the only jurisdiction to show a significant decline in performance (by 19 points).

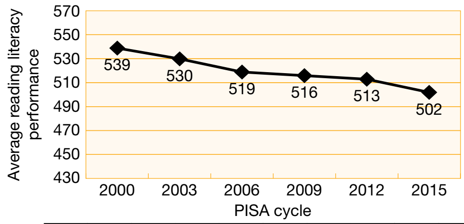
Between 2012 and 2015, no jurisdictions showed any significant change in performance.

Australian Capital Territory



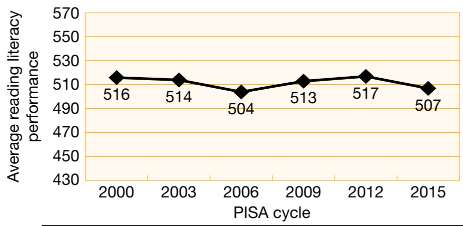
	Difference between years				
	2012	2009	2006	2003	2000
2015	−10	−16	−20 ▼	−34 ▼	−37 ▼
2012		−6	−10	−24 ▼	−27 ▼
2009			−4	−18	−21 ▼
2006				−14	−17 ▼
2003					−3

New South Wales



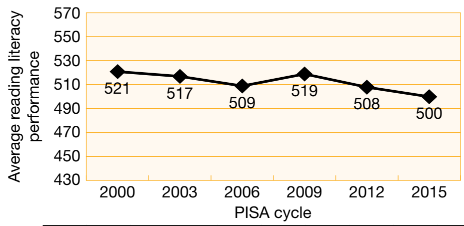
	Difference between years				
	2012	2009	2006	2003	2000
2015	−10	−13	−16	−28 ▼	−36 ▼
2012		−3	−6	−18 ▼	−26 ▼
2009			−3	−15	−23 ▼
2006				−12	−20 ▼
2003					−8

Victoria



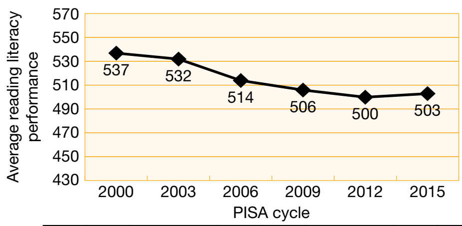
	Difference between years				
	2012	2009	2006	2003	2000
2015	−10	−7	2	−8	−9
2012		4	13	3	1
2009			9	−1	−3
2006				−10	−11
2003					−1

Queensland



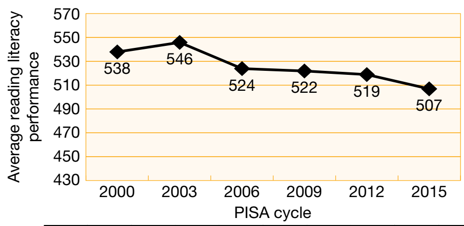
	Difference between years				
	2012	2009	2006	2003	2000
2015	−8	−19 ▼	−9	−17	−21
2012		−11	−1	−9	−13
2009			9	2	−2
2006				−7	−12
2003					−4

South Australia



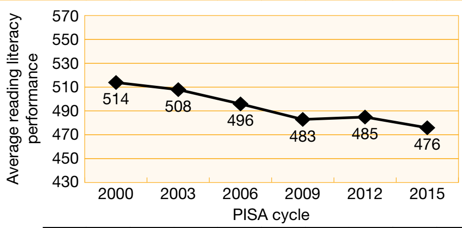
	Difference between years				
	2012	2009	2006	2003	2000
2015	3	−3	−11	−29 ▼	−34 ▼
2012		−6	−13	−32 ▼	−37 ▼
2009			−7	−26 ▼	−31 ▼
2006				−19 ▼	−23 ▼
2003					−5

Western Australia



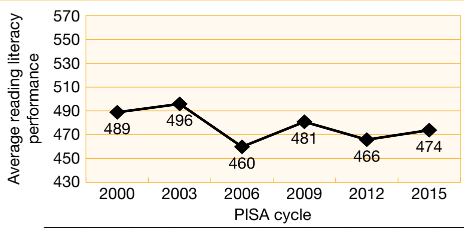
	Difference between years				
	2012	2009	2006	2003	2000
2015	−12	−15	−17	−39 ▼	−31 ▼
2012		−3	−5	−27 ▼	−19
2009			−2	−24 ▼	−16
2006				−22 ▼	−14
2003					8

Tasmania



	Difference between years				
	2012	2009	2006	2003	2000
2015	−8	−7	−20 ▼	−31 ▼	−38 ▼
2012		1	−12	−23 ▼	−30 ▼
2009			−13	−24 ▼	−31 ▼
2006				−11	−18
2003					−7

Northern Territory



	Difference between years				
	2012	2009	2006	2003	2000
2015	8	−7	14	−22	−15
2012		−15	6	−31 ▼	−23 ▼
2009			21	−16	−8
2006				−36 ▼	−29 ▼
2003					8

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.11 Average reading literacy performance and differences over time, and differences from PISA 2000 to 2015, by jurisdiction

Reading literacy proficiency

Figure 4.12 shows the proportions of low and high performers on the reading literacy proficiency scale from PISA 2000 to 2015 by jurisdiction.

In the period between 2000 and 2015, across all jurisdictions, there was an increase in the proportion of low performers and a decline in the proportion of high performers.

High performers

Between 2000 and 2015, the proportions of high performers decreased across all jurisdictions. The decrease ranged from 2% in the Northern Territory to 11% in the Australian Capital Territory.

Between 2000 and 2009, the proportions of high performers decreased across all jurisdictions. The decrease ranged from 1% in the Northern Territory to 9% in South Australia.

Between 2009 and 2015, the proportions of high performers decreased across all jurisdictions, except in South Australia and Tasmania. The decrease ranged from 1% in each of New South Wales, Victoria and the Northern Territory up to 4% in each of the Australian Capital Territory, Western Australia and Queensland.

Between 2012 and 2015, the proportions of high performers decreased across all jurisdictions, except in Tasmania and the Northern Territory. The decrease in high performers ranged from 1% to 2%.

Low performers

Between 2000 and 2015, the proportions of low performers increased across all jurisdictions. The increase ranged from 2% in Victoria to 9% in each of New South Wales and Tasmania.

Between 2000 and 2009, the proportions of low performers increased across all jurisdictions, except in Victoria and Queensland. The increase ranged from 2% in each of the Northern Territory and Western Australia to 4% in New South Wales.

Between 2009 and 2015, the proportions of low performers increased across all jurisdictions. The increase ranged from 2% in Victoria to 5% in each of New South Wales and Queensland.

Between 2012 and 2015, the proportions of low performers increased across all jurisdictions, except in the Northern Territory. The increase ranged from 2% in South Australia to 5% in each of Western Australia and Tasmania.

FIGURE 4.12 Percentage of low and high performers on the reading literacy proficiency scale over time, PISA 2000 to 2015, by jurisdiction

Students who achieved the National Proficient Standard

Table 4.6 shows the proportion of students who achieved the National Proficient Standard in reading literacy decreased in all jurisdictions between 2000 and 2015. The decreases ranged from 1% in Victoria to 17% in Tasmania.

Between 2012 and 2015, the proportions of students who achieved the National Proficient Standard in reading literacy decreased in all jurisdictions except South Australia. The decreases ranged from 2% in Queensland to 6% in the Australian Capital Territory.

TABLE 4.6 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2000 to 2015, by jurisdiction

Jurisdiction	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	77	2.1	78	1.9	75	2.1	70	2.3	72	1.7	65	2.3
NSW	73	2.5	71	1.6	67	1.8	66	1.9	64	1.3	59	1.3
VIC	64	2.9	67	2.1	63	2.0	65	2.2	68	1.5	63	1.7
QLD	66	3.1	66	3.5	64	1.5	66	2.6	62	1.4	60	1.6
SA	73	2.5	74	2.0	66	2.1	63	2.0	60	1.9	61	1.9
WA	71	3.5	77	1.7	71	2.8	68	2.7	67	1.5	63	1.7
TAS	65	3.9	63	2.9	59	2.3	52	2.5	53	2.1	48	2.1
NT	57	3.1	59	3.4	48	2.1	53	2.3	52	3.3	48	3.7

Reading literacy results for PISA 2015 across the school sectors

Reading literacy performance

Figure 4.13 shows the unadjusted average scores for reading literacy by school sector. This figure shows that students in the independent schools sector achieved significantly higher than students in Catholic schools or government schools, and students in Catholic schools achieved significantly higher than students in government schools.

Students in government schools achieved an average score of 484 points in reading literacy, while students in Catholic schools and independent schools achieved average scores of 517 points and 544 points respectively. The average score differences between students in government schools and students in Catholic schools, and between students in Catholic schools and students in independent schools was approximately 30 points or equal to around one year of schooling, while the average score difference between students in government schools and students in independent schools was 60 points or equal to around two years of schooling.

Students in government schools performed significantly lower than the OECD average, while students in Catholic schools or independent schools performed significantly higher than the OECD average.

Government schools had the broadest range of scores with 345 points between students in the 5th and 95th percentiles, whereas the differences in the spread of scores for Catholic schools and independent schools were narrower at 306 points and 297 points respectively.

School sector	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Government	484	2.2	479–488	345
Catholic	517	3.1	511–523	306
Independent	544	2.9	538–549	297

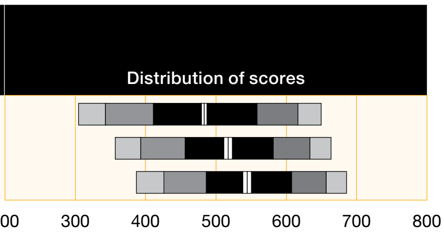


FIGURE 4.13 Average scores and distribution of students' performance on the reading literacy scale (unadjusted for student and school socioeconomic background), by school sector

The reporting of results by school sector using unadjusted average scores is misleading because there are higher proportions of students from lower socioeconomic backgrounds who attend government schools compared to the proportions of students from low socioeconomic backgrounds who attend Catholic or independent schools. To ensure fair comparisons, it is necessary to adjust for the differences in an individual student's family background or socioeconomic background as well as the school-level socioeconomic background.

Table 4.7 shows the average difference in the unadjusted score as well as the average score differences in reading literacy performance once student socioeconomic background and student- and school-level socioeconomic background are accounted for.

When student-level socioeconomic background is taken into account, students in independent schools performed significantly higher than students in Catholic schools, and students in Catholic schools performed significantly higher than students in government schools, although the differences are reduced.

When school-level socioeconomic background is also taken into account, the differences between students in government schools and students in Catholic schools, and the differences between students in government schools and students in independent schools are not significant. However, the differences between students in Catholic schools and students in independent schools remain significant. In other words, students in independent schools have a performance advantage over students in Catholic schools that is not attributable to student and school socioeconomic background.

TABLE 4.7 Differences in average reading literacy scores after adjusting for student- and school-socioeconomic background

School sector comparison	Difference in raw score (score points)	Difference in scores after student socioeconomic background is accounted for	Difference in scores after student and school level socioeconomic background is accounted for
Catholic-government	**33**	**17**	–1
independent-government	**60**	**36**	8
independent-Catholic	**27**	**20**	**12**

Note: statistically significant values are shown in bold.

Reading literacy proficiency

Figure 4.14 shows the proportion of students at each proficiency level on the reading literacy scale by school sector. The proportion of high performers in government schools was 8% and in Catholic schools was 12%, which were both lower than the proportion of high performers in independent schools (18%), while the proportion of low performers in government schools was higher (24%) than for Catholic (13%) or independent schools (7%).

Approximately half the students in government schools (53%) reached the National Proficient Standard in reading literacy compared to two-thirds of students in Catholic schools (67%) and approximately three-quarters of students in independent schools (77%).

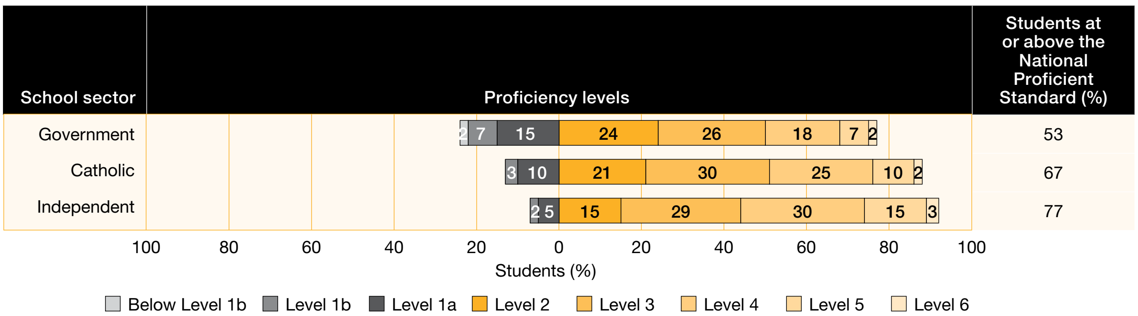


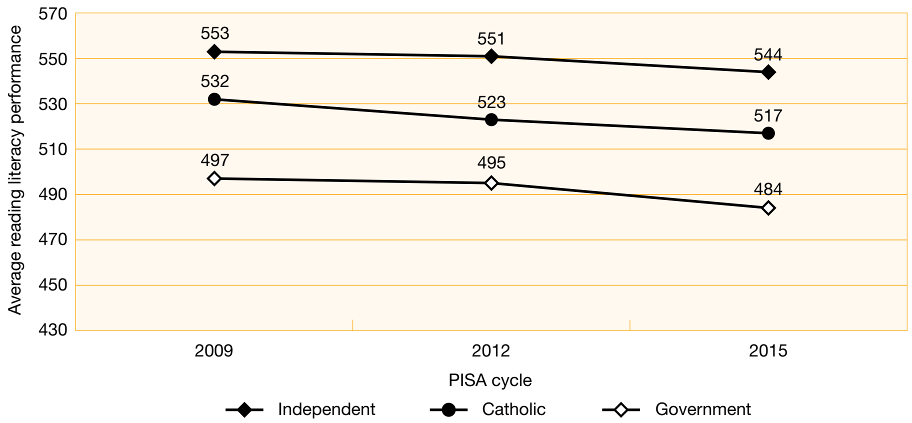
FIGURE 4.14 Percentage of students across the reading literacy proficiency scale, by school sector

Reading literacy results over time across the school sectors

Reading literacy performance

Figure 4.15 shows the average reading literacy performance from PISA 2009 (when results for school sector were first reported) to 2015, along with the change in performance between two cycles. The average reading literacy performance for students in government and Catholic schools declined significantly between 2009 and 2015 (by 13 and 16 points respectively), while the performance for students in independent schools did not change significantly.

The reading literacy performance has not changed significantly across the school sectors between 2012 and 2015.



Government	Difference between years	
	2012	2009
2015	−12	−13 ▼
2012		−1
2009		

Catholic	Difference between years	
	2012	2009
2015	−6	−16 ▼
2012		−10
2009		

Independent	Difference between years	
	2012	2009
2015	−7	−10
2012		−2
2009		

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.15 Average reading literacy performance and differences over time, PISA 2009 to 2015, by school sector

In 2009 and 2012, no significant differences in reading literacy performance between school sectors were found once student- and school-level socioeconomic background were taken into account. However in 2015, for the first time, differences between students in Catholic schools and students in independent schools remain significant once student- and school-level socioeconomic background are accounted for.

Reading literacy proficiency

Table 4.8 shows the proportions of low and high performers in PISA 2009 and 2015 by school sector. There was:

- a 5% increase in the proportion of low performers and a 2% decrease in the proportion of high performers in government schools
- a 5% increase in the proportion of low performers and a 1% decrease in the proportion of high performers in Catholic schools
- a 1% increase in the proportion of low performers and a 3% decrease in the proportion of high performers in independent schools.

TABLE 4.8 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and 2015, by school sector

	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
School sector	%	SE	%	SE	%	SE	%	SE
Government	19	0.9	10	1.2	24	0.8	8	0.6
Catholic	8	1.3	13	1.0	13	1.0	12	1.0
Independent	6	0.9	22	1.8	7	0.7	18	1.2

Students who achieved the National Proficient Standard

Table 4.9 shows the proportion of students who achieved the National Proficient Standard in reading literacy decreased across all school sectors between 2009 and 2015. The proportions decreased by:

- 5% in government schools
- 8% in Catholic schools.
- 3% in independent schools

Between 2012 and 2015, the proportions of students who achieved the National Proficient Standard in reading literacy across the school sectors decreased by:

- 4% in each of government and Catholic schools
- 3% in independent schools.

TABLE 4.9 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2009 to 2015, by school sector

	PISA 2009		PISA 2012		PISA 2015	
School sector	%	SE	%	SE	%	SE
Government	58	1.4	57	1.0	53	1.0
Catholic	74	2.0	71	1.4	67	1.3
Independent	80	1.5	80	1.3	77	1.2

Australia's reading literacy results for different demographic groups

Reading literacy results for PISA 2015 by Indigenous background

Reading literacy performance

Figure 4.16 shows Indigenous and non-Indigenous students' performance in reading literacy. Indigenous students achieved an average score of 435 points, which was 71 points lower than the average score of 506 points for non-Indigenous students. This average score difference equates to one proficiency level or around two-and-a-third years of schooling.

Indigenous students performed significantly lower in reading literacy than the OECD average (by 58 points), while non-Indigenous students performed significantly higher than the OECD average (by 13 points).

Indigenous students' performance was on par with students' performance in Uruguay, Romania, the United Arab Emirates, Bulgaria, Turkey, Costa Rica and Trinidad and Tobago while their performance was significantly higher than in Montenegro, Colombia and Mexico.

The spread of scores for Indigenous and non-Indigenous students was similar.

Indigenous background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Indigenous	435	3.6	428–442	330	
Non-Indigenous	506	1.7	503–509	335	

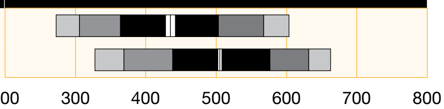


FIGURE 4.16 Average scores and distribution of students' performance on the reading literacy scale, by Indigenous background

Reading literacy proficiency

Figure 4.17 provides further details about Indigenous and non-Indigenous performance and shows the proportion of students in each of the reading literacy proficiency levels. As was the case for scientific literacy, there was an under-representation of Indigenous students at the higher levels and an over-representation of Indigenous students at the lower levels of the reading literacy proficiency scale. Three per cent of Indigenous students were high performers compared to 11% of non-Indigenous students. At Level 6, there were only 0.4% of Indigenous students compared to 2% of non-Indigenous students.

There were about two times as many low-performing Indigenous students than low-performing non-Indigenous students. Forty per cent of Indigenous students were low performers, which includes 24% of Indigenous students who achieved Level 1a and 16% of Indigenous students who achieved Level 1b or below. Seventeen per cent of non-Indigenous students were low performers, which includes 11% who achieved Level 1a and 6% who achieved below Level 1b or below.

The proportion of high-performing Indigenous students (3%) was about half that of high-performing students across the OECD (8%), while there were twice as many low-performing Indigenous students (40%) compared to low-performing students across the OECD (20%).

Approximately one-third of Indigenous students reached the National Proficient Standard in reading literacy compared to almost two-thirds of non-Indigenous students.

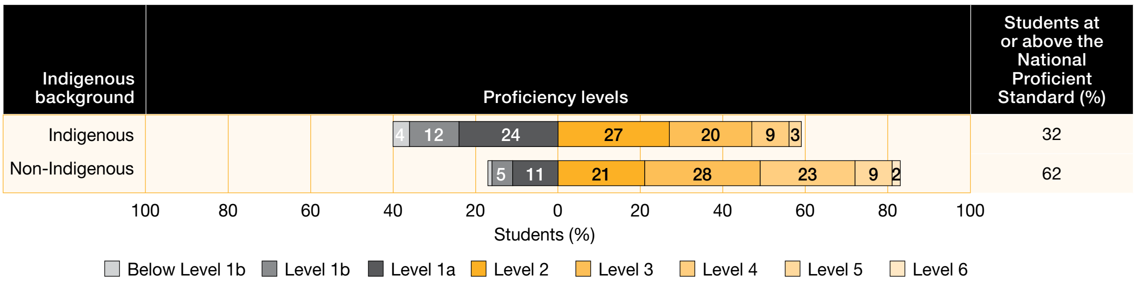


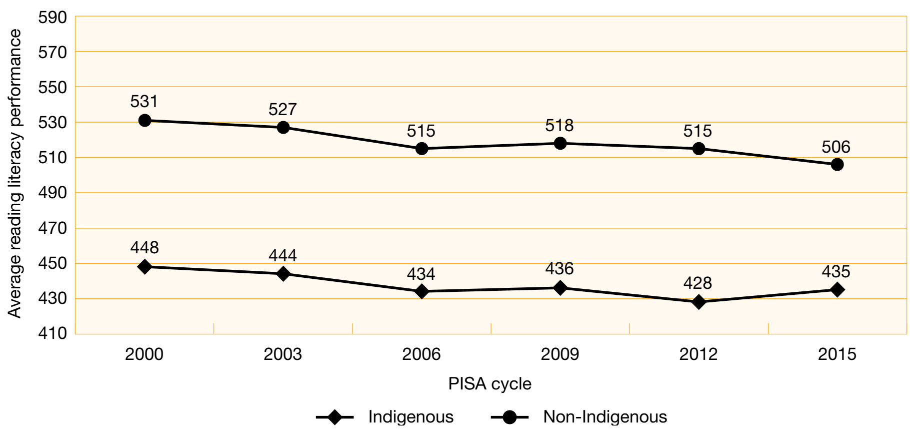
FIGURE 4.17 Percentage of students across the reading literacy proficiency scale, by Indigenous background

Reading literacy results over time by Indigenous background

Reading literacy performance

Figure 4.18 shows the average reading literacy performance and change in performance across the PISA cycles for Indigenous and non-Indigenous students. The performance in reading literacy for Indigenous students was only found to vary significantly between PISA 2000 and 2012, with a decline of 20 points. The decline in performance for non-Indigenous students between 2000 and each PISA cycle after 2003 was significant. Between 2000 and 2015, performance of non-Indigenous students significantly declined by 25 points.

The difference in performance between Indigenous and non-Indigenous students in 2000 was 83 points. The difference in performance between Indigenous and non-Indigenous students in 2015 was 71 points. This gap has not changed significantly between 2000 and 2015.



Indigenous	Difference between years				
	2012	2009	2006	2003	2000
2015	7	–1	1	–9	–13
2012		–8	–6	–16	–20 ▼
2009			2	–8	–12
2006				–10	–14
2003					–4

Non-Indigenous	Difference between years				
	2012	2009	2006	2003	2000
2015	–9	–12 ▼	–9	–21 ▼	–25 ▼
2012		–3	0	–12 ▼	–16 ▼
2009			2	–10	–13 ▼
2006				–12 ▼	–16 ▼
2003					–4

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.18 Average reading literacy performance and differences over time, PISA 2000 to 2015, by Indigenous background

Reading literacy proficiency

Table 4.10 shows the proportions of low and high performers for PISA 2009 and 2015 by Indigenous background. Between PISA 2009 and 2015:

- the proportion of low-performing Indigenous students increased by 1% and the proportion of high-performing Indigenous students also increased by 1%
- the proportion of low-performing non-Indigenous students increased by 4% and the proportion of high-performing non-Indigenous students decreased by 2%.

TABLE 4.10 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and 2015, by Indigenous background

	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Indigenous background	%	SE	%	SE	%	SE	%	SE
Indigenous	39	2.6	2	0.6	40	1.7	3	0.6
Non-Indigenous	13	0.5	13	0.8	17	0.5	11	0.5

Students who achieved the National Proficient Standard

Table 4.11 shows the proportions of students who achieved the National Proficient Standard in reading literacy from PISA 2000 to 2015 for Indigenous and non-Indigenous students.

Between 2000 and 2015, the proportion of students who achieved the National Proficient Standard decreased by 6% for Indigenous students and 8% for non-Indigenous students.

Between 2012 and 2015, the proportion of Indigenous students who achieved the National Proficient Standard increased by 1%, while the proportion of non-Indigenous students who achieved the National Proficient Standard decreased by 3%.

TABLE 4.11 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2000 to 2015, by Indigenous background

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Indigenous background	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Indigenous	38	3.4	38	3.9	33	2.5	35	2.7	31	1.7	32	1.4
Non-Indigenous	70	1.3	71	0.9	67	0.9	66	0.9	65	0.6	62	0.7

Reading literacy results for PISA 2015 by geographic location of school

Reading literacy performance

Figure 4.19 shows the performance of schools across the three broad categories of geographic location of schools, which were based on the MCEETYA Schools Geographic Location Classification (Jones, 2004).[39] On average, students from metropolitan schools scored 31 points higher in reading literacy (equivalent to around one year of schooling higher) than students who attended provincial schools. The average score difference between students from metropolitan schools and students from remote schools was even larger at 46 points, which is equal to about one-and-a-half years of schooling. No statistically significant differences in performance were found between students from provincial and remote schools.

39 The Reader's Guide provides more information about the MCEETYA Schools Geographic Location Classification.

The average performance for students from metropolitan schools was significantly higher than for students across the OECD (by approximately 20 points), but the average performance for students from provincial and remote schools was significantly lower than the OECD average (by 13 and 28 points respectively).

The spread of scores across the three geographic locations was simliar (ranging between 335 and 338 points).

Geographic location	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Metropolitan	511	1.9	508–515	335
Provincial	480	3.3	474–486	337
Remote	465	15.2	436–495	338

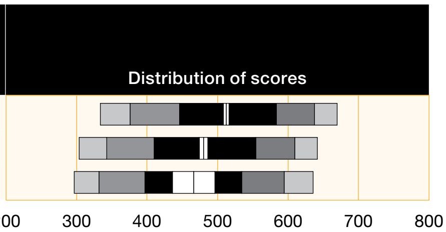


FIGURE 4.19 Average scores and distribution of students' performance on the reading literacy scale, by geographic location

Reading literacy proficiency

Figure 4.20 shows the proportions of students on the reading literacy proficiency scale for the three school geographic locations. There were twice as many high performers from metropolitan schools (12%) than high performers from provincial and remote schools (7% and 6% respectively). At Level 6, 2% of students were from metropolitan schools and even fewer students from provincial and remote schools achieved this level (1%).

There were about half as many low performers from metropolitan schools (16%) than low performers from provincial schools and remote schools (24% and 28% respectively). In the lowest two proficiency levels, below Level 1b and Level 1b, there were 5% of students from metropolitan schools compared to 9% of students from provincial schools and 11% of students from remote schools.

Sixty-four per cent of students from metropolitan schools reached the National Proficient Standard in reading literacy compared to 51% of students from provincial schools and 44% of students from remote schools.

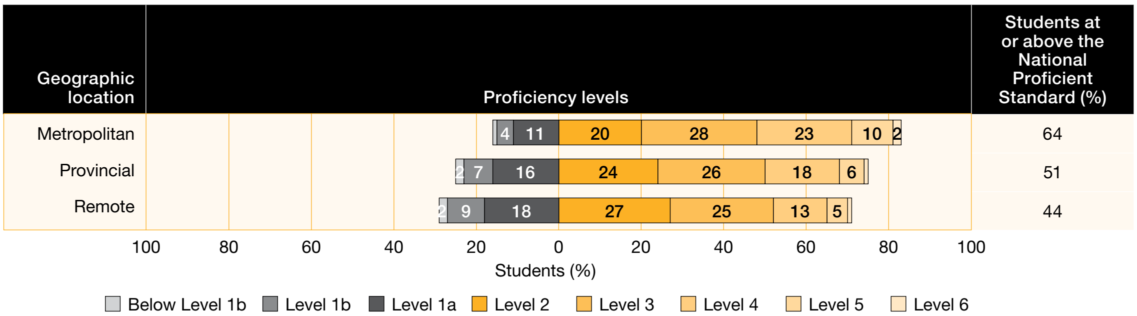


FIGURE 4.20 Percentage of students across the reading literacy proficiency scale, by geographic location

Reading literacy results over time by geographic location of school

Reading literacy performance

Figure 4.21 shows that between 2000 and 2015 the average reading literacy performance of students from metropolitan schools declined significantly by 23 points and the performance of students from provincial schools declined significantly by 38 points. There was no significant change in performance for students from remote schools between 2000 and 2015.

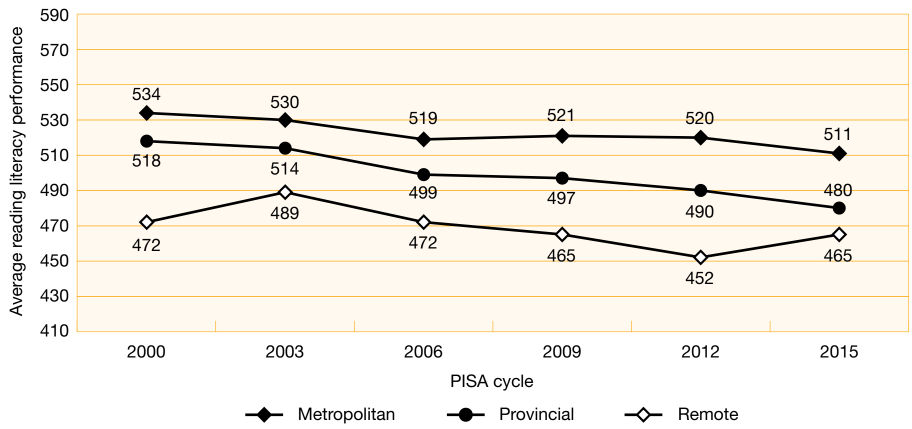
The difference in performance between students in metropolitan schools and students in provincial schools in 2000 was 16 points. The difference in performance between students in metropolitan schools and students in provincial schools in 2015 was 31 points. This gap has not changed significantly between 2000 and 2015.

The difference in performance between students in provincial schools and students in remote schools in 2000 was 46 points. The difference in performance between students in provincial schools and students in remote schools in 2015 was 15 points. This gap has not changed significantly between 2000 and 2015.

The difference in performance between students in metropolitan schools and students in remote schools in 2000 was 62 points. The difference in performance between students in metropolitan schools and students in remote schools in 2015 was 46 points. This gap has not changed significantly between 2000 and 2015.

Between 2000 and 2009, the average reading literacy performance was significantly lower for students from provincial schools (by 21 points), while there were no significant differences in performance for students from metropolitan or remote schools.

Between 2009 and 2015, the change in performance was significantly lower for students from metropolitan schools (by 10 points) and for students from provincial schools (by 17 points), while the change in performance for students from remote schools was not significant.



Metropolitan					
	Difference between years				
	2012	2009	2006	2003	2000
2015	–9	–10 ▼	–8	–19 ▼	–23 ▼
2012		–1	1	–10	–14
2009			2	–8	–13
2006				–11	–15 ▼
2003					–5

Provincial					
	Difference between years				
	2012	2009	2006	2003	2000
2015	–10	–17 ▼	–19 ▼	–34 ▼	–38 ▼
2012		–7	–9	–24 ▼	–28 ▼
2009			–2	–17 ▼	–21 ▼
2006				–15 ▼	–18 ▼
2003					–3

Remote					
	Difference between years				
	2012	2009	2006	2003	2000
2015	13	0	–7	–24	–6
2012		–13	–20	–37 ▼	–19
2009			–7	–24	–6
2006				–17	1
2003					18

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.21 Average reading literacy performance and differences over time, PISA 2000 to 2015, by geographic location

Reading literacy proficiency

Table 4.12 shows the proportion of low and high performers in PISA 2009 and 2015 by geographic location. Between 2009 and 2015, there was:

- a 3% increase in the proportion of low performers and a 2% decrease in high performers from metropolitan schools
- a 6% increase in the proportion of low performers and a 1% decrease in high performers from provincial schools
- a 2% decrease in the proportion of low performers and no change in the proportion of high performers from remote schools.

TABLE 4.12 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and 2015, by geographic location

	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Geographic location	%	SE	%	SE	%	SE	%	SE
Metropolitan	13	0.7	14	1.0	16	0.6	12	0.6
Provincial	18	1.3	8	0.9	24	1.2	7	0.7
Remote	30	3.6	6	1.9	28	6.2	6	3.1

Students who achieved the National Proficient Standard

Table 4.13 shows the proportion of students who achieved the National Proficient Standard in reading literacy from PISA 2000 to 2015 by geographic location.

Between 2000 and 2015, the proportion of students who achieved the National Proficient Standard decreased by:

- 7% for students from metropolitan schools
- 14% for students from provincial schools
- 5% for students from remote schools.

Between 2012 and 2015, the proportion of students from remote schools who achieved the National Proficient Standard increased by 1%, while the proportion of students who achieved the National Proficient Standard decreased by:

- 3% for students from metropolitan schools
- 5% for students from provincial schools.

TABLE 4.13 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2000 to 2015, by geographic location

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Geographic location	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Metropolitan	71	1.6	71	1.0	68	1.1	68	1.1	67	0.7	64	0.9
Provincial	65	1.5	66	2.3	60	1.4	59	2.0	56	1.3	51	1.4
Remote	49	8.2	55	5.7	49	8.0	49	4.5	43	6.2	44	5.5

Reading literacy results for PISA 2015 by socioeconomic background

Reading literacy performance

Figure 4.22 shows that students in the highest socioeconomic quartile achieved an average score of 551 points, which was higher than students in the lowest socioeconomic quartile, who achieved 462 points. This difference of 89 points was statistically significant and represents over one proficiency level or around three years of schooling. The difference between each socioeconomic quartile and the next was also significant, and equivalent to around one year of schooling.

The spread of scores between the highest and lowest performing students within each socioeconomic quartile ranged from 308 points for students in the highest quartile to 331 points for students in the lowest quartile.

The score for students in the highest quartile was significantly higher than that of the OECD average (with an average score difference of 31 points), while the score for students in the lowest quartile was significantly lower than for students across the OECD (with an average score difference of 58 points).

Socioeconomic background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Lowest quartile	462	3.0	456–468	331	
Second quartile	490	2.6	485–495	318	
Third quartile	517	2.2	513–522	315	
Highest quartile	551	2.8	545–556	308	

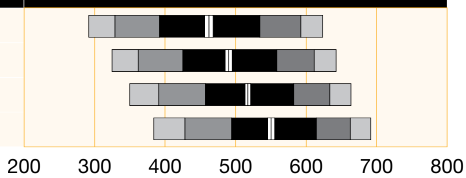


FIGURE 4.22 Average scores and distribution of students' performance on the reading literacy scale, by socioeconomic background

Reading literacy proficiency

Figure 4.23 shows there was a larger proportion of students from the higher quartiles at the higher proficiency levels and fewer students from the higher quartiles at the lower proficiency levels. Only 5% of students in the lowest quartile were high performers compared to 8% of students in the second quartile, 12% in the third quartile and 21% in the highest quartile. Thirty per cent of students in the lowest quartile were low performers compared to 20% of students in the second quartile, 13% in the third quartile and 7% in the highest quartile.

The proportion of high performers across the OECD (8%) was lower than the proportion of high performers in the third and highest quartiles, the same proportion as high performers in the second quartile, and higher than the proportion of high performers in the lowest quartile.

The proportion of low performers across the OECD (20%) was higher than the proportion of low performers in the third and highest quartiles, the same proportion as low performers in the second quartile, and lower than the proportion of low performers in the lowest quartile.

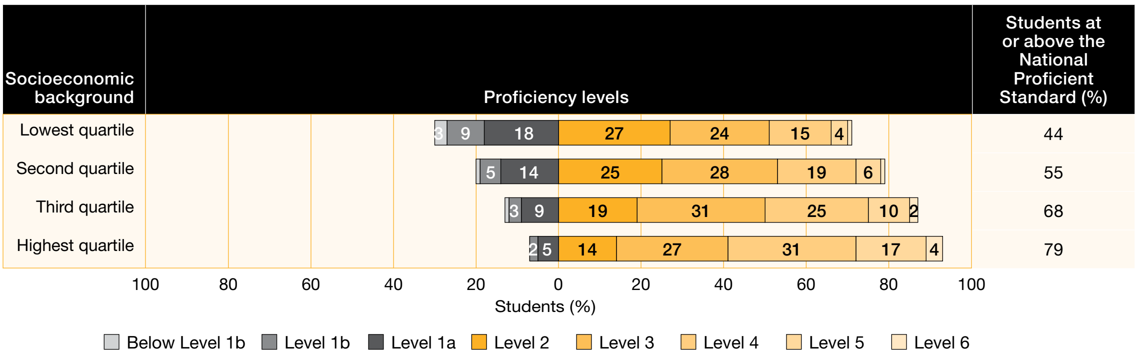


FIGURE 4.23 Percentage of students across the reading literacy proficiency scale, by socioeconomic background

Reading literacy results over time by socioeconomic background[40]

Reading literacy performance

The average performance in reading literacy for each quartile of socioeconomic background from PISA 2000 to 2015 is shown in Figure 4.24. Between 2000 and 2009, there was a significant decline of 22 points in the highest quartile.

Between 2000 and 2015, there was a significant decline in the average performance in all quartiles. There was:

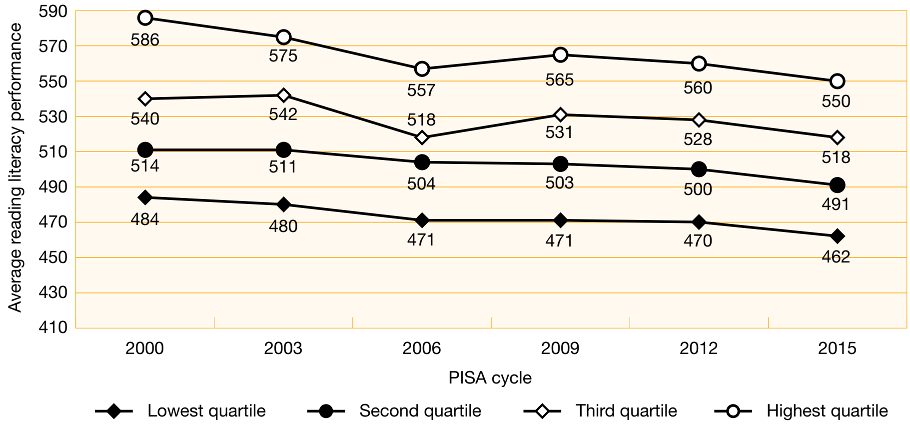
- a 22-point decline in the lowest and third quartiles
- a 23-point decline in the second quartile
- a 36-point decline in the highest quartile.

The difference in performance between students in the lowest quartile and students in the highest quartile in 2000 was 102 points. The difference in performance between students in the lowest quartile and students in the highest quartile in 2015 was 88 points. This gap has not changed significantly between 2000 and 2015.

Between 2009 and 2015, there was a significant decline in the average performance in three of the quartiles:

- a 12-point decline in the second quartile
- a 13-point decline in the third quartile
- a 15-point decline in the highest quartile.

40 While an ESCS index was included in all past PISA databases, the components of ESCS and the scaling model have changed over cycles, meaning that the ESCS scores are not comparable across cycles directly. An ESCS-trend index variable has been computed using similar methodology for the current cycle and for previous cycles in order to enable a trend study.



Lowest quartile					
	Difference between years				
	2012	2009	2006	2003	2000
2015	−9	−9	−9	−18 ▼	−22 ▼
2012		0	−1	−10	−13
2009			0	−9	−14
2006				−9	−13
2003					−4

Second quartile					
	Difference between years				
	2012	2009	2006	2003	2000
2015	−9	−12 ▼	−13	−19 ▼	−23 ▼
2012		−3	−4	−11	−14
2009			−1	−7	−11
2006				−6	−9
2003					−3

Third quartile					
	Difference between years				
	2012	2009	2006	2003	2000
2015	−10	−13 ▼	0	−24 ▼	−22 ▼
2012		−3	10	−14 ▼	−12
2009			13 ▲	−11 ▼	−9
2006				−24 ▼	−22 ▼
2003					2

Highest quartile					
	Difference between years				
	2012	2009	2006	2003	2000
2015	−10	−15 ▼	−7	−25 ▼	−36 ▼
2012		−5	3	−15 ▼	−26 ▼
2009			8	−10	−22 ▼
2006				−18 ▼	−29 ▼
2003					−11

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.24 Average reading literacy performance and differences over time, PISA 2000 to 2015, by socioeconomic background

Reading literacy proficiency

Table 4.14 shows there was an increase in the proportion of low performers, and with the exception of students in the lowest quartile, there was a decrease in the proportion of high performers.

For the high performers, there was:

- a 1% decrease in the second quartile
- a 3% decrease in the third quartile
- a 4% decrease in the highest quartile.

For the low performers, there was:

- a 5% increase in each of the lowest and second quartiles
- a 3% increase in each of the third and highest quartiles.

TABLE 4.14 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and 2015, by socioeconomic background

Socioeconomic background	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	25	1.2	4	0.5	30	1.3	5	0.6
Second quartile	14	0.8	8	0.6	19	1.0	8	0.8
Third quartile	10	0.6	15	1.1	13	0.8	12	0.8
Highest quartile	5	0.5	25	1.6	7	0.6	21	1.3

Students who achieved the National Proficient Standard

Table 4.15 shows that the proportions of students who achieved the National Proficient Standard in reading literacy have decreased over time.

Between PISA 2000 and 2015 there was:

- a 9% decrease in each of the lowest and second quartiles
- a 6% decrease in the third background quartile
- a 10% decrease in the highest quartile.

Between PISA 2012 and 2015, there was:

- a 3% decrease in each of the lowest and highest quartiles
- a 5% decrease in the second quartile
- a 4% decrease in the third quartile.

TABLE 4.15 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2000 to 2015, by socioeconomic background

Socioeconomic background	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	52	2.3	53	1.9	47	1.1	47	1.4	46	1.4	43	1.4
Second quartile	65	1.9	65	1.7	62	1.6	61	1.3	60	1.3	56	1.2
Third quartile	74	1.8	77	1.4	69	1.2	72	1.1	72	1.0	68	1.1
Highest quartile	89	1.3	87	1.1	83	1.0	84	0.9	82	0.9	79	1.0

Reading literacy results for PISA 2015 by immigrant background

Reading literacy performance

Figure 4.25 shows that Australian-born students achieved an average reading literacy score of 501 points, which was significantly lower than first-generation students (517 points). Foreign-born students achieved an average score of 500 points and also performed significantly lower than first-generation students. In this instance, the difference in average scores between Australian-born and first-generation students, and between foreign-born and first-generation students represents around half a year of schooling. The performance of Australian-born students was not statistically different to that of foreign-born students.

The performance of Australian-born and first-generation students was significantly higher than the OECD average (by 8 points and 24 points respectively), while the performance of foreign-born students was not significantly different to that of students across the OECD.

While the spread of scores was similar for Australian-born students and first-generation students, the spread of scores for foreign-born students was wider.

Immigrant background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Australian-born	501	2.3	496–505	331
First-generation	517	2.3	512–521	332
Foreign-born	500	3.9	492–508	355

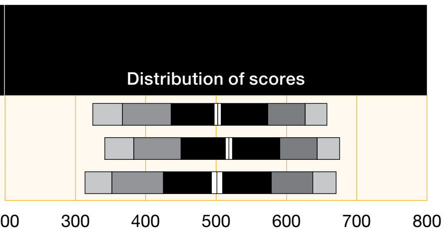


FIGURE 4.25 Average scores and distribution of students' performance on the reading literacy scale, by immigrant background

Reading literacy proficiency

Figure 4.26 shows that the proportion of students in each of the proficiency levels for the three immigrant background groups was very similar:

- 10% of Australian-born students were high performers compared to 14% of first-generation students and 12% of foreign-born students
- 18% of Australian-born students were low performers compared to 14% of first-generation students and 21% of foreign-born students.

The proportions of high performers in the three immigrant background groups were higher than the proportion of high performers across the OECD. The proportions of low-performing Australian-born students and first-generation students were lower than the proportion of low performers across the OECD, while the proportion of low-performing foreign-born students was similar to the proportion of low performers across the OECD.

Similar proportions of foreign-born students and Australian-born students achieved the National Proficient Standard (59% and 60% respectively), while the proportion of first-generation students was slightly higher at 66%.

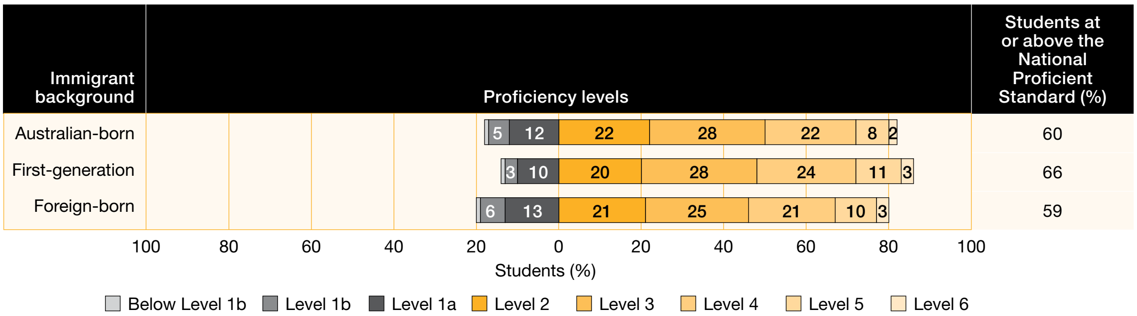


FIGURE 4.26 Percentage of students across the reading literacy proficiency scale, by immigrant background

Reading literacy results over time by immigrant background

Reading literacy performance

Figure 4.27 shows that between 2000 and 2015, the reading literacy performance for Australian-born students declined significantly by 29 points, and the performance for first-generation students declined significantly by 20 points, while the performance for foreign-born students was not significantly different over this time.

The difference in performance between Australian-born students and first-generation students in 2000 was 8 points. The difference in performance between Australian-born students and first-generation students in 2015 was 16 points. This gap has not changed significantly between 2000 and 2015.

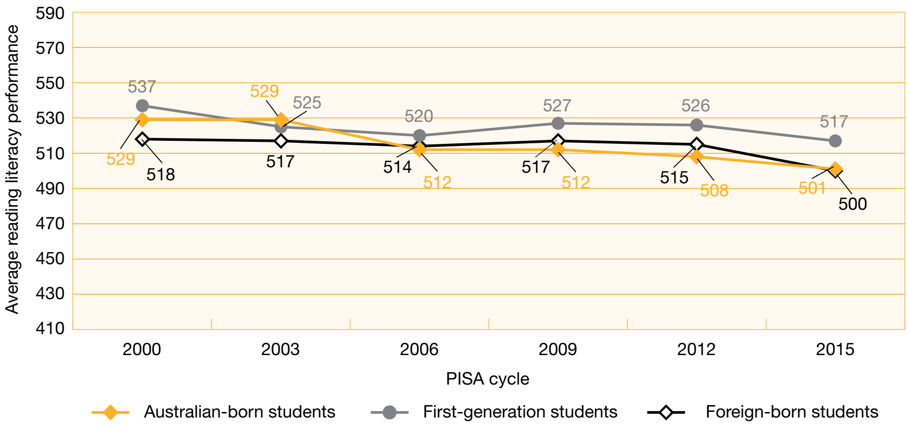
The difference in performance between Australian-born students and foreign-born students in 2000 was 11 points. The difference in performance between Australian-born students and foreign-born students in 2015 was 1 points. This gap has not changed significantly between 2000 and 2015.

The difference in performance between first-generation students and foreign-born students in 2000 was 19 points. The difference in performance between first-generation students and foreign-born students in 2015 was 17 points. This gap has not changed significantly between 2000 and 2015.

Between 2000 and 2009, the average score for Australian-born students declined significantly by 18 points, and there were no statistically significant changes in the performance of first-generation and foreign-born students.

Between 2009 and 2015, reading literacy performance declined significantly across all three immigrant background groups. The performance declined by 11 points for Australian-born students, 10 points for first-generation students and 17 points for foreign-born students.

Between 2012 and 2015, the only significant change in performance was found for the foreign-born students, with a decline of 15 points.



Australian-born	Difference between years				
	2012	2009	2006	2003	2000
2015	–8	–11 ▼	–12	–28 ▼	–29 ▼
2012		–3	–4	–20 ▼	–21 ▼
2009			–1	–17 ▼	–18 ▼
2006				–16 ▼	–17 ▼
2003					–1

First-generation	Difference between years				
	2012	2009	2006	2003	2000
2015	–10	–10 ▼	–3	–8	–20 ▼
2012		–1	6	1	–10
2009			7	2	–10
2006				–5	–17 ▼
2003					–12

Foreign-born	Difference between years				
	2012	2009	2006	2003	2000
2015	–15 ▼	–17 ▼	–14	–17 ▼	–18
2012		–2	1	–2	–3
2009			3	0	–1
2006				–3	–4
2003					–1

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.27 Average reading literacy performance and differences over time, PISA 2000 to 2015, by immigrant background

Reading literacy proficiency

Table 4.16 shows that between 2009 and 2015, the proportion of high performers decreased by:

- 2% for Australian-born students
- 1% for first-generation students
- 3% for foreign-born students.

In the same period, the proportion of low performers increased by:

- 3% for Australian-born and first-generation students
- 5% for foreign-born students.

TABLE 4.16 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and 2015, by immigrant background

Immigrant background	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Australian-born	14	0.7	11	0.6	18	0.6	10	0.6
First-generation	11	0.8	15	1.3	14	0.9	14	0.8
Foreign-born	15	1.5	15	2.2	21	1.4	12	1.3

Students who achieved the National Proficient Standard

Table 4.17 shows the proportion of students who achieved the National Proficient Standard in reading literacy from PISA 2000 to 2015 by immigrant background.

Between 2000 and 2015, there was a 9% decrease for Australian-born students and a 6% decrease for each of first-generation and foreign-born students.

Between 2012 and 2015, there was a 4% decrease for Australian-born students, a 3% decrease for first-generation students and a 5% decrease for foreign-born students.

TABLE 4.17 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2000 to 2015, by immigrant background

Immigrant background	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australian-born	70	1.5	71	1.0	66	0.9	64	1.1	64	0.8	60	0.9
First-generation	72	2.0	70	1.8	68	1.4	70	1.1	69	1.0	66	1.1
Foreign-born	65	3.4	66	2.3	65	2.4	65	2.4	64	1.6	59	1.7

Reading literacy results for PISA 2015 by language background

Reading literacy performance

Figure 4.28 shows that students who spoke English at home achieved an average reading literacy score of 507 points, a significant difference 20 points higher than students who spoke a language other than English at home. This average score difference equates to around two-thirds of a year of schooling.

Students who spoke English at home performed significantly higher than the OECD average (by 14 points), whereas there was no significant difference in performance between students who spoke a language other than English and the OECD average.

The spread of scores for students who spoke a language other than English at home was 377 points, which is 46 points wider than for students who spoke English at home.

Language background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
English spoken at home	507	1.8	503–510	331
Language other than English spoken at home	487	5.4	476–497	377

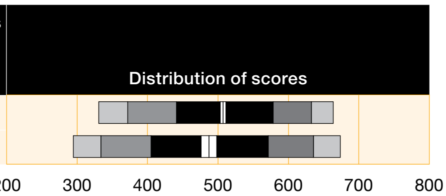


FIGURE 4.28 Average scores and distribution of students' performance on the reading literacy scale, by language background

Reading literacy proficiency

Figure 4.29 shows that while the same proportion of high performers (11%) were found in both language background groups, there were more low performers who spoke a language other than English at home (26%) than low performers who spoke English at home (17%).

The proportions of high performers for both language background groups were higher than the proportion of high performers across the OECD. The proportion of low performers was lower for students who spoke English at home and the proportion of low performers was higher for students who spoke a language other than English at home compared to the proportion of low performers across the OECD.

Almost two-thirds (62%) of students who spoke English at home achieved the National Proficient Standard in reading literacy, while half (53%) of the students who spoke a language other than English at home achieved this standard.

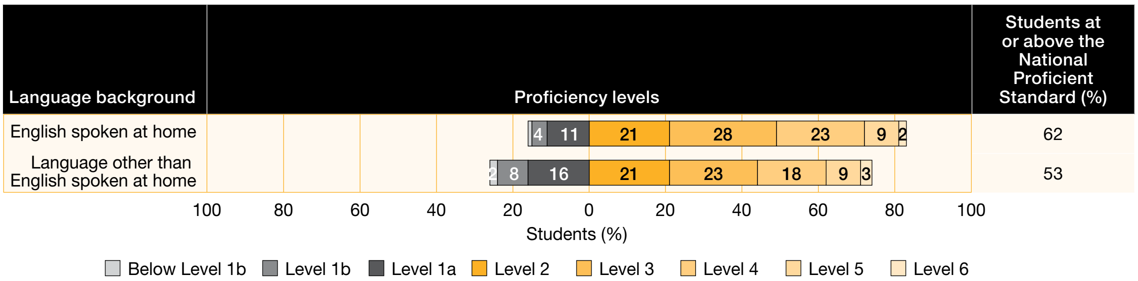


FIGURE 4.29 Percentage of students across the reading literacy proficiency scale, by language background

Reading literacy results over time by language background[41]

Reading literacy performance

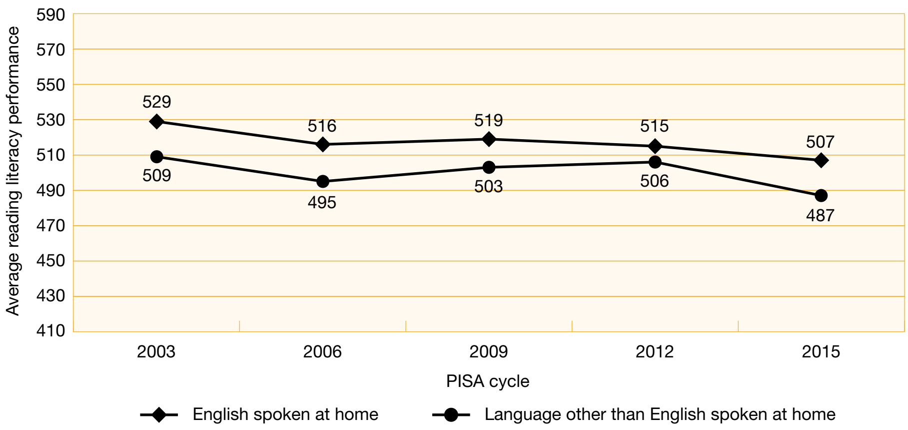
Figure 4.30 shows that the average reading literacy performance between 2009 and 2015 declined significantly for students who spoke English at home (by 12 points).

The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2003 was 20 points. The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2015 was also 20 points. This gap has not changed significantly between 2003 and 2015.

Between 2009 and 2015, reading literacy performance was not significantly different for students who spoke a language other than English at home, while between 2012 and 2015, reading literacy performance for students who spoke a language other than English at home declined significantly (by 20 points).

41 The question about students' language background in PISA 2000 was not asked in the same way as in other PISA assessments and is therefore not comparable. Results on language background for PISA 2000 have not been included in this section.

Between 2012 and 2015, there was no significant change in the performance for students who spoke English at home.



English spoken at home								
	Difference between years							
	2012		2009		2006		2003	
2015	–8		–12	▼	–10		–22	▼
2012			–4		–1		–14	▼
2009					3		–10	▼
2006							–13	▼

Language other than English spoken at home								
	Difference between years							
	2012		2009		2006		2003	
2015	–20	▼	–16		–9		–22	▼
2012			3		11		–3	
2009					8		–6	
2006							–13	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.30 Average reading literacy performance and differences over time, PISA 2003 to 2015, by language background

Reading literacy proficiency

Table 4.18 shows the proportion of low and high performers between PISA 2009 and 2015. During this period there was:

- a 4% increase in the proportion of low-performing students who spoke English at home
- a 6% increase in the proportion of low-performing students who spoke a language other than English at home
- a 2% decrease in the proportion of high-performing students who spoke English at home
- a 1% decrease in the proportion of high-performing students who spoke a language other than English at home.

TABLE 4.18 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2009 and PISA 2015, by language background

	PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Language background	%	SE	%	SE	%	SE	%	SE
English spoken at home	13	0.5	13	0.7	17	0.5	11	0.6
Language other than English spoken at home	20	2.0	13	3.0	26	1.9	11	1.5

Students who achieved the National Proficient Standard

Table 4.19 shows the proportion of students who achieved the National Proficient Standard in reading literacy has decreased over time.

- Between 2009 and 2015, there was a 5% decrease for students who spoke English at home and a 7% decrease for students who spoke a language at home other than English.
- Between 2012 and 2015, there was a 3% decrease for students who spoke English at home and a 7% decrease for students who spoke a language at home other than English.

TABLE 4.19 Percentage of students at or above the National Proficient Standard on the reading literacy proficiency scale from PISA 2003 to 2015, by language background

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Language background	%	SE	%	SE	%	SE	%	SE	%	SE
English spoken at home	71	0.9	67	0.8	67	0.8	66	0.6	62	0.7
Language other than English spoken at home	62	2.5	59	3.2	60	3.1	60	1.8	53	2.1

Note: Language background in PISA 2000 was asked in a different way than in the other PISA cycles so comparisons cannot be made.

Reading literacy results by sex

Reading literacy performance in PISA 2015 across countries by sex

Figure 4.31 provides the average scores and standard errors for females and males on the reading literacy scale, graphs the difference by sex and indicates whether the difference was statistically significant. Across the OECD countries, the average score for females was 506 points and for males was 479 points, which is a significant difference of 27 points.

In all participating countries, females performed significantly higher than males in reading literacy. Countries with the largest differences by sex were Cyprus, Trinidad and Tobago, the United Arab Emirates, Bulgaria, and Finland, where females scored, on average, 47 points or more higher than males.

In Australia, females scored 519 points on average and males scored 487 points. This difference of 32 points represents around half a proficiency level or is equal to about one year of schooling.

Country	Females Avg. score	Females SE	Males Avg. score	Males SE
Chile	465	2.9	453	3.4
Ireland	527	2.7	515	3.2
Japan	523	3.3	509	4.2
Costa Rica	435	2.9	420	3.1
Colombia	432	3.2	417	3.6
Mexico	431	2.9	416	2.9
Belgium	507	2.9	491	3.1
Italy	493	3.6	477	3.5
B-S-J-G (China)	503	5.8	486	5.0
Portugal	507	2.8	490	3.1
Romania	442	4.4	425	4.4
United States	507	3.9	487	3.7
Austria	495	3.7	475	4.3
Singapore	546	2.3	525	1.9
Spain	506	2.8	485	3.0
Germany	520	3.1	499	3.7
Luxembourg	492	2.2	471	1.9
United Kingdom	509	3.5	487	2.9
Denmark	511	3.4	489	2.8
Israel	490	4.6	467	5.4
Uruguay	448	2.7	424	3.4
Netherlands	515	2.9	491	3.0
Hungary	482	3.1	457	3.7
Vietnam	499	3.8	474	4.0
Chinese Taipei	510	3.4	485	3.7
Switzerland	505	3.4	480	3.4
Czech Republic	501	2.9	475	3.6
Russian Federation	507	3.5	481	3.4
Canada	540	2.5	514	2.6
Croatia	500	3.0	473	3.3
OECD average	**506**	**0.5**	**479**	**0.6**
Turkey	442	4.8	414	4.5
Estonia	533	2.3	505	2.9
Hong Kong (China)	541	3.6	513	3.4
France	514	3.3	485	3.3
Poland	521	2.8	491	2.9
Macao (China)	525	1.6	493	1.9
Australia	**519**	**2.3**	**487**	**2.3**
New Zealand	526	3.0	493	3.3
Montenegro	444	2.3	410	2.0
Slovak Republic	471	3.5	435	3.3
Greece	486	4.2	449	5.1
Lithuania	492	3.0	453	3.1
Sweden	520	3.5	481	4.1
Norway	533	2.9	494	3.1
Korea	539	4.0	498	4.8
Iceland	502	2.6	460	2.8
Latvia	509	2.4	467	2.3
Malta	468	2.2	426	2.7
Slovenia	528	2.1	484	2.3
Finland	551	2.8	504	3.0
Bulgaria	457	5.0	409	5.8
United Arab Emirates	458	3.3	408	3.9
Trinidad and Tobago	452	2.2	401	2.1
Cyprus	469	2.1	417	2.0

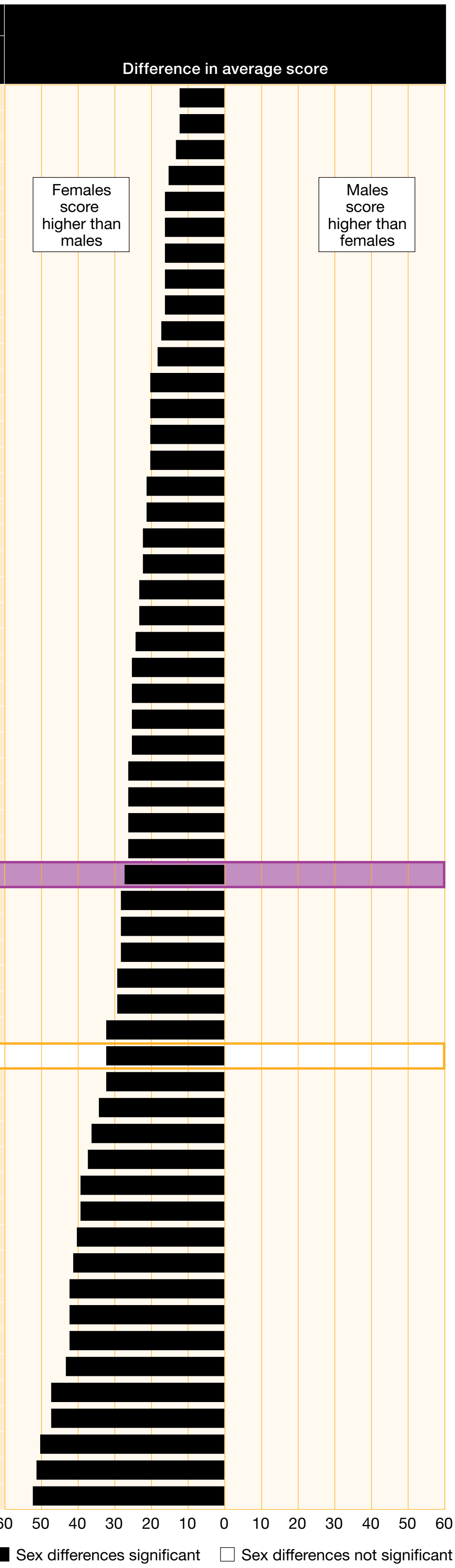


FIGURE 4.31 Average scores and differences in students' performance on the reading literacy scale, by country and sex

Reading literacy proficiency in PISA 2015 for Australia by sex

Figure 4.32 shows the proportion of females and males for Australia and the OECD average at each level of the reading literacy proficiency scale. The proportion of high-performing females and males was higher for Australia than for the OECD average; 13% of Australian females and 9% of Australian males were high performers compared to 10% of females and 7% of males across the OECD countries. Conversely, the proportion of low-performing students was lower for Australia than for the OECD average; 13% of Australian females and 23% of Australian males were low performers compared to 16% of females and 24% of males across the OECD countries.

Sixty-seven per cent of Australian females and 55% of Australian males achieved the National Proficient Standard in reading literacy.

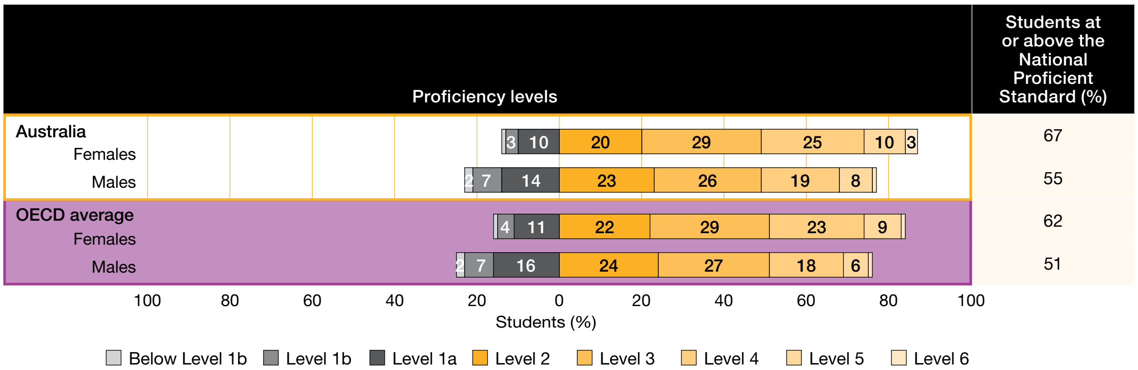


FIGURE 4.32 Percentage of students across the reading literacy proficiency scale, by sex, for Australia and the OECD average

Reading literacy performance over time across countries by sex

Table 4.20 shows that between 2009 and 2015, in the majority of countries, there was a significant change in the average scores in reading literacy for females or males.

- Across the OECD average, the score for females declined significantly by 7 points and the average score for males improved significantly by 5 points.
- The performance of females and males declined significantly between 2009 and 2015 in 7 countries (Australia, Costa Rica, Hungary, Iceland, Korea, the Slovak Republic and Turkey). The change in performance for females ranged from 14 points in Australia to 44 points in Turkey, and the change for males ranged from 9 points in Australia to 29 points in Turkey.
- The performance of both females and males significantly improved between 2009 and 2015 in 8 countries (Estonia, Ireland, Macao (China), Montenegro, the Russian Federation, Slovenia, Spain, and Trinidad and Tobago). The change in performance for females ranged from 7 points in Trinidad and Tobago to 26 points in the Russian Federation, and the change in performance of males ranged from 14 points in Trinidad and Tobago to 44 points in the Russian Federation.
- The performance of females significantly declined and the performance of males significantly improved between 2009 and 2015 in Italy and Malta.
- There were 23 countries whose male and female performance significantly changed:
  - in Colombia, the performance for females improved significantly
  - in Belgium, Finland, Greece, Hong Kong (China), Japan, New Zealand and Switzerland, the performance of females declined significantly (ranging from 9 points in Hong Kong (China) to 19 points in Greece)
  - in Canada, Chile, Croatia, the Czech Republic, Denmark, Germany, Israel, Lithuania, Luxembourg, Norway, Poland, Portugal, Romania, Singapore and Uruguay, the performance of males improved significantly (ranging from 6 points in Canada to 22 points in Romania).

TABLE 4.20 Average reading literacy performance scores for PISA 2009 and PISA 2015, and differences in performance between PISA 2009 and PISA 2015, by country and sex

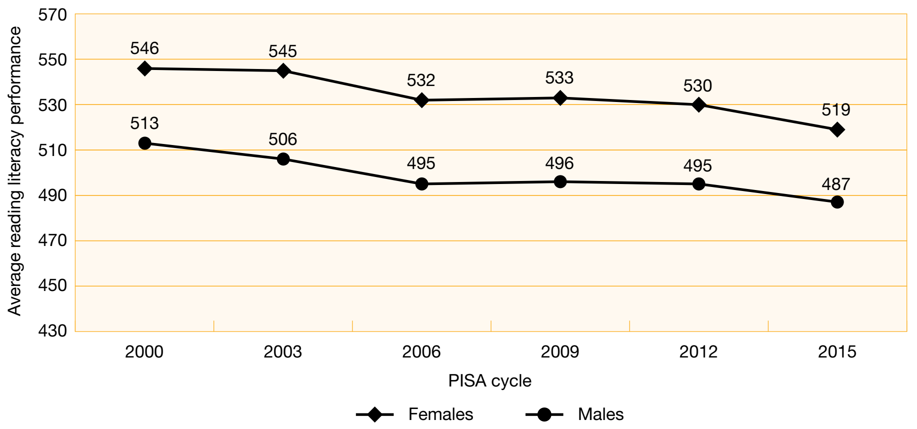
	PISA 2009				PISA 2015				Differences in average score between 2009 and 2015 (PISA 2015 – PISA 2009)					
	Females		Males		Females		Males		Females			Males		
Country	Avg. score	SE	Avg. score	SE	Avg. score	SE	Avg. score	SE	Score dif.		SE	Score dif.		SE
Australia	533	2.6	496	2.9	519	2.3	487	2.3	**–14**	▼	3.5	**–9**	▼	3.7
Belgium	520	2.9	493	3.4	507	2.9	491	3.1	**–13**	▼	4.1	–2		4.6
Bulgaria	461	5.8	400	7.3	457	5.0	409	5.8	–4		7.7	10		9.3
Canada	542	1.7	507	1.8	540	2.5	514	2.6	–2		3.0	**6**	▲	3.1
Chile	461	3.6	439	3.9	465	2.9	453	3.4	4		4.6	**14**	▲	5.1
Chinese Taipei	514	3.6	477	3.7	510	3.4	485	3.7	–4		5.0	8		5.2
Colombia	418	4.0	408	4.5	432	3.2	417	3.6	**15**	▲	5.1	8		5.7
Costa Rica	449	3.0	435	3.7	435	2.9	420	3.1	**–14**	▼	4.2	**–15**	▼	4.8
Croatia	503	3.7	452	3.4	500	3.0	473	3.3	–3		4.7	**21**	▲	4.8
Czech Republic	504	3.0	456	3.7	501	2.9	475	3.6	–3		4.2	**19**	▲	5.2
Denmark	509	2.5	480	2.5	511	3.4	489	2.8	2		4.2	**8**	▲	3.8
Estonia	524	2.8	480	2.9	533	2.3	505	2.9	**10**	▲	3.6	**26**	▲	4.2
Finland	563	2.4	508	2.6	551	2.8	504	3.0	**–13**	▼	3.7	–4		3.9
France	515	3.4	475	4.3	514	3.3	485	3.3	–1		4.8	10		5.4
Germany	518	2.9	478	3.6	520	3.1	499	3.7	2		4.3	**21**	▲	5.2
Greece	506	3.5	459	5.5	486	4.2	449	5.1	**–19**	▼	5.5	–10		7.5
Hong Kong (China)	550	2.8	518	3.3	541	3.6	513	3.4	**–9**	▼	4.6	–5		4.8
Hungary	513	3.6	475	3.9	482	3.1	457	3.7	**–31**	▼	4.7	**–18**	▼	5.4
Iceland	522	1.9	478	2.1	502	2.6	460	2.8	**–21**	▼	3.2	**–18**	▼	3.5
Ireland	515	3.1	476	4.2	527	2.7	515	3.2	**11**	▲	4.1	**39**	▲	5.3
Israel	495	3.4	452	5.2	490	4.6	467	5.4	–5		5.7	**15**	▲	7.5
Italy	510	1.9	464	2.3	493	3.6	477	3.5	**–17**	▼	4.1	**13**	▲	4.2
Japan	540	3.7	501	5.6	523	3.3	509	4.2	**–17**	▼	5.0	8		7.0
Korea	558	3.8	523	4.9	539	4.0	498	4.8	**–19**	▼	5.6	**–24**	▼	6.8
Latvia	507	3.1	460	3.4	509	2.4	467	2.3	1		3.9	7		4.2
Lithuania	498	2.6	439	2.8	492	3.0	453	3.1	–6		3.9	**14**	▲	4.2
Luxembourg	492	1.5	453	1.9	492	2.2	471	1.9	0		2.7	**18**	▲	2.6
Macao (China)	504	1.2	470	1.3	525	1.6	493	1.9	**21**	▲	2.0	**23**	▲	2.2
Malta	478	1.9	406	2.3	468	2.2	426	2.7	**–10**	▼	3.0	**20**	▲	3.5
Mexico	438	2.1	413	2.1	431	2.9	416	2.9	–6		3.6	3		3.6
Montenegro	434	2.1	382	2.1	444	2.3	410	2.0	**10**	▲	3.1	**28**	▲	2.9
Netherlands	521	5.3	496	5.1	515	2.9	491	3.0	–6		6.1	–5		5.9
New Zealand	544	2.6	499	3.6	526	3.0	493	3.3	**–19**	▼	4.0	–5		4.9
Norway	527	2.9	480	3.0	533	2.9	494	3.1	6		4.1	**13**	▲	4.3
Poland	525	2.9	476	2.8	521	2.8	491	2.9	–5		4.0	**16**	▲	4.0
Portugal	508	2.9	470	3.5	507	2.8	490	3.1	–1		4.1	**20**	▲	4.7
Romania	445	4.3	403	4.6	442	4.4	425	4.4	–3		6.1	**22**	▲	6.3
Russian Federation	482	3.4	437	3.6	507	3.5	481	3.4	**26**	▲	4.9	**44**	▲	5.0
Singapore	542	1.5	511	1.7	546	2.3	525	1.9	4		2.7	**15**	▲	2.5
Slovak Republic	503	2.8	452	3.5	471	3.5	435	3.3	**–32**	▼	4.5	**–16**	▼	4.8
Slovenia	511	1.4	456	1.6	528	2.1	484	2.3	**17**	▲	2.6	**28**	▲	2.8
Spain	496	2.2	467	2.2	506	2.8	485	3.0	**10**	▲	3.6	**19**	▲	3.8
Sweden	521	3.1	475	3.2	520	3.5	481	4.1	–1		4.7	6		5.2
Switzerland	520	2.7	481	2.9	505	3.4	480	3.4	**–15**	▼	4.3	–1		4.5
Trinidad and Tobago	445	1.6	387	1.9	452	2.2	401	2.1	**7**	▲	2.7	**14**	▲	2.9
Turkey	486	4.1	443	3.7	442	4.8	414	4.5	**–44**	▼	6.3	**–29**	▼	5.8
United Kingdom	507	2.9	481	3.5	509	3.5	487	2.9	3		4.5	6		4.6
United States	513	3.8	488	4.2	507	3.9	487	3.7	–6		5.5	–1		5.6
Uruguay	445	2.8	404	3.2	448	2.7	424	3.4	2		3.8	**21**	▲	4.6
OECD average 2009	514	0.5	474	0.6	506	0.5	479	0.6	**–7**	▼	0.8	**5**	▲	0.8

Notes: the symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
Only countries that participated in both PISA 2009 and 2015 are shown.

Figure 4.33 shows the reading literacy performance for Australian females and males from PISA 2000 to 2015. The performance of females and males has shown that:

- between 2000 and 2015, the average reading literacy score for females significantly declined (by 27 points) and the average score for males significantly declined (by 25 points).
- between 2000 and 2009, there was no significant change in performance for females, while the performance for males declined significantly (by 17 points).
- between 2009 and 2015, the performance of female students declined significantly (by 14 points), while the performance for males was not significantly different.

The difference in performance between females and males in 2000 was 33 points. The difference in performance between females and males in 2015 was 32 points. This gap has not changed significantly between 2000 and 2015.



	Females									
	Difference between years									
	2012		2009		2006		2003		2000	
2015	–11		–14	▼	–13		–27	▼	–27	▼
2012			–3		–2		–16	▼	–17	▼
2009					1		–13	▼	–13	
2006							–14	▼	–14	▼
2003									–1	

	Males									
	Difference between years									
	2012		2009		2006		2003		2000	
2015	–8		–9		–8		–19	▼	–25	▼
2012			–1		0		–11		–18	▼
2009					1		–10		–17	▼
2006							–11		–18	▼
2003									–7	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 4.33 Average reading literacy performance and differences over time, PISA 2000 to 2015, for Australia, by sex

Reading literacy proficiency over time for Australia by sex

Table 4.21 shows that between PISA 2000 and 2015, the proportion of low-performing females has increased by 5% and the proportion of low-performing males has increased by 7%, while the proportion of high-performing females has declined by 8% and the proportion of high-performing males has declined by 5%.

TABLE 4.21 Percentage of low and high performers on the reading literacy proficiency scale for PISA 2000, 2009 and 2015, by sex, for Australia

	PISA 2000				PISA 2009				PISA 2015			
	Low performers		High performers		Low performers		High performers		Low performers		High performers	
Sex	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Females	8	1.0	21	2.0	9	0.6	16	0.9	13	0.7	13	0.7
Males	16	1.4	14	1.1	20	0.8	10	0.8	23	0.7	9	0.6

Reading literacy performance in PISA 2015 across jurisdictions by sex

Figure 4.34 shows that females in all jurisdictions except the Northern Territory performed significantly higher than males. Queensland had the largest difference by sex (by 39 points), which represents more than half a proficiency level or around one-and-a-third years of schooling. New South Wales had the next largest difference (by 35 points), followed by Western Australia (by 34 points) and South Australia (by 30 points). The three jurisdictions with the smallest differences in performance by sex were Tasmania (by 26 points), the Australian Capital Territory (by 24 points), and Victoria (by 23 points). These differences are equal to almost one year of schooling.

Jurisdiction	Females Avg. score	Females SE	Males Avg. score	Males SE
QLD	520	4.5	481	4.6
NSW	520	4.1	485	3.9
WA	524	5.3	490	5.1
SA	518	4.4	488	5.5
TAS	490	5.8	464	6.8
ACT	528	5.6	504	5.5
VIC	518	4.4	495	5.0
NT	480	9.9	468	11.4

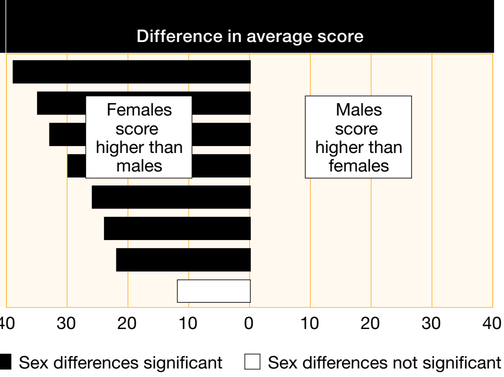


FIGURE 4.34 Average scores and differences in students' performance on the reading literacy scale, by jurisdiction and sex

Reading literacy proficiency in PISA 2015 across jurisdictions by sex

Figure 4.35 shows the proportion of low and high performers for each jurisdiction by sex. In addition, the proportion of females and males across the OECD countries has been included for comparison.

High-performing males

The proportion of high-performing males in reading literacy in Tasmania (6%) was lower than the proportion of high-performing males across the OECD (7%), while the proportion of high-performing males in the Northern Territory was the same as the proportion of high-performing males across the OECD. The proportions for the jurisdictions were:

- 8% in each of Queensland, South Australia and Western Australia
- 10% in each of New South Wales and Victoria
- 13% in the Australian Capital Territory.

High-performing females

The proportion of high-performing females in reading literacy in the Northern Territory (9%) was lower than the proportion of high-performing females across the OECD (10%), and the proportion of high-performing females in reading literacy in Tasmania was the same as the proportion of high-performing females across the OECD. The proportions for the other jurisdictions were:

- 11% in Victoria
- 13% in each of Queensland, South Australia and Western Australia
- 15% in each of Australian Capital Territory and New South Wales

Low-performing males

The proportion of low-performing males in reading literacy in the Northern Territory (30%) and Tasmania (31%) was higher than the OECD average for low-performing males (24%), while the proportion of low-performing males in New South Wales and Queensland was the same proportion of low-performing males as the OECD average. The proportions for the other jurisdictions were:

- 19% in the Australian Capital Territory
- 20% in Victoria
- 21% in Western Australia
- 22% in South Australia.

Low-performing females

The proportion of low-performing females in Tasmania (21%) and in the Northern Territory (27%) was higher than for low-performing females across OECD countries (16%). The proportions for the other jurisdictions were:

- 12% in each of Victoria and Western Australia
- 13% in each of the Australian Capital Territory, Queensland and South Australia
- 14% in New South Wales.

The proportion of females who achieved the National Proficient Standard in reading literacy ranged from 51% in the Northern Territory to 71% in the Australian Capital Territory, while the proportion of males who achieved the National Proficient Standard ranged from 44% in Tasmania to 59% in the Australian Capital Territory.

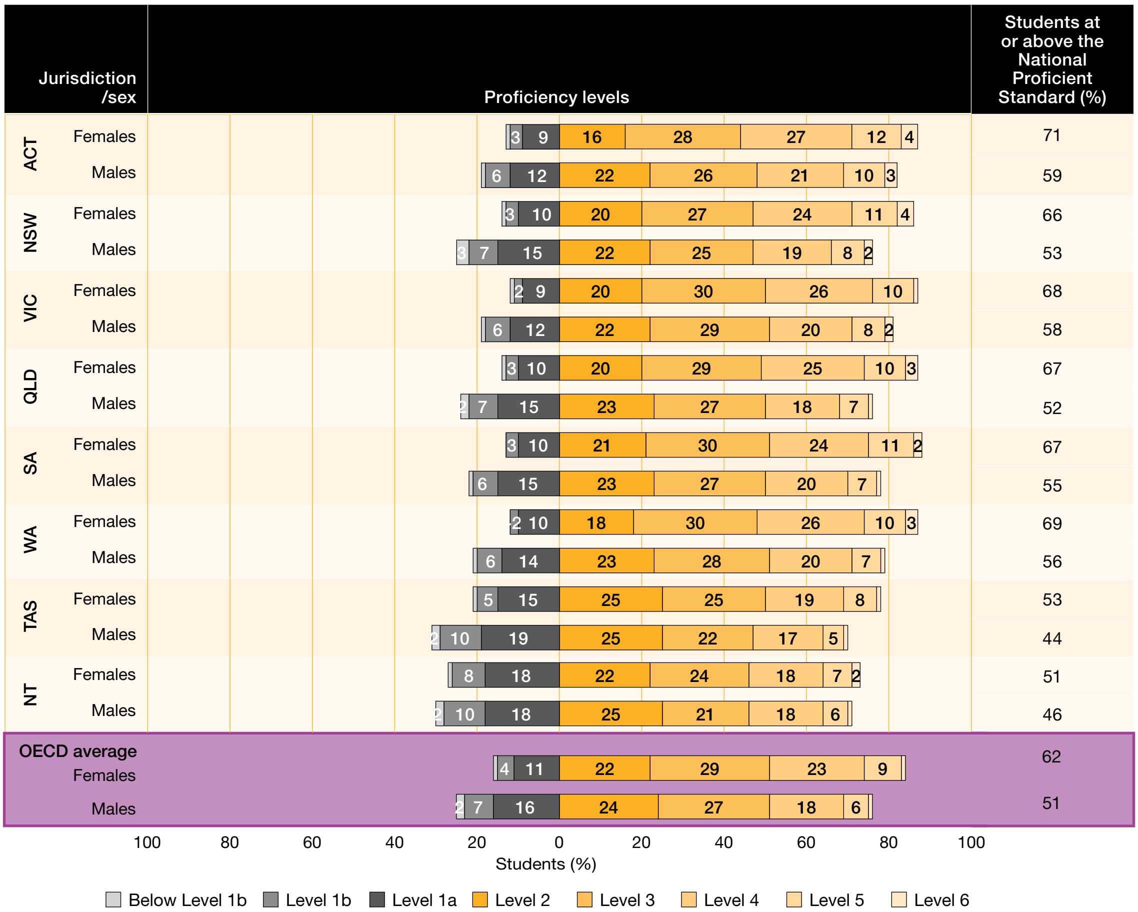


FIGURE 4.35 Percentage of students across the reading literacy proficiency scale, by jurisdiction and sex

Reading literacy performance in PISA 2015 across the school sectors by sex

Figure 4.36 shows that females from all school sectors performed significantly higher than males. Females from government and Catholic schools performed on average 33 points higher than males, while females from independent schools performed on average 23 points higher than males.

School sector	Females Avg. score	Females SE	Males Avg. score	Males SE
Government	501	2.9	467	2.7
Catholic	533	3.8	500	4.3
Independent	555	4.0	532	4.1

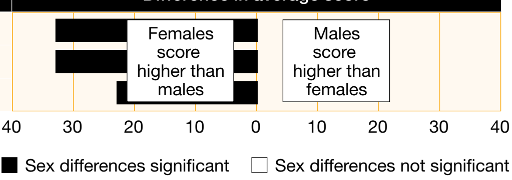


FIGURE 4.36 Average scores and differences in students' performance on the reading literacy scale, by school sector and sex

Reading literacy proficiency in PISA 2015 across the school sectors by sex

The proportion of high-performing females and high-performing males was higher in independent schools than in government or Catholic schools:

- 20% of high-performing females attended independent schools, 14% from Catholic schools and 10% from government schools
- 16% of high-performing males were from independent schools, 9% were from Catholic schools and 7% were from government schools.

Figure 4.37 shows the proportion of low-performing females and low-performing males was higher in government schools than in Catholic or independent schools:

- 18% of females attending government schools were low performers, compared to 8% of those in Catholic schools and 5% of those in independent schools
- 29% of low-performing males were from government schools, 17% from Catholic schools and 9% from independent schools.

Approximately half the males in government schools, almost two-thirds of males in Catholic schools and around three-quarters of males in independent schools achieved the National Proficient Standard in reading literacy, while over half the females in government schools, three-quarters of females in Catholic schools and over three-quarters of females in independent schools achieved the National Proficient Standard.

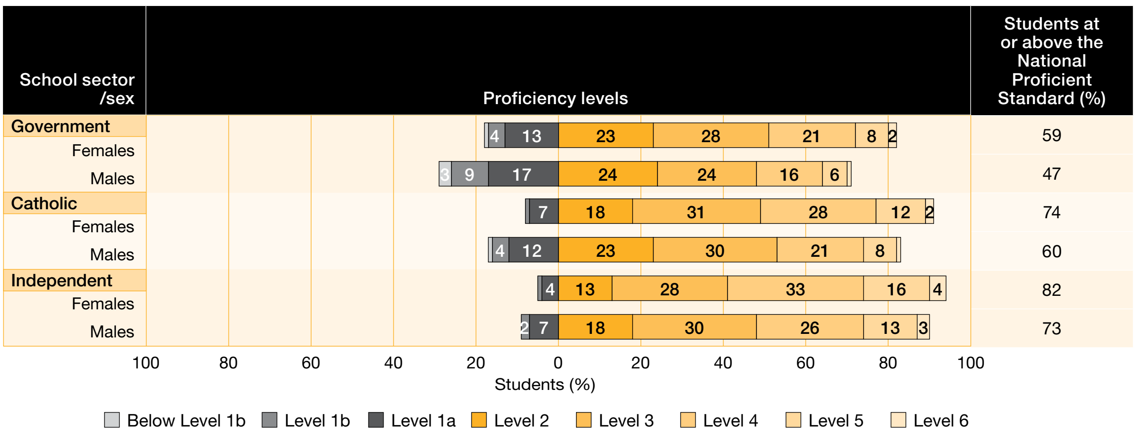


FIGURE 4.37 Percentage of students across the reading literacy proficiency scale, by school sector and sex

Reading literacy performance in PISA 2015 by Indigenous background and sex

Figure 4.38 shows student performance for Indigenous and non-Indigenous females and males in reading literacy. On average, Indigenous females significantly outperformed Indigenous males (by 31 points). This average score difference represents about half a proficiency level or is equal to around one year of schooling.

Indigenous females achieved an average score of 450 points, which was significantly lower than non-Indigenous females (by 72 points), which equals around one proficiency level or is equal to almost two-and-a-half years of schooling. Indigenous males scored 418 points on average, which was significantly lower than non-Indigenous males (by 71 points).

Indigenous females scored significantly lower than females across the OECD (by 56 points), while the difference between Indigenous males and males across the OECD was 61 points.

Indigenous background	Females Avg. score	Females SE	Males Avg. score	Males SE
Indigenous	450	4.3	419	4.5
Non-Indigenous	522	2.3	490	2.3

FIGURE 4.38 Average scores and differences in students' performance on the reading literacy scale, by Indigenous background and sex

Reading literacy proficiency in PISA 2015 by Indigenous background and sex

Figure 4.39 shows that only 4% of Indigenous females and 3% of Indigenous males were high performers in reading literacy compared to 14% of non-Indigenous females and 9% of non-Indigenous males. Thirty-four per cent of Indigenous females and 47% of Indigenous males were low performers in reading literacy compared to 12% of non-Indigenous females and 22% of non-Indigenous males.

Thirty-eight per cent of Indigenous females and 27% of Indigenous males achieved the National Proficient Standard in reading literacy, while 68% of non-Indigenous females and 56% of non-Indigenous males achieved the National Proficient Standard.

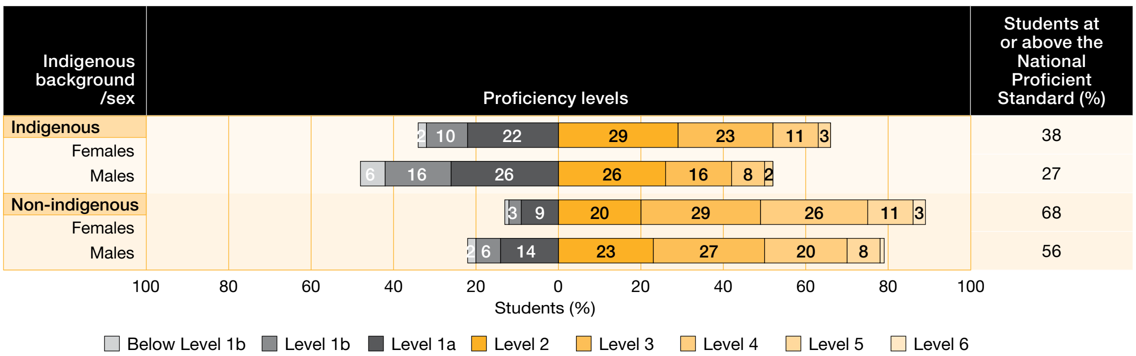


FIGURE 4.39 Percentage of students across the reading literacy proficiency scale, by Indigenous background and sex

CHAPTER 5

Australian students' performance in mathematical literacy

Key findings

- Australian students achieved an average score of 494 points in mathematical literacy, which was significantly higher than the OECD average of 490 points.
- Australia's performance was significantly lower than 19 countries (Singapore, Hong Kong (China), Macao (China), Chinese Taipei, Japan, B-S-J-G (China), Korea, Switzerland, Estonia, Canada, the Netherlands, Denmark, Finland, Slovenia, Belgium, Germany, Poland, Ireland and Norway).
- Australia's performance was not significantly different from that of 10 countries (Austria, New Zealand, Vietnam, the Russian Federation, Sweden, France, the United Kingdom, the Czech Republic, Portugal and Italy).
- Australia's performance was significantly higher than 39 countries, which included 12 OECD countries.
- Australia's proportion of high performers (11%) was consistent with the OECD average (10%).
- Australia's proportion of low performers (22%) was similar to the OECD average (23%).
- 55% of Australian students achieved the National Proficient Standard (Level 3) in mathematical literacy.
- Australia was one of 13 countries whose performance declined significantly between 2003 and 2015. Australia's performance declined by 30 points.
- The Australian Capital Territory, Western Australia and Victoria performed at a significantly higher level than the OECD average. New South Wales, South Australia, Queensland and the Northern Territory performed not significantly different to the OECD average. Tasmania performed significantly lower than the OECD average.
- The proportion of students who reached the National Proficient Standard in mathematical literacy was 44% in Tasmania; 47% in the Northern Territory; 53% in Queensland; 54% in South Australia; 55% in New South Wales; 58% in Victoria; 60% in Western Australia; and 61% in the Australian Capital Territory.

- In Victoria and the Northern Territory, there was no decline in mathematical literacy scores between 2003 and 2015. All other jurisdictions experienced a significant decline. New South Wales had the smallest decline (32 points), followed by Queensland (33 points), Tasmania (38 points), the Australian Capital Territory (42 points), Western Australia (44 points) and South Australia with the largest decline (46 points).
- Indigenous students achieved significantly lower than non-Indigenous students in mathematical literacy, with a difference of 70 score points on average, which equates to around two-and a-third years of schooling.
- Students from metropolitan schools scored, on average, 29 points higher in mathematical literacy (equal to around one year of schooling) than students from provincial schools, and scored 42 points on average higher than students from remote schools (equal to around one-and-a-half years of schooling).
- Students in the highest socioeconomic background quartile achieved an average score of 541 points, which was significantly higher than students in the lowest socioeconomic background quartile, who achieved 455 points. This difference of 86 points represents around three years of schooling.
- Australian-born students achieved an average score that was significantly lower than first-generation students and not statistically different to that of foreign-born students.
- Students who spoke English at home achieved an average mathematical literacy score that was not significantly different to students who spoke a language other than English at home.
- Females scored 491 points on average, which was not significantly different to the average score of 497 points for males.

Mathematical literacy was assessed as a major assessment domain in PISA 2003 and 2012. In PISA 2015, mathematical literacy was assessed as a minor assessment domain so the definition and constructs in the PISA assessment framework remain unchanged since the mathematical literacy assessment framework was last revised in PISA 2012; however, the assessment framework includes new detail to reflect the change in mode of assessment.

This chapter begins with a summary of the PISA mathematical literacy assessment domain, which includes a definition of mathematical literacy, an overview of the assessment framework and a description of how PISA measures and reports mathematical literacy.[42] The next section presents the results of student performance in mathematical literacy for the PISA 2015 assessment in terms of average scores and proficiency levels. The performance of Australian PISA students is compared to the performance of PISA students from other participating countries. Results are also presented by jurisdiction and by different demographic groups. The last section discusses the changes in mathematical literacy performance over time.

How is mathematical literacy defined in PISA?

PISA defines mathematical literacy as follows:

> Mathematical literacy is an individual's capacity to formulate, employ, and interpret mathematics in a variety of contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. It assists individuals to recognise the role that mathematics plays in the world and to make the well-founded judgements and decisions needed by constructive, engaged and reflective citizens.
>
> OECD, 2016a, p. 65

42 Details about the mathematical literacy framework, structure of the assessment and proficiency scale have been assembled from the *PISA 2015 Assessment and Analytical Framework* (OECD, 2016) and from *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016a).

How is mathematical literacy assessed in PISA?

The PISA mathematical literacy assessment framework was written to encourage an approach to teaching and learning mathematics that:

- gives strong emphasis to the processes associated with confronting a problem in a real-world context
- transforms the problem into one amenable to mathematical treatment
- makes use of the relevant mathematical knowledge to solve it
- evaluates the solution in the original problem context.

If students can learn to do these things, they will be much better equipped to make use of their mathematical knowledge and skills throughout their lives. PISA measures not only the extent to which students can use their mathematical content knowledge, but assesses what they know and how they apply their knowledge of mathematics to new situations.

The main features of the PISA 2012 mathematical literacy assessment framework, and how they relate to each other, are shown in Figure 5.1. The PISA assessment framework for mathematical literacy is organised into three broad components: the context of a challenge or problem that arises in the real world; the nature of mathematical thought and action that can be used to solve the problem; and the processes that the problem solver uses to construct a solution.

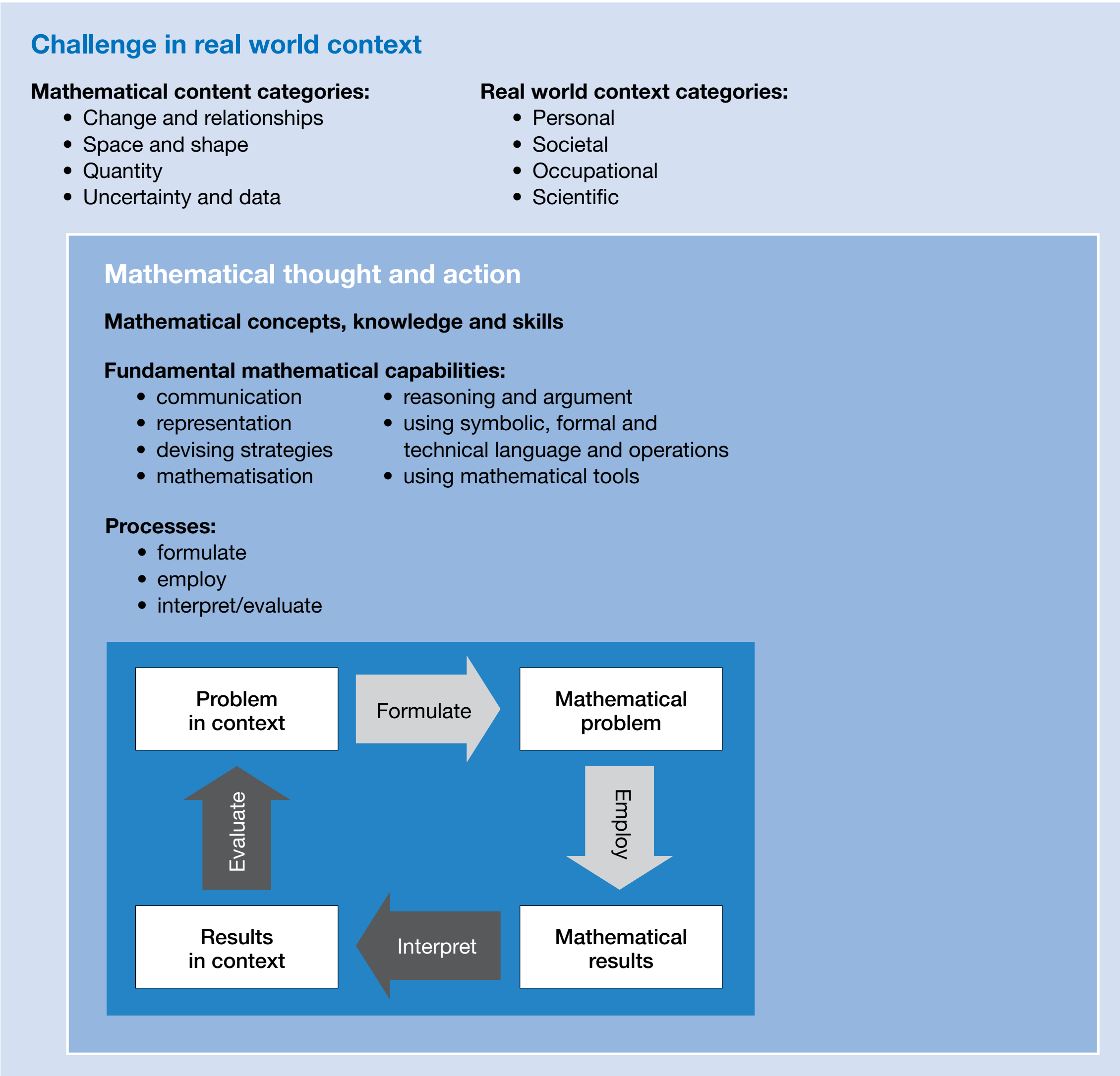


FIGURE 5.1 Main features of the mathematical literacy framework (OECD, 2016a)

Mathematical content categories

Mathematical content knowledge in PISA is based around broad classes of problems that have motivated the development of specific mathematical concepts and procedures. These mathematical phenomenon are typically found in national mathematics curricula. The mathematical literacy framework defines mathematical content into four categories:

1. *Change and relationships* focuses on the temporary and permanent relationships among objects and circumstances, where changes occur within systems of interrelated objects or in circumstances where the elements influence one another.
2. *Space and shape* encompasses a wide range of phenomena that are encountered everywhere: patterns, properties of objects, positions and orientations, representations of objects, decoding and encoding of visual information, navigation and dynamic interaction with real shapes and their representations.
3. *Quantity* incorporates the quantification of attributes of objects, relationships, situations and entities in the world, understanding various representations of those quantifications, and judging interpretations and arguments based on quantity.
4. *Uncertainty and data* involves identifying and summarising messages that are embedded in sets of data that are presented in many ways.

Mathematical context categories

An important aspect of mathematical literacy is the ability to use and do mathematics in a variety of real-world situations. As in previous PISA cycles, PISA 2015 students were shown written materials that described various situations that students could conceivably confront. Four situations or contexts are defined in the PISA mathematical literacy assessment framework:

1. *personal*: relates to individuals', families' and peers' daily lives
2. *societal*: relates to the community (local, national or global) in which an individual lives
3. *occupational*: relates to the world of work
4. *scientific*: relates to the use of mathematics in science and technology.

Mathematical processes

The mathematical processes in PISA describe what students do to connect the context of a problem with the mathematics involved to solve the problem. These mathematical processes have been defined in terms of three categories:

1. *Formulating situations mathematically*: the problem solver identifies or formulates the situation mathematically and makes assumptions to simplify the situation. In doing this, the problem solver transforms the problem in context into a mathematical problem.
2. *Employing mathematical concepts, facts, procedures and reasoning*: the problem solver employs mathematical concepts, facts, procedures and reasoning to obtain the mathematical results.
3. *Interpreting, applying and evaluating mathematical outcomes*: the problem solver interprets the mathematical results, considering the original problem, to obtain the results in context.

In developing items and analysing the ways in which students respond to items, PISA has identified a set of fundamental mathematical capabilities that underpins each of the mathematical processes. These mathematical capabilities can be learned in order to understand and engage with the world in a mathematical way. Seven fundamental mathematical capabilities have been used in the mathematical literacy assessment: communication; mathematising; representation; reasoning and argument; devising strategies for solving problems; using symbolic, formal and technical language and operations; and using mathematical tools.

The PISA 2015 mathematical literacy assessment structure

The assessment framework serves as the conceptual basis for assessing students' proficiency in mathematical literacy. The materials presented to students reflect the concepts in the assessment framework.

Mathematical literacy items in the assessment

The PISA 2015 mathematical literacy assessment was based on six clusters, including 81 items, all trend items, which allow comparisons of student performance to be reported for this cycle and also previous cycles of PISA.

As the PISA questions are set in real contexts, they usually involve multiple processes, contents and contexts. Judgements have been made to allocate the item to the category that reflects the highest cognitive focus. The goal in constructing the assessment was to create a balanced distribution of items with respect to the categories in each of the mathematical components. Table 5.1 shows the number and proportion of items selected for the PISA 2015 mathematical literacy assessment by mathematical component and category.

TABLE 5.1 Distribution of items by components and categories in the mathematical literacy assessment[43]

Mathematical components and categories	Items	
	No.	%
Content		
Change and relationships	20	25
Quantity	21	26
Space and shape	19	23
Uncertainty and data	21	26
Context		
Personal	13	16
Societal	28	35
Occupational	20	25
Scientific	20	25
Processes		
Formulating situations mathematically	23	28
Employing mathematical concepts, facts, procedures and reasoning	35	43
Interpreting, applying and evaluating mathematical outcomes	23	28

Note: Due to rounding, some percentages may not match to totals in the text. This relates to all tables and graphs in this chapter. See the Reader's Guide for more information.

Item response formats

The response formats used for the mathematical literacy assessment were also the same types of response formats used in assessing the scientific and reading literacy assessment domains. These included:

- *selected-response:* simple and complex multiple-choice items
- *closed constructed-response items:* where students were asked to provide a written response, typically numerical
- *open-constructed-response items:* where students were asked to provide an extended written response, for example asking students to show how their answer was reached.

43 Information collated from data provided from Annex C2 in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016b).

Table 5.2 shows that closed constructed-response items were the most common type of item response format in the mathematical literacy assessment.

TABLE 5.2 Distribution of items by item response format in the mathematical literacy assessment[44]

	Items	
Item format	No.	%
Simple multiple-choice	20	25
Complex multiple-choice	14	17
Open constructed-response	47	58

Examples of released items

All mathematical literacy items that were included in the PISA 2015 assessment were used in previous assessments. As the mathematical literacy items for PISA 2015 were all trend items, no mathematical literacy items were released after the assessment. However, a number of example items have been made public, and can be found in previous National PISA reports or through the OECD website at http://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm.

How is mathematical literacy reported in PISA?

PISA uses average scores and proficiency levels to provide a summary of student performance and to compare the relative standing between countries and different groups. As mathematical literacy was a minor assessment domain in PISA 2015, the reporting of mathematical literacy performance was based on the overall mathematical literacy scale from 2012, when mathematical literacy was last a major domain.

Average scores and distribution of scores

The average score on the PISA 2015 mathematical literacy scale across participating OECD countries was 491 points, with a standard deviation of 93 points. This is the benchmark against which each country's mathematical literacy performance in PISA 2015 was compared.

Proficiency levels

The mathematical literacy proficiency scale for PISA 2015 was divided into six proficiency levels[45], with Level 6 as the highest and Level 1b as the lowest. Figure 5.2 gives descriptions of each of these levels, which are based on the framework-related cognitive demands imposed by tasks that are located within each level to describe the kinds of knowledge and skills needed to successfully complete those tasks, and which can then be used as characterisations of the substantive meaning of each level. A difference of 62 points represents one proficiency level on the PISA mathematical literacy scale.

Students who placed at Level 5 or 6 (scoring 607 points or higher) are considered high performers who are highly proficient in mathematical literacy. These students are highly proficient and demonstrate high levels of skills and knowledge in mathematical literacy. Students placed at the highest proficiency level, Level 6, can conceptualise, generalise and use information. They are capable of advanced mathematical thinking and reasoning; have a mastery of symbolic and formal mathematical operations and relationships; and can formulate and precisely communicate their findings, interpretations and arguments.

44 Information collated from data provided from Annex C2 in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016b).

45 The six proficiency levels are the same as those established for the PISA 2003 and PISA 2012 assessments.

	Proficiency level	What students can typically do at each level
High performers	6	Students can conceptualise, generalise and use information based on their investigations and modelling of complex problem situations, and can use their knowledge in relatively non-standard contexts. They can link different information sources and representations, and flexibly translate among them. Students at this level are capable of advanced mathematical thinking and reasoning. These students can apply this insight and understanding, along with a mastery of symbolic and formal mathematical operations and relationships, to develop new approaches and strategies for addressing novel situations. Students at this level can reflect on their actions and can formulate and precisely communicate their actions and reflections regarding their findings, interpretations, arguments and the appropriateness of these to the original situations.
	669.3 score points	
	5	Students can develop and work with models for complex situations, identifying constraints and specifying assumptions. They can select, compare and evaluate appropriate problem-solving strategies for dealing with complex problems related to these models. Students at this level can work strategically using broad, well-developed thinking and reasoning skills, appropriate linked representations, symbolic and formal characterisations, and insights pertaining to these situations. They begin to reflect on their work and can formulate and communicate their interpretations and reasoning.
	607.0 score points	
Middle performers	4	Students can work effectively with explicit models for complex, concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic representations, linking them directly to aspects of real-world situations. Students at this level can use their limited range of skills and can reason with some insight, in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations, reasoning and actions.
	544.7 score points	
	3	Students can execute clearly described procedures, including those that require sequential decisions. Their interpretations are sufficiently sound to be a base for building a simple model or for selecting and applying simple problem-solving strategies. Students at this level can interpret and use representations based on different information sources and reason directly from them. They typically show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships. Their solutions reflect that they have engaged in basic interpretation and reasoning.
	482.4 score points	
Low performers	2	Students can interpret and recognise situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of the results.
	420.1 score points	
	1	Students can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined. They are able to identify information and carry out routine procedures according to direct instructions in explicit situations. They can perform actions that are almost always obvious and follow immediately from the given stimuli.
	357.8 score points	

FIGURE 5.2 Summaries of the six proficiency levels on the mathematical literacy scale

Students who placed below Level 2 (scoring 420 points or lower) are considered low performers. Level 2 has been defined internationally as a baseline proficiency level and defines the level of performance on the PISA scale at which students begin to demonstrate the mathematical literacy competencies that will enable them to actively participate in life situations. Students who fail to reach Level 2 (students who are placed at Level 1 or below) have not acquired the skills and knowledge to allow them to adequately participate in the 21st century workforce and contribute as productive citizens. These students have low levels of cognitive ability in mathematical literacy. Students placed at Level 1 can answer questions involving familiar contexts where all relevant information is present and the questions are clearly defined, identify information and carry out routine procedures, and perform actions that are almost always obvious and follow immediately from the given stimuli. Students who are placed below the lower boundary of Level 1 (358 points) could not be reliably described because there were not enough mathematical literacy assessment items in this lower region of the scale. However, students placed at this lower level of the mathematical literacy have demonstrated limited mathematical literacy skills and are likely to have serious difficulties in using mathematics to benefit their future.

In Australia, the nationally agreed proficient standard (as agreed in *Measurement Framework for Schooling in Australia*) is Level 3. This level was chosen because it 'represents a "challenging but reasonable" expectation of student achievement at a year level with students needing to demonstrate more than elementary skills expected at that year level' (ACARA, 2015, p. 5). Students who performed at or above Level 3 have met or exceeded the National Proficient Standard.

Interpreting differences in PISA scores: how big is 'big'?

How do we go about understanding the difference in average mathematical literacy scores between two groups of students? The following comparisons can help in judging the magnitude of score differences.

In terms of proficiency levels

A difference of 62 points represents one proficiency level on the PISA mathematical literacy scale. In substantive terms, this can be considered a comparatively large difference in student performance. For example, compare the skill sets for those students who are proficient at Level 2 and those who are proficient at Level 3. Students who reach Level 2 on the mathematical literacy scale are able to able to interpret and recognise situations in contexts that require no more than direct interference and can extract relevant information from a single source. However, students who reach Level 3 are proficient with the tasks at Level 2 and can also make sequential decisions and interpret and reason from different information sources.

In terms of schooling

It is possible to estimate the score point difference that is associated with one year of schooling. This difference can be estimated for Australia because the Australian PISA 2015 sample included a sizeable number of students from different school year levels. Analyses of these data indicate that the difference between two year levels is, on average, around 30 points on the PISA mathematical literacy scale.

Australia's mathematical literacy results from an international perspective

Mathematical literacy performance in PISA 2015

Australian students achieved an average score of 494 points on the mathematical literacy scale in PISA 2015, which was significantly higher than the OECD average of 490 points.

Australia was one of 22 countries or economies[46] (17 OECD; 5 partner) to achieve an average score that was significantly higher than the OECD average. The OECD countries were Japan, Korea, Switzerland, Estonia, Canada, the Netherlands, Denmark, Finland, Slovenia, Belgium, Germany, Poland, Ireland, Norway, Austria, New Zealand and Australia. The 5 partner countries were: Singapore, Hong Kong (China), Macao (China), Chinese Taipei and B-S-J-G (China). Nine countries (7 OECD: Sweden, France, the United Kingdom, the Czech Republic, Portugal, Italy and Iceland; 2 partner: Vietnam and the Russian Federation) performed not significantly different to the OECD average. All other countries, including 11 OECD countries (Spain, Luxembourg, Latvia, Hungary, the Slovak Republic, Israel, the United States, Greece, Chile, Turkey and Mexico) as well as a number of other partner countries performed significantly lower than the OECD average.

Singapore achieved the highest average score on the mathematical literacy assessment with a score of 564 points, which was significantly higher than any other participating country. Singapore's score was around one proficiency level higher than the OECD average, or equal to almost two-and-a-half years of schooling. The next three highest performing countries, Hong Kong (China), Macao (China), and Chinese Taipei, scored in the 540s, which is equal to more than one-and-a-half years of schooling higher that the OECD average.

Australian students' performance in mathematical literacy was significantly below 19 countries (14 OECD: Japan, Korea, Switzerland, Estonia, Canada, the Netherlands, Denmark, Finland, Slovenia, Belgium, Germany, Poland, Iceland and Norway; 5 partner: Singapore, Hong Kong (China), Macao (China), Chinese Taipei and B-S-J-G (China). Australia's performance was not significantly different from that of 10 countries (8 OECD: Austria, New Zealand, Sweden, France, the United Kingdom, the Czech Republic, Portugal and Italy; 2 partner: Vietnam and the Russian Federation), while Australia's performance was significantly higher than 39 countries, which included 12 OECD countries.

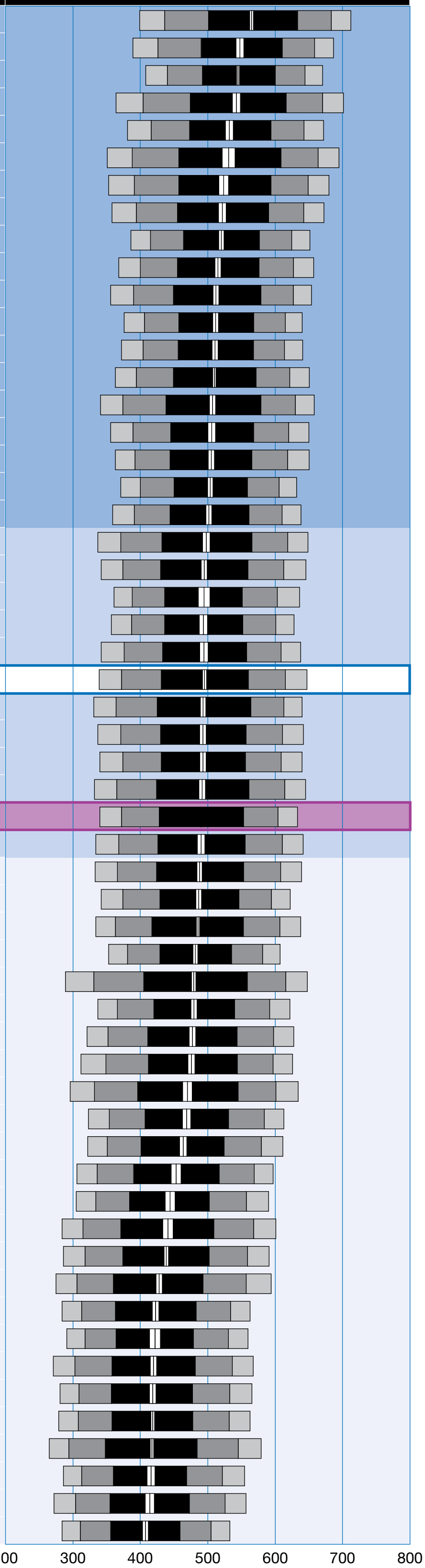
The spread between the 5th and 95th percentiles for the OECD average was about mid-range with 293 points. The largest spread in achievement between the lowest and highest achievers was found in Malta (359 points) and B-S-J-G (China) (345 points). The smallest spread between low and high achievers was found in Mexico (248 points) and Latvia (255 points). Among the highest performing countries, the spread between the low and high achievers varied: Singapore's spread was 312 points, Hong Kong (China)'s was 298 points, Macao (China)'s was 261 points and Chinese Taipei's was 337 points. In Australia, there were 309 points between students in the 5th and 95th percentiles.

Figure 5.3 shows the average mathematical literacy scores, along with the standard errors, confidence intervals around the average, and the difference between the 5th and 95th percentiles, as well as the graphical distribution of student performance. Countries are shown in order from the highest to the lowest average mathematical literacy score and the three colour bands indicate whether a particular country has performed at a significantly higher or lower level, or whether they performed at a level not significantly different to Australia. Although there were 72 participating countries in PISA 2015, countries that achieved average scores lower than Mexico, the lowest performing OECD country, have not been included.[47]

46 For ease of reading, economic regions such as B-S-J-G (China) are referred to as countries.

47 For brevity, results for those countries that achieved an average score *lower* than Mexico (408 score points) have not been included in this chapter. These countries were: Algeria, Brazil, Colombia, Costa Rica, the Dominican Republic, the Former Yugoslav Republic of Macedonia, Georgia, Indonesia, Jordan, Kosovo, Lebanon, Peru, Qatar, and Tunisia.
Results for Argentina, Malaysia and Kazakhstan have not been reported because their coverage was too small to ensure comparability.

	Country	Avg. score	SE	Confidence interval	Difference between 5th & 95th percentiles	Proficiency levels
Significantly higher than Australia	Singapore	564	1.5	561–567	312	
	Hong Kong (China)	548	3.0	542–554	298	
	Macao (China)	544	1.1	542–546	261	
	Chinese Taipei	542	3.0	536–548	337	
	Japan	532	3.0	527–538	290	
	B-S-J-G (China)	531	4.9	522–541	345	
	Korea	524	3.7	517–531	327	
	Switzerland	521	2.9	516–527	313	
	Estonia	520	2.0	516–524	264	
	Canada	516	2.3	511–520	289	
	Netherlands	512	2.2	508–517	298	
	Denmark	511	2.2	507–515	264	
	Finland	511	2.3	507–516	270	
	Slovenia	510	1.3	507–512	288	
	Belgium	507	2.4	502–512	316	
	Germany	506	2.9	500–512	293	
	Poland	504	2.4	500–509	286	
	Ireland	504	2.1	500–508	262	
	Norway	502	2.2	497–506	279	
Not significantly different from Australia	Austria	497	2.9	491–502	311	
	New Zealand	495	2.3	491–500	304	
	Vietnam	495	4.5	486–503	275	
	Russian Federation	494	3.1	488–500	271	
	Sweden	494	3.2	488–500	296	
	Australia	**493**	**2.1**	**489–497**	**309**	
	France	493	2.1	489–497	309	
	United Kingdom	492	2.5	488–497	303	
	Czech Republic	492	2.4	488–497	300	
	Portugal	492	2.5	487–497	312	
	OECD average	**490**	**0.4**	**489–491**	**293**	
	Italy	490	2.8	484–495	306	
Significantly lower than Australia	Iceland	488	2.0	484–492	306	
	Spain	486	2.2	482–490	279	
	Luxembourg	486	1.3	483–488	304	
	Latvia	482	1.9	479–486	255	
	Malta	479	1.7	475–482	359	
	Lithuania	478	2.3	474–483	284	
	Hungary	477	2.5	472–482	307	
	Slovak Republic	475	2.7	470–480	313	
	Israel	470	3.6	463–477	337	
	United States	470	3.2	463–476	290	
	Croatia	464	2.8	459–469	290	
	Greece	454	3.8	446–461	292	
	Romania	444	3.8	437–451	285	
	Bulgaria	441	4.0	433–449	317	
	Cyprus	437	1.7	434–441	305	
	United Arab Emirates	427	2.4	423–432	318	
	Chile	423	2.5	418–428	279	
	Turkey	420	4.1	412–429	268	
	Moldova	420	2.5	415–424	297	
	Uruguay	418	2.5	413–423	285	
	Montenegro	418	1.5	415–421	284	
	Trinidad and Tobago	417	1.4	414–420	314	
	Thailand	415	3.0	410–421	269	
	Albania	413	3.4	406–420	284	
	Mexico	408	2.2	404–412	248	



Note: refer to the Reader's Guide for the interpretation of this graph. This applies to all graphs with similar formatting in this chapter.

FIGURE 5.3 Average scores and distribution of students' performance on the mathematical literacy scale, by country

Mathematical literacy proficiency in PISA 2015

Figure 5.4 shows the proportion of students at each mathematical literacy level from below Level 1 to Level 6, by country. Countries have been ordered by the percentage of students who performed below Level 2 (the low performers), which is the internationally assigned baseline benchmark. Countries with the lowest proportion of students below Level 2 are placed at the top of the figure and countries with the highest proportion of students below Level 2 are placed at the bottom.

High performers

Students who placed at Level 5 or 6 demonstrated the highest levels of mathematical literacy proficiency and are referred to as high performers. On average, 11% of students across the OECD countries were high performers, which was the same proportion of high performers as Australia, France, Portugal, New Zealand, Norway, the United Kingdom, and Italy. Thirty-five per cent of students in Singapore performed at this level while approximately 25% of students in Chinese Taipei, Hong Kong (China) and B-S-J-G (China), and around 20% of students in Macao (China), Korea and Japan were highly proficient in mathematical literacy. A number of countries had fewer than 3% of high-performing students.

Students who achieved scores higher than 669 points were placed at proficiency Level 6. On average, 2% of students across OECD countries achieved Level 6. In Singapore, 13% of students achieved this highest level, while Chinese Taipei had the next highest proportion with 10% of students. Australia was among one of 10 countries with 3% of students who achieved at Level 6. Around 20 countries had fewer than 1% of students who achieved this level.

Low performers

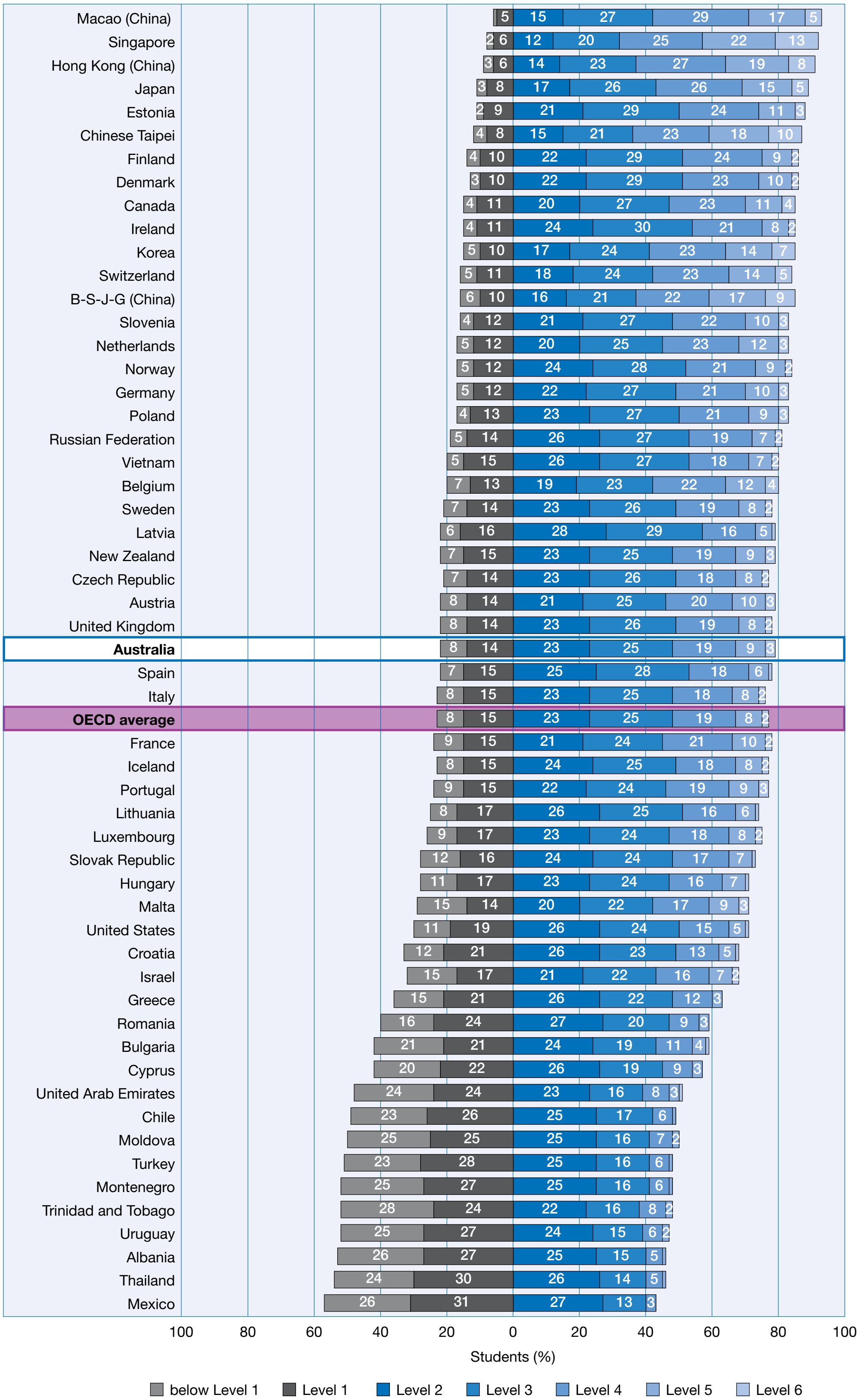
In PISA, Level 2 is considered the baseline level of mathematical literacy proficiency. Students who do not reach this level are considered to have limited skills that will prevent them from actively participating successfully in life situations related to mathematics. Students who do not achieve Level 2 are considered low performers. On average, 23% of students across OECD countries were low performers. Australia, New Zealand, the United Kingdom, the Czech Republic, Austria and Spain had 22% of low performers. The high-performing countries, Macao (China), Singapore and Hong Kong (China), had fewer than 10% of low performers on the mathematical literacy proficiency scale. Other high-performing countries had higher proportions of low performers, such as Japan (11%), Chinese Taipei (13%), Korea (15%) and B-S-J-G (China) (16%). In some low-performing countries, such as Turkey, Montenegro, Trinidad and Tobago, Uruguay, Albania, Thailand and Mexico, more than half the students were low performers.

On average, 15% of students across the OECD performed at Level 1. In Australia, 14% of students achieved this level compared to between 5% and 13% of students in the countries which performed significantly higher than Australia. Mexico and Thailand had the highest proportion of students placed at Level 1, with 31% and 30% of students respectively.

Eight per cent of students in Australia were placed at below Level 1. This was also the same proportion as the OECD average of students and of 5 other countries (Lithuania, Iceland, Italy, Austria and the United Kingdom). Twelve countries, including Trinidad and Tobago, Albania, Mexico and Uruguay, had 20% or more students at below Level 1.

Middle performers

Students who were neither high performers nor low performers, and had achieved a proficiency of Level 2, 3 or 4, were referred to as middle performers. On average, 66% of students across the OECD performed at these levels. Countries with similar proportions of middle performers were Austria, Iceland, Italy, Australia, New Zealand and the United Kingdom. The countries with the highest proportion of middle performers were Ireland, Denmark, Finland, and Estonia with 75% of students, while low-performing countries, such as Mexico, Thailand, and Trinidad and Tobago, had around 45% of students who were middle performers.



Note: if the proportion of students in a proficiency level is one per cent or less, the level still appears in the figure but the numeric label '1' does not. This convention has been used for all figures about proficiency levels in this chapter.

FIGURE 5.4 Percentage of students across the mathematical literacy proficiency scale, by country

Students who achieved the National Proficient Standard

In Australia, Level 3 is the agreed National Proficient Standard in PISA and represents a baseline proficiency that students are expected to demonstrate in mathematical literacy. Fifty-five per cent of Australian students achieved the National Proficient Standard in mathematical literacy, which was similar to the proportion of students (54%) who reached Level 3 or higher across the OECD countries.

Mathematical literacy performance over time

The full assessments of mathematical literacy took place in PISA 2003 and in 2012, when mathematical literacy was the major domain. This sixth cycle of PISA enables comparisons in mathematical literacy performance to be reported across the five most recent PISA assessments. Table 5.3 shows the average mathematical literacy scores from 2003 to 2015, and the difference in average scores between 2003 and 2015, and between 2012 and 2015.

In PISA 2015, the OECD average was not significantly different from the OECD average in 2012.

Between 2003 and 2015, 6 countries (the Russian Federation, Portugal, Italy, Mexico, Macao (China) and Poland) showed a significant improvement in their mathematical literacy performance and 13 countries (Finland, Australia, New Zealand, Iceland, the Netherlands, the Czech Republic, the Slovak Republic, Belgium, Korea, France, Canada, the United Kingdom and Sweden), showed a significant decline in their mathematical literacy performance. Australia's average performance in 2003 was 524 points, which declined by 30 points to 494 points in 2015.

Between PISA 2012 and 2015, 7 countries (Albania, Sweden, Norway, the Russian Federation, Denmark, Slovenia and Montenegro) showed a significant improvement in their mathematical literacy performance and 10 countries (Korea, Turkey, Chinese Taipei, Vietnam, Hong Kong (China), Poland, the United States, the Netherlands, Australia and Singapore) showed a significant decline in their mathematical literacy performance. Australia's average performance in 2012 was 504 points, which declined by 10 points to 494 points in 2015.

TABLE 5.3 Average mathematical literacy scores over time, PISA 2003 to 2015, and differences in performance between 2003 and 2015, and 2012 and 2015, by country

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015		Average score difference between 2003 and 2015 (PISA 2015 – PISA 2003)			Average score difference between 2012 and 2015 (PISA 2015 – PISA 2012)		
Country	Avg. score	SE	Avg. score	SE	Avg. score	SE	Avg. score	SE	Avg. score	SE	Score dif.		SE	Score dif.		SE
Albania	✧	✧	✧	✧	377	4.0	394	2.0	413	3.4	✧		✧	**19**	▲	5.3
Australia	524	2.1	520	2.2	514	2.5	504	1.6	494	1.6	**–30**	▼	6.2	**–10**	▼	4.2
Austria	506	3.3	505	3.7	✧	✧	506	2.7	497	2.9	–9		7.1	–9		5.3
Belgium	529	2.3	520	3.0	515	2.3	515	2.1	507	2.4	**–22**	▼	6.5	–8		4.8
Bulgaria	✧	✧	413	6.1	428	5.9	439	4.0	441	4.0	✧		✧	2		6.6
Canada	532	1.8	527	2.0	527	1.6	518	1.8	516	2.3	**–17**	▼	6.3	–2		4.6
Chile	✧	✧	411	4.6	421	3.1	423	3.1	423	2.5	✧		✧	0		5.3
Chinese Taipei	✧	✧	549	4.1	543	3.4	560	3.3	542	3.0	✧		✧	**–18**	▼	5.7
Croatia	✧	✧	467	2.4	460	3.1	471	3.5	464	2.8	✧		✧	–7		5.7
Cyprus	✧	✧	✧	✧	✧	✧	440	1.1	437	1.7	✧		✧	–3		4.1
Czech Republic	516	3.5	510	3.6	493	2.8	499	2.9	492	2.4	**–24**	▼	7.1	–7		5.1
Denmark	514	2.7	513	2.6	503	2.6	500	2.3	511	2.2	–3		6.6	**11**	▲	4.8
Estonia	✧	✧	515	2.7	512	2.6	521	2.0	520	2.0	✧		✧	–1		4.6
Finland	544	1.9	548	2.3	541	2.2	519	1.9	511	2.3	**–33**	▼	6.3	–8		4.7
France	511	2.5	496	3.2	497	3.1	495	2.5	493	2.1	**–18**	▼	6.5	–2		4.8
Germany	503	3.3	504	3.9	513	2.9	514	2.9	506	2.9	3		7.1	–8		5.4
Greece	445	3.9	459	3.0	466	3.9	453	2.5	454	3.8	9		7.8	1		5.7
Hong Kong (China)	550	4.5	547	2.7	555	2.7	561	3.2	548	3.0	–2		7.8	**–13**	▼	5.6
Hungary	490	2.8	491	2.9	490	3.5	477	3.2	477	2.5	–13		6.8	0		5.4
Iceland	515	1.4	506	1.8	507	1.4	493	1.7	488	2.0	**–27**	▼	6.1	–5		4.4
Ireland	503	2.4	501	2.8	487	2.5	501	2.2	504	2.1	1		6.5	2		4.7
Israel	✧	✧	442	4.3	447	3.3	466	4.7	470	3.6	✧		✧	3		6.9
Italy	466	3.1	462	2.3	483	1.9	485	2.0	490	2.8	**24**	▲	7.0	4		5.0
Japan	534	4.0	523	3.3	529	3.3	536	3.6	532	3.0	–2		7.5	–4		5.9
Korea	542	3.2	547	3.8	546	4.0	554	4.6	524	3.7	**–18**	▼	7.5	B	▼	6.9
Latvia	483	3.7	486	3.0	482	3.1	491	2.8	482	1.9	–1		7.0	–8		4.9
Lithuania	✧	✧	486	2.9	477	2.6	479	2.6	478	2.3	✧		✧	0		5.0
Luxembourg	493	1.0	490	1.1	489	1.2	490	1.1	486	1.3	–7		5.8	–4		3.9
Macao (China)	527	2.9	525	1.3	525	0.9	538	1.0	544	1.1	**17**	▲	6.4	6		3.8
Mexico	385	3.6	406	2.9	419	1.8	413	1.4	408	2.2	**23**	▲	7.1	–5		4.4
Montenegro	✧	✧	399	1.4	403	2.0	410	1.1	418	1.5	✧		✧	**8**	▲	4.0
Netherlands	538	3.1	531	2.6	526	4.7	523	3.5	512	2.2	**–26**	▼	6.8	**–11**	▼	5.4
New Zealand	523	2.3	522	2.4	519	2.3	500	2.2	495	2.3	**–28**	▼	6.5	–5		4.8
Norway	495	2.4	490	2.6	498	2.4	489	2.7	502	2.2	7		6.5	**12**	▲	5.0
Poland	490	2.5	495	2.4	495	2.8	518	3.6	504	2.4	**14**	▲	6.6	**–13**	▼	5.6
Portugal	466	3.4	466	3.1	487	2.9	487	3.8	492	2.5	**26**	▲	7.0	5		5.8
Romania	✧	✧	415	4.2	427	3.4	445	3.8	444	3.8	✧		✧	–1		6.4
Russian Federation	468	4.2	476	3.9	468	3.3	482	3.0	494	3.1	**26**	▲	7.7	**12**	▲	5.6
Singapore	✧	✧	✧	✧	562	1.4	573	1.3	564	1.5	✧		✧	**–9**	▼	4.1
Slovak Republic	498	3.3	492	2.8	497	3.1	482	3.4	475	2.7	**–23**	▼	7.1	–6		5.6
Slovenia	✧	✧	504	1.0	501	1.2	501	1.2	510	1.3	✧		✧	**9**	▲	4.0
Spain	485	2.4	480	2.3	483	2.1	484	1.9	486	2.2	1		6.5	2		4.6
Sweden	509	2.6	502	2.4	494	2.9	478	2.3	494	3.2	**–15**	▼	6.9	**16**	▲	5.3
Switzerland	527	3.4	530	3.2	534	3.3	531	3.0	521	2.9	–5		7.2	–10		5.5
Thailand	417	3.0	417	2.3	419	3.2	427	3.4	415	3.0	–2		7.0	–11		5.8
Turkey	423	6.7	424	4.9	445	4.4	448	4.8	420	4.1	–3		9.7	**–28**	▼	7.3
United Arab Emirates	✧	✧	✧	✧	✧	✧	434	2.4	427	2.4	✧		✧	–7		4.9
United Kingdom	508	2.4	495	2.1	492	2.4	494	3.3	492	2.5	**–16**	▼	6.6	–1		5.4
United States	483	2.9	474	4.0	487	3.6	481	3.6	470	3.2	–13		7.1	**–12**	▼	6.0
Uruguay	422	3.3	427	2.6	427	2.6	409	2.8	418	2.5	–4		7.0	9		5.1
Vietnam	✧	✧	✧	✧	✧	✧	511	4.8	495	4.5	✧		✧	**–17**	▼	7.5
OECD average 2003	499	0.6	497	0.5	✧	✧	496	0.5	491	0.5	–8		5.7	–5		3.6
OECD average 2006	✧	✧	494	0.5	✧	✧	494	0.5	490	0.4	✧		✧	–4		3.6
OECD average 2009	✧	✧	494	0.5	495	0.5	494	0.5	490	0.4	✧		✧	–4		3.6

Notes: the symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
✧ Did not participate in this cycle or comparisons cannot be made.
Countries that did not participate in PISA 2012 and 2015 have not been included.
Due to rounding, some differences may not match to totals in the text. This relates to all tables and graphs in this chapter. See the Reader's Guide for more information.

Table 5.4 shows the relative position of a participating country to Australia's in mathematical literacy performance from PISA 2003 to 2015. Countries are shown in order of the highest to the lowest performing country in mathematical literacy in PISA 2015.[48]

- There were 22 countries whose performance has been consistently significantly lower than Australia's across the PISA assessments (12 OECD: Chile, Greece, Hungary, Iceland, Israel, Latvia, Luxembourg, Mexico, the Slovak Republic, Spain, Turkey and the United States; 10 partner: Albania, Bulgaria, Croatia, Lithuania, Montenegro, Romania, Serbia, Thailand, the United Arab Emirates and Uruguay).
- There were 10 countries whose performance has been consistently higher than Australia's across the PISA assessments (5 OECD: Canada, Finland, Japan[49], Korea, and the Netherlands; 5 partner: Chinese Taipei, Hong Kong (China), Liechtenstein[50], Shanghai (China), and Singapore).

There were a number of countries whose relative performances to Australia's have changed over time:

- the performances of Belgium, Estonia, Macao (China) and Switzerland in their first PISA cycle were not significantly different to Australia's; however, in 2015, these countries' performances were significantly higher than Australia's.
- the performances of 6 OECD countries (Denmark, Germany, Ireland, Norway, Poland and Slovenia) in their first PISA cycle were significantly lower than Australia's; however, in 2015, these countries' performances were significantly higher than Australia's.
- the performances of 7 countries (Austria, France, Italy, Portugal, the Russian Federation, Sweden and the United Kingdom) in earlier PISA cycles were significantly lower than Australia's; however, their performances in 2015 were not significantly different to Australia's.
- the performances of the Czech Republic and New Zealand in 2003 and in 2015 were not significantly different to Australia's.

48 With the exception of Liechtenstein, Serbia and Shanghai (China), which have been placed at the bottom of the table as they did not participate in PISA 2015, or did not participate in PISA 2015 as the same entity.

49 With the exception of PISA 2006 where Japan's performance was not significantly different to Australia's.

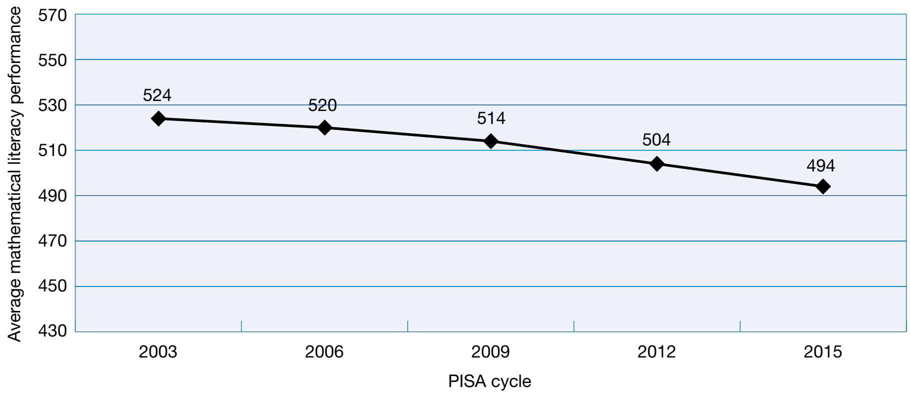
50 With the exception of PISA 2006 where Liechtenstein's performance was not significantly different to Australia's.

TABLE 5.4 Relative trends in mathematical literacy performance, by country

	Position relative to Australia in				
Country	PISA 2015	PISA 2012	PISA 2009	PISA 2006	PISA 2003
Singapore	▲	▲	▲	–	–
Hong Kong (China)	▲	▲	▲	▲	▲
Macao (China)	▲	▲	▲	▲	●
Chinese Taipei	▲	▲	▲	▲	–
Japan	▲	▲	▲	●	▲
Korea	▲	▲	▲	▲	▲
Switzerland	▲	▲	▲	▲	●
Estonia	▲	▲	●	●	–
Canada	▲	▲	▲	▲	▲
Netherlands	▲	▲	▲	▲	▲
Denmark	▲	●	▼	▼	▼
Finland	▲	▲	▲	▲	▲
Slovenia	▲	●	▼	▼	–
Belgium	▲	▲	●	●	●
Germany	▲	▲	●	▼	▼
Poland	▲	▲	▼	▼	▼
Ireland	▲	●	▼	▼	▼
Norway	▲	▼	▼	▼	▼
Austria	●	●	–	▼	▼
New Zealand	●	●	●	●	●
Russian Federation	●	▼	▼	▼	▼
Sweden	●	▼	▼	▼	▼
Australia					
France	●	▼	▼	▼	▼
United Kingdom	●	▼	▼	▼	–
Czech Republic	●	●	▼	▼	●
Portugal	●	▼	▼	▼	▼
Italy	●	▼	▼	▼	▼
Iceland	▼	▼	▼	▼	▼
Spain	▼	▼	▼	▼	▼
Luxembourg	▼	▼	▼	▼	▼
Latvia	▼	▼	▼	▼	▼
Lithuania	▼	▼	▼	▼	–
Hungary	▼	▼	▼	▼	▼
Slovak Republic	▼	▼	▼	▼	▼
Israel	▼	▼	▼	▼	–
United States	▼	▼	▼	▼	▼
Croatia	▼	▼	▼	▼	–
Greece	▼	▼	▼	▼	▼
Romania	▼	▼	▼	▼	–
Bulgaria	▼	▼	▼	▼	–
United Arab Emirates	▼	▼	▼	–	–
Chile	▼	▼	▼	▼	–
Turkey	▼	▼	▼	▼	▼
Uruguay	▼	▼	▼	▼	▼
Montenegro	▼	▼	▼	▼	–
Thailand	▼	▼	▼	▼	▼
Albania	▼	▼	▼	–	–
Mexico	▼	▼	▼	▼	▼
Liechtenstein	–	▲	▲	●	▲
Serbia	–	▼	▼	▼	–
Shanghai (China)	–	▲	▲	–	–

Note: ▲ Score signficantly higher than Australia's
● Score not significantly different to Australia's
▼ Score signficantly lower than Australia's
– Did not participate in this cycle or comparisons cannot be made
B-S-J-G (China), Cyprus, Malta, Moldova, Trinidad and Tobago, and Vietnam are not included in this table.

Figure 5.5 provides more details about Australia's performance in mathematical literacy from PISA 2003 to 2015. In 2003, when mathematical literacy was first assessed as a major domain, Australia achieved an average score of 524 points. Between 2003 and 2006, and between 2006 and 2009, the changes in performance were not significant, whereas between 2009 and 2012, there was a significant decline (by 10 points) in performance, and between 2012 and 2015, there was a further significant decline in performance (by another 10 points). Between 2003 and 2015, mathematical literacy performance declined by 30 points to an average score of 494 points in 2015.

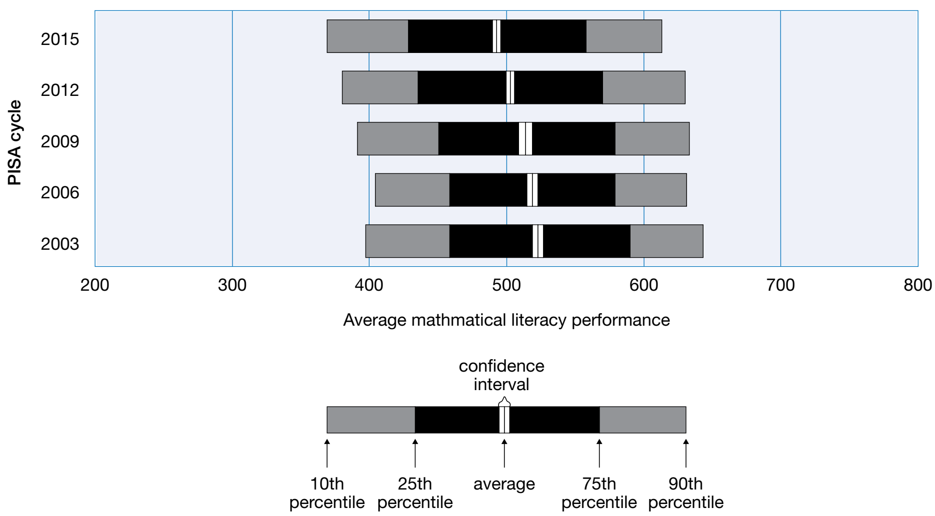


	Difference between years							
	2012		2009		2006		2003	
2015	–10	▼	–20	▼	–26	▼	–30	▼
2012			–10	▼	–16	▼	–20	▼
2009					–6		–10	▼
2006							–4	

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

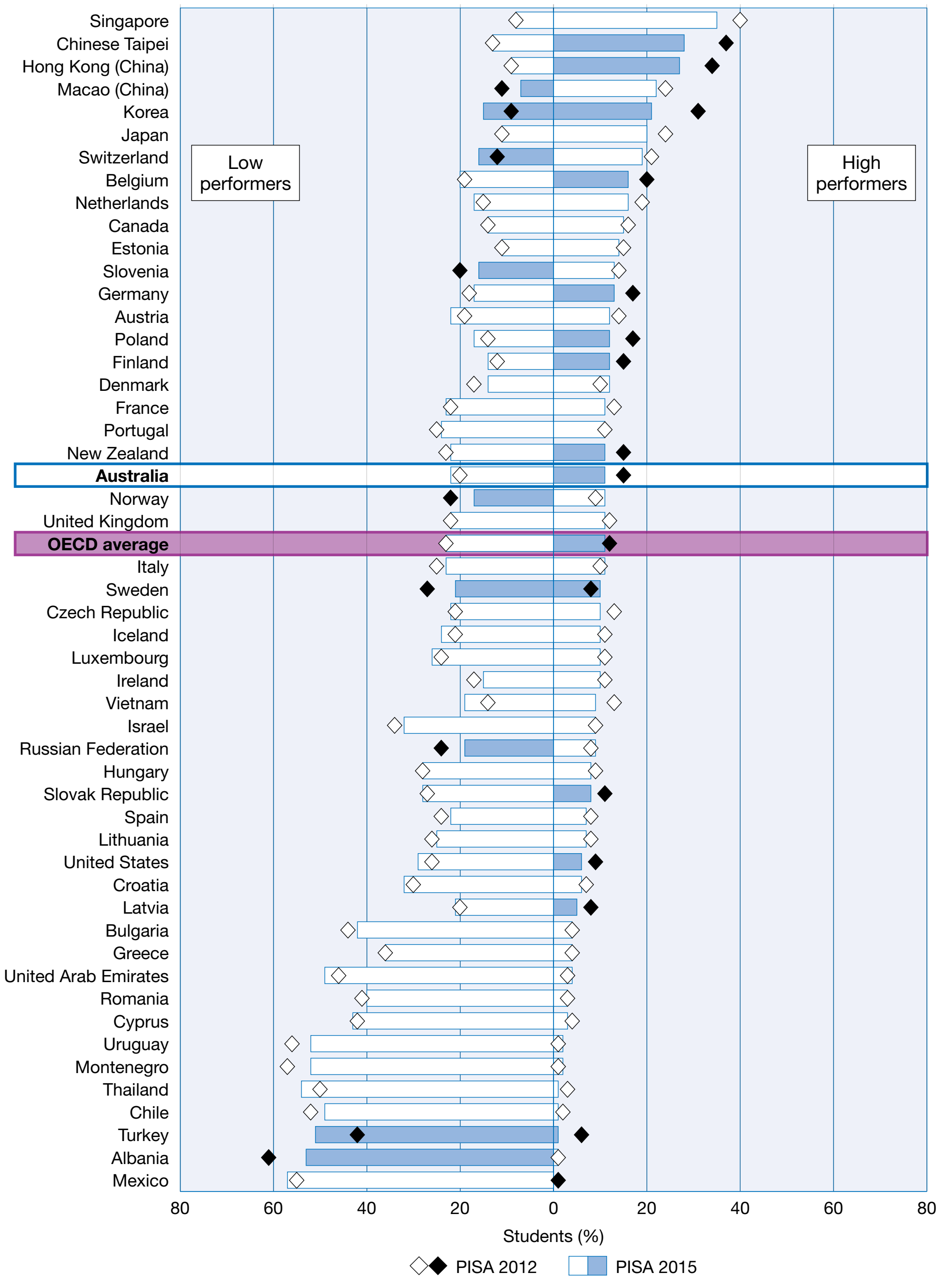
FIGURE 5.5 Average mathematical literacy performance and differences over time, PISA 2003 to 2015, for Australia

Percentiles also provide further detail in helping to understand where the decline in Australia's mathematical literacy performance has occurred. Figure 5.6 shows that between 2003 and 2015, the decline in average scores can be observed among all students alike. Mathematical literacy performance at the 10th and 25th percentiles declined significantly (by 27 and 30 points), while for the 75th and 90th percentiles, the decline (again significant) was 33 and 31 points. Between 2012 and 2015, changes among the low- and high-performing students were also found: mathematical literacy performance declined significantly at the 10th percentile by 11 points, at the 75th percentile by 12 points, and at the 90th percentile by 17 points.



Note: The 10th, 25th, 75th and 90th percentiles are shown in this figure.

FIGURE 5.6 Distribution of students' performance on the mathematical literacy scale over time, PISA 2003 to 2015, for Australia



Notes: only countries that participated in both PISA 2012 and 2015 are shown. Countries are ordered in descending order of the percentage of high performers. A coloured bar and a black diamond indicate that the difference in the proportion of students between PISA 2012 and 2015 is significant.

FIGURE 5.7 Percentage of low and high performers in mathematical literacy for PISA 2012 and 2015, by country

Mathematical literacy proficiency over time

Figure 5.7 shows the proportion of low and high performers for countries which participated in PISA 2012 and 2015. There were a number of countries whose proportions of low performers and proportions of high performers changed significantly between 2012 and 2015.

- Across the OECD countries, there was no change in the proportion of low performers, but a 2% decrease in the proportion of high performers, which was significant between 2012 and 2015.
- In Sweden, there was a significant decrease in the proportion of low performers and there was a significant increase in the proportion of high performers, that is, there were fewer low performers and more high performers in 2015 than in 2012.

- In Korea and Turkey, there were significant increases in the proportions of low performers and there were significant decreases in the proportions of high performers in 2015 than in 2012.
- The proportions of low performers in 5 countries (Albania, Macao (China), Norway, the Russian Federation and Slovenia) decreased significantly between 2012 and 2015. This decrease ranged from 4% in Macao (China) and Slovenia to 7% in Albania.
- The proportions of high performers in 12 countries (Australia, Belgium, Chinese Taipei, Finland, Germany, Hong Kong (China), Latvia, Mexico, New Zealand, Poland, the Slovak Republic and the United States) declined significantly. The decrease in the proportions of high performers ranged from 0.3% in Mexico to 9% in Chinese Taipei. In Australia, the proportion of high performers between 2012 and 2015 fell by 3%.
- Switzerland experienced a 3% increase in the proportion of low performers.

Figure 5.8 shows the average proportion of students performing at each mathematical literacy proficiency level from PISA 2003 to 2015, and illustrates a shift in performance at either end of the proficiency scale, with an increase in the proportion of low performers and a decrease in the proportion of high performers.

- Between 2003 and 2012, the proportion of low performers increased by 5% and the proportion of high performers decreased by 5%.
- Between 2012 and 2015, the proportion of low performers increased by 2% and the proportion of high performers decreased by 3%.
- The proportion of low performers was 14% in 2003, 13% in 2006, 16% in 2009, 20% in 2012 and 22% in 2015.
- The proportion of high performers was 20% in 2003, 16% in 2006 and 2009, 15% in 2012 and 11% in 2015.

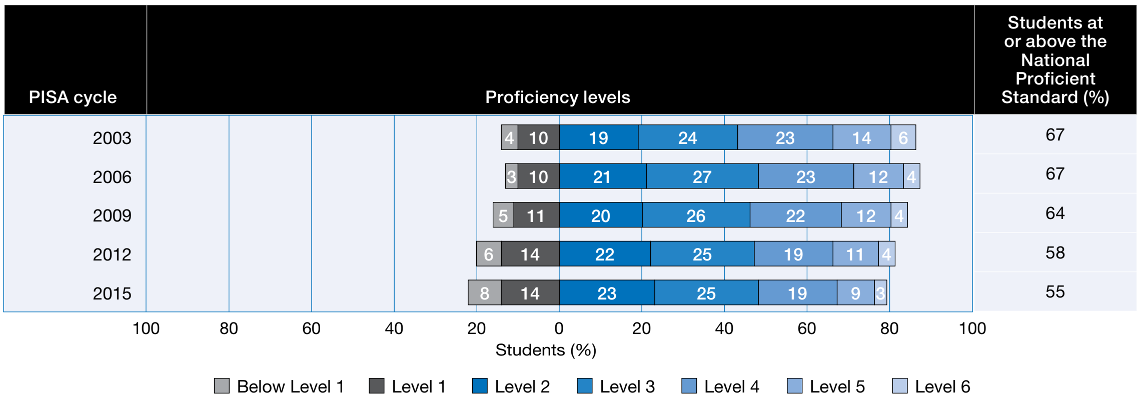


FIGURE 5.8 Percentage of students across the mathematical literacy proficiency scale over time, PISA 2003 to PISA 2015, for Australia

Australia's mathematical literacy results in a national context

Mathematical literacy results for PISA 2015 by jurisdiction

Mathematical literacy performance

Figure 5.9 shows the mathematical literacy performance and distribution of scores for students in each of the Australian jurisdictions. It lists the average scores, together with the standard error, confidence intervals around the average, the difference between the 5th and 95th percentiles, and shows the distribution of mathematical literacy scores of each jurisdiction. The average scores and distributions for Australia, Singapore and the OECD average are included for comparison. In addition, Table 5.5 provides further insight into jurisdiction-level performance by indicating significant differences in performance between the jurisdictions and the OECD average.

The Australian Capital Territory was the jurisdiction that achieved the highest average score (505 points) in mathematical literacy performance while Tasmania achieved the lowest average score (469 points). The average score difference between students' performance in the Australian Capital Territory and Tasmania was 36 points, which was around half a proficiency level or equal to around one year of schooling.

The Northern Territory displayed the widest spread of student performance, with a range of 332 points between the 5th and 95th percentiles. Victoria and South Australia had the narrowest spread, with 292 points respectively and 293 points separating the 5th and 95th percentiles.

Singapore performed significantly higher (by 59 points on average), than the highest performing jurisdiction, the Australian Capital Territory, and by 95 points on average higher compared to the lowest performing jurisdiction, Tasmania.

Jurisdiction	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
ACT	505	3.6	498–513	306	
NSW	494	3.0	488–500	322	
VIC	499	3.1	493–505	292	
QLD	486	3.3	480–493	305	
SA	489	4.2	481–498	293	
WA	504	3.9	496–511	295	
TAS	469	4.1	461–477	309	
NT	478	6.9	465–492	332	
Australia	**494**	**1.6**	**491–497**	**306**	
OECD average	**490**	**0.4**	**489–491**	**293**	
Singapore	564	1.5	561–567	312	

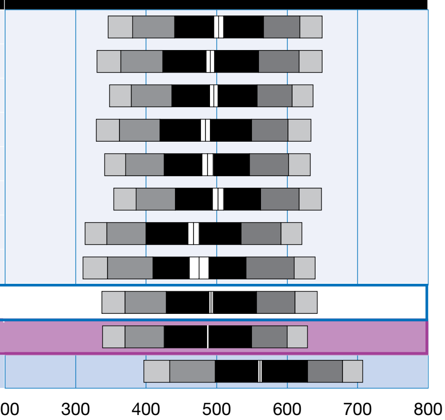


FIGURE 5.9 Average scores and distribution of students' performance on the mathematical literacy scale, by jurisdiction

Table 5.5 shows a pairwise comparison of average mathematical literacy performance between any two jurisdictions. The Australian Capital Territory, Western Australia and Victoria performed at a statistically similar level; however, the Australian Capital Territory outperformed all other jurisdictions. The Northern Territory's performance was not significantly different to that of Tasmania.

The Australian Capital Territory, Western Australia and Victoria performed at a significantly higher level than the OECD average (490 points). Four jurisdictions (New South Wales, South Australia, Queensland and the Northern Territory) performed not significantly different to the OECD average. Tasmania performed significantly lower than the OECD average.

TABLE 5.5 Multiple comparisons of average mathematical literacy performance, by jurisdiction

Jurisdiction	Avg. score	SE	ACT	WA	VIC	NSW	SA	QLD	NT	TAS	OECD average
ACT	505	3.6		●	●	▲	▲	▲	▲	▲	▲
WA	504	3.9	●		●	●	▲	▲	▲	▲	▲
VIC	499	3.1	●	●		●	●	▲	▲	▲	▲
NSW	494	3.0	▼	●	●		●	●	▲	▲	●
SA	489	4.2	▼	▼	●	●		●	●	▲	●
QLD	486	3.3	▼	▼	▼	●	●		●	▲	●
NT	478	6.9	▼	▼	▼	▼	●	●		●	●
TAS	469	4.1	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**490**	**0.4**	▼	▼	▼	●	●	●	●	▲	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

Appendix E provides information about the mathematical literacy performance of each jurisdiction compared to participating countries.

Mathematical literacy proficiency

Figure 5.10 shows the average proportion of students at each of the mathematical literacy proficiency levels in each jurisdiction, together with the percentages for Australia, the OECD average and Singapore.

High performers

As mentioned in earlier chapters, students who achieved Level 5 or Level 6 were considered high performers.

- The Australian Capital Territory was the jurisdiction with the highest proportion of high performers with a proportion of 14%, compared to Singapore, which had 35%. New South Wales had a proportion of 13% and Western Australia had 12%. These proportions were higher than the OECD average of 11%.
- Victoria and the Northern Territory each had proportions of 11% of high performers, which was the same as the OECD average.
- Queensland and Tasmania had 9% and 8% respectively of high performers, which were each lower than the OECD average.

Three per cent of students from the Australian Capital Territory, New South Wales, and Western Australia achieved Level 6, which was higher than the OECD average (2%); 2% of students in Victoria, Queensland, South Australia, and the Northern Territory achieved Level 6. Only 1% of students from Tasmania achieved Level 6, which was lower than the OECD average.

Low performers

Students who were low performers (performing below Level 2), have not demonstrated the mathematical literacy competencies that will enable them to actively participate in society.

- Tasmania (32%), the Northern Territory (28%) and Queensland (24%) had the highest proportions of low performers. These proportions were higher than the proportion of low performers across the OECD (23%).
- New South Wales and South Australia had 23% of low performers, which was the same as the OECD average.
- The Australian Capital Territory and Victoria each had 19%, and Western Australia had 18%, which were all lower than the OECD average.

Students who scored below 358 points were placed below Level 1. Although the PISA mathematical literacy proficiency scale does not describe the competencies these students typically demonstrate, PISA recognises that these students have not been able to utilise their mathematical literacy skills and knowledge to successfully complete the easiest PISA tasks. These students are likely to have serious difficulties in using mathematical literacy to better their future. For most jurisdictions, the proportion of students who placed below Level 1 ranged from 5% to 9%, while the Northern Territory had 12% and Tasmania had 13%.

Students who achieved the National Proficient Standard

Figure 5.10 shows the proportion of students in each jurisdiction who achieved the National Proficient Standard in mathematical literacy ranged from 44% in Tasmania to 61% in the Australian Capital Territory.

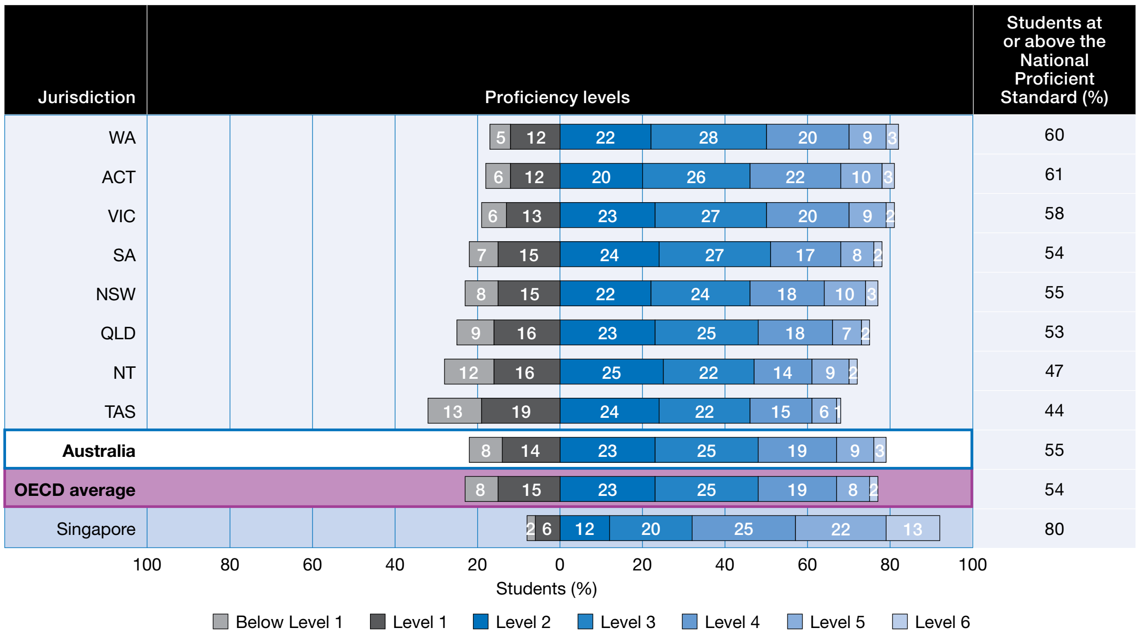


FIGURE 5.10 Percentage of students across the mathematical literacy proficiency scale, by jurisdiction

Mathematical literacy results over time by jurisdiction

Mathematical literacy performance

Figure 5.11 shows the average mathematical literacy performance for PISA 2003 to 2015, by jurisdiction. It also shows the change in performance between each cycle and indicates whether this change in performance is significant or not significant.

The average mathematical literacy scores between PISA 2003 and 2012 show that with the exception of Victoria, all other jurisdictions experienced a significant decline in mathematical literacy performance:

- Queensland's performance declined by 16 points (the smallest decline of any jurisdiction)
- New South Wales' performance declined by 17 points
- the Australian Capital Territory's and Tasmania's performance each declined by 30 points
- Western Australia's performance declined by 32 points
- the Northern Territory's performance declined by 45 points
- South Australia's performance declined by 46 points (the largest decline of any jurisdiction).

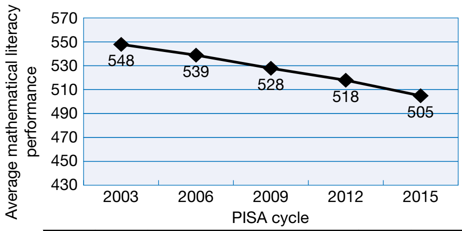
The changes in mathematical literacy performance between 2012 and 2015 were significantly different in four jurisdictions:

- Western Australia's performance declined by 12 points
- New South Wales' performance declined by 15 points
- Queensland's performance declined by 17 points
- the Northern Territory's performance improved by 26 points.

The changes in mathematical literacy performance between 2003 and 2015 were significantly different in six jurisdictions:

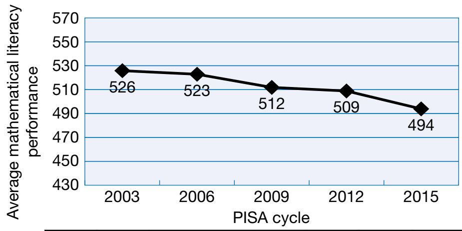
- New South Wales' performance declined by 32 points
- Queenslands' performance declined by 33 points
- Tasmania's performance declined by 38 points
- the Australian Capital Territory's performance declined by 42 points
- Western Australia's performance declined by 44 points
- South Australia's performance declined by 46 points.

Australian Capital Territory



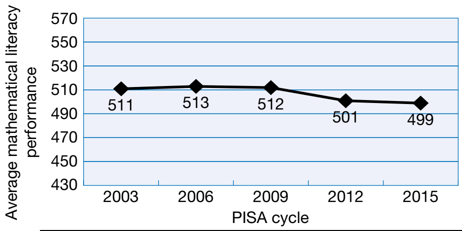
Difference between years	2012		2009		2006		2003	
2015	−12		−23	▼	−33	▼	−42	▼
2012			−11		−21	▼	−30	▼
2009					−11		−20	▼
2006							−9	

New South Wales



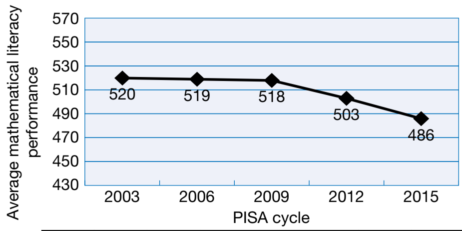
Difference between years	2012		2009		2006		2003	
2015	−15	▼	−18	▼	−28	▼	−32	▼
2012			−3		−14	▼	−17	▼
2009					−10		−14	▼
2006							−4	

Victoria



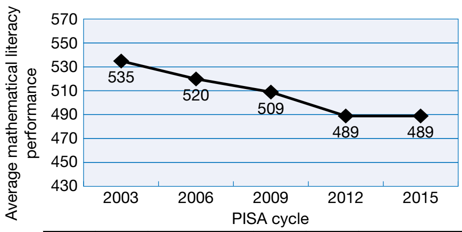
Difference between years	2012		2009		2006		2003	
2015	−2		−13		−15	▼	−12	
2012			−11		−12	▼	−10	
2009					−1		1	
2006							2	

Queensland



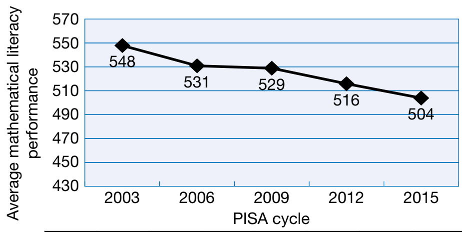
Difference between years	2012		2009		2006		2003	
2015	−17	▼	−31	▼	−33	▼	−33	▼
2012			−15		−16	▼	−16	▼
2009					−2		−2	
2006							0	

South Australia



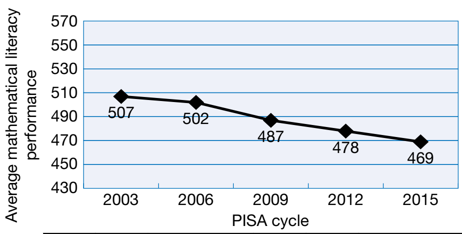
Difference between years	2012		2009		2006		2003	
2015	0		−20	▼	−31	▼	−46	▼
2012			−20	▼	−31	▼	−46	▼
2009					−11		−26	▼
2006							−15	▼

Western Australia



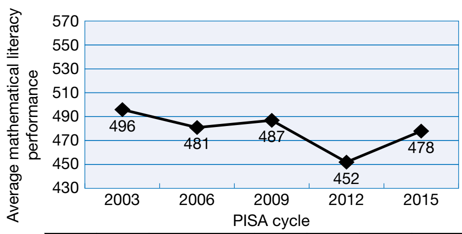
Difference between years	2012		2009		2006		2003	
2015	−12	▼	−25	▼	−28	▼	−44	▼
2012			−12		−15	▼	−32	▼
2009					−3		−19	▼
2006							−17	▼

Tasmania



Difference between years	2012		2009		2006		2003	
2015	−9		−18	▼	−33	▼	−38	▼
2012			−9		−24	▼	−30	▼
2009					−15	▼	−20	
2006							−5	

Northern Territory



Difference between years	2012		2009		2006		2003	
2015	26	▲	−9		−3		−18	
2012			−35	▼	−29	▼	−45	▼
2009					6		−9	
2006							−15	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.11 Average mathematical literacy performance, and differences from 2003 to PISA 2015, by jurisdiction

Mathematical literacy proficiency

Figure 5.12 shows the proportion of low and high performers on the mathematical literacy scale, by jurisdiction, from PISA 2003 to 2015.

High performers

Between 2003 and 2015, in every jurisdiction, there was a decrease in the proportion of high performers. The decrease ranged by a minimum of 3% in the Northern Territory up to a maximum of 15% in Western Australia.

Between 2012 and 2015, the proportions of high performers decreased across all jurisdictions, except for the Northern Territory, where the proportion of high performers increased by 4%. For the other jurisdictions, the proportion of high performers decreased by 1% in Victoria, South Australia and Tasmania and 5% in the Australian Capital Territory, New South Wales, Queensland, and Western Australia

Low performers

Between 2003 and 2015, the proportions of low performers increased across all jurisdictions. The difference in proportion of low performers during this period increased by a minimum of 2% in Victoria up to a maximum of 14% in Tasmania.

Between 2012 and 2015, there were changes in the proportions of low performers for all jurisdictions except in Victoria. In 2 jurisdictions, the proportion of low performers decreased by 1% in South Australia and 8% in the Northern Territory, and in the other jurisdictions, the increase in the proportion of low performers ranged from 2% in Western Australia to 5% in each of Queensland and Tasmania.

Students who achieved the National Proficient Standard

Table 5.6 shows the proportion of students who achieved the National Proficient Standard in mathematical literacy decreased in all jurisdictions between 2003 and 2012. The decreases ranged from 5% in Victoria to 16% in the Northern Territory.

While the proportion of students who achieved the National Proficient Standard in mathematical literacy between 2012 and 2015 remained constant in Victoria, the proportion of students increased by 1% in South Australia and by 6% in the Northern Territory, and the proportion of students who achieved the National Proficient Standard decreased in the other jurisdictions. The decreases ranged from 3% in each of the Australian Capital Territory and Western Australia to 6% in Queensland.

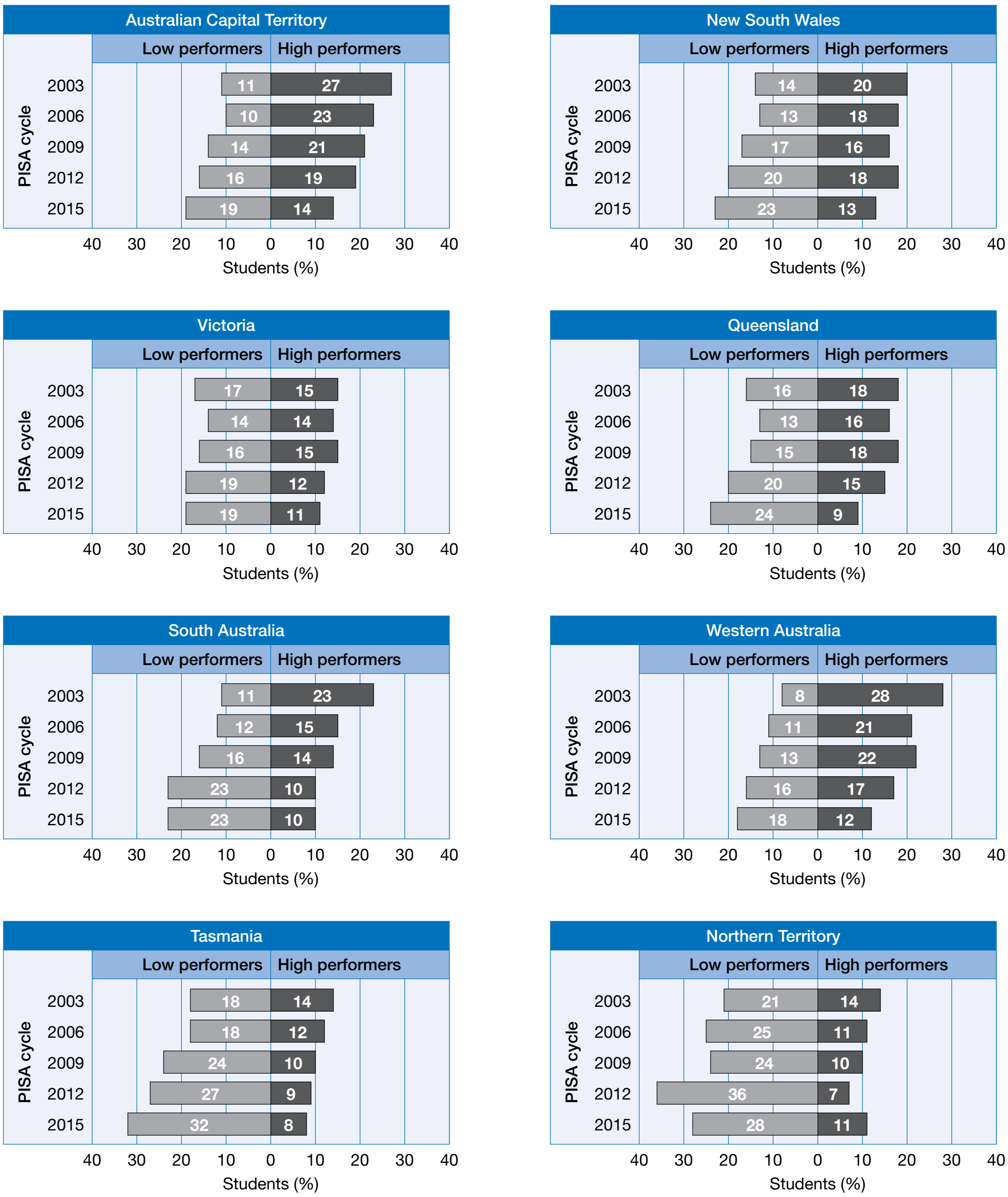


FIGURE 5.12 Percentage of low and high performers on the mathematical literacy proficiency scale over time, PISA 2003 to 2015, by jurisdiction

TABLE 5.6 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by jurisdiction

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	76	1.8	74	2.5	69	2.4	65	1.9	61	2.1
NSW	67	1.6	67	1.8	63	1.8	59	1.4	55	1.4
VIC	63	2.2	64	2.0	63	2.3	58	1.6	58	1.7
QLD	66	2.7	67	1.9	65	2.8	58	1.6	53	1.8
SA	73	2.5	67	2.3	63	2.2	53	1.7	54	2.2
WA	76	1.9	72	3.0	69	3.0	63	1.7	60	2.1
TAS	61	4.2	58	2.3	52	2.5	48	1.7	44	2.2
NT	57	2.8	52	2.2	54	2.5	41	5.5	47	3.5

Mathematical literacy results for PISA 2015 across the school sectors

Mathematical literacy performance

Figure 5.13 shows the unadjusted average scores for mathematical literacy by school sector. Students in independent schools performed significantly higher than students in Catholic or government schools, and students in Catholic schools scored significantly higher than students in government schools. Students in government schools achieved an average score of 477 points in mathematical literacy, while students in Catholic schools scored an average of 503 points and students in independent schools achieved an average of 532 points.

The average mathematical literacy score differences between school sectors were similar to those found for the scientific and reading literacy results. The average score differences between students in government schools and students in Catholic schools, and between students in Catholic schools and students in independent schools were approximately 30 points or equal to around one year of schooling. The average score difference between students in government schools and students in independent schools was even larger at 55 points or equal to around two years of schooling.

The average mathematical literacy scores for Catholic schools and independent schools were significantly higher than the OECD average (by 13 points and 42 points respectively), while the average score for government schools was significantly lower than the OECD average (by 13 points).

School sector	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Government	477	2.2	473–482	309
Catholic	503	3.3	497–510	283
Independent	532	3.4	525–539	282

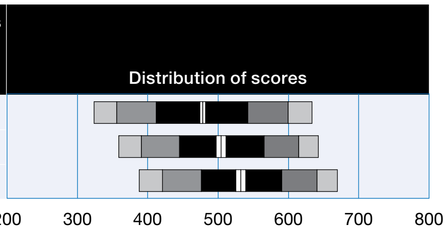


FIGURE 5.13 Average scores and distribution of students' performance on the mathematical literacy scale (unadjusted for student and school socioeconomic background) by school sector

The reporting of results by school sector using unadjusted average scores is misleading because there are higher proportions of students from lower socioeconomic backgrounds who attend government schools compared to the proportions of students from low socioeconomic backgrounds who attend Catholic or independent schools. To ensure fair comparisons, it is necessary to adjust for the differences in an individual student's family background or socioeconomic background as well as the school-level socioeconomic background.

Table 5.7 shows the average difference in the unadjusted score as well as the average score differences in mathematical literacy performance once student socioeconomic background, and student- and school-level socioeconomic background are accounted for.

When student-level socioeconomic background is taken into account, students in independent schools performed significantly higher than students in Catholic schools, and students in Catholic schools performed significantly higher than students in government schools, although the differences are reduced.

When school-level socioeconomic background is also taken into account, the differences between students in government schools and students in Catholic schools, and the differences between students in government schools and students in independent schools are not significant. However, the differences between students in Catholic schools and students in independent schools remain significant. In other words, students in independent schools have a performance advantage over students in Catholic schools that is not attributable to student and school socioeconomic background.

TABLE 5.7 Differences in average mathematical literacy scores after adjusting for student- and school-level socioeconomic background

School sector comparison	Difference in raw score (score points)	Difference in scores after student socioeconomic background is accounted for	Difference in scores after student and school level socioeconomic background is accounted for
Catholic-government	**26**	**11**	–7
independent-government	**55**	**31**	5
independent-Catholic	**28**	**21**	**13**

Note: statistically significant values are shown in bold.

Mathematical literacy proficiency

Figure 5.14 shows the proportion of students at each proficiency level on the mathematical literacy scale by school sector. The proportion of low performers in government schools (28%) was higher than the proportion of low performers in Catholic schols (17%) or independent schools (10%), while the proportions of high performers were lower in government schools (9%) and in Catholic schools (12%), which were both lower than the proportion of high performers in independent schools (19%).

Approximately half the students in government schools (48%) achieved the National Proficient Standard in mathematical literacy compared to almost two-thirds of students in Catholic schools (60%) and approximately three-quarters of students in independent schools (73%).

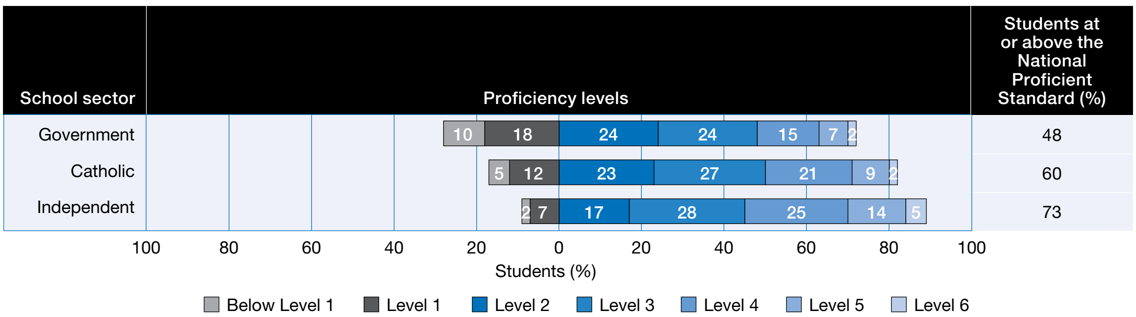
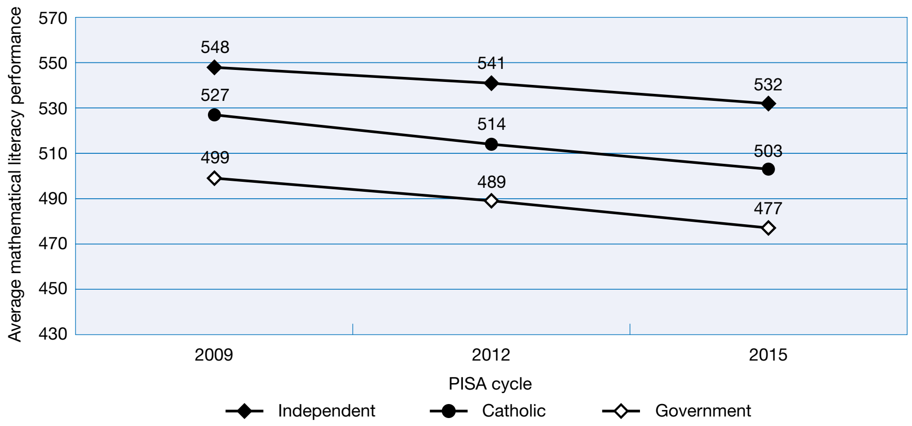


FIGURE 5.14 Percentage of students across the mathematical literacy proficiency scale, by school sector

Mathematical literacy results over time across the school sectors

Mathematical literacy performance

Figure 5.15 shows the average mathematical literacy performance from PISA 2009 to 2015, along with the change in performance across the school sectors. The average mathematical literacy performance for each school sector declined significantly over this period. There was a 22-point decline for students in government schools, a 23-point decline for students in Catholic schools, and a 17-point decline for students in independent schools. Between 2012 and 2015, the change in performance was significant for students in government schools (by 12 points); however, there was no significant change for students in Catholic schools and in independent schools.



Government	Difference between years			
	2012		2009	
2015	–12	▼	–22	▼
2012			–10	▼
2009				

Catholic	Difference between years			
	2012		2009	
2015	–11		–23	▼
2012			–13	▼
2009				

Independent	Difference between years			
	2012		2009	
2015	–9		–17	▼
2012			–8	
2009				

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.15 Average mathematical literacy performance and differences over time, PISA 2009 to 2015, by school sector

Mathematical literacy proficiency

Table 5.8 shows the proportion of low and high performers in PISA 2012 and 2015 by school sector.

Between 2012 and 2015, there was:

- a 3% increase in the proportion of low performers and a 4% decrease in the proportion of high performers in government schools
- a 3% increase in the proportion of low performers and a 3% decrease in the proportion of high performers in Catholic schools
- a 1% increase in the proportion of low performers and a 4% decrease in the proportion of high performers in independent schools.

TABLE 5.8 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and 2015, by school sector

	PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers	
School sector	%	SE	%	SE	%	SE	%	SE
Government	25	0.8	12	0.9	28	0.9	9	0.6
Catholic	14	1.1	14	1.0	17	1.1	12	1.1
Independent	9	1.2	23	1.5	10	1.0	19	1.6

Students who achieved the National Proficient Standard

Table 5.9 shows that between 2009 and 2015, the proportion of students who achieved the National Proficient Standard in mathematical literacy decreased across the school sectors by:

- 9% in government schools
- 12% in Catholic schools
- 5% in independent schools.

Between 2012 and 2015, the proportion of students who achieved the National Proficient Standard in mathematical literacy decreased across the school sectors by:

- 3% in government schools
- 5% in Catholic schools
- 2% in independent schools.

TABLE 5.9 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2009 to 2015, by school sector

	PISA 2009		PISA 2012		PISA 2015	
School sector	%	SE	%	SE	%	SE
Government	57	1.5	51	1.0	48	1.2
Catholic	72	2.3	65	1.6	60	1.9
Independent	78	1.4	74	1.5	73	1.6

Australia's mathematical literacy results for different demographic groups

Mathematical literacy results for PISA 2015 by Indigenous background

Mathematical literacy performance

Figure 5.16 shows the performance of Indigenous and non-Indigenous students in mathematical literacy. Indigenous students achieved an average score of 427 points, which was significantly lower than the average of 497 points achieved by non-Indigenous students. This score difference of 70 points equates to about one proficiency level or around two-and-a-third years of schooling. Indigenous students performed significantly lower in mathematical literacy than the OECD average (by 63 points), while non-Indigenous students performed significantly higher than the OECD average (by 7 points).

The spread of scores between students in the 5th and 95th percentiles was slightly narrower for Indigenous students than for non-Indigenous students (by 16 points.)

Indigenous background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Indigenous	427	3.1	421–433	288	
Non-Indigenous	497	1.7	494–500	304	

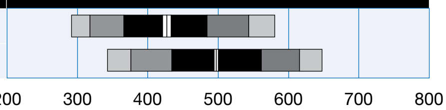


FIGURE 5.16 Average scores and distribution of students' performance on the mathematical literacy scale, by Indigenous background

Mathematical literacy proficiency

Figure 5.17 shows the proportion of Indigenous and non-Indigenous students in each of the mathematical literacy proficiency levels:

- 3% of Indigenous students were high performers in mathematical literacy compared to 12% of high-performing non-Indigenous students
- of the students performing at Level 6, only 0.3% were Indigenous students compared to 3% of non-Indigenous students
- half the Indigenous students (49%) were low performers compared to 21% of low-performing non-Indigenous students
- 27% of Indigenous students were placed at Level 1 compared to 14% of non-Indigenous students; 22% of Indigenous students achieved below Level 1 compared to 7% of non-Indigenous students
- the proportion of high-performing Indigenous students (3%) was much lower than high-performing students across the OECD (11%), while there were more than twice as many low-performing Indigenous students (49%) compared to the low-performing students across the OECD (23%)
- 25% of Indigenous students achieved the National Proficient Standard compared to 57% of non-Indigenous students.

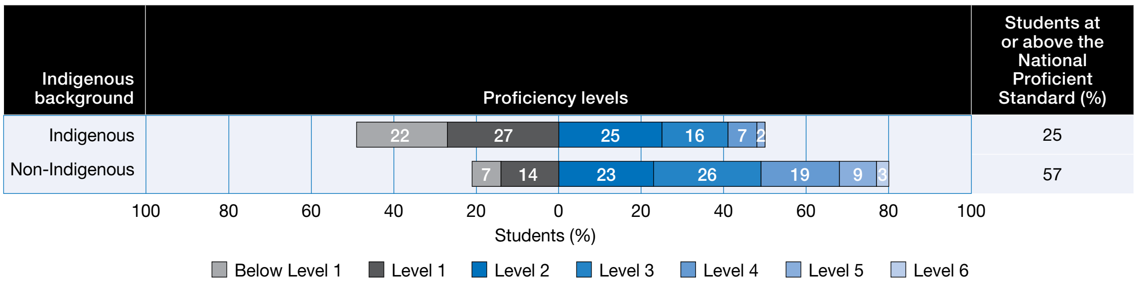


FIGURE 5.17 Percentage of students across the mathematical literacy proficiency scale, by Indigenous background

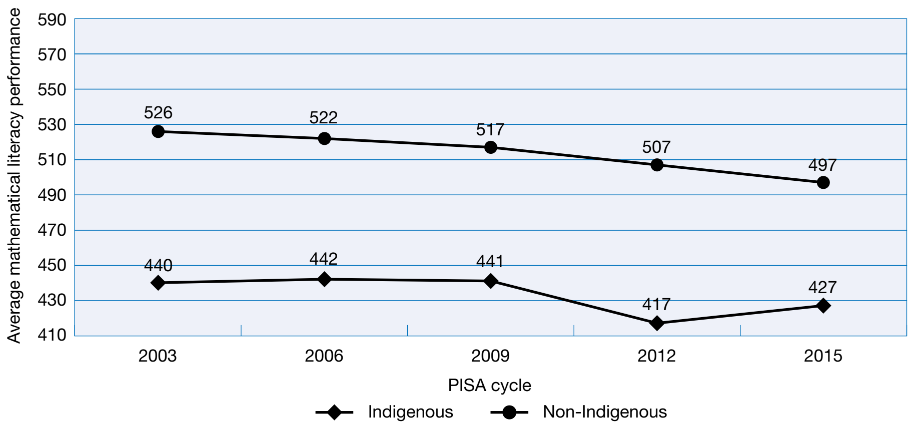
Mathematical literacy results over time by Indigenous background

Mathematical literacy performance

Figure 5.18 shows the average mathematical literacy performance, and change in performance across the PISA cycles for Indigenous and non-Indigenous students. The performance in mathematical literacy for Indigenous students remained constant between 2003 and 2009; however, in 2012 there was a significant decrease in performance to an average score of 417 points, which was a decline of 23 points from 2009. Between 2012 and 2015, and also between 2003 and 2015, the changes in performance for Indigenous students were not significant.

There have been a number of significant changes in the mathematical literacy performance of non-Indigenous students between the PISA cycles. The change in performance between 2003 and 2015 was significant with a decline of 29 points, and the change in performance between 2012 and 2015 was also significant, with a decline of 10 points.

The difference in performance between Indigenous and non-Indigenous students in 2003 was 86 points. The difference in performance between Indigenous and non-Indigenous students in 2015 was 70 points. This gap has not changed significantly between 2003 and 2015.



Indigenous	Difference between years			
	2012	2009	2006	2003
2015	10	–14 ▼	–15	–13
2012		–24 ▼	–25 ▼	–23 ▼
2009			–1	1
2006				2

Non-Indigenous	Difference between years			
	2012	2009	2006	2003
2015	–10 ▼	–20 ▼	–25 ▼	–29 ▼
2012		–9 ▼	–15 ▼	–19 ▼
2009			–6	–9 ▼
2006				–4

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.18 Average mathematical literacy performance and differences over time, PISA 2003 to 2015, by Indigenous background

Mathematical literacy proficiency

Table 5.10 shows the proportion of low-performing Indigenous students decreased by 1% between 2012 and 2015, while there was no change in the proportion of high-performing Indigenous students. During this same period, the proportion of low-performing non-Indigenous students increased by 2% and the proportion of high-performing non-Indigenous students decreased by 4%.

TABLE 5.10 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and 2015, by Indigenous background

	PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Indigenous background	%	SE	%	SE	%	SE	%	SE
Indigenous	50	2.2	2	0.4	49	1.8	3	0.5
Non-Indigenous	19	0.6	15	0.7	21	0.6	12	0.6

Students who achieved the National Proficient Standard

Table 5.11 shows the proportion of students who achieved the National Proficient Standard in mathematical literacy from PISA 2003 to 2015 for Indigenous and non-Indigenous students. Between 2003 and 2015, the proportion of students who achieved the National Proficient Standard decreased by 5% for Indigenous students and 11% for non-Indigenous students.

Between 2012 and 2015, the proportion of students who achieved the National Proficient Standard increased by 2% for Indigenous students and decreased by 3% for non-Indigenous students.

TABLE 5.11 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by Indigenous background

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Indigenous background	%	SE	%	SE	%	SE	%	SE	%	SE
Indigenous	30	3.2	32	2.6	34	2.6	23	1.6	25	1.3
Non-Indigenous	68	0.9	68	0.9	65	1.0	60	0.8	57	0.9

Mathematical literacy results for PISA 2015 by geographic location of school

Mathematical literacy performance

Figure 5.19 shows the performance of schools across the three broad categories of geographic location of schools, which were based on the MCEETYA *Schools Geographic Location Classification* (Jones, 2004).[51] On average, students from metropolitan schools scored 29 points higher in mathematical literacy (equal to around one year of schooling) than students from provincial schools. The average score difference between students from metropolitan schools and students from remote schools was even larger at 42 points (equal to around one-and-a-half years of schooling). The performance between students from provincial schools and students from remote schools was not significantly different.

The performance for students from metropolitan schools was significantly higher than the OECD average (by 12 points), but the performance for students from provincial schools and remote schools was significantly lower than the OECD average (by 17 points and 30 points respectively).

The spread of scores for students in the three geographic location groups was very similar, and ranged from 305 points for students from metropolitan schools to 289 points for students from remote schools.

Geographic location	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Metropolitan	502	2.1	498–506	305
Provincial	473	2.8	468–479	298
Remote	460	10.7	439–481	289

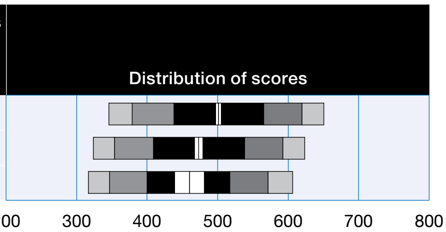


FIGURE 5.19 Average scores and distribution of students' performance on the mathematical literacy scale, by geographic location

51 The Reader's Guide provides more information about the MCEETYA Schools Geographic Location Classification.

Mathematical literacy proficiency

Figure 5.20 shows the mathematical literacy proficiency levels for the three geographical locations of schools. The results show that:

- the proportion of high performers from metropolitan schools (13%) was almost twice that of high performers from provincial schools (7%); the proportion of high performers in remote schools was lower again with 5% of students performing at the high level
- the proportion of low performers from metropolitan schools was 19% compared to 29% from provincial schools and 33% from remote schools
- there was a higher proportion of high performers in metropolitan schools compared to high-performing students across the OECD (11%), while the proportion of high-performing students from provincial and remote schools was lower than the proportion of high performers across the OECD
- there was a lower proportion of low-performing students from metropolitan schools (19%) compared to the proportion of low-performing students across the OECD (23%), whereas there was a higher proportion of low-performing students from provincial and remote schools (29% and 33% respectively) than the low-performing students across the OECD
- 59% of students from metropolitan schools achieved the National Proficient Standard in mathematical literacy compared to 46% of students from provincial schools and 40% of students from remote schools.

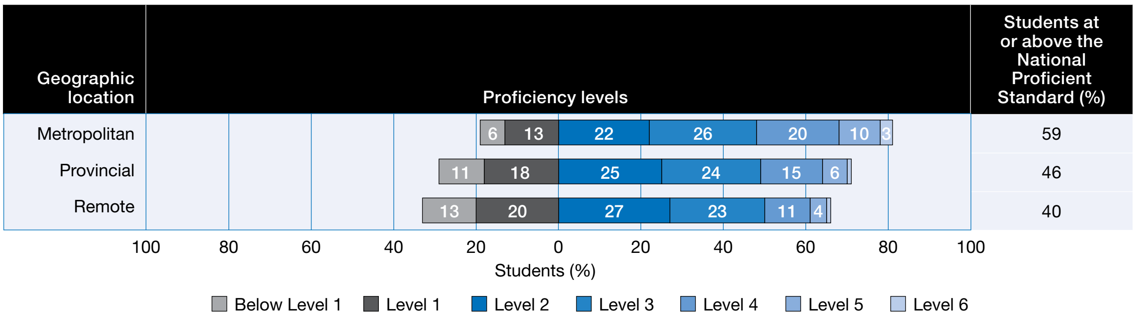


FIGURE 5.20 Percentage of students across the mathematical literacy proficiency scale, by geographic location

Mathematical literacy results over time by geographic location of school

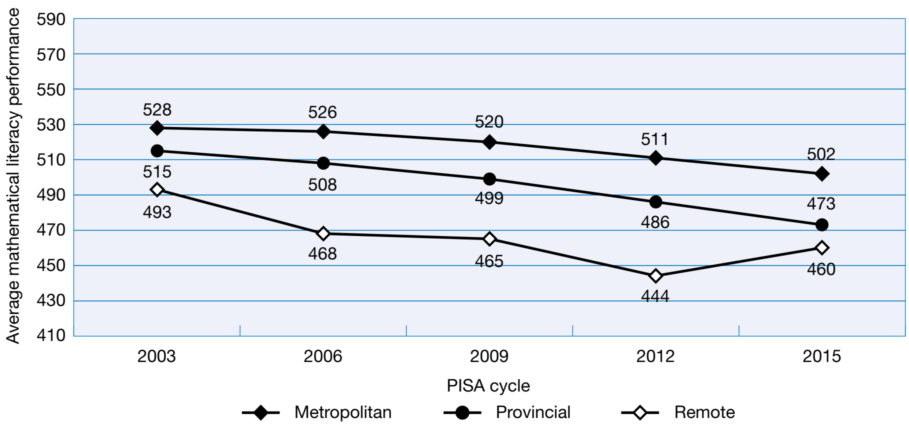
Mathematical literacy performance

Figure 5.21 shows the average mathematical literacy performance by geographic location from PISA 2003 to 2015. Over this period, the average mathematical literacy performance declined significantly for all geographic locations. There was a 27-point decline for students from metropolitan schools, a 42-point decline for students from provincial schools, and a 33-score point decline for students from remote schools. Between 2012 and 2015, significant differences were only found for students from metropolitan schools, with a decline of 10 points.

The difference in performance between students in metropolitan schools and students in provincial schools in 2003 was 13 points. The difference in performance between students in metropolitan schools and students in provincial schools in 2015 was 29 points. This gap has not changed significantly between 2003 and 2015.

The difference in performance between students in provincial schools and students in remote schools in 2003 was 22 points. The difference in performance between students in provincial schools and students in remote schools in 2015 was 13 points. This gap has not changed significantly between 2003 and 2015.

The difference in performance between students in metropolitan schools and students in remote schools in 2003 was 35 points. The difference in performance between students in metropolitan schools and students in remote schools in 2015 was 42 points. This gap has not changed significantly between 2003 and 2015.



Metropolitan — Difference between years

	2012		2009		2006		2003	
2015	–10	▼	–19	▼	–24	▼	–27	▼
2012			–9	▼	–14	▼	–17	▼
2009					–6		–8	
2006							–2	

Provincial — Difference between years

	2012		2009		2006		2003	
2015	–13		–26	▼	–35	▼	–42	▼
2012			–13	▼	–23	▼	–29	▼
2009					–10		–16	▼
2006							–6	

Remote — Difference between years

	2012		2009		2006		2003	
2015	16		5		–8		–33	▼
2012			–21		–24		–49	▼
2009					–3		–28	
2006							–25	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.21 Average mathematical literacy performance and differences over time, PISA 2003 to 2015, by geographic location

Mathematical literacy proficiency

Table 5.12 shows the proportion of low and high performers in PISA 2012 and 2015 by geographic location. Between 2006 and 2015, there was:

- a 1% increase in the proportion of low performers from metropolitan schools and a 4% decrease in the proportion of high performers
- a 6% increase in the proportion of low performers from provincial schools and a 3% decrease in the proportion of high performers
- a 6% decrease in the proportion of low performers from remote schools and no change in the proportion of high performers.

TABLE 5.12 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and PISA 2015, by geographic location

	PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers	
Geographic location	%	SE	%	SE	%	SE	%	SE
Metropolitan	18	0.7	17	0.8	19	0.7	13	0.8
Provincial	23	1.1	10	0.7	29	1.5	7	0.8
Remote	39	7.0	5	2.3	33	4.8	5	2.4

Table 5.13 shows the proportion of students who achieved the National Proficient Standard in mathematical literacy by geographic location. Between 2003 and 2015, the proportion of students who achieved the National Proficient Standard decreased by:

- 9% for students from metropolitan schools
- 18% for students from provincial schools
- 12% for students from remote schools.

Between 2012 and 2015, the proportion of students who achieved the National Proficient Standard increased for students in remote schools by 2%, while the proportion decreased for students who achieved the National Proficient Standard by:

- 3% for students from metropolitan schools
- 5% for students from provincial schools.

TABLE 5.13 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by geographic location

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		PISA 2015	
Geographic location	%	SE	%	SE	%	SE	%	SE	%	SE
Metropolitan	68	1.1	69	1.1	66	1.1	61	0.9	59	1.0
Provincial	64	1.7	63	1.6	58	1.9	51	1.3	46	1.4
Remote	51	6.5	44	5.8	43	7.5	38	7.2	40	4.9

Mathematical literacy results for PISA 2015 by socioeconomic background

Mathematical literacy performance

Figure 5.22 shows that socioeconomic background is related to student performance, and shows that students in the higher quartiles of socioeconomic background performed significantly higher than those in the lower quartiles of socioeconomic background.

Students in the highest quartile achieved an average score of 541 points, which was significantly higher than students in the lowest quartile, who achieved 455 points. This difference of 86 points represents over one proficiency level or almost three years of schooling. The difference between each socioeconomic quartile and the next was also significant, at around 30 points on average, and equivalent to around one year of schooling.

The score for students in the highest quartile was significantly higher than the OECD average (with an average score difference of 51 points), while the score for students in the lowest quartile was significantly lower than for students across the OECD (with an average score difference of 35 points).

The spread of scores across the four socioeconomic quartiles was very similar.

Socioeconomic background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles	Distribution of scores
Lowest quartile	455	2.3	451–460	289	
Second quartile	482	2.1	478–486	283	
Third quartile	507	2.2	502–511	287	
Highest quartile	541	2.9	535–546	284	

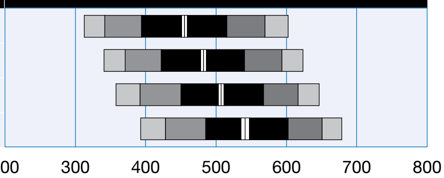


FIGURE 5.22 Average scores and distribution of students' performance on the mathematical literacy scale, by socioeconomic background

Mathematical literacy proficiency

Figure 5.23 shows that, on average, students in the highest quartile performed well, with a larger proportion of high performers and a smaller proportion of low performers. Only 4% of students in the lowest quartile were high performers compared to 7% in the second quartile, 12% in the third quartile and 23% in the highest quartile. Thirty-five per cent of students in the lowest quartile were low performers compared to 24% in the second quartile, 16% in the third quartile, and 9% in the highest quartile.

The proportion of high performers across the OECD (11%) was lower than the proportion of high performers in the highest and third quartiles and higher than the proportion of high performers in the second and lowest quartiles.

The proportion of low performers across the OECD (23%) was higher than the proportion of high performers in the third and highest quartiles, similar to the low performers in the second quartile, and lower than the proportion of low performers in the lowest quartile.

There were twice as many students in the highest quartile (76%) who achieved the National Proficient Standard in mathematical literacy compared to students in the lowest quartile (37%).

Socioeconomic background	Proficiency levels	Students at or above the National Proficient Standard (%)
Lowest quartile		37
Second quartile		50
Third quartile		62
Highest quartile		76

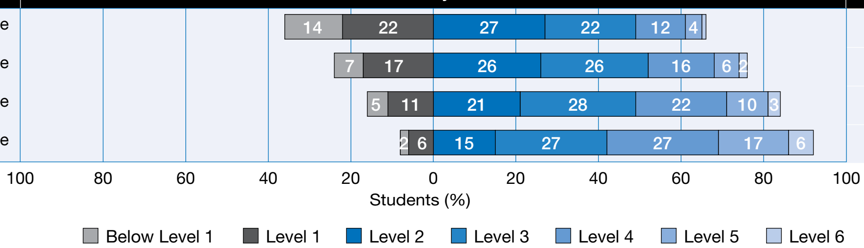


FIGURE 5.23 Percentage of students across the mathematical literacy proficiency scale, by socioeconomic background

Mathematical literacy results over time by socioeconomic background[52]

Mathematical literacy performance

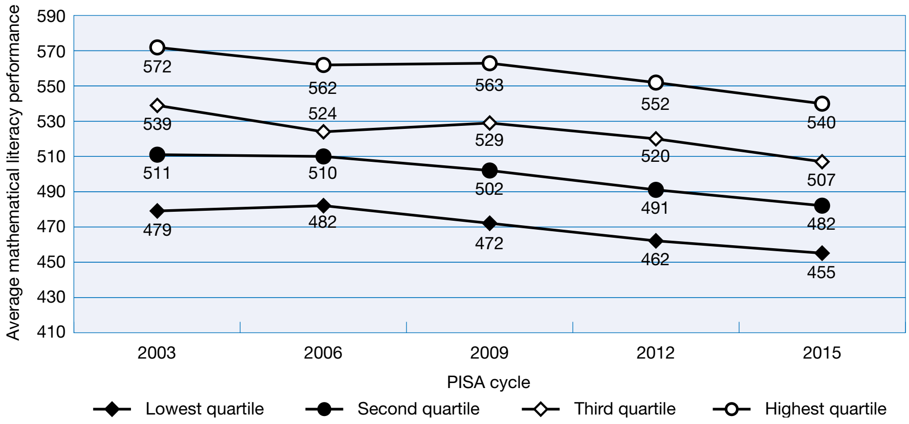
Figure 5.24 shows the average performance in mathematical literacy for each quartile of socioeconomic background since PISA 2003, along with details about the change in performance, and significance, between cycles.

52 While an ESCS index was included in all past PISA databases, the components of ESCS and the scaling model has changed over cycles, meaning that the ESCS scores are not comparable across cycles directly. An ESCS-Trend index variable has been computed using similar methodology for the current cycle and for previous cycles in order to enable a trend study.

Between 2003 and 2015, mathematical literacy performance declined significantly in each socioeconomic quartile. It declined by 24 points in the lowest quartile; 28 points in the second quartile; 32 points in the third quartile; and 31 points in the highest quartile.

Between 2012 and 2015, there were significant declines across two of the quartiles: a decline of 13 points in the third quartile and a decline of 12 points in the highest quartile.

The difference in performance between students in the lowest quartile and students in the highest quartile in 2003 was 93 points. The difference in performance between students in the lowest quartile and students in the highest quartile in 2015 was 85 points. This gap has not changed significantly between 2003 and 2015.



Lowest quartile								
	Difference between years							
	2012		2009		2006		2003	
2015	–7		–17	▼	–27	▼	–24	▼
2012			–10	▼	–19	▼	–17	▼
2009					–10	▼	–7	
2006							2	

Second quartile								
	Difference between years							
	2012		2009		2006		2003	
2015	–9		–20	▼	–28	▼	–28	▼
2012			–11	▼	–19	▼	–20	▼
2009					–8	▼	–9	▼
2006							–1	

Third quartile								
	Difference between years							
	2012		2009		2006		2003	
2015	–13	▼	–22	▼	–17	▼	–32	▼
2012			–9	▼	–4		–19	▼
2009					5		–10	▼
2006							–15	▼

Highest quartile								
	Difference between years							
	2012		2009		2006		2003	
2015	–12	▼	–23	▼	–22	▼	–31	▼
2012			–12	▼	–10	▼	–20	▼
2009					1		–8	
2006							–10	▼

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.24 Average mathematical literacy performance and differences over time, PISA 2003 to 2015, by socioeconomic background

Mathematical literacy proficiency

Table 5.14 shows that between PISA 2012 and 2015, there was an increase in the proportion of low performers and a decrease in the proportion of high performers in mathematical literacy proficiency.

For the high performers, there was:

- a 1% decrease in the lowest quartile
- a 2% decrease in the second quartile
- a 5% decrease in each of the the third and highest quartiles.

For the low performers, there was:

- a 2% increase in each of the lowest and second quartiles
- a 3% increase in the third quartile
- a 1% increase in the highest quartile.

TABLE 5.14 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and PISA 2015, by socioeconomic background

Socioeconomic background	20012 PISA				2015 PISA			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	33	1.1	6	0.6	35	1.2	4	0.6
Second quartile	22	1.1	10	0.7	24	1.1	7	0.8
Third quartile	13	1.0	17	1.0	16	0.9	12	1.0
Highest quartile	8	0.7	28	1.3	9	0.8	23	1.4

Students who achieved the National Proficient Standard

Table 5.15 shows the proportion of students who achieved the National Proficient Standard in mathematical literacy by socioeconomic background quartiles from PISA 2003 to 2015.

Between 2003 and 2015, there was an 11% decrease in the lowest quartile, a 13% decrease in the second quartile, a 12% decrease in the third quartile and a 9% decrease in the highest quartile.

Between 2012 and 2015, there was a 3% decrease in the lowest quartile, a 4% decrease in each of the second and third quartiles and a 2% decrease in the highest quartile.

TABLE 5.15 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by socioeconomic background

Socioeconomic background	PISA 2003		PISA 2006		PISA 2009		PISA 2012		2015 PISA	
	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	48	1.8	49	1.2	45	1.3	40	1.2	37	12
Second quartile	62	1.5	62	1.4	59	1.7	53	1.1	50	1.2
Third quartile	74	1.2	70	1.1	71	1.3	66	1.2	63	1.4
Highest quartile	85	1.1	83	1.0	84	0.9	78	1.0	76	1.4

Mathematical literacy results for PISA 2015 by immigrant background

Mathematical literacy performance

Figure 5.25 shows the results for mathematical literacy performance based on students' immigrant background (a self-report of where they and their parents were born).[53] Australian-born students achieved an average mathematical literacy score of 491 points, which was significantly lower than the score of first-generation students (505 points). The difference between these average scores is equal to around half a year of schooling. Foreign-born students achieved an average score of 497 points, which was not significantly different to the performance of Australian-born students or first-generation students.

53 The Reader's Guide provides more information about immigrant background.

The mathematical literacy performance of first-generation students was significantly higher than the OECD average (by 15 points), while the performance of Australian-born and foreign-born students was not significantly different to that of students across the OECD.

The spread of scores between the lowest and highest achieving students was similar for Australian-born students (299 points) and first-generation students (303 points), but was narrower than the spread of scores for foreign-born students (324 points).

Immigrant background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
Australian-born	491	1.5	488–494	299
First-generation	505	2.8	500–511	303
Foreign-born	497	4.1	489–505	324

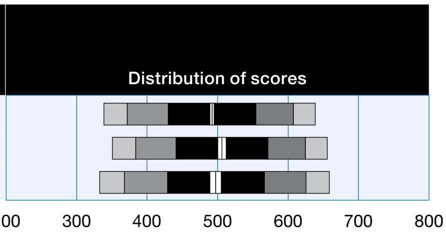


FIGURE 5.25 Average scores and distribution of students' performance on the mathematical literacy scale, by immigrant background

Mathematical literacy proficiency

Figure 5.26 shows the proportion of students by immigrant background at each proficiency level on the mathematical literacy scale. Ten per cent of Australian-born students were high performers compared to 14% of first-generation students and 14% of foreign-born students. At the lower end of the mathematical literacy proficiency scale, the proportions of low performers for Australian-born and foreign-born students were similar (22%), while the proportion of first-generation students was 18%.

The proportion of high-performing Australian-born students was similar to the proportion of high-performing students across the OECD, while the proportions of high-performing first-generation and foreign-born students were higher than the proportion of high-performing students across the OECD. Conversely, the proportions of low-performing Australian-born and foreign-born students were similar to the proportion of low-performing students across the OECD, and the proportion of low-performing first-generation students was lower than the proportion of low-performing students across the OECD.

Fifty-five per cent of Australian-born students achieved the National Proficient Standard in mathematical literacy compared to 60% of first-generation students and 56% of foreign-born students.

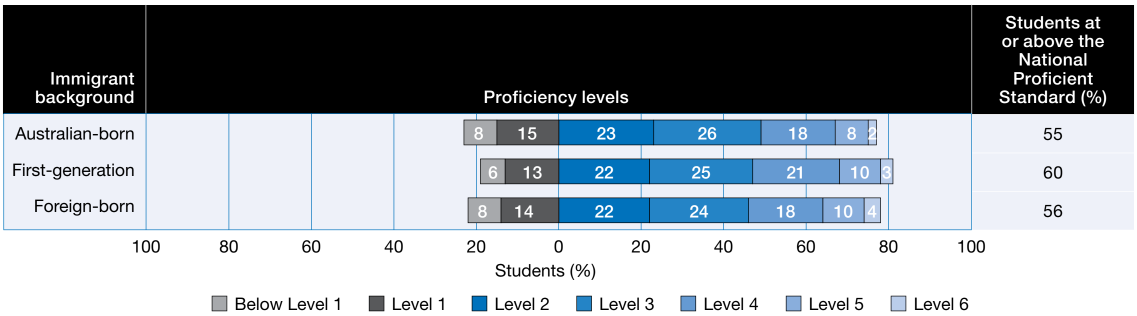


FIGURE 5.26 Percentage of students across the mathematical literacy proficiency scale, by immigrant background

Mathematical literacy results over time by immigrant background

Mathematical literacy performance

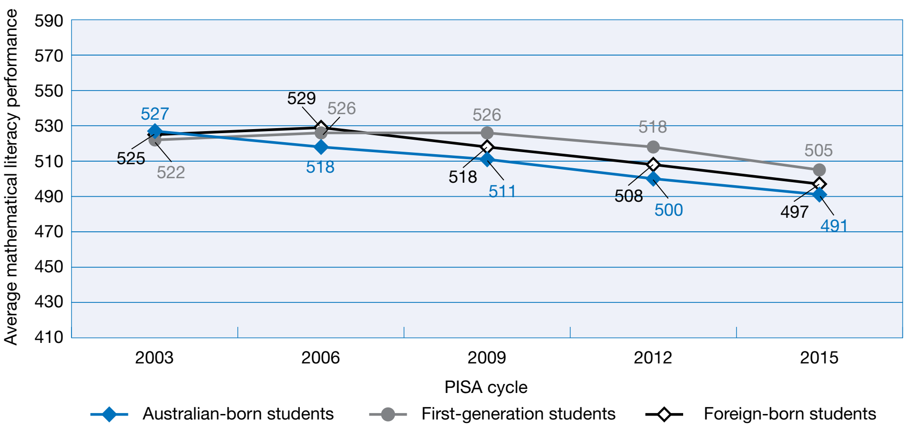
Figure 5.27 shows the average performance in mathematical literacy from PISA 2003 to 2015, along with details about the change in performance, and significance between cycles, by immigrant background.

Between 2003 and 2015, mathematical literacy performance declined significantly for all immigrant background groups. There was a 35-point decline for Australian-born students, a 17-point decline for first-generation students and a 28-point decline for foreign-born students.

The difference in performance between Australian-born students and first-generation students in 2003 was 5 points. The difference in performance between Australian-born students and first-generation students in 2015 was 14 points. This gap has not changed significantly between 2003 and 2015.

The difference in performance between Australian-born students and foreign-born students in 2003 was 2 points. The difference in performance between Australian-born students and foreign-born students in 2015 was 6 points. This gap has not changed significantly between 2003 and 2015.

The difference in performance between first-generation students and foreign-born students in 2003 was 3 points. The difference in performance between first-generation students and foreign-born students in 2015 was 8 points. This gap has not changed significantly between 2003 and 2015.



Australian-born								
	Difference between years							
	2012		2009		2006		2003	
2015	–9	▼	–19	▼	–27	▼	–35	▼
2012			–11	▼	–18	▼	–27	▼
2009					–7	▼	–16	▼
2006							–9	▼

First-generation								
	Difference between years							
	2012		2009		2006		2003	
2015	–13	▼	–21	▼	–21	▼	–17	▼
2012			–8		–8		–3	
2009					0		4	
2006							4	

Foreign-born								
	Difference between years							
	2012		2009		2006		2003	
2015	–11		–21	▼	–33	▼	–28	▼
2012			–10		–21	▼	–17	▼
2009					–11		–7	
2006							4	

Note: read across the table row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.27 Average mathematical literacy performance over time, PISA 2003 to 2015, by immigrant background

Mathematical literacy proficiency

Table 5.16 shows the proportion of low and high performers in mathematical literacy for PISA 2012 and 2015. The proportion of high performers for each of the immigrant backgrounds decreased between 2012 and 2015: by 2% for Australian-born students, 6% for first-generation students and 4% for foreign-born students. In this same period, the proportion of low performers for each of the immigrant backgrounds increased: there was a 3% increase for Australian-born students and a 2% increase for each of the first-generation and foreign-born students.

TABLE 5.16 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and PISA 2015, by immigrant background

Immigrant background	PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
Australian-born	19	0.8	12	0.5	22	1.0	10	0.6
First-generation	17	0.8	19	1.3	18	0.9	14	1.2
Foreign-born	20	1.3	17	1.3	22	1.8	14	1.4

Students who achieved the National Proficient Standard

Table 5.17 shows that between PISA 2003 and 2015, the proportion of students who achieved the National Proficient Standard in mathematical literacy decreased. There was a 14% decrease for Australian-born students, a 5% decrease for first-generation students and an 11% decrease for foreign-born students. Between 2012 and 2015, there was a 3% decrease for each of the immigrant background groups who achieved the National Proficient Standard.

TABLE 5.17 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by immigrant background

Immigrant background	PISA 2003		PISA 2006		PISA 2009		PISA 2012		2015 PISA	
	%	SE	%	SE	%	SE	%	SE	%	SE
Australian-born	68	0.9	66	1.1	63	1.2	58	0.9	55	0.9
First-generation	65	2.0	69	1.5	68	1.1	63	1.2	60	1.4
Foreign-born	67	2.2	68	2.1	64	2.4	59	1.6	56	2.2

Mathematical literacy results for PISA 2015 by language background

Mathematical literacy performance

Figure 5.28 shows that the mathematical literacy performance of students who spoke English at home was not significantly different to students who spoke a language other than English at home. The performance of students who spoke English at home was significantly higher than the OECD average, by 6 points, while there were no significant differences between students who spoke a language other than English and the OECD average.

The spread of scores for students who spoke a language other than English at home was 337 points, and 36 points larger than for students who spoke English at home.

Language background	Avg. score	SE	Confidence interval	Differences between 5th & 95th percentiles
English spoken at home	496	1.5	499–494	301
Language other than English spoken at home	487	4.7	496–478	337

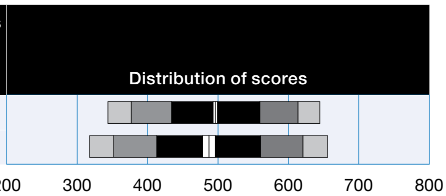


FIGURE 5.28 Average scores and distribution of students' performance on the mathematical literacy scale, by language background

Mathematical literacy proficiency

Figure 5.29 shows the similarity between the high performers in the two language background groups. Eleven per cent of students who spoke English at home and 13% of students who spoke a language other than English at home were high performers, while 21% of students who spoke English at home and 27% of students who spoke a language other than English at home were low performers.

The proportion of high performers, regardless of the language spoken at home, was similar to the proportion of high performers across the OECD, while the proportion of low performers who spoke English at home was lower than for the proportion of low performers across the OECD. The proportion of low performers who spoke a language other than English at home was higher than the proportion of low performers across the OECD.

Fifty-seven per cent of students who spoke English at home achieved the National Proficient Standard, and 52% of the students who spoke a language other than English at home achieved this standard.

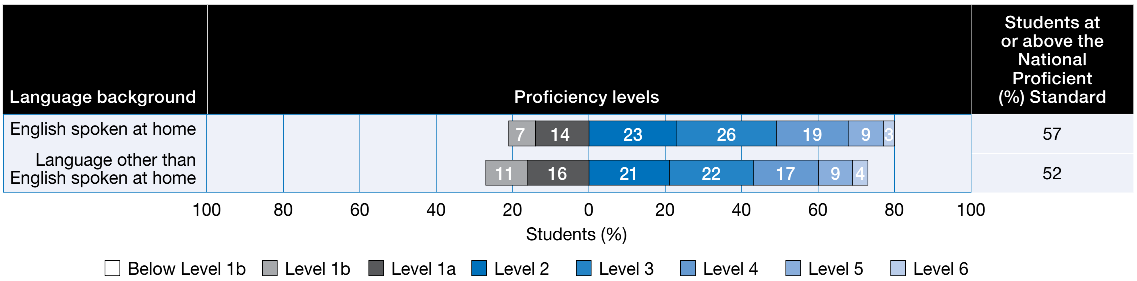


FIGURE 5.29 Percentage of students across the mathematical literacy proficiency scale, by language background

Mathematical literacy results over time by language background[54]

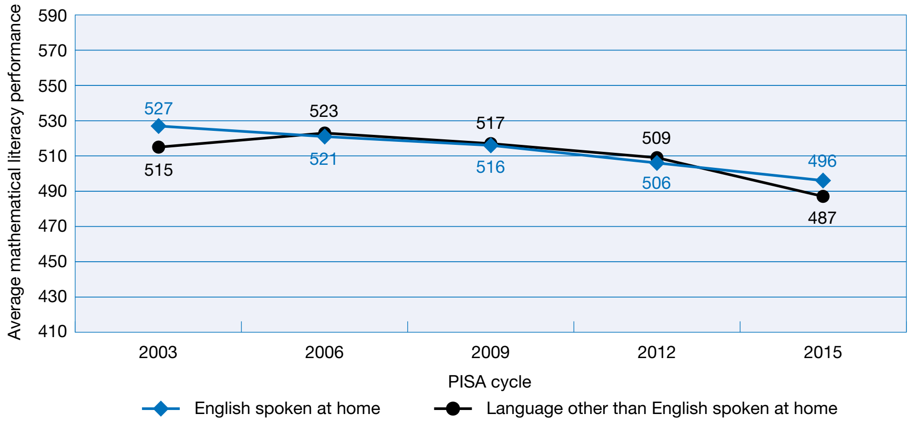
Mathematical literacy performance

Figure 5.30 shows that between PISA 2003 and 2015, mathematical literacy performance declined significantly for both language group backgrounds. There was a 31-point decline for students who spoke English at home, and a 28-point decline for students who spoke a language other than English at home.

Between 2012 and 2015, mathematical literacy performance also declined; however, the change in performance was larger for students who spoke a language other than English at home (by 22 points) compared to students who spoke English at home (by 9 points).

The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2003 was 12 points. The difference in performance between students who spoke English at home and students who spoke a language other than English at home in 2015 was also 9 points. This gap has not changed significantly between 2003 and 2015.

54 The question about students' language background in PISA 2000 was not asked in the same way as in other PISA assessments and is therefore not comparable. Results on language background for PISA 2000 have not been included in this section.



English spoken at home								
	Difference between years							
	2012		2009		2006		2003	
2015	−9	▼	−20	▼	−25	▼	−31	▼
2012			−11	▼	−16	▼	−22	▼
2009					−5		−11	▼
2006							−6	

Language other than English spoken at home								
	Difference between years							
	2012		2009		2006		2003	
2015	−22	▼	−30	▼	−36	▼	−28	▼
2012			−8		−13		−6	
2009					−6		2	
2006							8	

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.30 Average mathematical literacy performance over time, PISA 2003 to PISA 2015, by language background

Mathematical literacy proficiency

Table 5.18 shows the proportion of low and high performers in mathematical literacy in 2012 and 2015 by language background. During this period, there was a 3% decrease in the proportion of high performers who spoke English at home and a 7% decrease in the proportion of high performers who spoke a language other than English at home. At the lower end of the proficiency scale, there was a 2% increase in the proportion of low performers who spoke English at home and a 4% increase in the proportion of low performers who spoke a language other than English at home.

TABLE 5.18 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2012 and 2015, by language background

Language background	PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers	
	%	SE	%	SE	%	SE	%	SE
English spoken at home	19	0.6	14	0.6	21	0.6	11	0.6
Language other than English spoken at home	23	1.5	20	2.1	27	2.0	13	1.6

Students who achieved the National Proficient Standard

Table 5.19 shows that between PISA 2003 and 2015, the proportion of students who achieved the National Proficient Standard in mathematical literacy decreased by 12% for students who spoke English at home and 10% for students who spoke a language other than English between.

Between 2012 and 2015, the proportions of students who achieved the National Proficient Standard in mathematical literacy decreased by 3% for students who spoke English at home and 7% for students who spoke a language other than English.

TABLE 5.19 Percentage of students at or above the National Proficient Standard on the mathematical literacy scale from PISA 2003 to 2015, by language background

Language background	PISA 2003		PISA 2006		PISA 2009		PISA 2012		2015 PISA	
	%	SE	%	SE	%	SE	%	SE	%	SE
English spoken at home	68	0.9	67	0.9	65	1.0	59	0.8	57	0.8
Language other than English spoken at home	62	2.5	65	2.7	62	2.8	59	1.8	52	2.4

Mathematical literacy results by sex

Mathematical literacy performance in PISA 2015 across countries by sex

Figure 5.31 provides the average scores and standard errors for females and males on the mathematical literacy scale, graphs the difference by sex and indicates whether the difference is statistically significant.

Across the OECD countries, the average score for females was 486 points and for males was 494 points, a significant difference of 8 points. Females significantly outperformed males in 4 countries (Albania, Finland, Macao (China), and Trinidad and Tobago), with the largest difference found in Trinidad and Tobago where females scored 18 points higher than males. Males significantly outperformed females in 20 countries with the largest differences found in Italy and Austria where males scored, on average, 20 points or more higher than females. In Australia, females scored 491 points on average, which was not significantly different to the average score of 497 points for males.

Country	Females Avg. score	Females SE	Males Avg. score	Males SE
Austria	483	3.6	510	3.8
Italy	480	3.4	500	3.5
Chile	413	3.0	432	3.1
Germany	498	3.0	514	3.5
Ireland	495	2.4	512	3.0
Spain	478	2.8	494	2.4
Belgium	500	2.8	514	3.1
Japan	525	3.1	539	3.8
Uruguay	412	2.5	425	3.6
Croatia	458	3.4	471	3.7
Switzerland	515	3.5	527	3.2
United Kingdom	487	3.1	498	2.9
Poland	499	2.8	510	2.8
Luxembourg	480	2.0	491	2.0
Portugal	487	2.7	497	3.0
Denmark	506	2.8	516	2.5
Canada	511	2.6	520	2.9
New Zealand	491	2.7	499	3.4
United States	465	3.4	474	3.6
Israel	466	4.0	474	5.4
Hungary	473	3.0	481	3.6
OECD average	**486**	**0.5**	**494**	**0.6**
Mexico	404	2.4	412	2.7
Czech Republic	489	2.8	496	3.3
France	490	2.6	496	2.9
Russian Federation	491	3.2	497	4.0
Turkey	418	4.9	423	4.6
B-S-J-G (China)	528	5.7	534	4.8
Australia	**491**	**2.5**	**497**	**2.1**
Slovak Republic	472	3.6	478	3.0
Chinese Taipei	539	4.1	545	4.7
Estonia	517	2.3	522	2.7
Slovenia	508	2.2	512	1.9
Netherlands	511	2.5	513	2.6
Hong Kong (China)	547	4.3	549	3.6
Romania	444	4.1	444	4.2
Montenegro	418	2.0	418	2.1
Greece	454	3.6	454	4.7
Singapore	564	1.7	564	2.1
Iceland	489	2.4	487	2.9
Lithuania	479	2.5	478	2.8
Bulgaria	442	4.3	440	4.8
Moldova	421	3.1	419	2.9
Latvia	483	2.5	481	2.6
Sweden	495	3.3	493	3.8
Norway	503	2.3	501	2.9
Thailand	417	3.4	414	3.7
Vietnam	496	4.8	493	4.7
Malta	481	2.4	477	2.4
Cyprus	440	2.2	435	2.1
United Arab Emirates	431	2.9	424	3.9
Korea	528	3.9	521	5.2
Finland	515	2.6	507	2.6
Macao (China)	548	1.5	540	1.7
Albania	418	3.5	409	4.2
Trinidad and Tobago	426	2.0	408	2.1

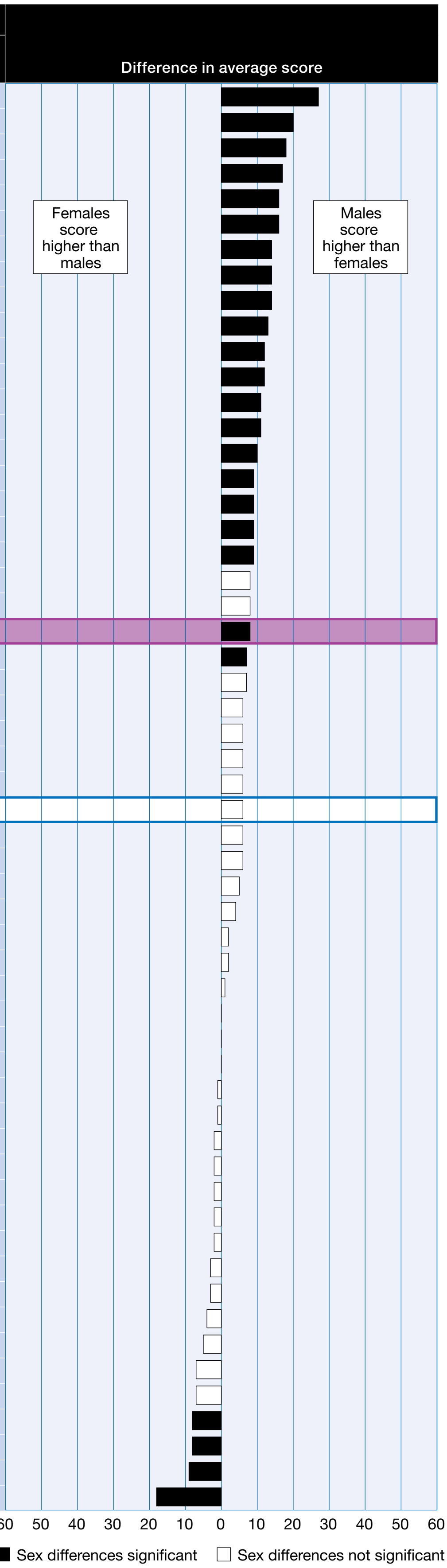


FIGURE 5.31 Average scores and differences in students' performance on the mathematical literacy scale, by country and sex

Mathematical literacy proficiency in PISA 2015 for Australia by sex

Figure 5.32 shows the proportion of females and males for Australia and the OECD average at each level of the mathematical literacy proficiency scale. The proportion of high-performing females and males for Australia was similar to the proportion of high-performing females and males for the OECD average. The results show that:

- 10% of Australian females and 13% of Australian males were high performers
- 9% of females and 12% of males across the OECD were high performers.

The proportion of low-performing females and males for Australia was also similar to the proportion of low-performing females and males for the OECD average. The results show that:

- 22% each of Australian females and Australian males were low performers
- 24% of females and 23% of males across the OECD were low performers.

Similar proportions of Australian females and males achieved the National Proficient Standard in mathematical literacy.

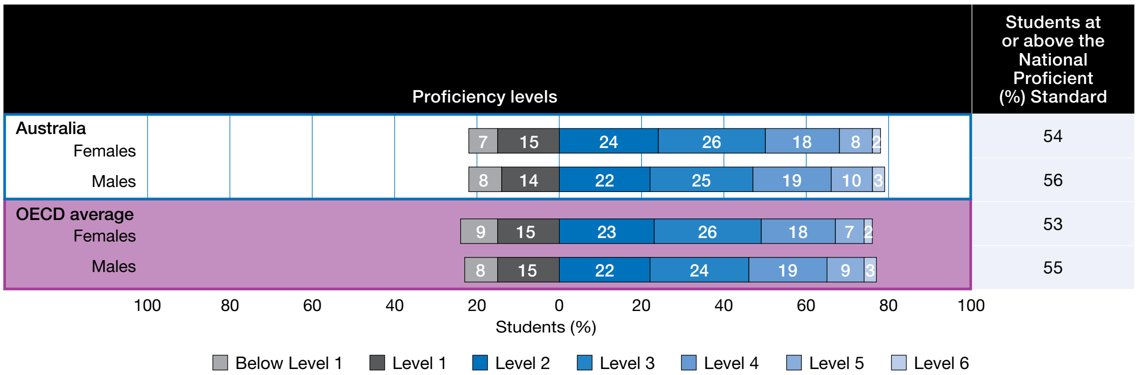


FIGURE 5.32 Percentage of students across the mathematical literacy proficiency scale by sex, for Australia and the OECD average

Mathematical literacy results over time across countries by sex

Table 5.20 shows the average mathematical literacy scores for females and males for PISA 2012 and 2015, along with the average differences for females and males between 2012 and 2015. Over this period, the average performance in mathematical literacy across the OECD declined significantly for females by 3 points and for males by 6 points. Table 5.20 also shows that:

- The performance of females and males declined significantly between 2012 and 2015 in 6 countries (Australia, Chinese Taipei, Korea, Singapore, Switzerland and Turkey). The change in performance for females ranged from 7 points in Australia to 26 points in Turkey, and the change for males ranged from 8 points in Singapore to 41 points in Korea.
- The performance of both females and males significantly improved between 2012 and 2015 in 6 countries (Albania, Denmark, Montenegro, Norway, Slovenia and Sweden). The change in performance for females ranged from 8 points in Montenegro to 23 points in Albania, and the change in performance of males ranged from 8 points in Montenegro to 16 points in Sweden.
- There were 18 countries whose performance for females or males significantly changed between 2012 and 2015:
  - in Austria, Belgium, Germany, Iceland, Latvia, Poland, Thailand and the United States, the performance of females declined significantly (ranging from 7 points in Iceland to 17 points in Poland)
  - in Uruguay and Macao (China), the average performance of females improved significantly (8 and 11 points)
  - in Cyprus, Finland, Hong Kong (China), Luxembourg, Mexico, the Netherlands and Vietnam, male performance declined significantly (ranging from 5 points in Cyprus to 24 points in Vietnam)
  - in the Russian Federation, male performance improved significantly by 16 points.

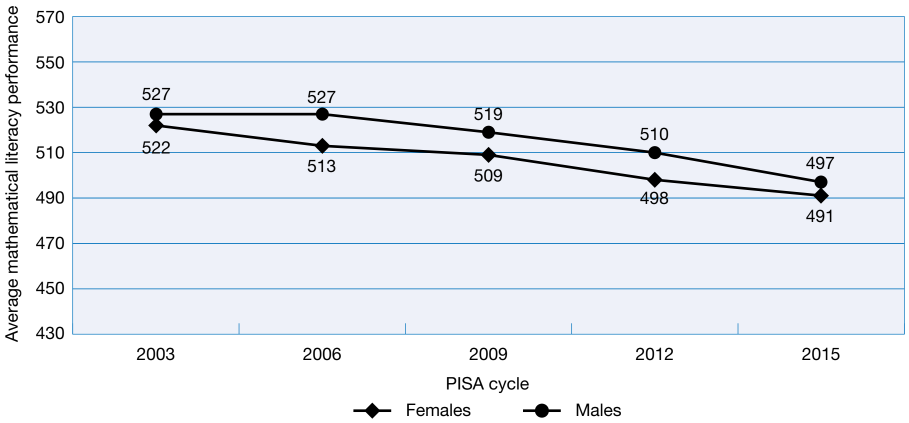
TABLE 5.20 Average mathematical literacy scores for PISA 2012 and PISA 2015, and differences in performance between PISA 2012 and PISA 2015, by country and sex

	PISA 2012				PISA 2015				Differences in average score between 2012 and 2015 (PISA 2015 – PISA 2012)					
	Females		Males		Females		Males		Females			Males		
Country	Avg. score	SE	Avg. score	SE	Avg. score	SE	Avg. score	SE	Score dif.		SE	Score dif.		SE
Albania	395	2.6	394	2.6	418	3.5	409	4.2	**23**	▲	4.3	**15**	▲	5.0
Australia	498	2.0	510	2.4	491	2.5	497	2.1	**–7**	▼	3.2	**–13**	▼	3.2
Austria	494	3.3	517	3.9	483	3.6	510	3.8	**–11**	▼	4.8	–7		5.4
Belgium	509	2.6	520	2.9	500	2.8	514	3.1	**–9**	▼	3.8	–6		4.2
Bulgaria	440	4.2	438	4.7	442	4.3	440	4.8	2		6.1	3		6.7
Canada	513	2.1	523	2.1	511	2.6	520	2.9	–2		3.3	–3		3.6
Chile	411	3.1	436	3.8	413	3.0	432	3.1	3		4.3	–4		4.9
Chinese Taipei	557	5.7	563	5.4	539	4.1	545	4.7	**–18**	▼	7.0	**–17**	▼	7.2
Croatia	465	3.7	477	4.4	458	3.4	471	3.7	–7		5.0	–6		5.7
Cyprus	440	1.6	440	1.5	440	2.2	435	2.1	0		2.7	**–5**	▼	2.6
Czech Republic	493	3.6	505	3.7	489	2.8	496	3.3	–4		4.5	–9		5.0
Denmark	493	2.3	507	2.9	506	2.8	516	2.5	**13**	▲	3.6	**9**	▲	3.8
Estonia	518	2.2	523	2.6	517	2.3	522	2.7	–1		3.2	–1		3.7
Finland	520	2.2	517	2.6	515	2.6	507	2.6	–5		3.4	**–10**	▼	3.7
France	491	2.5	499	3.4	490	2.6	496	2.9	–1		3.7	–3		4.5
Germany	507	3.4	520	3.0	498	3.0	514	3.5	**–9**	▼	4.5	–6		4.6
Greece	449	2.6	457	3.3	454	3.6	454	4.7	5		4.5	–3		5.7
Hong Kong (China)	553	3.9	568	4.6	547	4.3	549	3.6	–6		5.8	**–19**	▼	5.8
Hungary	473	3.6	482	3.7	473	3.0	481	3.6	0		4.7	–1		5.2
Iceland	496	2.3	490	2.3	489	2.4	487	2.9	**–7**	▼	3.3	–2		3.7
Ireland	494	2.6	509	3.3	495	2.4	512	3.0	2		3.6	3		4.4
Israel	461	3.5	472	7.8	466	4.0	474	5.4	5		5.3	2		9.5
Italy	476	2.2	494	2.4	480	3.4	500	3.5	4		4.1	6		4.3
Japan	527	3.6	545	4.6	525	3.1	539	3.8	–2		4.8	–6		6.0
Korea	544	5.1	562	5.8	528	3.9	521	5.2	**–16**	▼	6.5	**–41**	▼	7.8
Latvia	493	3.2	489	3.4	483	2.5	481	2.6	**–9**	▼	4.0	–7		4.3
Lithuania	479	3.0	479	2.8	479	2.5	478	2.8	0		3.9	–1		4.0
Luxembourg	477	1.4	502	1.5	480	2.0	491	2.0	3		2.4	**–11**	▼	2.5
Macao (China)	537	1.3	540	1.4	548	1.5	540	1.7	**11**	▲	2.0	0		2.2
Mexico	406	1.4	420	1.6	404	2.4	412	2.7	–2		2.8	**–9**	▼	3.1
Montenegro	410	1.6	410	1.6	418	2.0	418	2.1	**8**	▲	2.6	**8**	▲	2.6
Netherlands	518	3.9	528	3.6	511	2.5	513	2.6	–7		4.6	**–14**	▼	4.4
New Zealand	492	2.9	507	3.2	491	2.7	499	3.4	–1		4.0	–8		4.7
Norway	488	3.4	490	2.8	503	2.3	501	2.9	**15**	▲	4.1	**10**	▲	4.0
Poland	516	3.8	520	4.3	499	2.8	510	2.8	**–17**	▼	4.7	–9		5.1
Portugal	481	3.9	493	4.1	487	2.7	497	3.0	5		4.8	4		5.1
Romania	443	4.0	447	4.3	444	4.1	444	4.2	1		5.7	–2		6.0
Russian Federation	483	3.1	481	3.7	491	3.2	497	4.0	8		4.4	**16**	▲	5.4
Singapore	575	1.8	572	1.9	564	1.7	564	2.1	**–11**	▼	2.5	**–8**	▼	2.8
Slovak Republic	477	4.1	486	4.1	472	3.6	478	3.0	–4		5.4	–8		5.1
Slovenia	499	2.0	503	2.0	508	2.2	512	1.9	**9**	▲	3.0	**9**	▲	2.8
Spain	476	2.0	492	2.4	478	2.8	494	2.4	2		3.4	1		3.4
Sweden	480	2.4	477	3.0	495	3.3	493	3.8	**15**	▲	4.1	**16**	▲	4.9
Switzerland	524	3.1	537	3.5	515	3.5	527	3.2	**–9**	▼	4.7	**–10**	▼	4.8
Thailand	433	4.1	419	3.6	417	3.4	414	3.7	**–16**	▼	5.3	–5		5.2
Turkey	444	5.7	452	5.1	418	4.9	423	4.6	**–26**	▼	7.5	**–29**	▼	6.9
United Arab Emirates	436	3.0	432	3.8	431	2.9	424	3.9	–6		4.2	–7		5.4
United Kingdom	488	3.8	500	4.2	487	3.1	498	2.9	–1		4.9	–2		5.1
United States	479	3.9	484	3.8	465	3.4	474	3.6	**–14**	▼	5.2	–10		5.3
Uruguay	404	2.9	415	3.5	412	2.5	425	3.6	**8**	▲	3.8	10		5.0
Vietnam	507	4.7	517	5.6	496	4.8	493	4.7	–11		6.7	**–24**	▼	7.3
OECD average	491	0.6	501	0.6	488	0.5	495	0.6	**–3**	▼	0.8	**–6**	▼	0.9

Notes: the symbols indicate if the change in performance is significantly higher (▲) or signifcantly lower (▼).
Only countries that participated in both PISA 2012 and 2015 are shown.

Figure 5.33 shows the average mathematical literacy scores for Australian females and males from PISA 2003 to 2015. In 2015, females achieved an average score of 491 points, which was significantly lower than their average score in 2003 (by 31 points). The difference in performance for females between 2012 and 2015 was not significantly different. The difference in performance for males between 2003 and 2015, and also between 2012 and 2015 was significant. In 2015, males achieved an average score of 497 points, which was 30 points lower than in 2003 and 13 points lower than in 2012.

The difference in performance between females and males in 2003 was 9 points. The difference in performance between females and males in 2015 was 8 points. This gap has not changed significantly between 2003 and 2015.



Females				
	Difference between years			
	2012	2009	2006	2003
2015	–7	–18 ▼	–22 ▼	–31 ▼
2012		–12 ▼	–15 ▼	–24 ▼
2009			–3	–12 ▼
2006				–9 ▼

Males				
	Difference between years			
	2012	2009	2006	2003
2015	–13 ▼	–23 ▼	–30 ▼	–30 ▼
2012		–9 ▼	–17 ▼	–17 ▼
2009			–8	–7
2006				0

Note: read across the row to determine whether the performance in the row year is significantly higher (▲) or signifcantly lower (▼) than the performance in the column year.

FIGURE 5.33 Average mathematical literacy performance and differences over time, PISA 2003 to 2015, for Australia by sex

Mathematical literacy proficiency over time for Australia by sex

Table 5.21 shows that since mathematical literacy results were first reported in 2003, the proportion of low-performing females has increased by 8% and proportion of low-performing males has increased by 7%, while the proportion of high-performing females has declined by 8% and the proportion of high-performing males has declined by 9%.

TABLE 5.21 Percentage of low and high performers on the mathematical literacy proficiency scale for PISA 2003, 2012 and 2015, by sex, for Australia

	PISA 2003				PISA 2012				PISA 2015			
	Low performers		High performers		Low performers		High performers		Low performers		High performers	
Sex	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Females	14	0.9	18	1.0	21	0.8	12	0.6	22	1.0	10	0.8
Males	15	0.8	22	1.2	18	0.8	17	1.0	22	0.9	13	0.7

Mathematical literacy performance in PISA 2015 across jurisdictions by sex

Figure 5.34 shows that males performed significantly higher than females in two jurisdictions: Victoria and the Northern Territory. In Victoria, 13 points separated males from females, which equates to around half a year of schooling, while the gap in performance between males and females in the Northern Territory was larger (28 points), and represents around one year of schooling.

	Females		Males	
Jurisdiction	Avg. score	SE	Avg. score	SE
NT	464	6.9	492	10.2
VIC	492	4.2	505	3.9
SA	486	4.9	493	5.5
ACT	502	4.9	509	4.8
WA	501	4.5	506	5.3
NSW	492	4.1	496	4.1
TAS	467	5.7	471	6.2
QLD	487	4.4	486	4.3

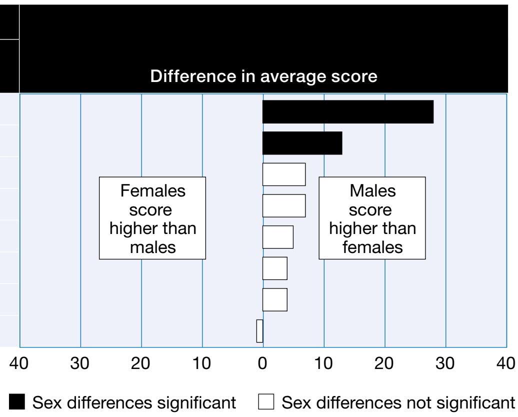


FIGURE 5.34 Average scores and differences in students' performance on the mathematical literacy scale, by jurisdiction and sex

Mathematical literacy proficiency in PISA 2015 across jurisdictions by sex

Figure 5.35 shows the proportion of females and males across the mathematical literacy proficiency scale by jurisdiction. The proportion of females and males across the OECD countries has also been included for comparison.

High-performing males

In three jurisdictions, the proportion of high-performing males was lower than the proportion of high-performing males across the OECD (12%) and in the other jurisdictions, the proportion of high-performing males was higher than the proportion of high-performing males across the OECD. The proportions of high-performing males ranged from 8% in Tasmania to 16% in each of the Australian Capital Territory and the Northern Territory.

High-performing females

In 4 jurisdictions, the proportion of high-performing females was lower than the proportion of high-performing females across the OECD (9%) and in the other jurisdictions, the proportion of high-performing females was either the same or higher than the proportion of high-performing females across the OECD. The proportions of high-performing females ranged from 6% in the Northern Territory to 12% in New South Wales.

Low-performing males

In 4 jurisdictions, the proportion of low-performing males was lower than the proportion of low-performing males across the OECD (23%) and in the other jurisdictions, the proportion of low-performing males was either the same or higher than the proportion of low-performing males across the OECD. The proportions of low-performing males ranged from 18% in Western Australia to 31% in Tasmania.

Low-performing females

In 6 jurisdictions, the proportion of low-performing females was lower than the proportion of low-performing females across the OECD (24%) and in the other jurisdictions, the proportion of low-performing females was higher than the proportion of low-performing females across the OECD. The proportions of low-performing females ranged from 17% in Western Australia to 33% in Tasmania.

The proportion of females who achieved the National Proficient Standard in mathematical literacy ranged from 42% in Tasmania to 61% in the Australian Capital Territory, while the proportion of males who achieved the National Proficient Standard ranged from 46% in Tasmania to 61% in the Australian Capital Territory.

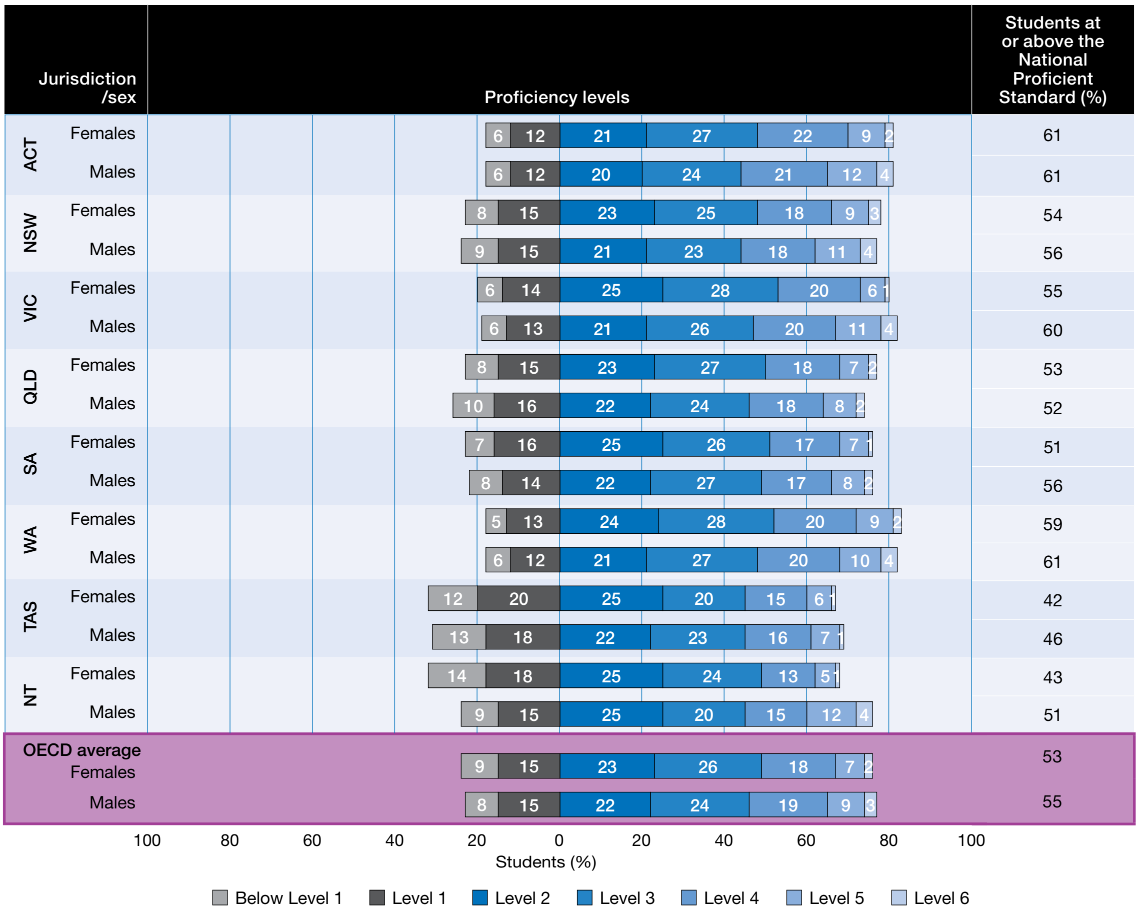


FIGURE 5.35 Percentage of students across the mathematical literacy proficiency scale, by jurisdiction and sex

Mathematical literacy performance in PISA 2015 across the school sectors by sex

Figure 5.36 shows that there were no significant differences between the performances of females and males in mathematical literacy across the school sectors.

School sector	Females Avg. score	Females SE	Males Avg. score	Males SE
Government	475	3.3	480	2.5
Catholic	501	3.9	506	4.6
Independent	526	4.4	538	4.0

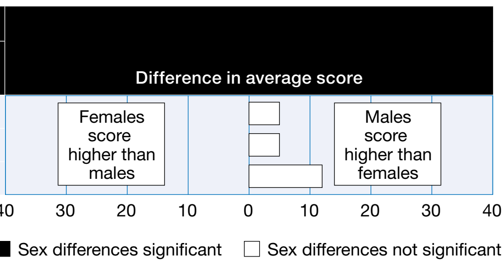


FIGURE 5.36 Average scores and differences in students' performance on the mathematical literacy scale, by school sector and sex

Mathematical literacy proficiency in PISA 2015 across the school sectors by sex

Figure 5.37 shows that 7% of females in government schools were high performers, which was lower than the proportion of high-performing females in Catholic schools (10%), and about half the proportion of high-performing females in independent schools (16%). For high-performing males, 10% were in government schools compared to 13% in Catholic schools and 22% in independent schools.

The proportion of low-performing females in government schools was 28%, which was higher than the proportion of low-performing females in Catholic schools (17%) and in independent schools (11%). The findings were similar for low-performing males, with 28% in government schools, 18% in Catholic schools and 9% in independent schools.

Each school sector had a similar proportion of females and males who achieved the National Proficient Standard in mathematical literacy.

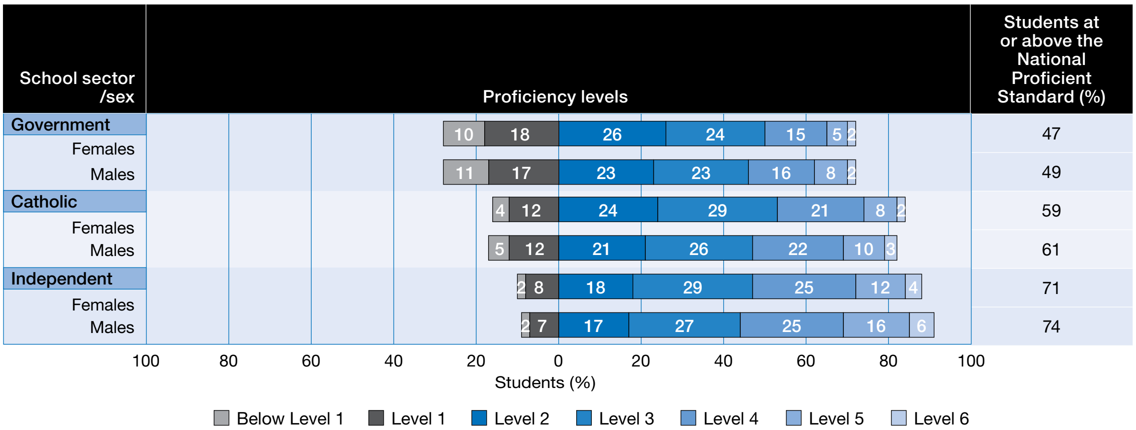


FIGURE 5.37 Percentage of students across the mathematical literacy proficiency scale, by school sector and sex

Mathematical literacy performance in PISA 2015 by Indigenous background and sex

Figure 5.38 shows that there were no significant differences between the performance of Indigenous females and males in mathematical literacy, and no significant differences between the performance of non-Indigenous females and males.

Indigenous background	Females		Males	
	Avg. score	SE	Avg. score	SE
Indigenous	425	4.1	430	4.1
Non-Indigenous	494	2.5	500	2.2

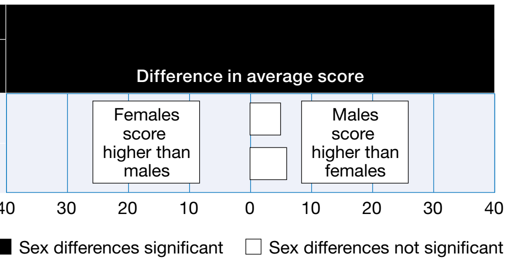


FIGURE 5.38 Average scores and differences in students' performance on the mathematical literacy scale, by Indigenous background and sex

Mathematical literacy proficiency in PISA 2015 by Indigenous background and sex

Figure 5.39 shows that there were similar proportions of high-performing Indigenous females (2%) compared to high-performing Indigenous males (3%), and there were similar proportions of low-performing Indigenous females and low-performing Indigenous males (50%).

The proportion of high-performing non-Indigenous female students was 10% and the proportion of high-performing non-Indigenous males was 13%. The proportion of low-performing non-Indigenous female students was the same proportion as the low-performing non-Indigenous males (21%).

The proportions of Indigenous and non-Indigenous females and males who achieved the National Proficient Standard in mathematical literacy were similar.

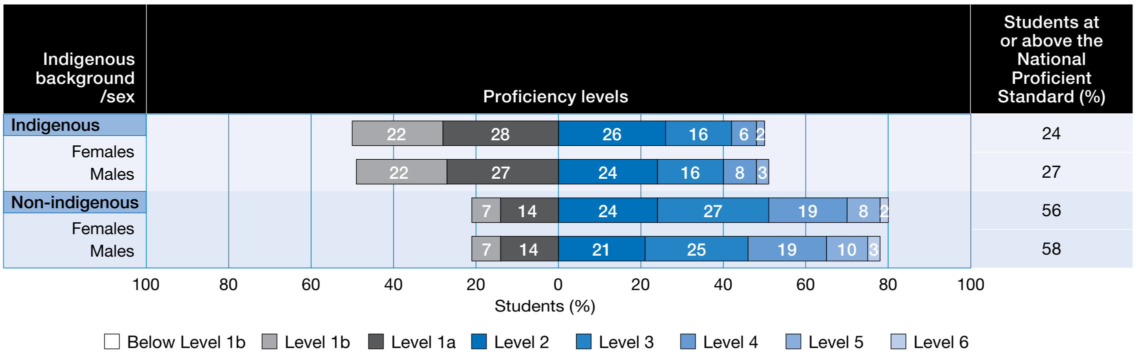


FIGURE 5.39 Percentage of students across the mathematical literacy proficiency scale, by Indigenous background and sex

CHAPTER 6

Equity in learning opportunities and outcomes

Key findings

- The overall socioeconomic gradient for Australia follows that of all other countries: each increment of the PISA scale of economic, social and cultural status (ESCS) was associated with an increase in performance in scientific literacy.
- The key proxy for equity in PISA is the strength of the relationship between socioeconomic background and performance – that is the degree to which variance in scientific literacy performance scores was explained by students' socioeconomic background. On this measure, the strength of the relationship in Australia was similar to that on average across OECD countries.
- The slope of the socioeconomic gradient was steeper in Australia than on average across the OECD. In Australia, the effect of socioeconomic background on performance in scientific literacy was higher than on average across the OECD.
- Victoria was the only jurisdiction in which the strength of the relationship between socioeconomic background and performance was weaker than on average across the OECD, placing it as high-equity. Victoria also had the flattest slope, indicating there was less of a relationship between ESCS and performance in Victoria than in other jurisdictions or on average across Australia.
- The difference between advantaged and disadvantaged students was 88 score points on average across the OECD and 92 score points in Australia. This is the equivalent of around three years of schooling or one full proficiency level.
- The amount of variance in performance between Australian schools was lower than the OECD average; however, the amount of variance within Australian schools was greater. With 25% of the variation being between schools though, it still matters which school a child attends.
- Regardless of their own socioeconomic background, students enrolled in a school with a high average socioeconomic background tended to perform at a higher level than students enrolled in a school with a low average socioeconomic background.

- Tasmanian schools had a larger proportion of disadvantaged students (those in the lowest quartile of ESCS) than any other jurisdiction, closely followed by Queensland. The Australian Capital Territory had a much greater proportion of high socioeconomic background students than any other jurisdiction.
- Independent schools had a proportionally greater number of high socioeconomic background students than Catholic schools, who in turn had a far greater proportion than government schools. Conversely, government schools had a far greater proportion of low socioeconomic background students than either Catholic or independent schools.

The Melbourne Declaration (MCEETYA, 2008) commits Australian governments to promoting excellence and equity in Australian schools. Among other things, this means that governments aim to:

- provide all students with access to high-quality schooling that is free from discrimination based on gender, language, sexual orientation, pregnancy, culture, ethnicity, religion, health or disability, socioeconomic background or geographic location
- ensure that Indigenous status and socioeconomic disadvantage ceases to be a significant determinant of educational outcomes
- reduce the effect of other sources of disadvantage, such as disability, homelessness, refugee status and remoteness (p. 7).

This understanding of equity in education resonates in the Sustainable Development Goals that were adopted by the United Nations in September 2015. In particular, Goal 4 encourages all countries to ensure 'inclusive and equitable quality education and promote lifelong learning opportunities for all'.

PISA collects a wealth of background data that, along with the achievement data, enables policymakers to examine progress towards both national and international goals. In particular, socioeconomic background and its relationship with achievement is the focus of this chapter, in terms of how it relates in a number of ways to 'fairness' and equity.

The PISA index of economic, social and cultural status

Socioeconomic status or background is a broad concept that summarises many different aspects of a student, school or system. In PISA, a students' socioeconomic background is measured by the *index of economic, social and cultural status* (ESCS), which is based on the highest level of the occupation of the students' parents or guardians, the highest level of parents' education, and an index of home possessions, which includes educational resources, cultural possessions and other items in the home. The index was built to allow international comparisons, and reflects many important differences across students and schools.

Socioeconomic advantage and disadvantage

Students are considered to be socioeconomically advantaged if they can be included in the 25% of students with the highest ESCS in their country, and they are considered to be socioeconomically disadvantaged if they can be included in the 25% of students with the lowest ESCS in their country.

PISA consistently finds that socioeconomic background is associated with performance at the system, school and student levels. These patterns reflect, to some extent, the inherent advantages in resources that relatively high socioeconomic status can provide. However, they may also reflect other characteristics that are associated with high socioeconomic status that are not measured by the PISA ESCS index. For example, high average socioeconomic status at the system level could be related to higher spending on education; at the school level, as a higher level and quality of educational resources; and at the student level, on parental attitudes and understanding of education, aspirations, and the provision of further resources.

In Australia, students from a socioeconomically advantaged background were much more likely to have parents with at least a tertiary degree or advanced research degree: 98% of advantaged students reported that at least one parent had this level of education compared to just 17% of disadvantaged students. Similarly, 98% of students from advantaged backgrounds reported that their parents were employed in skilled occupations (such as managers, teachers, doctors) compared to just 10% of the parents of disadvantaged students, who were most likely to be employed in semi-skilled blue-collar jobs (47%; building trades workers for example) or semi-skilled white-collar jobs (43%; sales people). In terms of home resources, 50% of students from advantaged backgrounds reported having more than 200 books in their home, compared with 7% of students from disadvantaged backgrounds, and 90% of students from advantaged backgrounds reported three or more computers in the home compared with 42% of students from disadvantaged backgrounds.

OECD research (OECD, 2015) has shown that a student who attends a disadvantaged school (i.e. a school with aggregate student socioeconomic background in the lowest quartile of achievement) in Australia was eight times more likely to be a low performer in mathematics than a student who attended a school with an advantaged student population (that is, a school in the top SES quartile). After the student's family's socioeconomic status was taken into account, the student in the disadvantaged school was four times more likely to be a low performer. This indicates that the social composition of schools has just as strong an impact on the likelihood of being a low achiever as a student's own family background.

The relationship between student background and achievement

The relationship between student background and achievement has been touched upon in each of the chapters of this report. In each of the PISA 2015 assessment domains of scientific literacy, reading literacy and mathematical literacy, there were significant increases in average performance from one socioeconomic quartile to the next. This relationship was also explored at the school-sector level in previous chapters, and these analyses showed that the average performance differences between sectors generally disappeared once student and average school-level socioeconomic background were accounted for. The differences in student performance that could be attributed to differences in the environments of government, Catholic and independent schools may be more to do with the socioeconomic background of the families of the students, and the cumulative effect of the cohort of students with whom the student attends school.

Across the OECD, 46 points separated the scientific literacy performance of students from advantaged backgrounds (those in the highest quartile of socioeconomic background) and the average student. In Australia, this difference was higher (59 points) and represented about two full years of schooling. Not surprisingly, the difference between advantaged and disadvantaged students was even larger: 88 points on average across the OECD and 92 score points in Australia. This is the equivalent of more than three years of schooling and one full proficiency level.

Socioeconomic gradients

The term 'socioeconomic gradient' refers to the relationship between an outcome and socioeconomic background. For PISA, the outcome is students' performance and the measure of socioeconomic background is the ESCS index. PISA data shows that there was a significant relationship between students' performance and their socioeconomic background as measured by ESCS. This relationship was evident in Australia and all other PISA countries, although the strength of the relationship differs among countries. Using a graphical representation, the line of best fit for the points that represent performance against socioeconomic background (ESCS) provides information about several aspects of the relationship. This line is referred to as the socioeconomic or social gradient.

Figure 6.1 shows the socioeconomic gradient for Australia plotted with the average gradient of the OECD countries participating in the PISA 2015 scientific literacy assessment. The slope of the gradient for Australia follows the general pattern for the international population as a whole, that is, each increment on the PISA ESCS scale was associated with a roughly consistent increase in performance on the scientific literacy scale.

Care should be taken in interpreting the association between achievement and socioeconomic background, especially when it is expressed as a single line as in Figure 6.1. The line represents an *average* indication of the association between achievement and socioeconomic background. If all students were situated on the line, it would mean that scientific literacy achievement could be accurately predicted simply by knowing a student's socioeconomic background. This was not the case, as there was a diverse range of scores that students achieved that did not fall on the line. To illustrate the range of results that was obtained, 10% of students were randomly chosen from the Australian sample and their results plotted as points on the graph. Each point represents one student. It can be seen that there was a wide range of results; a number of low socioeconomic background students achieved high scores and, conversely, students with high socioeconomic backgrounds achieved low scores.

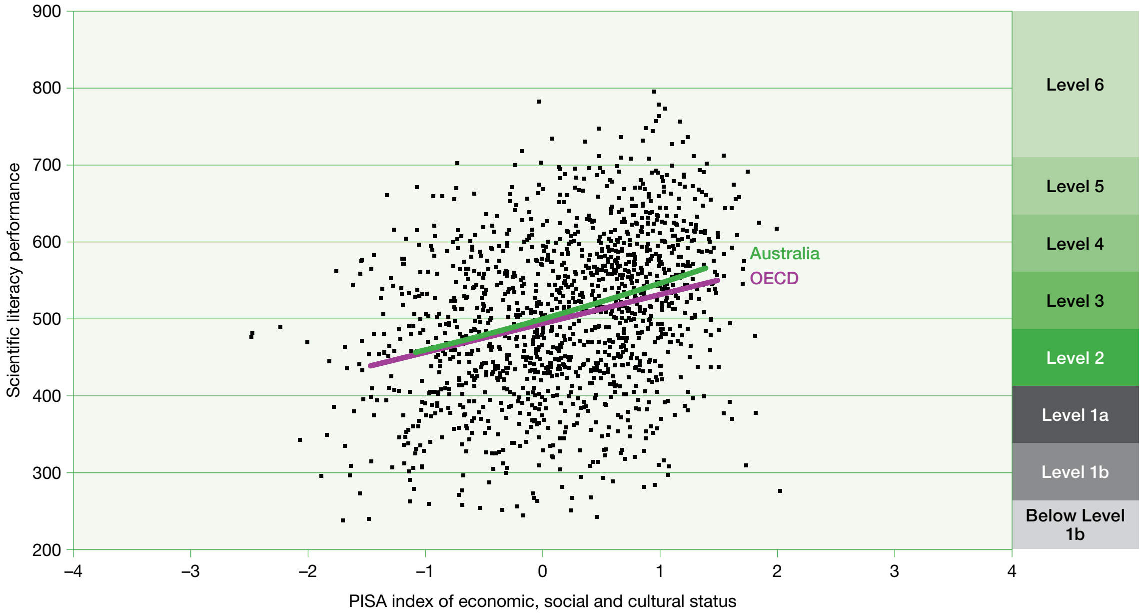


FIGURE 6.1 Socioeconomic gradients for Australia and the OECD in scientific literacy

The analysis of socioeconomic gradients is a means of characterising equity in terms of student performance and providing guidance for educational policy. Socioeconomic gradients can be used to compare the relationships between outcomes and student background across and within countries, and to examine changes in equity that occur from one cycle of PISA to another. Two of the key measures of this relationship are:

- The strength of the relationship between achievement and socioeconomic background, which refers to how well socioeconomic background predicts performance. It is important to consider how close individual results are to the line of best fit. In other words, are the points representing the performance and ESCS measures for all the individual students situated close to the line of best fit or are they widely scattered about it? The closer all the points are to the line of best fit, the greater the strength of the relationship. This aspect of the social gradient is represented by the percentage of the variation in performance that can be explained by the ESCS index. If the percentage is large it indicates that performance is relatively highly determined by ESCS, whereas if it is small it indicates that performance is not highly determined by ESCS.

- For OECD countries as a whole, the strength of the relationship between achievement in scientific literacy and socioeconomic background was 13%, which means that 13% of the variation in student performance was accounted for by socioeconomic background.
- In Australia, the strength of the relationship was 12%, which means that about 12% of the variation in achievement was explained by socioeconomic background. This was not significantly different to the OECD average.

- The slope of the gradient line, which refers to the impact of socioeconomic background on performance. A steeper slope indicates a greater impact of socioeconomic background on performance such that there is a bigger difference in performance between low socioeconomic background students and high socioeconomic background students than in systems with gentler slopes. Education systems typically aim to decrease the differences in performance between different social groups. Greater equity would thus be indicated by a flatter gradient. The slope of the gradient line for Australia for scientific literacy was 44, which was significantly higher than the OECD average of 38. This indicates significantly lower levels of equity than the OECD average.
- The slope and the strength of the gradient measure different aspects of the relationship between socioeconomic background and performance. If the slope of the gradient is steep and the strength of the relationship between socioeconomic background and performance is strong, the challenges for systems are the greatest. That is, students in these systems are more likely to perform at a level determined by their socioeconomic background and there is a greater performance differential between students from the most advantaged and least advantaged backgrounds. In Australia, it would seem that this was not the case, that while it did happen to some extent, there were many exceptions.

Figure 6.2 shows the strength and impact of students' socioeconomic background for countries that achieved average science scores that were equal to or higher than the OECD average, along with all Australian jurisdictions. Countries that scored significantly higher than Australia are also labelled. The upward sloping line of best fit shows that countries in which the impact of socioeconomic background on achievement was high tend to also show a high strength in the relationship between the two. In Australia, and separately for the jurisdictions of the Australian Capital Territory, New South Wales, Queensland, Tasmania and the Northern Territory, the impact of socioeconomic background was significantly higher than for the OECD on average. For the other jurisdictions, the impact was similar to the OECD.

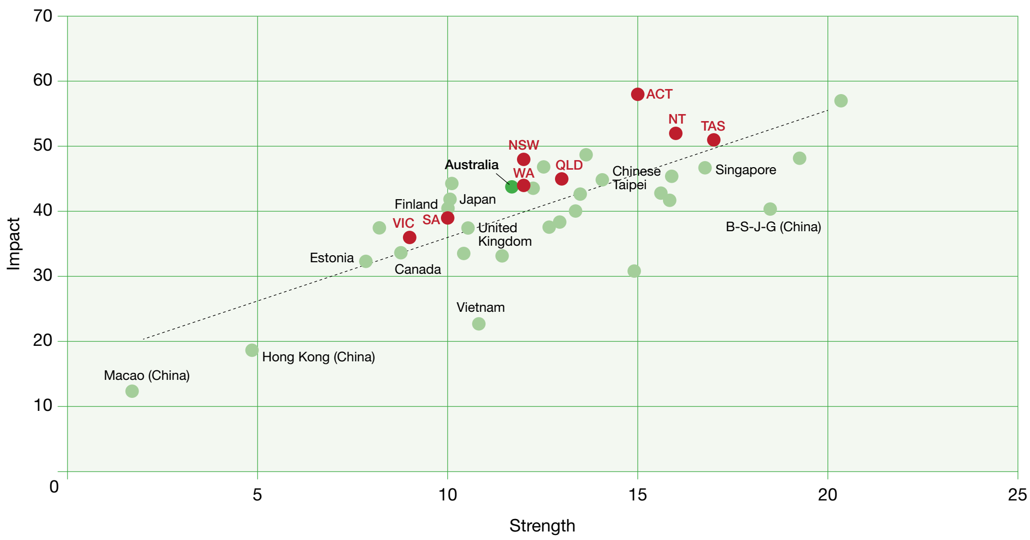


FIGURE 6.2 Relationship between strength and impact of socioeconomic background internationally and for the Australian jurisdictions

There were no discernible patterns among the countries that outperformed Australia. Hong Kong (China) and Macao (China) were two high-scoring countries that seemed to have relatively equal outcomes in regards to socioeconomic differences, while socioeconomic background had a relatively strong influence in Singapore and Chinese Taipei.

It is also important to consider:

- the average level of the line in the graph. This gives an indication of how well the overall population has achieved on the given assessment. Lines at higher levels indicate higher mean performance by students.
- the length of the line, which indicates the range of ESCS. The graphs in this chapter are plotted between the 5th percentile and the 95th percentile of ESCS, that is, the graphs span the middle 90% of the values of ESCS for each country. A smaller range indicates less difference in socioeconomic background between students from the highest and lowest socioeconomic backgrounds. The range can be measured by projecting the starting point and finishing point of the gradient onto the horizontal axis.
- the linearity of the gradient. This measures the extent to which the performance edge associated with an advantaged background remains constant across levels of socioeconomic background. The index of curvilinearity allows us to judge this. A positive index indicates that the socioeconomic gradient becomes steeper for more advantaged socioeconomic students, in other words as socioeconomic background increases there is an increase in the extent to which this translates into higher performance scores. A negative index indicates a flattening off of the gradient at higher socioeconomic levels – as socioeconomic advantage increases there is a decrease in the amount of effect this has on performance.

In terms of the socioeconomic gradients for Australia and the OECD, the average level of the line was higher for Australia than the OECD, although only marginally. At lower levels of ESCS, the achievement level for Australia was not significantly different to that of the average across the OECD, while at the higher levels of ESCS, achievement in Australia was on average 20 points higher than across the OECD.

The range of ESCS for Australia was smaller than that of the OECD as a whole, which was to be expected given that the OECD covers a wide range of countries. The index of curvilinearity for Australia shows a slight curvature, showing on the graph as an advantage for students with a higher level of ESCS over those with lower levels.

Figure 6.3 displays the socioeconomic gradients for the Australian jurisdictions. At the very lowest levels of socioeconomic background, students in Western Australia, Victoria, South Australia, New South Wales and Queensland clearly scored higher than students in the Northern Territory and Tasmania. ESCS ranged to lower levels on Queensland, Tasmania and the Northern Territory, and at these lower levels there was a wide range of scores: 419 points in the Northern Territory, 426 points in Tasmania and 439 points in Queensland. The relationship between performance and socioeconomic background was stronger in Tasmania and the Northern Territory than the Australian average, and lower in Victoria than the Australian average. ESCS ranged to about the same levels in all jurisdictions. The highest levels of ESCS scores ranged from 582 points in Western Australia to 551 points in South Australia.

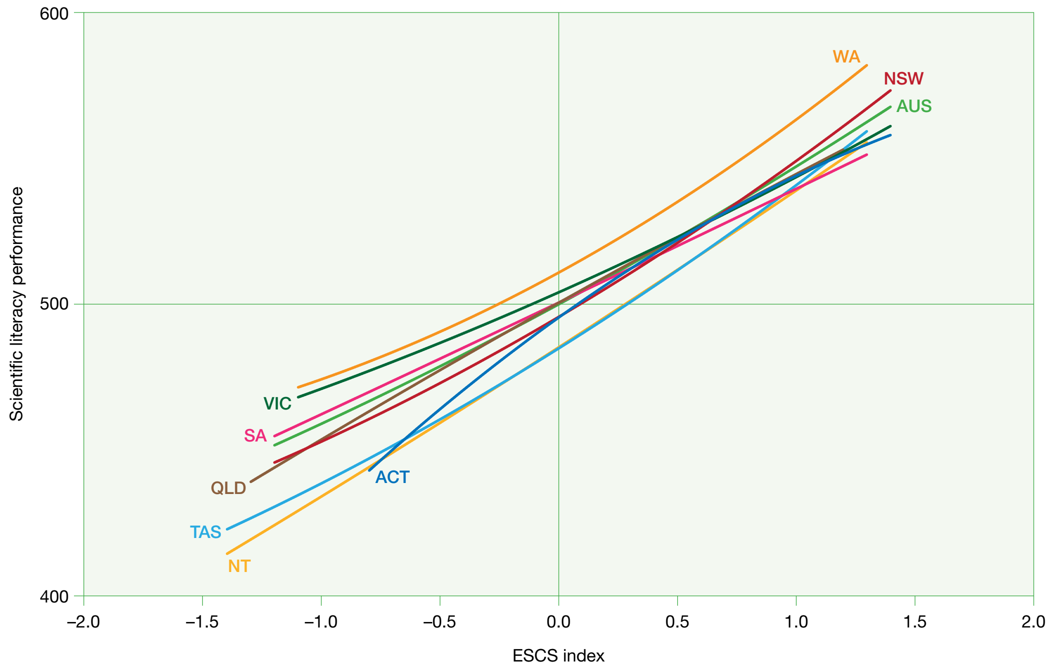


FIGURE 6.3 Socioeconomic gradients for Australia and the jurisdictions

Table 6.1 provides the background data underlying Figure 6.3. From this, it is clear that, for example, that the socioeconomic background of students in the Australian Capital Territory was higher than in the other jurisdictions, and that schools in Tasmania and the Northern Territory had to cater for students from much lower levels of socioeconomic background.

TABLE 6.1 Socioeconomic relationships for Australian jurisdictions

	Unadjusted average score		Strength of the relationship between student performance and the ESCS	Slope of the socio-economic gradient	Length of the projection of the gradient line	
					5th percentile of the ESCS	95th percentile of the ESCS
Jurisdiction	Avg. score	SE	Percentage of explained variance in student performance	Score point difference associated with one unit increase in the ESCS	Index	Index
ACT	495	4.6	14.9	58	–0.8	1.4
NSW	496	2.6	12.3	48	–1.2	1.4
VIC	504	3.2	8.8	36	–1.1	1.4
QLD	501	3.0	13.3	45	–1.3	1.2
SA	501	3.3	9.8	39	–1.2	1.3
WA	511	3.7	12.4	44	–1.1	1.3
TAS	485	3.7	16.8	51	–1.4	1.3
NT	485	5.6	16.0	52	–1.4	1.3

Table 6.2 presents the mean performance in science in PISA 2015 alongside a number of indicators that are used by the OECD to define equity, which include strength and slope. While they do not capture all possible inequalities within a country, the OECD argues that they provide a reliable indication of levels of fairness and inclusion.

International and national indicators of equity

Two of the main indictors of inclusion are access to schooling and the proportion of students who achieve at or above proficiency Level 2, the OECD baseline level of skills. All but two of the countries to achieve a score in scientific literacy higher than the OECD average, PISA samples cover more than 80% of the national population of 15-year-olds, which implies that 80% or more of the students in this age group in these countries are enrolled in at least Year 7 at school. The exceptions to this were B-S-J-G (China), where coverage was just 64% of students, and Vietnam, where it was 49% of students. In Australia, 91% of the 15-year-old population attended at least Year 7. In all but one of the countries that performed at a higher level than the OECD average (Belgium), the proportion of students who achieved below proficiency Level 2 was smaller than on average across the OECD. In Australia, 18% of students achieved below Level 2, compared to 21% of students across the OECD. Taken together, Australia and the other higher-performing countries educated a large majority of their 15-year-old students at an overall good standard.

In 10 of the 24 high-performing countries, the strength of the relationship between socioeconomic background and performance in scientific literacy was weaker than the OECD average. In another 9 countries, including Australia, the strength of the relationship was not significantly different to the OECD average. This measure of the strength of the relationship is used as a proxy measure for equity in PISA, and Australia was therefore classed as having similar equity levels as the OECD overall. For countries such as France and the Czech Republic, which had scores for strength around 20, socioeconomic background predicts performance to a greater extent than, on average, across the OECD, while in countries Canada and Norway, with scores for strength of about 8, the association was much less defined.

In 15 of the high-performing countries, the difference in student performance associated with a one unit increase in the ESCS index, the slope of the line (or impact), was either below or similar to the OECD average. However, in Chinese Taipei, Korea, Slovenia, New Zealand and the Netherlands, the strength of the relationship was higher than the OECD average, which means that socioeconomic background had a greater than average effect on performance.

A column in Table 6.2 provides the percentage of resilient students within each country. The OECD labels students as 'resilient' if they are in the bottom quarter of the PISA index of ESCS in the country of assessment but perform in the top quarter of students in the focus subject (scientific literacy in 2015) among all countries, when compared to students with the same socioeconomic background. Across the OECD, 29% of low-achieving students were classed as resilient. In Australia, 33% of low-achieving students were classed as resilient, which was much lower than Vietnam (76%) and Macao (China) (65%) but comparable to the United Kingdom (37%) and the United States (32%).

On average across the OECD, 62.9% of the between-school variation was able to be explained by the combination of students' ESCS and schools' ESCS. In Australia, these factors accounted for exactly the same amount of variance between schools. This varied widely internationally, from 90% in Luxembourg through to 7% in Macao (China).

TABLE 6.2 Countries' and economies' performance in scientific literacy and major indicators of equity in education

			Equity in education									
			Inclusion			Fairness						
	Average performance in science		Coverage of the national 15-year-old population (PISA Coverage index 3)	Percentage of students performing below Level 2 in science		Percentage of variation in science performance explained by students' socio-economic status		Score-point difference in science associated with a one-unit increase in the ESCS[1]		Percentage of resilient students[2]		Percentage of the between-school variation in science performance explained by students' and schools' ESCS
Country	Avg. score	SE	Index	%	SE	%	SE	Score dif.	SE	%	SE	%
OECD average	**493**	**(0.4)**	**0.89**	**21**	**(0.2)**	**13**	**(0.2)**	**38**	**(0.3)**	**29**	**(0.3)**	**62.9**
Singapore	556	(1.2)	0.96	10	(0.4)	17	(1.0)	47	(1.5)	49	(1.5)	64.9
Japan	538	(3.0)	0.95	10	(0.7)	10	(1.0)	42	(2.2)	49	(1.9)	63.0
Estonia	534	(2.1)	0.93	9	(0.6)	8	(0.9)	32	(1.8)	48	(1.8)	48.2
Chinese Taipei	532	(2.7)	0.85	12	(0.8)	14	(1.4)	45	(2.7)	46	(1.8)	72.3
Finland	531	(2.4)	0.97	11	(0.7)	10	(1.0)	40	(2.3)	43	(1.9)	46.1
Macao (China)	529	(1.1)	0.88	8	(0.4)	2	(0.4)	12	(1.7)	65	(1.4)	7.3
Canada	528	(2.1)	0.84	11	(0.5)	9	(0.7)	34	(1.5)	39	(1.4)	53.7
Vietnam	525	(3.9)	0.49	6	(0.8)	11	(2.2)	23	(2.7)	76	(2.7)	45.8
Hong Kong (China)	523	(2.5)	0.89	9	(0.7)	5	(0.9)	19	(1.9)	62	(1.8)	40.9
B-S-J-G (China)	518	(4.6)	0.64	16	(1.3)	18	(2.4)	40	(2.5)	45	(2.5)	65.0
Korea	516	(3.1)	0.92	14	(0.9)	10	(1.3)	44	(2.7)	40	(1.9)	63.7
New Zealand	513	(2.4)	0.90	17	(0.9)	14	(1.2)	49	(2.6)	30	(1.9)	73.0
Slovenia	513	(1.3)	0.93	15	(0.5)	13	(0.9)	43	(1.5)	35	(1.5)	74.0
Australia	**510**	**(1.5)**	**0.91**	**18**	**(0.6)**	**12**	**(0.8)**	**44**	**(1.5)**	**33**	**(1.2)**	**63.0**
United Kingdom	509	(2.6)	0.84	17	(0.8)	11	(1.0)	37	(1.9)	35	(1.5)	69.2
Germany	509	(2.7)	0.96	17	(1.0)	16	(1.2)	42	(1.9)	34	(1.8)	74.6
Netherlands	509	(2.3)	0.95	19	(1.0)	13	(1.3)	47	(2.6)	31	(1.7)	64.5
Switzerland	506	(2.9)	0.96	18	(1.1)	16	(1.2)	43	(1.9)	29	(1.8)	55.4
Ireland	503	(2.4)	0.96	15	(1.0)	13	(1.0)	38	(1.6)	30	(1.8)	61.5
Belgium	502	(2.3)	0.93	20	(0.9)	19	(1.3)	48	(1.8)	27	(1.4)	78.7
Denmark	502	(2.4)	0.89	16	(0.8)	10	(1.0)	34	(1.7)	28	(1.6)	50.7
Poland	501	(2.5)	0.91	16	(0.8)	13	(1.3)	40	(2.0)	35	(1.9)	63.5
Portugal	501	(2.4)	0.88	17	(0.9)	15	(1.4)	31	(1.5)	38	(1.9)	65.2
Norway	498	(2.3)	0.91	19	(0.8)	8	(0.9)	37	(2.2)	26	(1.4)	34.0
United States	496	(3.2)	0.84	20	(1.1)	11	(1.1)	33	(1.8)	32	(1.9)	54.0
Austria	495	(2.4)	0.83	21	(1.0)	16	(1.3)	45	(2.0)	26	(1.6)	68.8
France	495	(2.1)	0.91	22	(0.9)	20	(1.3)	57	(2.0)	27	(1.3)	✧
Sweden	493	(3.6)	0.94	22	(1.1)	12	(1.1)	44	(2.2)	25	(1.5)	65.0
Czech Republic	493	(2.3)	0.94	21	(1.0)	19	(1.2)	52	(2.1)	25	(1.7)	75.4
Spain	493	(2.1)	0.91	18	(0.8)	13	(1.1)	27	(1.1)	39	(1.4)	61.9
Latvia	490	(1.6)	0.89	17	(0.8)	9	(1.0)	26	(1.6)	35	(1.7)	58.7
Russian Federation	487	(2.9)	0.95	18	(1.1)	7	(1.0)	29	(2.4)	26	(2.0)	43.5
Luxembourg	483	(1.1)	0.88	26	(0.7)	21	(1.0)	41	(1.1)	21	(1.4)	90.3
Italy	481	(2.5)	0.80	23	(1.0)	10	(1.0)	30	(1.7)	27	(1.7)	52.5
Hungary	477	(2.4)	0.90	26	(1.0)	21	(1.4)	47	(1.9)	19	(1.5)	80.1
Lithuania	475	(2.7)	0.90	25	(1.1)	12	(1.3)	36	(2.1)	23	(1.5)	59.6
Croatia	475	(2.5)	0.91	25	(1.2)	12	(1.1)	38	(1.9)	24	(1.7)	65.7
Iceland	473	(1.7)	0.93	25	(0.9)	5	(0.8)	28	(2.1)	17	(1.5)	49.7
Israel	467	(3.4)	0.94	31	(1.4)	11	(1.3)	42	(2.3)	16	(1.3)	59.7
Malta	465	(1.6)	0.98	33	(0.8)	14	(1.0)	47	(1.8)	22	(1.6)	69.2
Slovak Republic	461	(2.6)	0.89	31	(1.1)	16	(1.4)	41	(2.3)	18	(1.4)	70.4
Greece	455	(3.9)	0.91	33	(1.9)	13	(1.3)	34	(2.1)	18	(1.6)	60.1
Chile	447	(2.4)	0.80	35	(1.2)	17	(1.3)	32	(1.4)	15	(1.2)	66.5
Bulgaria	446	(4.4)	0.81	38	(1.9)	16	(1.5)	41	(2.3)	14	(1.5)	74.6
United Arab Emirates	437	(2.4)	0.91	42	(1.1)	5	(0.6)	30	(1.8)	8	(0.7)	34.0
Uruguay	435	(2.2)	0.72	41	(1.1)	16	(1.3)	32	(1.4)	14	(1.1)	68.8
Romania	435	(3.2)	0.93	39	(1.8)	14	(1.8)	34	(2.4)	11	(1.4)	60.4
Cyprus	433	(1.4)	0.95	42	(0.8)	9	(0.9)	31	(1.5)	10	(1.1)	62.2
Moldova	428	(2.0)	0.93	42	(1.1)	12	(1.3)	33	(1.9)	13	(1.3)	55.7
Turkey	425	(3.9)	0.70	44	(2.1)	9	(1.9)	20	(2.1)	22	(2.5)	49.2
Trinidad and Tobago	425	(1.4)	0.76	46	(0.8)	10	(0.9)	31	(1.4)	13	(1.2)	70.1
Thailand	421	(2.8)	0.71	47	(1.5)	9	(1.9)	22	(2.3)	18	(1.6)	55.0
Costa Rica	420	(2.1)	0.63	46	(1.2)	16	(1.4)	24	(1.3)	9	(1.0)	70.0
Qatar	418	(1.0)	0.93	50	(0.5)	4	(0.4)	27	(1.4)	6	(0.5)	34.3
Colombia	416	(2.4)	0.75	49	(1.3)	14	(1.7)	27	(1.8)	11	(1.0)	64.4
Mexico	416	(2.1)	0.62	48	(1.3)	11	(1.3)	19	(1.1)	13	(1.2)	54.5

Higher quality or equity than the OECD average — Not statistically different from the OECD average — Lower quality or equity than the OECD average

Note: [1] ESCS refers to the PISA index of economic, social and cultural status.
[2] A student is classified as resilient if he or she is in the bottom quarter of the PISA index of economic, social and cultural status (ESCS) in the country/economy of assessment and performs in the top quarter of students among all countries/economies, after accounting for socio-economic status.
✧ Data have been withdrawn or have not been collected at the request of the country.

There are many differences in the extent to which countries were able to moderate the association between socioeconomic background and performance. The relationship between equity and mean scientific literacy for a selection of the countries that participated in PISA 2015 is shown in Figure 6.4. The horizontal axis represents the strength of the relationship between socioeconomic background and performance, used as a proxy for equity in the distribution of learning opportunities. Countries such as Hong Kong (China), Canada and Estonia in which the strength of the relationship between socioeconomic background and performance was significantly lower than for the OECD on average, were plotted to the right of the line, which delineates the average strength of the relationship across the OECD. Mean performance is plotted on the vertical axis, with the line at 493 representing the OECD average.

Countries whose performance places them in the top right-hand quadrant, with scientific literacy scores *higher* than the OECD average and the strength of the relationship between socioeconomic background *lower* than that of the OECD, are classified as High Quality, High Equity. Similarly, countries to the left of the OECD average slope line have a *higher* impact of socioeconomic background than the OECD average, and so are classified as Low Equity, with those achieving at a higher level than the OECD average classed as High Quality and those below as Low Quality. As with all data there are confidence intervals. The markers on Figure 6.4 indicates whether the difference between the score for the country and the OECD average for equity was significant or not.

In 6 of the 9 countries to outperform Australia, the strength of the relationship between socioeconomic background and performance was below the OECD average (High Equity, High Quality), only Singapore was significantly higher than the OECD average and in Chinese Taipei and Vietnam the difference were not significant.

Figure 6.4 also shows the levels of quality and equity for the Australian jurisdictions. Only Victoria was significantly different to the OECD average in terms of equity.

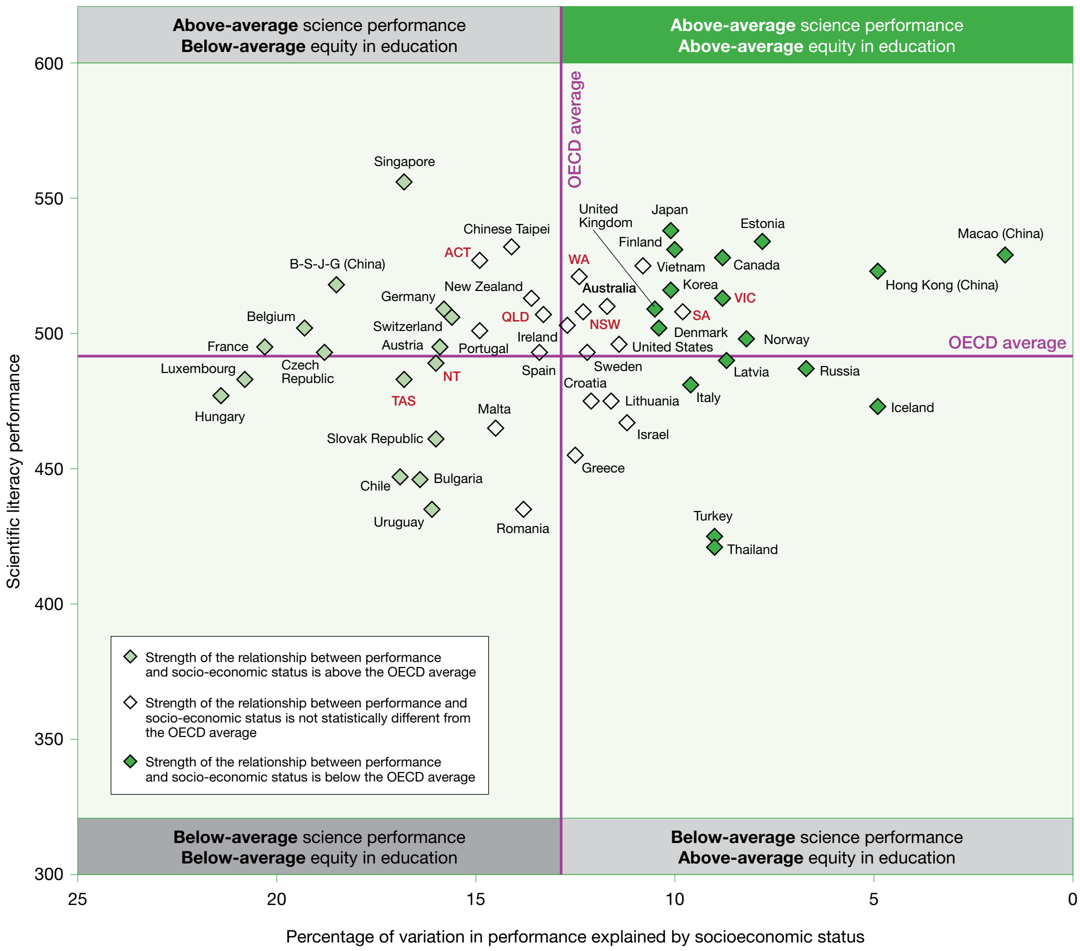


FIGURE 6.4 Equity of performance in scientific literacy, internationally

Socioeconomic background as a predictor of low and high performance

When examining fairness in education systems, it is also informative to look at the influence of socioeconomic background on both high- and low-achieving students. Does the impact vary at high or low levels of achievement?

Figure 6.5 shows the relationship between socioeconomic background and five different levels of performance in scientific literacy, whereas the results reported previously provide an ‘on average’ assessment of this relationship. If there were no variation in this relationship for high- and low-performing students, each of the lines in Figure 6.5 would be flat. In contrast, a curved line would imply a greater or lesser impact of socioeconomic background, depending on level of performance.

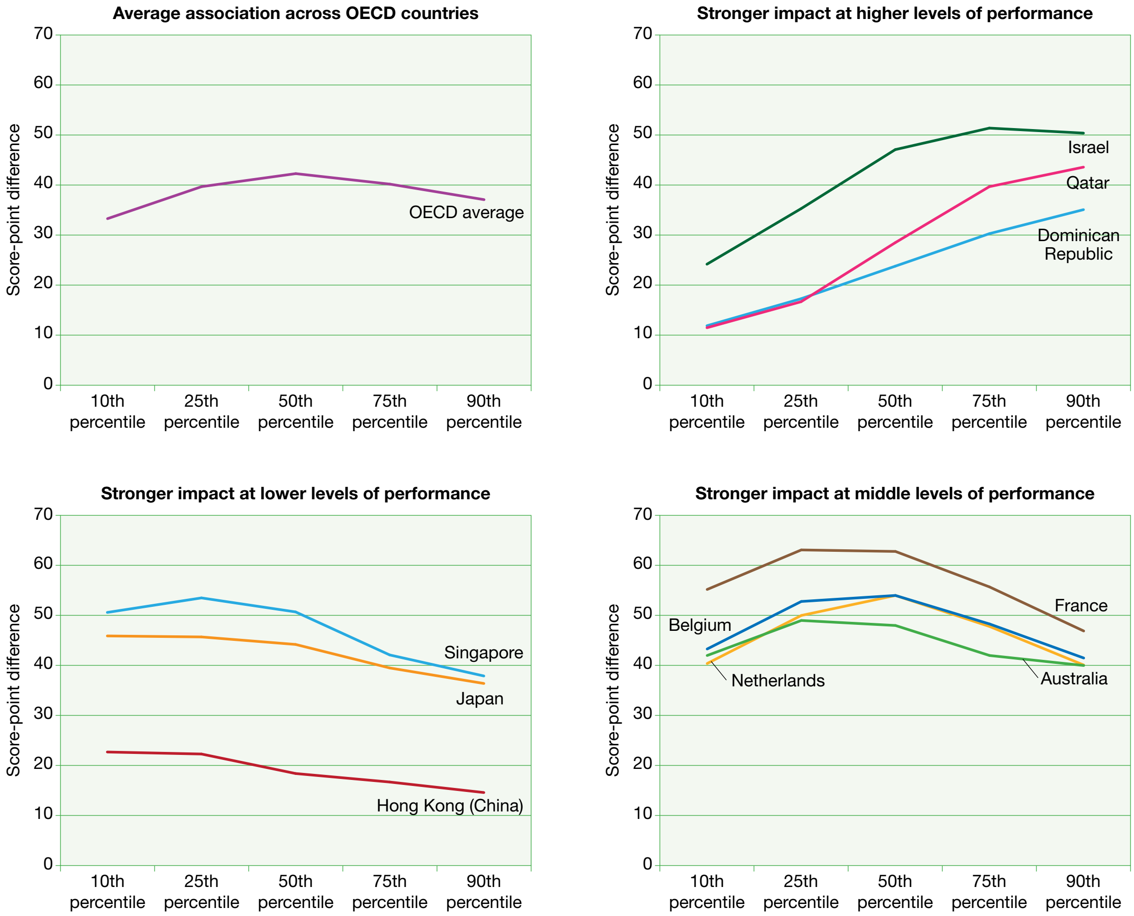


FIGURE 6.5 Relationship of performance and socioeconomic background

The upper left panel of Figure 6.5 shows that, on average across OECD countries, the impact of socioeconomic background was slightly weaker among both high-performing and low-performing students (a one-unit change in ESCS was associated with a difference of 37 points among students at the 90th percentile) and stronger for those students who performed around the median (for whom a one-unit change was associated with a difference in performance of 42 points).

The upper right panel of Figure 6.5 shows how in the Dominican Republic, Israel and Qatar, the impact of socioeconomic background was higher among higher performing students than among lower performing students. This suggests that in these countries, an advantaged background was a prerequisite for high performance.

The bottom left panel shows that in countries such as Hong Kong (China), Japan and Singapore, the opposite pattern holds: that the impact of socioeconomic background was higher for low performers than among high performers. This indicates that in school systems in these countries, socioeconomic advantage acted more as a protection against low performance than as a springboard to high achievement.

Finally, the bottom right panel shows how, in another group of countries including Australia, Belgium, France and the Netherlands, the association between performance and socioeconomic background mirrors that of the OECD overall but in a more pronounced way. In these countries, socioeconomic background matters particularly for those students with average scores in scientific literacy. In Australia, this could be related to the proportion of students who attended independent schools. Further investigation of this will be undertaken in due course.

Resilient students

It was clear from Figure 6.1 that while the general trend over all OECD countries, including Australia, was for socioeconomic background to be positively associated with performance, whether it was at all levels of performance or more strongly with some than others, there were always exceptions. A proportion of students overcame their socioeconomic background and went on to achieve amongst the highest scores in the world. These students have been labelled by the OECD as 'resilient students'. According to PISA, a student can be classed as resilient if they score in the bottom quarter of the PISA ESCS index *in their country* and in the top quarter of achievement among *all countries*. This is shown in Figure 6.6.

Figure 6.6 shows, on average across OECD countries, 29% of students in the lowest quartile of socioeconomic background in PISA 2015 could be considered resilient. In B S J G (China), Estonia, Finland, Hong Kong (China), Japan, Korea, Singapore, Chinese Taipei and Vietnam, more than 4 in 10 disadvantaged students were considered to be resilient, although low coverage rates in B-S-J-G (China) and Vietnam mean that most disadvantaged 15-year-old students are probably not represented in these results. In Australia, about 33% of the lowest ESCS quartile students were considered to be resilient. By contrast, fewer than 1 in 10 students from the lowest quartile of socioeconomic background in Costa Rica, the United Arab Emirates and Qatar would be considered resilient.

The relationship between performance and socioeconomic background between and within schools

Ensuring consistently high standards across schools is a challenge for all school systems. Performance differences may be due to the socioeconomic composition of the school's student population or other characteristics of the student body. In Australia these differences were most evident when examining differences between schools in the three different sectors.

Note: A student is classified as resilient if he or she is in the bottom quarter of the PISA index of economic, social and cultural status (ESCS) in the country/economy of assessment and performs in the top quarter of students among all countries/economies, after accounting for socio-economic status.

FIGURE 6.6 Percentage of resilient students, by country

In Figure 6.7, Australian students are grouped according to their socioeconomic background – disadvantaged are those in the lowest quartile of ESCS, advantaged students are those in the highest quartile of ESCS, and those in the middle two quartiles are placed in the average category. Schools were categorised in a similar way using the Socio-Economic Indexes for Areas (SEIFA). SEIFA was developed by the Australian Bureau of Statistics and ranks areas in Australia according to their relative socioeconomic advantage and disadvantage. The indexes are based on information from the five-yearly national census and are attached to the schools according to their postcode. The scientific literacy achievement of disadvantaged, average and advantaged students in disadvantaged, average and advantaged schools is plotted in Figure 6.7.

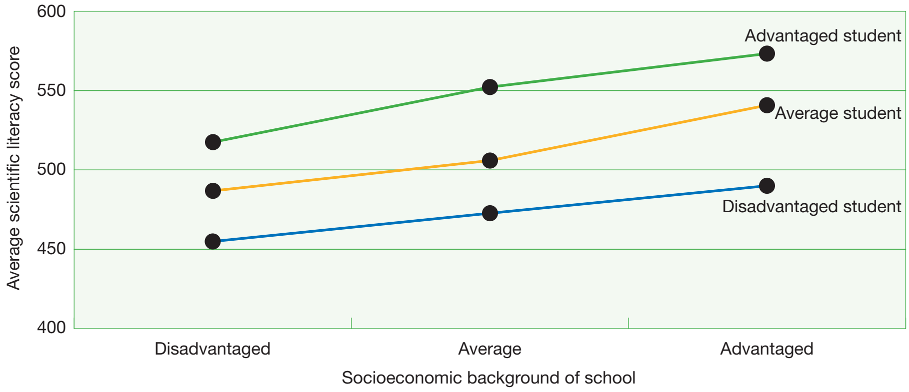
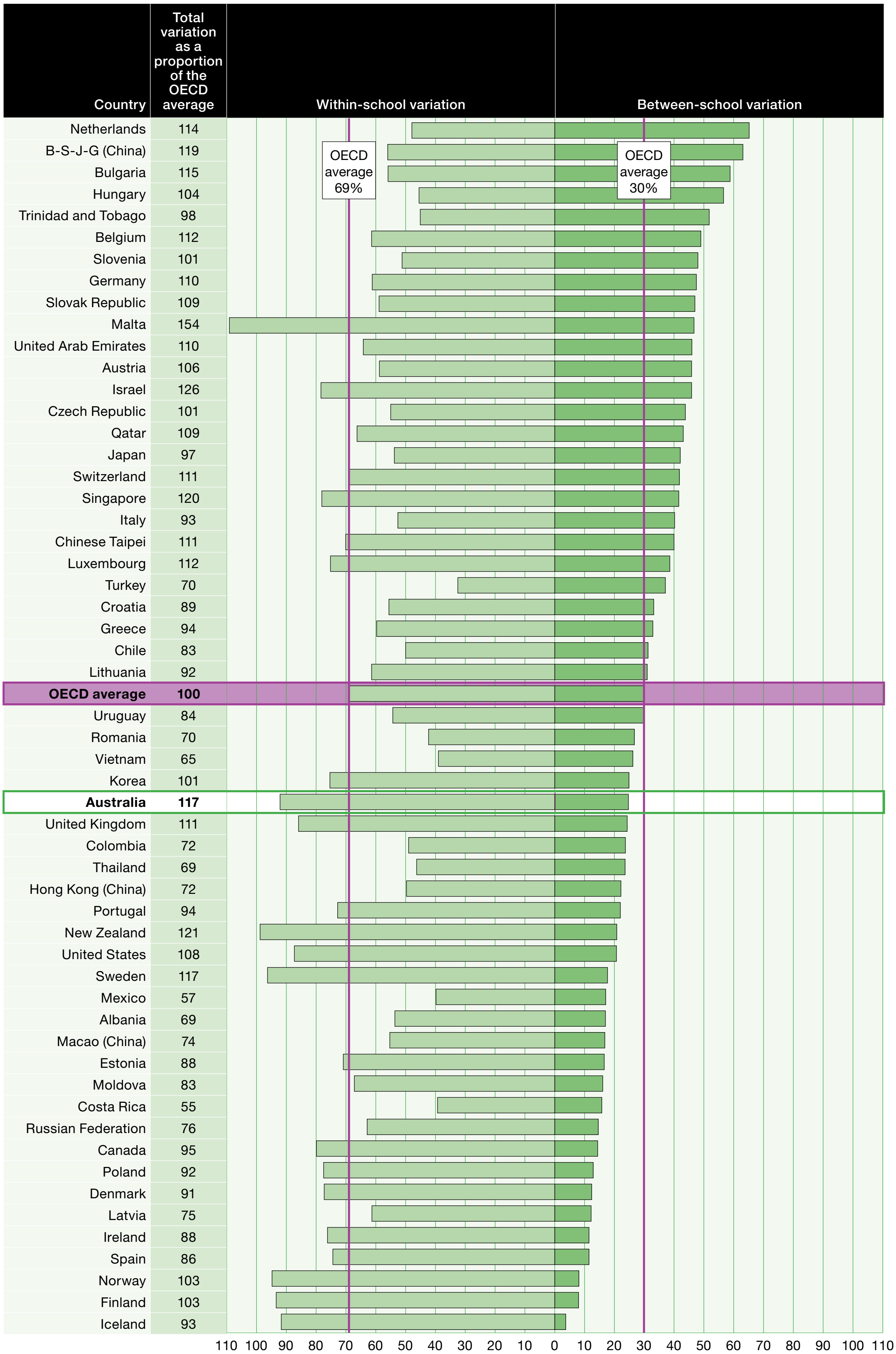


FIGURE 6.7 Scientific literacy achievement of students and schools by socioeconomic background

As can be seen in Figure 6.7, all students perform relatively lower when they attend disadvantaged schools; however, disadvantaged students suffer the most. The average score of a disadvantaged student in a disadvantaged school was 455 score points, which was substantially and significantly lower than the OECD average. In comparison, the average score for advantaged students attending advantaged schools was 574 points, which was even higher than the average score for Singapore. This difference between disadvantaged and advantaged students and disadvantaged and advantaged schools was 119 points and represents more than four years of schooling.

The benefit to disadvantaged students of not attending disadvantaged schools is also evident in Figure 6.7. Disadvantaged students in average socioeconomic level schools scored about 25 points, or almost a year of schooling, higher than those in disadvantaged schools. Similarly, disadvantaged students in advantaged schools scored another 33 points, which was equal to more than one year of schooling.

Figure 6.8 shows the proportion of variance in achievement for each country in PISA 2015 divided into the amount of between-school variation (i.e. the performance variation attributable to differences in student results in different schools) and the amount of within-school variation (i.e. the performance variation attributable to the range of student results that cannot be attributed to differences between schools).



Source: Figure I.6.11 PISA 2015 Results (Volume I): Excellence and Equity in Education © OECD 2016

FIGURE 6.8 Variation in scientific literacy performance between and within schools, by country

Across the OECD on average, just over 30% of performance differences were observed between schools, and the remaining variation was observed within schools. In Finland, Iceland and Norway, between-school differences accounted for less than 10% of the variation in performance, while in Canada, Denmark, Ireland, Latvia, Estonia, Macao (China), Poland and Spain they accounted for between 10% and 15% of the variance. As Canada, Denmark, Finland, Ireland, Norway, Estonia, Macao (China) and Poland also achieved higher than average mean performance in scientific literacy, in practical terms this means that parents and students could expect that students can achieve at high levels no matter which school they attend.

In contrast, in an economy such as B-S-J-G (China) and countries such as the Netherlands, Bulgaria, Hungary, and Trinidad and Tobago, differences between schools accounted for more than 50% of the variation in performance. This makes it important to attend the 'right' school.

In Australia overall, the amount of variation between schools was lower than on average across the OECD, while the amount of variation within schools was higher than on average across the OECD. This pattern was similar to that seen in the United Kingdom, New Zealand, the United States and Canada. While the Australian school system is not streamed as in some countries, there were differences between schools that could have important implications for parents in terms of which school to send their child to.

How the variation in performance is shared within and between schools is often determined by the degree of socioeconomic diversity between schools. Figure 6.9 shows the proportion of between- and within-school variation in scientific literacy performance that can be attributed to socioeconomic differences within and between schools.

For Australia and on average across the OECD, 63% of the performance differences observed across students in different schools can be accounted for by socioeconomic differences across students and schools. Only around 4% of the performance difference between students attending the same school was associated with their socioeconomic background. The amount of variation within schools was similar for Australia.

This varies widely across countries. Between-school socioeconomic disparities are closely associated with performance in Germany, Bulgaria, the Czech Republic, Belgium and Hungary, where more than 75% of the between-school variation in performance was accounted for by the socioeconomic background of students and schools.

Country	Within-school variation as a percentage of the average total variation in science performance across OECD countries	Between-school variation as a percentage of the average total variation in science performance across OECD countries
Macao (China)	55	17
Norway	95	8
United Arab Emirates	64	46
Qatar	66	43
Hong Kong (China)	50	22
Russian Federation	63	15
Vietnam	39	26
Finland	93	8
Estonia	71	17
Turkey	33	37
Iceland	92	4
Denmark	77	12
Italy	53	40
Canada	80	14
United States	87	21
Mexico	40	17
Thailand	46	24
Switzerland	69	42
Moldova	67	16
Latvia	61	12
Lithuania	61	31
Israel	78	46
Greece	60	33
Romania	42	27
Ireland	76	12
Spain	74	12
OECD average	**69**	**30**
Australia	**92**	**25**
Japan	54	42
Poland	77	13
Korea	75	25
Colombia	49	24
Netherlands	48	65
Singapore	78	42
B-S-J-G (China)	56	63
Sweden	96	18
Portugal	73	22
Croatia	56	33
Chile	50	31
Austria	59	46
Uruguay	54	30
United Kingdom	86	24
Malta	109	47
Costa Rica	39	16
Trinidad and Tobago	45	52
Slovak Republic	59	47
Chinese Taipei	70	40
New Zealand	99	21
Slovenia	51	48
Germany	61	48
Bulgaria	56	59
Czech Republic	55	44
Belgium	61	49
Hungary	46	57
Luxembourg	75	39

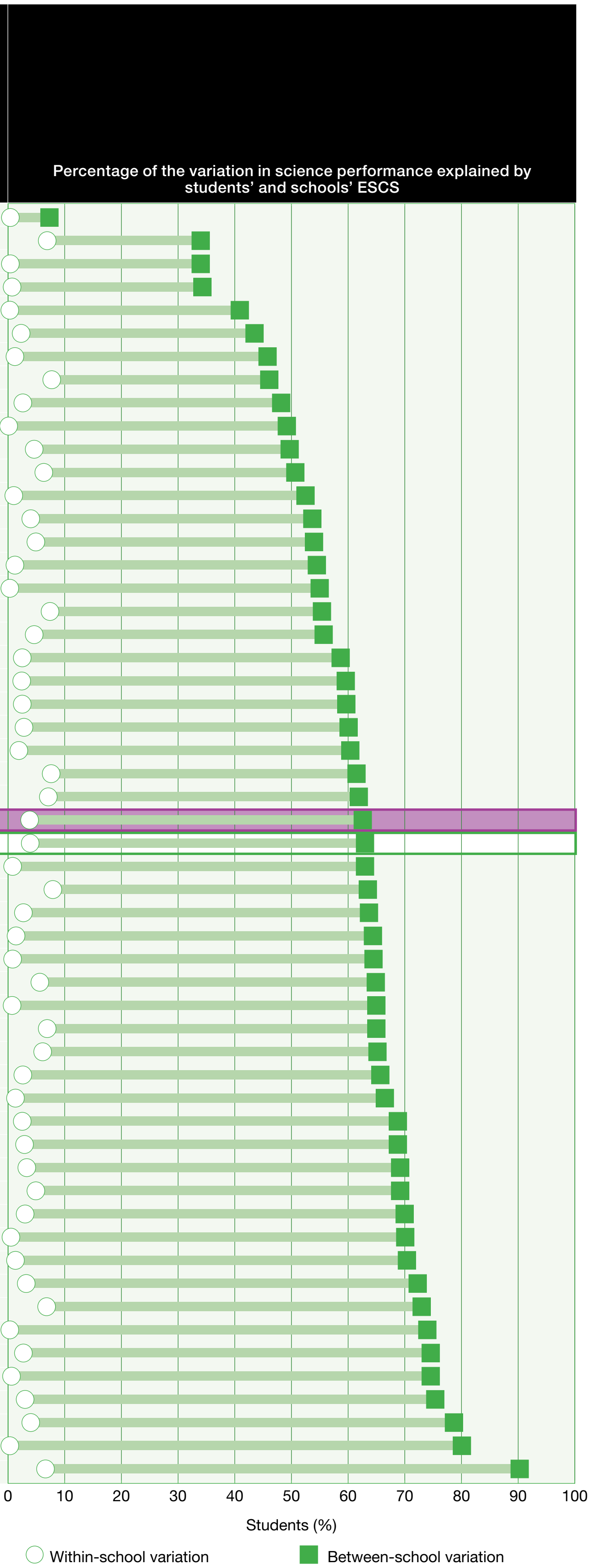


FIGURE 6.9 Performance differences between and within schools explained by students' and schools' socioeconomic status, by country

Differences in the socioeconomic background of students and schools

The findings in this and earlier chapters showed that achievement levels were higher in some jurisdictions, in Catholic schools, in independent schools, and in metropolitan schools. Further examination of the socioeconomic backgrounds in these systems and schools was carried out. Figure 6.10 shows the proportion of students in each quartile of socioeconomic background by jurisdiction, sector and geographic location.

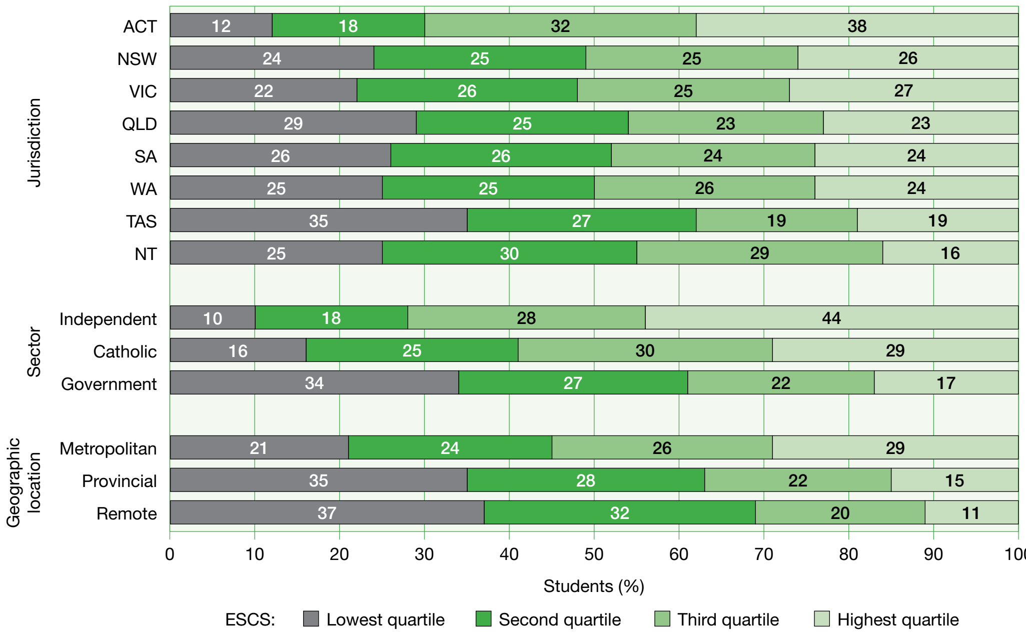


FIGURE 6.10 Proportion of students in each ESCS quartile, selected groups within Australia

Clearly, Tasmania and Queensland had the largest proportions of low socioeconomic students in their schools, while the Australian Capital Territory had the highest proportion of students from high socioeconomic backgrounds. Similarly, the range of socioeconomic backgrounds was much greater at government schools than in either Catholic schools or independent schools and the number of students from low socioeconomic backgrounds was clearly much greater in government schools than in either Catholic schools or independent schools. Figure 6.10 also shows that provincial and remote schools had a much larger percentage of students from lower socioeconomic backgrounds than metropolitan schools.

CHAPTER 7

Australian students' motivation and beliefs in science

Key findings

- High-performing countries in PISA tend to display high levels of motivation and self-efficacy in science, with students who are in the highest quartile across many of the indices outperforming those in the lowest quartile, on average, by the equivalent of two to three years of schooling.
- On average, Australian students demonstrated higher levels of instrumental motivation to learn science and higher levels in their enjoyment of learning science compared to the OECD average. Australian students also demonstrated higher levels of interest in broad science topics compared to students across the OECD. Overall, within Australia, students reported higher levels of motivation and enjoyment in learning science than an interest in broad science topics.
- Singapore, Hong Kong (China) and Canada consistently exceeded the OECD average in relation to motivation to learn science, self-efficacy in science, environmental awareness and optimism and value beliefs about science.
- Within Australian schools, students in Western Australia had a higher motivation to learn science and self-efficacy in science, while students in Queensland and Tasmania tended to be lower in motivation and self-efficacy.
- On average, across OECD countries, nearly one-quarter of students reported that they expect to work in an occupation that requires further science training beyond compulsory school education. Nearly 30% of Australian students reported expecting to work in a science-related career by age 30.
- Overall, nearly one-third of students in Victoria and Western Australia expected to work in a science-related career by age 30 compared to just over one-fifth of students from the Australian Capital Territory and Tasmania.
- In Australia, males tended to be more interested in science, to enjoy science and to have higher self-efficacy in science compared to females. This was reflected in males being four times more likely to expect to work in science and engineering or ICT professions than their female peers. New South Wales reported the highest level of students aspiring to work in non-science related careers (50%); however, just over one–quarter of students in the Australian Capital Territory reported the highest proportion of vague, missing or indecisive career expectations suggesting they were undecided about their future career aspirations.

As scientific literacy was the major assessment domain assessed in PISA 2015, students' interest and motivation in science, technology, engineering and mathematics (STEM) subjects, plus related beliefs and behaviour are an important assessment dimension. Schools play a critically important role in shaping students and particularly females confidence, belief in themselves, and their attitudes to succeed in science. For this reason the 2015 school, students and teacher questionnaires had a particular focus on capturing detail specifically related to the teaching and learning of science in Australian schools and the extent to which schools and teachers are encouraging students to pursue higher level education in science fields that will lead to careers in science-related fields.

The overarching aim of the school, student and teacher questionnaires was to gather data that can help policymakers and educators understand why and how students achieve certain levels of performance. PISA questionnaires must cover the most important antecedents and processes of student learning at the individual, school, and system level.

This chapter explores students' perceptions of their interest and enjoyment of science, as well as their beliefs in the area. Students' motivation and beliefs were also considered in relation to scientific literacy performance in order to explore the relationship between motivation and beliefs in science.

Students' motivation to learn science and their beliefs about themselves as science learners are important guides for policy and education goals in Australia. This is particularly important due to a decline in the number of students, particularly females, who choose to study science at senior secondary school level and university but who subsequently decide not to pursue careers requiring science.

The results presented in this chapter show how students responded to different sets of questions about science: their motivation and beliefs, interest in science, and awareness and optimism about science issues. Scores are provided for constructed indices designed to standardise responses onto one scale.[55] Results for Australian students were investigated at the jurisdictional level, and according to Indigenous background, geographic location, socioeconomic background and sex. Further, in order to place Australian students' responses within a wider context, nine countries were selected for comparison with Australia. These were high-performing countries Singapore, Japan, Estonia, Finland, Hong Kong (China) and Canada, in addition to the culturally similar English-speaking OECD countries New Zealand, the United Kingdom and the United States.

Students' beliefs and learning science

Self-efficacy in science

Self-efficacy has been found to be a strong predictor of academic achievement, subject selection and career decisions across domains and age levels. Information about student experiences of self-efficacy may help science educators facilitate student progress by promoting and encouraging students to continue to study science and pursue careers in science-related fields.

According to Bandura (1997), self-efficacy beliefs affect academic performance because they influence a number of behavioural and psychological processes. Students who have a strong belief that they can succeed in science subjects will be more likely to choose science subjects and work hard to achieve success. Students with positive self-efficacy beliefs are more likely to persevere if they do not understand a topic and draw on their confidence to undertake science tasks.

To assess self-efficacy in science, students were asked to rate the ease with which they believed they could perform the following eight scientific tasks:

- recognise the science question that underlies a newspaper report on a health issue
- explain why earthquakes occur more frequently in some areas than in others
- describe the role of antibiotics in the treatment of disease
- identify the science question associated with the disposal of garbage

55 The Reader's Guide provides more information about the PISA indices.

- predict how changes to an environment will affect the survival of certain species
- interpret the scientific information provided on the labelling of food items
- discuss how new evidence can lead someone to change their understanding about the possibility of life on Mars
- identify the better of two explanations about the formation of acid rain.[56]

Students responded to each item on a four-point scale (I could do this easily; I could do this with a bit of effort; I would struggle to do this on my own; and I couldn't do this).

The eight items were standardised to create an index of self-efficacy in science. Positive values on this index indicated higher levels of self-efficacy in science.

Figure 7.1 presents the students' mean index scores for Australia and the selected comparison countries. Students in Canada had the highest levels of self-efficacy in science with a mean index score of 0.35, followed by students in the United Kingdom (mean index score: 0.27) and the United States (mean index score: 0.26) while students in Japan had the lowest levels of self-efficacy (mean index score: –0.46). Students in Australia had a mean index score of 0.07 similar to the OECD average of 0.04.

	All students	
Country	Mean index	SE
Australia	**0.07**	**0.0**
Hong Kong (China)	–0.07	0.0
Singapore	0.11	0.0
Japan	–0.46	0.0
Finland	–0.04	0.0
Estonia	–0.04	0.0
New Zealand	–0.03	0.0
Canada	0.35	0.0
United Kingdom	0.27	0.0
United States	0.26	0.0

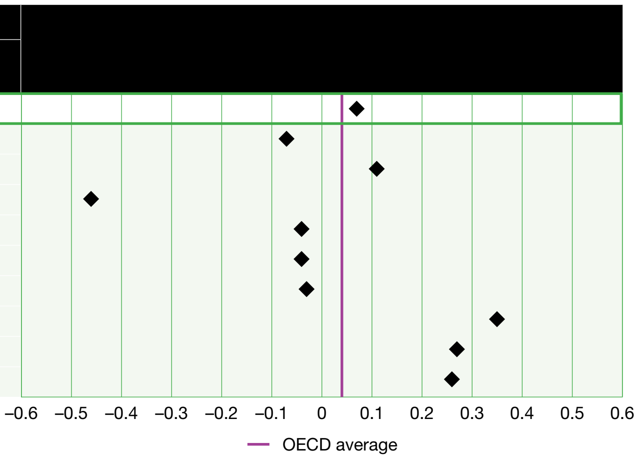


FIGURE 7.1 Index of self-efficacy in science: Australian and international results

Figure 7.2 explores the relationship between science self-efficacy and scientific literacy performance. For Australian students, there was a positive relationship between self-efficacy in science and scientific literacy performance (r = 0.34). Students in the highest quartile scored 105 points on average higher than students in the lowest quartile. This score point difference is equal to around 3 years of schooling.

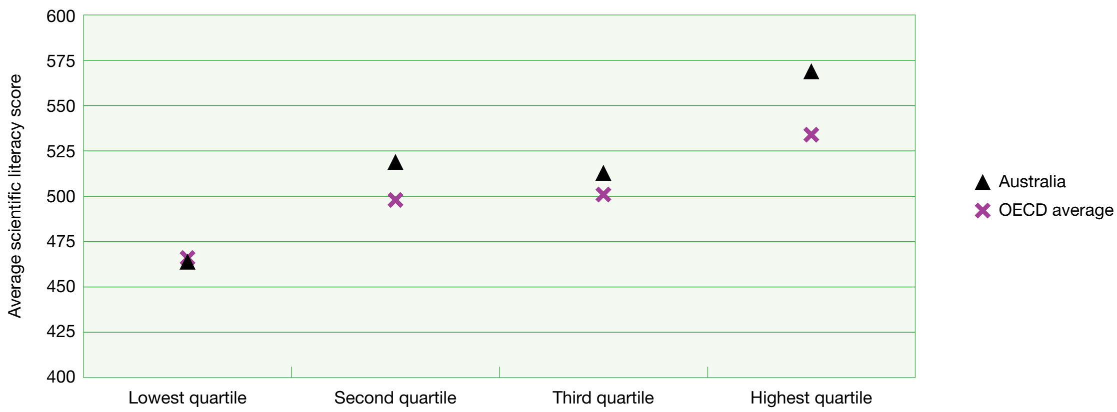


FIGURE 7.2 Relationship between students' self-efficacy in science and scientific literacy performance for Australia and the OECD average

56 Further information on the percentages of students who responded to each set of items that comprise an index is presented in a separate supplement and is available online at https://www.acer.org/ozpisa/reports.

Figure 7.3 shows students' self-efficacy in science within Australian schools by jurisdiction. On average, students from the Australian Capital Territory had the highest levels of self-efficacy in science with a mean index score of 0.28, followed by New South Wales, Western Australia and Tasmania. South Australia, Victoria, Queensland and the Northern Territory reported means that were significantly lower than the OECD average of 0.04.

	All students	
Jurisdiction	Mean index	SE
ACT	0.28	0.1
NSW	0.19	0.0
VIC	−0.03	0.0
QLD	−0.03	0.0
SA	0.01	0.0
WA	0.12	0.0
TAS	0.11	0.1
NT	−0.03	0.1

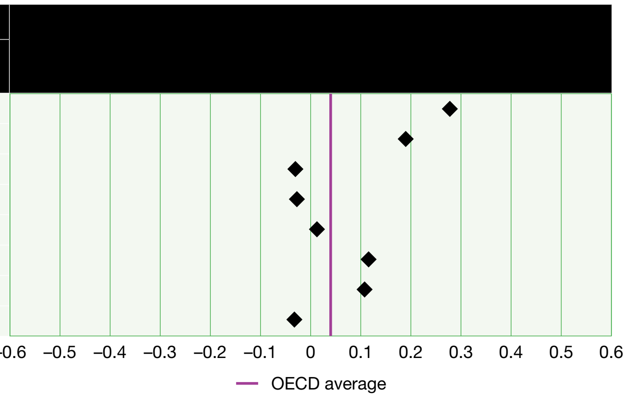


FIGURE 7.3 Self-efficacy in science, by jurisdiction

Figure 7.4 presents Australian students' self-efficacy in science by demographic characteristics. Non-Indigenous students showed a significantly higher level of self-efficacy in science than Indigenous students. Students from metropolitan schools also showed a significantly higher level of self-efficacy in science than students from provincial schools and remote schools. Students from the highest and third socioeconomic quartiles had significantly higher levels of self-efficacy in science with respect to explaining scientific tasks than students from the other two quartiles. Last, males had significantly higher levels of self-efficacy in science than females.

	All students	
Demographic group	Mean index	SE
Indigenous background		
Indigenous	−0.24	0.0
Non-Indigenous	0.08	0.0
Geographic location		
Metropolitan	0.10	0.0
Provincial	−0.04	0.0
Remote	−0.01	0.0
Socioeconomic background		
Lowest quartile	−0.27	0.0
Second quartile	−0.08	0.0
Third quartile	0.15	0.0
Highest quartile	0.45	0.0
Sex		
Males	0.19	0.0
Females	−0.06	0.0
Australia	**0.07**	**0.0**

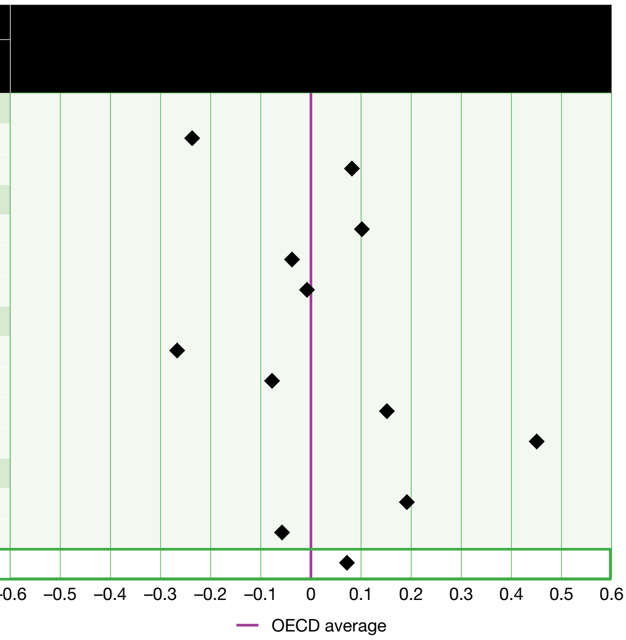


FIGURE 7.4 Self-efficacy in science, by Indigenous background, geographic location, socioeconomic background and sex

Motivation to learn science

Motivation to learn involves a collection of closely related beliefs, perceptions, values, interest and actions. Together with motivation, student engagement is viewed in the literature as a significant factor in leading to increased learning and enhanced educational outcomes. Students' motivation to learn and achieve is integral in determining their preparedness for life-long learning as a core skill in the twenty-first century. (Krapp and Prenzel, 2011).

Motivation to learn science in PISA 2015 covers three constructs: interest in broad science topics, enjoyment of science and instrumental motivation. Motivation to learn based on interest and enjoyment is experienced as self-determinate and intrinsic (Krapp and Prenzel, 2011).

Interest in broad science topics

According to Hidi and Renninger (2006), individual interest in a domain such as science is based on having a knowledge base in science, valuing science and experiencing positive affect when engaged in scientific activities. Students with an individual interest in science are more likely to embrace opportunities to engage with scientific activities, often actively seeking out such opportunities.

In order to measure interest in broad science topics, students were asked to indicate the extent to which they had an interest in the following five broad science topics:

- biosphere (e.g. ecosystem services, sustainability)
- motion and forces (e.g. velocity, friction, magnetic and gravity forces)
- energy and its transformation (e.g. conservation, chemical reactions)
- the universe and its history
- how science can help us prevent disease.

Students used a five-point scale (not interested; hardly interested; interested; highly interested; and I don't know what this is). The five items were standardised to have a mean of 0 and a standard deviation of 1 to create an index of interest in broad science topics. Positive values on this index indicated higher levels of interest in broad science topics.

Figure 7.5 illustrates students' responses for Australia and the selected comparison countries. Students from Singapore had the highest levels of interest in broad science topics with a mean index score of 0.28, followed by students in Canada (mean index score: 0.26) and Hong Kong (China) (mean index score: 0.25) while students in Japan had the lowest levels of interest in broad science topics (mean index score: −0.11). Students in Australia had a mean index score of 0.04, which was significantly higher than the OECD average of 0.00.

	All students	
Country	Mean index	SE
Australia	**0.04**	**0.0**
Hong Kong (China)	0.25	0.0
Singapore	0.28	0.0
Japan	−0.11	0.0
Finland	−0.09	0.0
Estonia	0.02	0.0
New Zealand	0.09	0.0
Canada	0.26	0.0
United Kingdom	0.01	0.0
United States	0.05	0.0

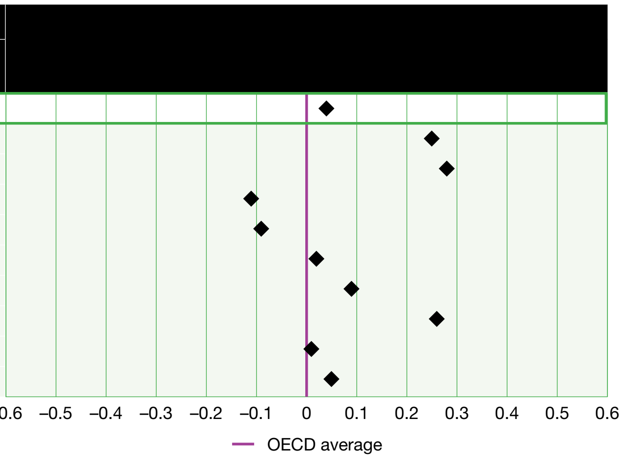


FIGURE 7.5 Index of interest in broad science topics: Australian and international results

The index of interest in broad science topics was divided into quartiles. Figure 7.6 explores the relationship between quartiles of students' interest in broad science topics and scientific literacy performance for Australia and the OECD average.

For Australian students, there was a positive relationship between interest in broad science topics and scientific literacy performance (r = 0.34). Students in the highest quartile scored, on average, 95 points higher than students in the lowest quartile. This score point difference was equal to around 3 years of schooling.

More so for Australia than the OECD average, the pattern between broad interest in science and scientific literacy followed a slight curvilinear pattern, with students who reported higher levels of broad interest in science tending to have higher average scientific literacy scores. Results for the OECD also showed a slight curvilinear pattern.

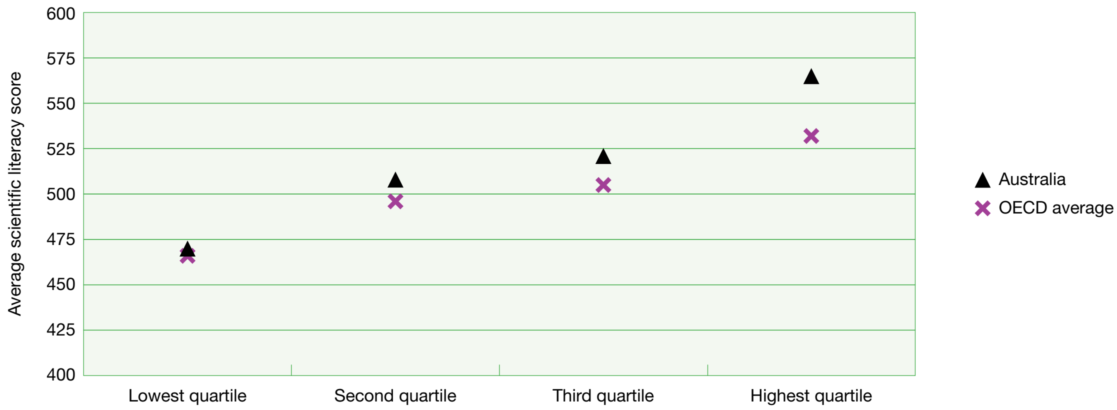


FIGURE 7.6 Relationship between students' interest in broad science topics and scientific literacy performance for Australia and the OECD average

Figure 7.7 shows students' interest in broad science topics within Australian schools by jurisdiction. On average, students in Western Australia had the highest levels of broad interest in science topics with a mean index score of 0.15, followed by students in the Australian Capital Territory, the Northern Territory and South Australia. Queensland and Tasmania had means that were similar to the OECD average.

	All students	
Jurisdiction	Mean index	SE
ACT	0.14	0.1
NSW	0.05	0.0
VIC	0.02	0.0
QLD	−0.03	0.0
SA	0.11	0.0
WA	0.15	0.0
TAS	−0.04	0.1
NT	0.13	0.0

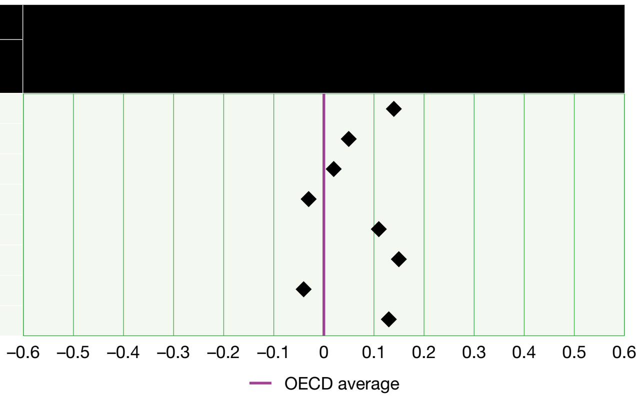


FIGURE 7.7 Interest in broad science topics, by jurisdiction

Figure 7.8 presents Australian students' broad interest in science topics by demographic characteristics.

Overall, non-Indigenous students reported a significantly higher level of interest in broad science topics than Indigenous students. Students from metropolitan schools reported a significantly higher level of interest in broad science topics than students from provincial schools. Students from the highest socioeconomic background quartile also reported significantly higher levels of interest in broad science topics. Last, males had significantly higher levels of interest in broad science topics than females.

Demographic group	All students: Mean index	All students: SE
Indigenous background		
Indigenous	−0.18	0.0
Non-Indigenous	0.05	0.0
Geographic location		
Metropolitan	0.07	0.0
Provincial	−0.06	0.0
Remote	0.02	0.1
Socioeconomic background		
Lowest quartile	−0.16	0.0
Second quartile	−0.02	0.0
Third quartile	0.09	0.0
Highest quartile	0.25	0.0
Sex		
Males	0.17	0.0
Females	−0.09	0.0
Australia	**0.04**	**0.0**

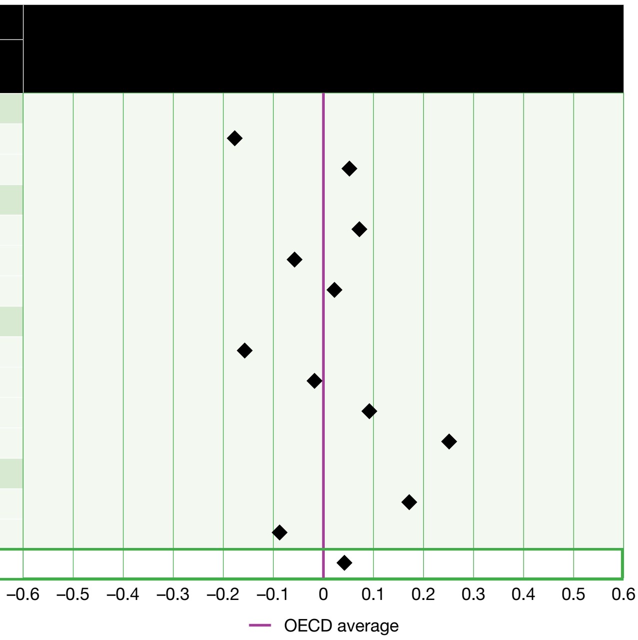


FIGURE 7.8 Interest in broad science topics, by Indigenous background, geographic location, socioeconomic background and sex

Enjoyment of learning science

The extent to which students enjoy their school subjects plays an important role in influencing their level of interest and engagement and their overall academic performance. Enjoyment of science affects students' willingness to spend time and effort in science-related activities (Nugent et al, 2015).

An index measuring students' level of enjoyment of learning science was derived from their level of agreement with the following five statements, measured on a four-point scale (strongly disagree; disagree; agree; strongly agree):

- I generally have fun when I am learning science topics.
- I like reading about science topics.
- I am happy working on science topics.
- I enjoy acquiring new knowledge in science.
- I am interested in learning about science.

The five items were standardised to create an index of enjoyment of learning science. Positive values on this index indicated higher levels of student enjoyment of science.

Figure 7.9 illustrates students' index scores for Australia and the selected comparison countries. Students in Singapore had the highest levels of enjoyment of learning science with a mean index score of 0.59, while students in Japan had the lowest levels of enjoyment of learning science with a mean index score of −0.33. Students in Australia had a mean index score of 0.12, which was significantly higher than the OECD average of 0.02.

Country	All students: Mean index	All students: SE
Australia	**0.12**	**0.0**
Hong Kong (China)	0.28	0.0
Singapore	0.59	0.0
Japan	−0.33	0.0
Finland	−0.07	0.0
Estonia	0.16	0.0
New Zealand	0.20	0.0
Canada	0.40	0.0
United Kingdom	0.15	0.0
United States	0.23	0.0

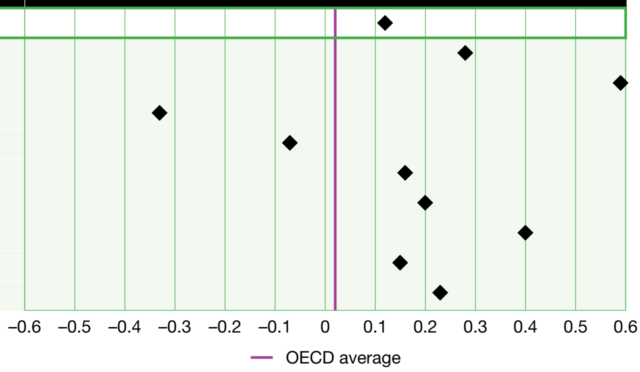


FIGURE 7.9 Index of enjoyment of learning science: Australian and international results

Figure 7.10 explores the relationship between students' enjoyment of learning science and scientific literacy performance. Consistent with the findings for interest in broad science topics, higher levels of enjoyment in science tended to be associated with higher scientific literacy scores (r = 0.38). Students in the highest quartile scored 105 points on average higher than students in the lowest quartile. This score point difference was equal to more than three years of schooling.

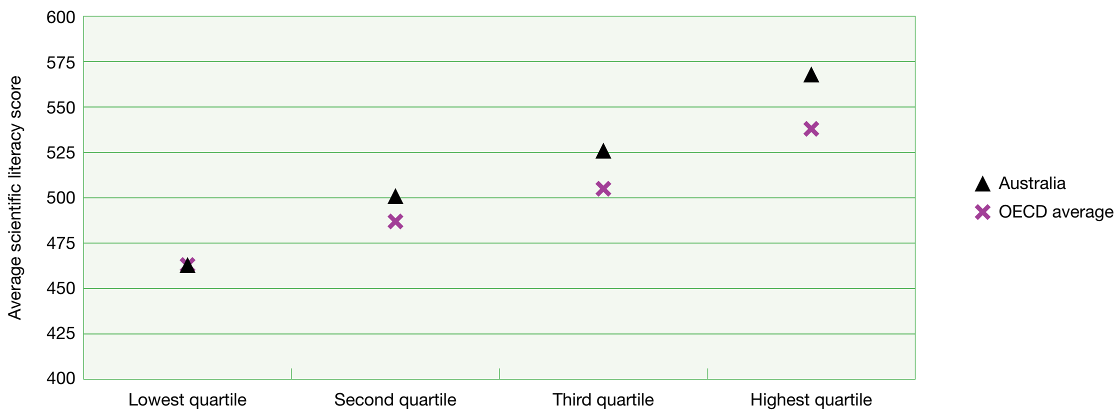


FIGURE 7.10 Relationship between students' enjoyment of learning science and scientific literacy performance for Australia and the OECD average

Figure 7.11 shows students' enjoyment of learning science within Australian schools by jurisdiction. On average, students in Western Australia had the highest levels of enjoyment of learning science with a mean index score of 0.29, followed by students in the Northern Territory and Victoria. Students in the Australian Capital Territory and South Australia had the same level of enjoyment of learning science. These jurisdictions had significantly higher levels of enjoyment of learning science than the OECD average. Students in Queensland and Tasmania had significantly lower levels of enjoyment of science than the OECD average.

Jurisdiction	All students Mean index	SE
ACT	0.13	0.1
NSW	0.10	0.0
VIC	0.15	0.0
QLD	0.03	0.0
SA	0.13	0.0
WA	0.29	0.0
TAS	−0.08	0.1
NT	0.19	0.1

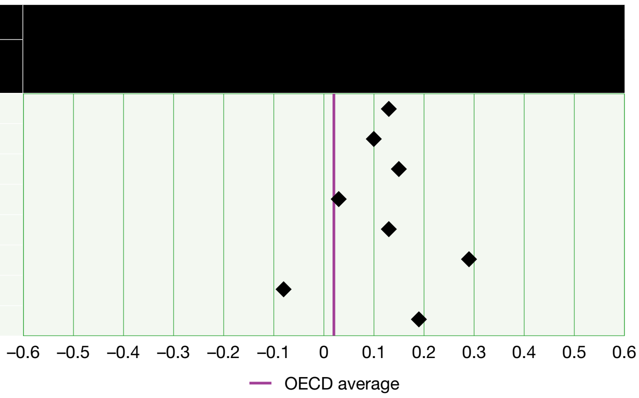


FIGURE 7.11 Enjoyment of learning science, by jurisdiction

Figure 7.12 presents Australian students' enjoyment of learning science by demographic characteristics. Non-Indigenous students reported a significantly higher level of enjoyment of learning science than Indigenous students. Students from metropolitan schools also reported a significantly higher level of enjoyment of learning science than students from provincial schools and remote schools. Students in the highest socioeconomic quartile reported significantly higher levels of enjoyment of learning science than those in other socioeconomic quartiles. Male students also reported a significantly higher level of enjoyment of learning science than females. Australian students in the lowest socioeconomic quartile and Indigenous students reported levels of enjoyment of learning science that were significantly lower than the OECD average.

Demographic group	All students Mean index	SE
Indigenous background		
Indigenous	−0.13	0.0
Non-Indigenous	0.13	0.0
Geographic location		
Metropolitan	0.17	0.0
Provincial	−0.03	0.0
Remote	0.02	0.1
Socioeconomic background		
Lowest quartile	−0.11	0.0
Second quartile	0.01	0.0
Third quartile	0.17	0.0
Highest quartile	0.40	0.0
Sex		
Males	0.20	0.0
Females	0.04	0.0
Australia	**0.12**	**0.0**

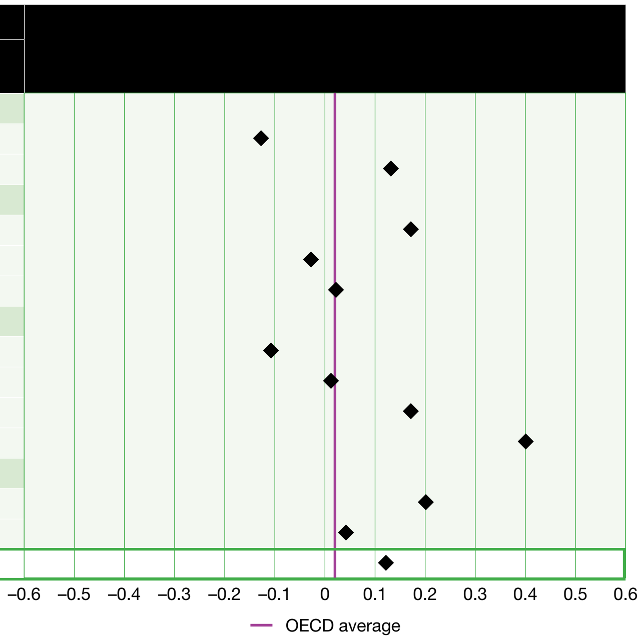


FIGURE 7.12 Enjoyment of learning science, by Indigenous background, geographic location, socioeconomic background and sex

Instrumental motivation to learn science

PISA 2015 not only examined students' general interest in science but also how students assess the relevance of science to their own life and the role external motivation plays in influencing their performance in science. Eccles and Wigfield (1995) report instrumental motivation has been found to be an important predictor of course selection, career choice and academic performance. This is particularly topical today in light of the declining enrolments in science subjects and in particular declining numbers of females who choose to study science and STEM subjects in later years of secondary school and in post-secondary education.

To measure student instrumental motivation to learn science, students responded to four statements about the importance of learning science for either their future studies or job prospects. Students responded to each statement on a four-point scale (strongly agree; agree; disagree; strongly disagree). The four items comprised:

- Making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on.
- What I learn in my science subject(s) is important for me because I need this for what I want to do later on.
- Studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects.
- Many things I learn in my science subject(s) will help me to get a job.

The index of instrumental motivation was created by standardising responses to the four items. Positive values on this index indicated higher levels of instrumental motivation in learning science.

Figure 7.13 presents students' responses for Australia and the selected comparison countries. With the exception of students in Japan who reported a mean index score of –0.02, which was significantly lower than the OECD average of 0.13, students from all other comparison countries reported moderate to high levels of instrumental motivation to learn science. Students in Singapore (mean index score: 0.51) and Canada (mean index score: 0.46) reported the highest levels of motivation to learn science. Australian students reported significantly higher levels of motivation to learn science compared to the OECD average.

	All students	
Country	Mean index	SE
Australia	**0.16**	**0.0**
Hong Kong (China)	0.23	0.0
Singapore	0.51	0.0
Japan	−0.02	0.0
Finland	0.16	0.0
Estonia	0.19	0.0
New Zealand	0.38	0.0
Canada	0.46	0.0
United Kingdom	0.38	0.0
United States	0.32	0.0

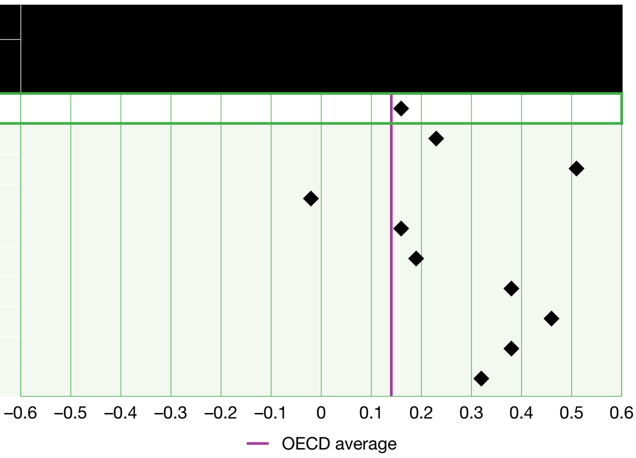


FIGURE 7.13 Index of students' instrumental motivation to learn science: Australian and international results

Figure 7.14 explores the relationship between instrumental motivation to learn science and scientific literacy performance. For Australian students, there was a positive relationship between instrumental motivation to learn science and scientific literacy performance (*r* = 0.18). On the index of instrumental motivation to learn science, students in the highest quartile scored 55 points on average higher than students in the lowest quartile. This score point difference was equal to around one-and-three-quarter years of schooling.

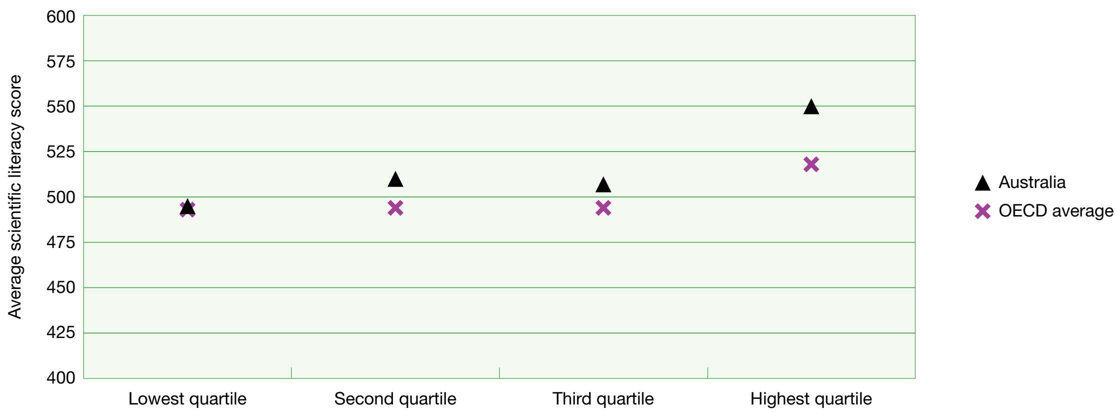


FIGURE 7.14 Relationship between students' instrumental motivation to learn science and scientific literacy performance for Australia and the OECD average

Figure 7.15 shows students' instrumental motivation to learn science within Australian schools by jurisdiction. On average, students in Western Australia (mean index score: 0.28) and South Australia (mean index score: 0.25) had the highest levels of instrumental motivation to learn science. Students from Queensland and the Australian Capital Territory reported the lowest levels of instrumental motivation.

	All students	
Jurisdiction	Mean index	SE
ACT	0.08	0.05
NSW	0.13	0.02
VIC	0.19	0.02
QLD	0.08	0.03
SA	0.25	0.03
WA	0.28	0.03
TAS	0.20	0.04
NT	0.18	0.05

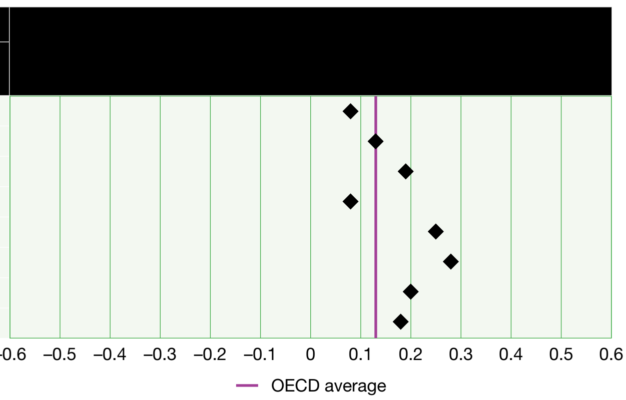


FIGURE 7.15 Instrumental motivation to learn science, by jurisdiction

Figure 7.16 illustrates Australian students' instrumental motivation to learn science by demographic characteristics. Non-Indigenous students were significantly more instrumentally motivated to learn science than the OECD average (0.13) and Indigenous students (0.00). Australian students from metropolitan schools also were significantly more instrumentally motivated to learn science than the OECD average. In terms of socioeconomic background, with the exception of students within the lowest quartile, all Australian students were significantly more instrumentally motivated to learn science than the OECD average. Further, males were significantly more motivated to learn science than females, and were also significantly more motivated than the OECD average.

	All students	
Demographic group	Mean index	SE
Indigenous background		
Indigenous	0.00	0.0
Non-Indigenous	0.17	0.0
Geographic location		
Metropolitan	0.18	0.0
Provincial	0.12	0.0
Remote	0.24	0.1
Socioeconomic background		
Lowest quartile	−0.02	0.0
Second quartile	0.12	0.0
Third quartile	0.21	0.0
Highest quartile	0.32	0.0
Sex		
Males	0.19	0.0
Females	0.14	0.0
Australia	**0.16**	**0.0**

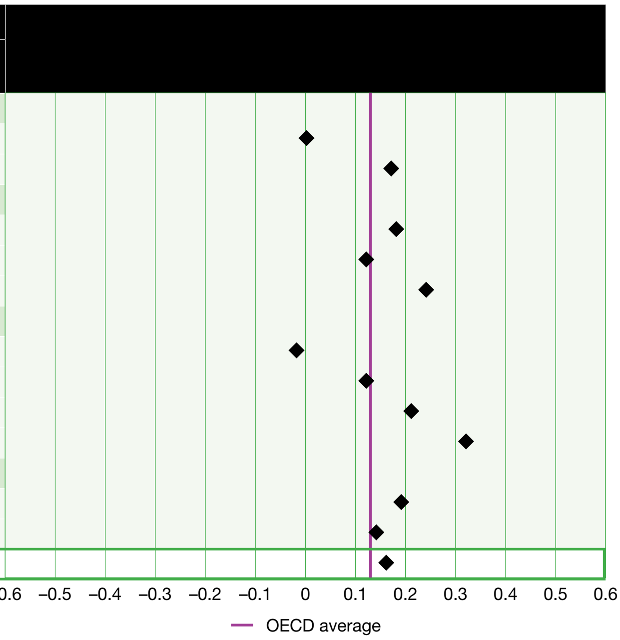


FIGURE 7.16 Instrumental motivation to learn science, by Indigenous background, geographic location, socioeconomic background and sex

Beliefs about science

The student questionnaire contained a number of questions aimed at investigating student awareness and understanding of environmental issues and epistemological value beliefs about science.

Environmental awareness

The study of science at school plays an important role in informing, building and shaping students' environmental awareness, attitudes and their sense of environmental responsibility. The scientific skills and knowledge they gain equip them to assess environmental situations and instil a level of awareness and understanding to engage in active participation in the protection of the environment.

To measure students' environmental awareness, students were asked to respond to seven environmental issues and indicate how informed they were about each issue:

- the increase of greenhouse gases in the atmosphere
- the use of genetically modified organisms (GMO)
- nuclear waste
- the consequences of clearing forests/other land use
- air pollution
- extinction of plants and animals
- water shortage.

Students responded on a four-point scale (I have never heard of this; I have heard about this but I would not be able to explain what it is really about; I know something about this and could explain the general issue; I am familiar with this and I would be able to explain this well).

The seven items were standardised to create an index of environmental awareness. Positive values on this index indicated higher levels of environmental awareness.

Figure 7.17 presents students' index scores for Australia and the selected comparison countries. Students in Singapore and Canada had the highest levels of environmental awareness with mean index scores of 0.40 and 0.39 respectively, followed by students in the United Kingdom (mean index score: 0.30), while students in Japan (mean index score: –0.48) and New Zealand (mean index score: –0.19) had the lowest levels of environmental awareness. Students in Australia had a mean index score of 0.10, which was significantly higher than the OECD average of 0.07.

	All students	
Country	Mean index	SE
Australia	**0.10**	**0.0**
Hong Kong (China)	0.06	0.0
Singapore	0.40	0.0
Japan	–0.48	0.0
Finland	0.05	0.0
Estonia	0.26	0.0
New Zealand	–0.19	0.0
Canada	0.39	0.0
United Kingdom	0.30	0.0
United States	0.11	0.0

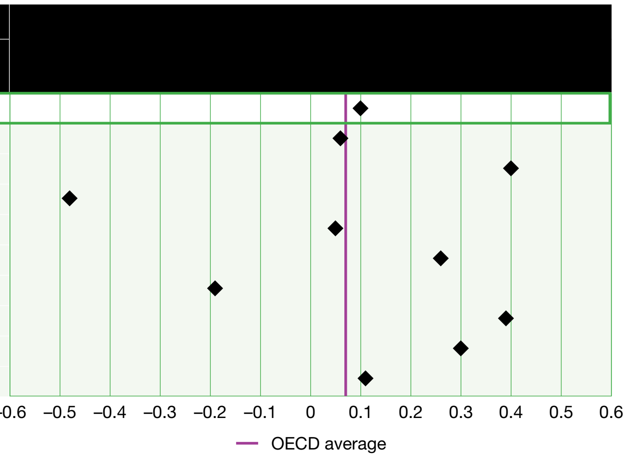


FIGURE 7.17 Index of environmental awareness: Australian and international results

Figure 7.18 explores the relationship between environmental awareness and scientific literacy performance. For Australian students, there was a positive relationship between environmental awareness and scientific literacy performance ($r = 0.30$). On average, students in the highest quartile scored 90 points higher than students in the lowest quartile. This score point difference is equal to around 3 years of schooling.

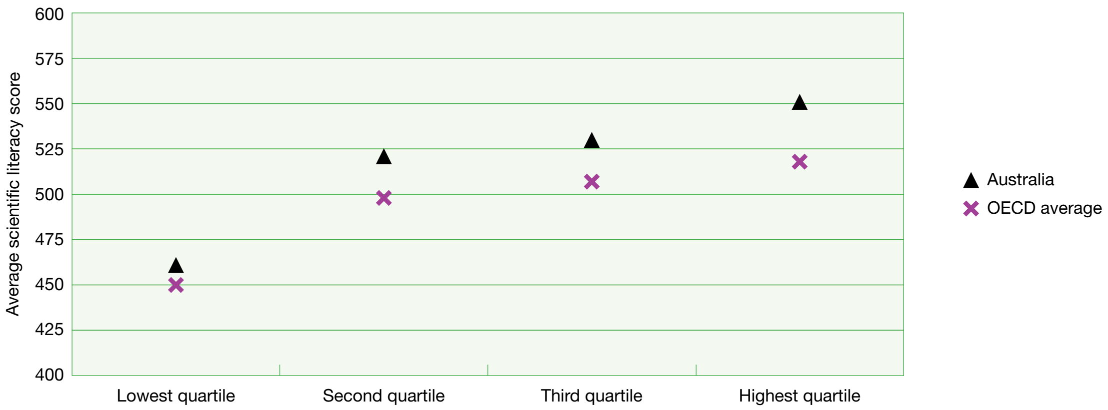


FIGURE 7.18 Relationship between students' environmental awareness and scientific literacy performance for Australia and the OECD average[57]

57 Data for the OECD averages by quartiles for the index of environmental awareness were computed using the International SPSS student data file using only OECD countries.

Figure 7.19 shows students' environmental awareness within Australian schools by jurisdiction. On average, students in New South Wales had the highest levels of environmental awareness with a mean index score of 0.22, followed by the Australian Capital Territory and Western Australia. South Australia, the Northern Territory, Victoria and Queensland had means that were lower than the OECD average of 0.07, while students in Tasmania had a mean index score of –0.15 that was significantly lower than the OECD average.

Jurisdiction	All students	
	Mean index	SE
ACT	0.19	0.1
NSW	0.22	0.0
VIC	0.02	0.0
QLD	0.03	0.0
SA	0.05	0.0
WA	0.17	0.0
TAS	–0.15	0.1
NT	0.05	0.1

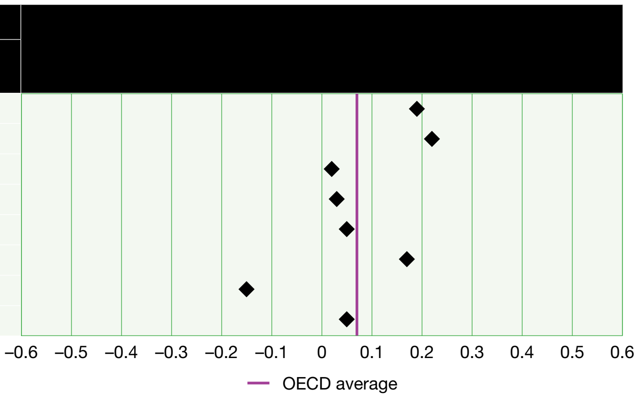


FIGURE 7.19 Environmental awareness, by jurisdiction

Figure 7.20 presents Australian students' environmental awareness by demographic characteristics. Non-Indigenous students showed a significantly lower level of environmental awareness than Indigenous students. Students from metropolitan schools also showed significantly higher levels of environmental awareness than students from provincial schools and remote schools. Students from the highest and third socioeconomic quartiles had significantly higher environmental awareness than students from the other two quartiles. Last, males had significantly higher levels of environmental awareness than females. Overall, Australian students reported a significantly higher level of environmental awareness than the OECD average of 0.07.

Demographic group	All students	
	Mean index	SE
Indigenous background		
Indigenous	0.11	0.0
Non-Indigenous	–0.18	0.0
Geographic location		
Metropolitan	0.15	0.0
Provincial	–0.04	0.0
Remote	0.07	0.2
Socioeconomic background		
Lowest quartile	–0.22	0.0
Second quartile	0.02	0.0
Third quartile	0.19	0.0
Highest quartile	0.42	0.0
Sex		
Males	0.18	0.0
Females	0.03	0.0
Australia	**0.10**	**0.0**

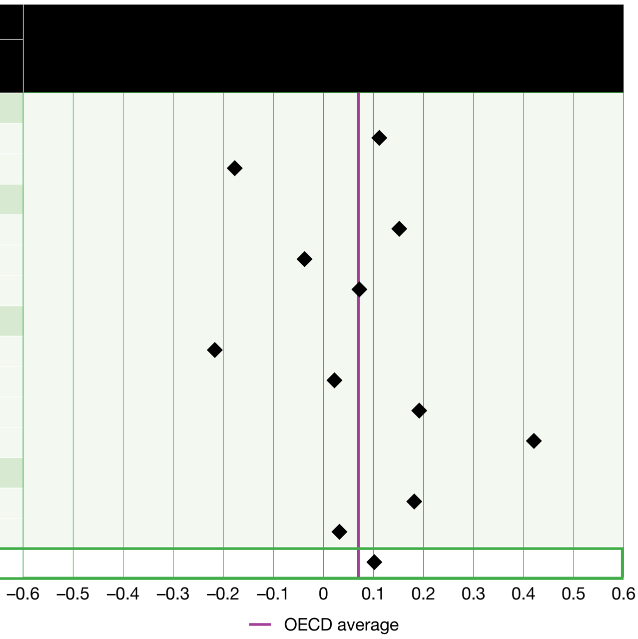


FIGURE 7.20 Environmental awareness, by Indigenous background, geographic location, socioeconomic background and sex

Environmental optimism

Knowledge and scientific understanding of the environment can help to instil a sense of responsibility towards the environment. But if young people cannot make the link between what they learn in school and the environmental challenges that surround them in real life, or if they have unrealistically high or low expectations of meeting those challenges, students will not have the knowledge and skills to be able to effectively apply what they have learned in science in the classroom to real-life challenges (OECD, 2012).

To measure students' environmental optimism, students were asked whether they thought that the problem associated with the following seven environmental issues would improve or get worse over the next 20 years. Students responded to each statement on a three-point scale (improve; stay about the same; get worse). The seven items comprised:

- air pollution
- extinction of plants and animals
- clearing of forests for other land use
- water shortages
- nuclear waste
- the increase of greenhouse gases in the atmosphere
- the use of genetically modified organisms (GMO).

The seven items were standardised to create an index of environmental optimism. Positive values on this index indicated students reported higher levels of environmental optimism.

Figure 7.21 presents students' index scores for Australia and the selected comparison countries. Students in Estonia (mean index score: 0.48), Japan (mean index score: 0.32) and the United States (mean index score: 0.16) were the most optimistic about environmental issues improving over the next 20 years, while students in Canada, Australia and New Zealand had the lowest levels of environmental optimism. Students in Australia had a mean index score of –0.24, which was significantly lower than the OECD average of –0.03. Students' environmental optimism varied significantly across the comparison countries. However, comparisons across countries should be interpreted with caution, since students in different countries may not answer questions on environmental issues in exactly the same way.

	All students	
Country	Mean index	SE
Australia	**–0.24**	**0.0**
Hong Kong (China)	–0.01	0.0
Singapore	–0.05	0.0
Japan	0.32	0.0
Finland	0.02	0.0
Estonia	0.48	0.0
New Zealand	–0.24	0.0
Canada	–0.31	0.0
United Kingdom	–0.07	0.0
United States	0.16	0.0

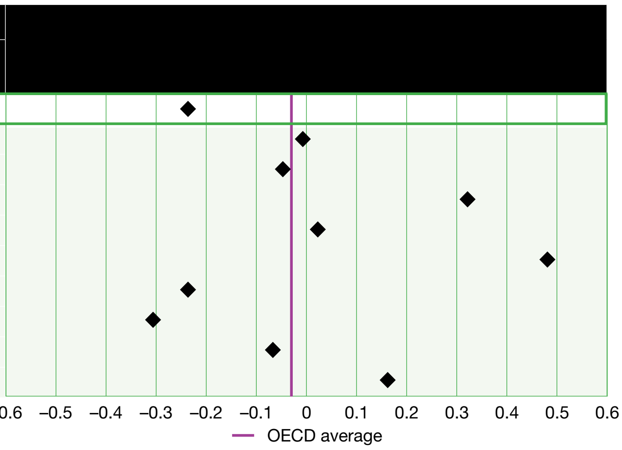


FIGURE 7.21 Index of environmental optimism: Australian and international results

Figure 7.22 explores the relationship between environmental optimism and scientific literacy performance. For Australian students, there was a positive relationship between environmental optimism and scientific literacy performance (*r* = 0.16). On average, students in the highest quartile scored 68 points higher than students in the lowest quartile on the index of environmental optimism. This score point difference is equal to around 2 years of schooling.

The positive relationship in Australia is a very different pattern to the one shown on average across the OECD, where students in the highest quartile of optimism performed significantly lower than students in all other quartiles.

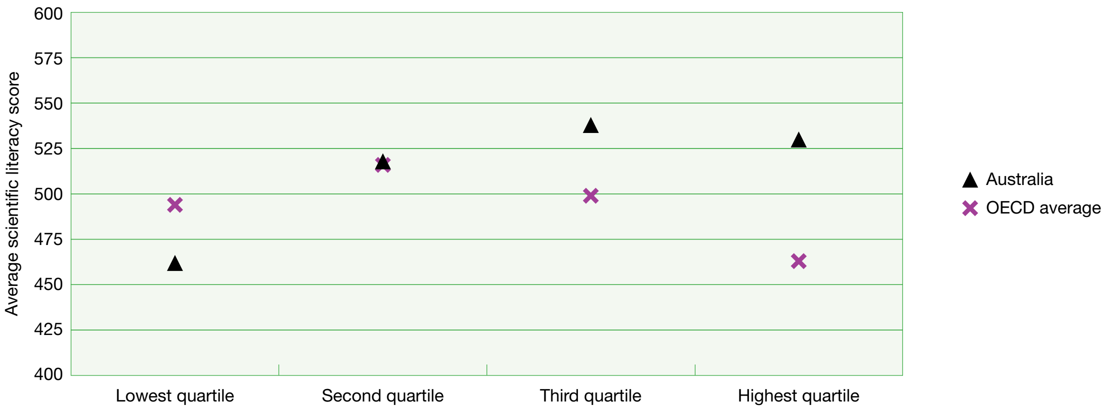


FIGURE 7.22 Relationship between students' environmental optimism and scientific literacy performance for Australia and the OECD average[58]

Figure 7.23 shows students' environmental optimism within Australian schools by jurisdiction. On average, students in Tasmania had the highest levels of environmental optimism (mean index score: –0.14) followed by South Australia (mean index score: –0.15). Students in the Northern Territory, Western Australia and Queensland reported the lowest levels of environmental optimism. Students across all jurisdictions had significantly lower levels of environmental optimism than the OECD average of –0.03.

	All students	
Jurisdiction	Mean index	SE
ACT	–0.21	0.06
NSW	–0.24	0.03
VIC	–0.20	0.03
QLD	–0.30	0.03
SA	–0.15	0.03
WA	–0.31	0.03
TAS	–0.14	0.04
NT	–0.40	0.06

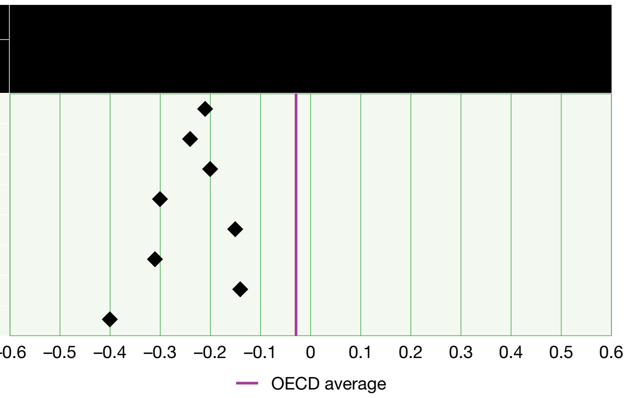


FIGURE 7.23 Environmental optimism, by jurisdiction

58 Data for the OECD averages by quartiles for the index of environmental optimism were computed using the International SPSS student data file using only OECD countries.

Figure 7.24 presents Australian students' environmental optimism by demographic characteristics. Indigenous students showed a significantly higher level of environmental optimism than non-Indigenous students. Students from metropolitan schools also showed similar levels of environmental optimism to students from provincial schools. Students from the highest socioeconomic quartile had significantly lower environmental optimism than students from each of the other three socioeconomic quartiles. Finally, males had significantly higher levels of environmental optimism than females. Overall, Australian students reported a significantly lower level of environmental optimism than the OECD average (–0.03.)

Demographic group	All students: Mean index	All students: SE
Indigenous background		
Indigenous	−0.09	0.1
Non-Indigenous	−0.25	0.0
Geographic location		
Metropolitan	−0.24	0.0
Provincial	−0.24	0.0
Remote	−0.07	0.2
Socioeconomic background		
Lowest quartile	−0.15	0.0
Second quartile	−0.21	0.0
Third quartile	−0.29	0.0
Highest quartile	−0.31	0.0
Sex		
Males	−0.11	0.0
Females	−0.37	0.0
Australia	**−0.24**	**0.0**

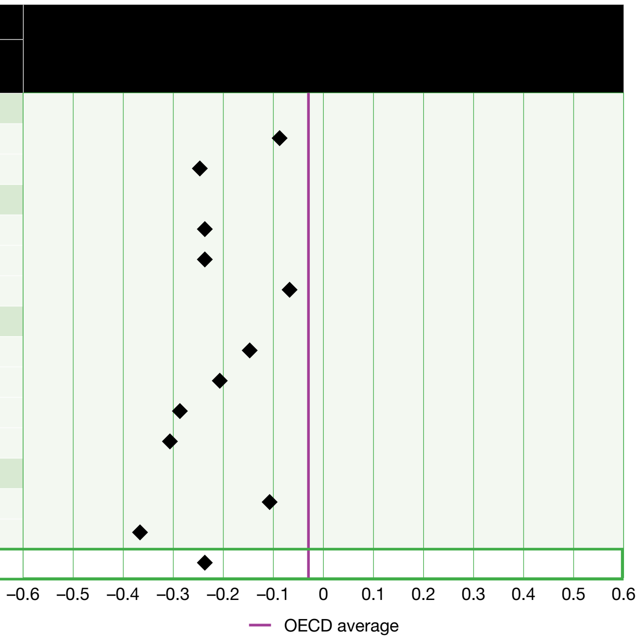


FIGURE 7.24 Environmental optimism, by Indigenous background, geographic location, socioeconomic background and sex

Value beliefs about science (epistemological beliefs)

Students' epistemological beliefs about science, that is how knowledge of science is constructed, are closely related to students' general values of science and scientific inquiry (Hofer and Pintrich, 2002).

Students were asked to indicate their level of agreement to a series of six statements about their knowledge of how value beliefs about science are constructed. Students responded on a four-point scale (strongly disagree; disagree; agree; strongly agree). The value beliefs about science statements were:

- A good way to know if something is true is to do an experiment.
- Ideas in science sometimes change.
- Good answers are based on evidence from many different experiments.
- It is good to try experiments more than once to make sure of your findings.
- Sometimes broad science scientists change their minds about what is true.
- The ideas in science books sometimes change.

The six items were standardised to create an index of epistemological beliefs (valuing scientific approaches to enquiry). Positive values on this index indicated higher levels of value beliefs about science. Figure 7.25 shows the result for this index for Australia and the comparison countries.

Students in Singapore had the highest levels of epistemic beliefs (mean index score: 0.30), followed by students in the United States (mean index score: 0.26) and Australia (mean index score: 0.26). These results were also significantly higher than the OECD average of –0.01. New Zealand (mean index score: –0.06) and Estonia (mean index score: –0.07) had the lowest levels of knowledge of how science beliefs are constructed.

	All students	
Country	Mean index	SE
Australia	**0.26**	**0.0**
Hong Kong (China)	0.22	0.0
Singapore	0.30	0.0
Japan	0.22	0.0
Finland	0.01	0.0
Estonia	–0.07	0.0
New Zealand	–0.06	0.0
Canada	0.22	0.0
United Kingdom	0.04	0.0
United States	0.26	0.0

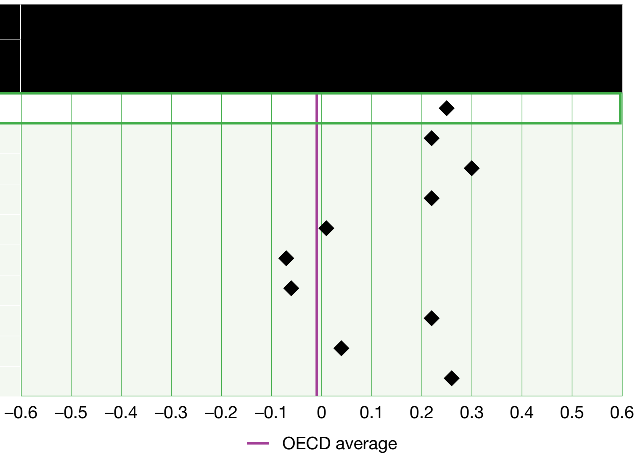


FIGURE 7.25 Index of epistemic beliefs about science: Australian and international results

Figure 7.26 explores the relationship between students' epistemic beliefs and scientific literacy performance. For Australian students, there was a positive relationship between epistemological beliefs about science and scientific literacy performance (r = 0.39). On average, students in the highest quartile scored 104 points higher than students in the lowest quartile. This score point difference was equal to around 3 years of schooling.

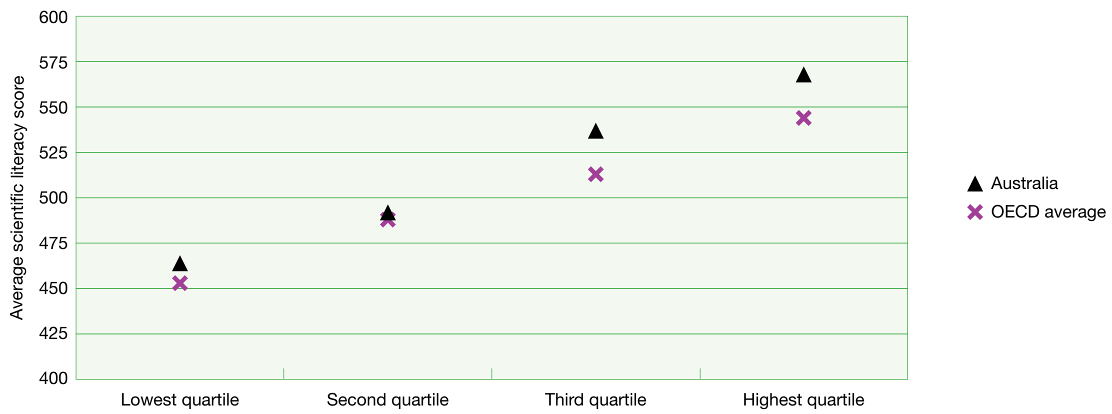


FIGURE 7.26 Relationship between students' epistemic beliefs about science and scientific literacy performance for Australia and the OECD average

Figure 7.27 shows students' epistemic beliefs within Australian schools by jurisdiction. On average, students in Victoria had the highest levels of epistemic beliefs about science (mean index score: 0.30), followed by students in New South Wales (mean index score: 0.27) and Western Australia (mean index score: 0.25). All remaining jurisdictions reported lower levels of epistemic beliefs about science than the Australian average (mean index score: 0.26); however, students in all jurisdictions had significantly higher levels of epistemic beliefs about science than the OECD average (mean index score: –0.01).

Jurisdiction	All students: Mean index	All students: SE
ACT	0.24	0.1
NSW	0.27	0.0
VIC	0.30	0.0
QLD	0.22	0.0
SA	0.20	0.0
WA	0.25	0.0
TAS	0.18	0.0
NT	0.22	0.1

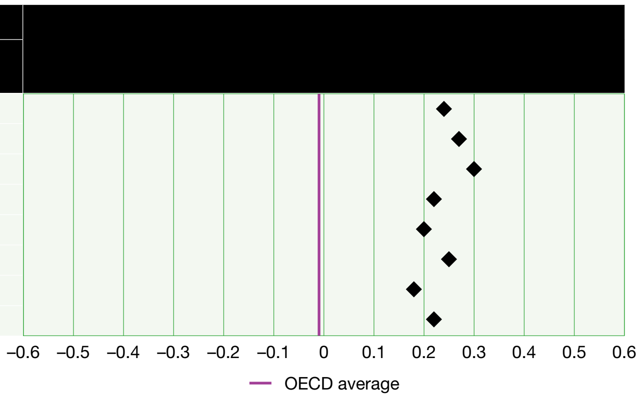


FIGURE 7.27 Epistemic beliefs about science, by jurisdiction

Figure 7.28 presents Australian students' epistemic beliefs about science by demographic characteristics. Indigenous students reported showing significantly more knowledge of how science beliefs are constructed than the average for all OECD countries. Australian students from metropolitan and provincial schools also reported having significantly higher levels of knowledge of how science beliefs are constructed than the OECD average. Students from the highest socioeconomic quartile had significantly higher expistemic beliefs about how science beliefs are constructed than students from each of the other three socioeconomic quartiles. Students from the highest quartile had a reported mean index score nearly double that of students from the third quartile. Finally, females reported significantly higher levels of knowledge of how science beliefs are constructed than males and males and females reported higher epistemic beliefs about science than the OECD average (mean index score: −0.01).

Demographic group	All students: Mean index	All students: SE
Indigenous background		
Indigenous	0.27	0.0
Non-Indigenous	−0.02	0.0
Geographic location		
Metropolitan	0.30	0.0
Provincial	0.17	0.0
Remote	0.02	0.1
Socioeconomic background		
Lowest quartile	0.05	0.0
Second quartile	0.16	0.0
Third quartile	0.29	0.0
Highest quartile	0.55	0.0
Sex		
Males	0.25	0.0
Females	0.28	0.0
Australia	**0.26**	**0.0**

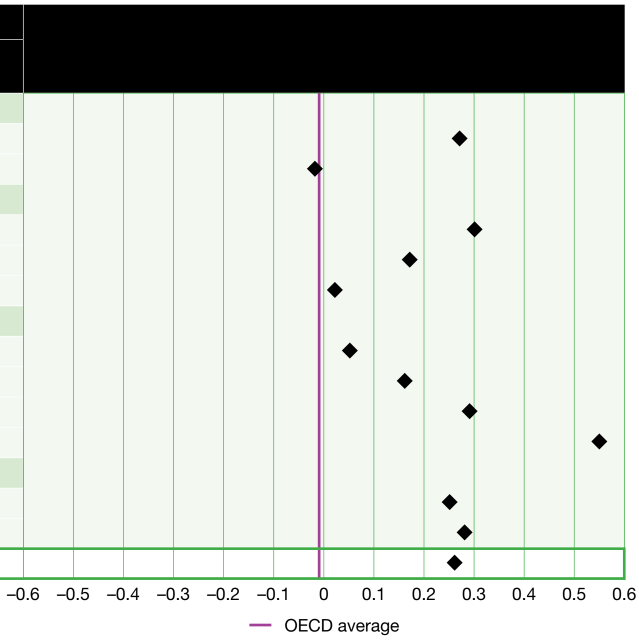


FIGURE 7.28 Epistemic beliefs about science, by Indigenous background, geographic location, socioeconomic background and sex

Career aspirations in science

Career in science-related occupation at age 30

In PISA 2015, students were asked about their career aspirations at age 30 and to indicate the type of job they expected to have at that time. Student responses were coded using the International Standard Classification of Occupations (ISCO-08)[59]. These codes were then used to create an indicator of science-related career expectations defined as those that require the study of science beyond compulsory education, typically at the tertiary education level.

According to ISCO-08, science-related careers are defined as those that involve a considerable amount of science, plus careers that involve tertiary education in a scientific field. Therefore, science-related careers include careers that go beyond the traditional understanding of a scientist to include, for example, careers in engineering, meteorology, pharmacology, optometry and medicine.

The percentage of students who expect to have a science-related career is an indicator of an important educational outcome. Given the decline of Australian students, in particular females, in pursuing higher level studies in mathematics and science at senior secondary school and subsequently at university level, there is a shortage of science professionals in the labour market. An analysis of students reporting that they expected to have science-related careers, in conjunction with other background factors such as the socioeconomic background of students and gender, can help to identify in which student groups, and to what extent, science orientation may be less pronounced.

Table 7.1 shows students' science-related career expectations at age 30 across the selected comparison countries. On average, across OECD countries, nearly one-quarter of students reported they expect to work in an occupation that requires further science training beyond compulsory school education. The proportions of students who expect to work in a science-related career varied across countries, with 38% of students in the United States, and 34% of students in Canada expecting to work in a science-related career compared to 18% of students in Japan and 17% of students in Finland. In Australia, 29% of students reported expecting to work in science-related careers, which was significantly higher than the OECD average.

On average across the OECD, 55% of students reported that they expected to work in non-science related careers at age 30. The highest proportions of students expecting to work in a non-science related career were from Japan (64%) and Estonia (60%), followed by Finland and Singapore (58% respectively). Fifty-five per cent of Australian students expected to work in non-science related careers.

On average, just over 20% of students across OECD countries reported vague career expectations where students gave responses that included 'I don't know', 'a good job' or they did not provide a career. In comparison, a significantly lower proportion of Australian students responded with vague careers expectations (15%).

Overall, in Australia, students' career expectations separated by science-related disciplines showed students' career expectations were significantly higher than the OECD average for each discipline, with the exception of careers in the fields of ICT. Students in Australia were most likely to anticipate a science-related career as a *health professional* (15%), followed by *science and engineering professionals* (10%). Less than 5% of Australian students anticipated a career as an *information and communication technology professional* (3%) or *science-related technician or associate professional* (1%).

59 International Labour Organisation. ISCO-88 International Standard Classification of Occupations. http://www.ilo.org/public/english/bureau/stat/isco/isco08/index.htm. Accessed 19 July 2016.

TABLE 7.1 Students' career expectations at age 30: Australia and international comparisons

Country	Students who expect to work in science-related occupations at age 30					
	Science and Engineering professionals		Health professionals		Information and communication technology professionals	
	%	SE	%	SE	%	SE
Australia	**10**	**0.4**	**15**	**0.4**	**3**	**0.1**
Hong Kong (China)	9	0.4	13	0.6	2	0.2
Singapore	14	0.5	12	0.5	2	0.2
Japan	5	0.4	10	0.5	2	0.3
Finland	4	0.3	11	0.5	2	0.2
Estonia	8	0.5	8	0.4	8	0.4
New Zealand	8	0.4	13	0.5	2	0.2
Canada	12	0.4	19	0.5	2	0.1
United Kingdom	13	0.5	14	0.5	3	0.2
United States	13	0.6	22	0.7	2	0.2
OECD average	**9**	**0.1**	**11**	**0.1**	**3**	**0.0**

Country	Students who expect to work in science-related occupations at age 30					
	Science-related technicians and associate professionals		Students who expect to work in non-Science related occupations at age 30		Students with vague career expectations*	
	%	SE	%	SE	%	SE
Australia	**1**	**0.1**	**55**	**0.6**	**15**	**0.5**
Hong Kong (China)	0	0.1	57	0.8	20	0.9
Singapore	1	0.1	58	0.7	14	0.5
Japan	1	0.1	64	1.0	18	0.8
Finland	1	0.1	58	0.7	25	0.7
Estonia	1	0.1	60	0.7	15	0.5
New Zealand	1	0.1	51	0.8	24	0.6
Canada	1	0.1	45	0.6	21	0.6
United Kingdom	0	0.1	53	0.8	17	0.8
United States	1	0.1	49	0.9	14	0.8
OECD average	**1**	**0.0**	**55**	**0.1**	**21**	**0.1**

Note: * Students with vague career expectations include those whose answer is missing or invalid (undecided, does not know)

Table 7.2 shows students' science-related career expectations at age 30 by jurisdiction. Overall, nearly one-third of students in Victoria and Western Australia expect to work in a science-related career at age 30, compared to just over one-fifth of students in the Australian Capital Territory and Tasmania.

Separated by science-related disciplines, irrespective of jurisdiction, students in Australia were more likely to report careers aspirations as *health professionals* with the highest proportions of students in Victoria and Western Australia (17% respectively). Students from the Australian Capital Territory (8%) and Tasmania (7%) were less inclined to report aspiring to work in *science and engineering professions*.

Students in New South Wales reported the highest level of students aspiring to work in non-science related careers at age 30 (57%) while just over 25% of students in the Australian Capital Territory had vague, missing or indecisive career expectations which suggests they were undecided about their future career aspirations and preferred to provide a considered response only.

TABLE 7.2 Students' career expectations at age 30, by jurisdiction

Jurisdiction	Students who expect to work in science-related occupations at age 30: Science and Engineering professionals %	SE	Health professionals %	SE	Information and communication technology professionals %	SE
ACT	8	0.9	12	1.2	3	0.6
NSW	9	0.6	15	0.8	3	0.3
VIC	11	0.9	17	0.7	3	0.4
QLD	11	0.8	15	0.8	2	0.3
SA	10	0.8	16	0.9	3	0.5
WA	10	0.8	17	1.0	3	0.5
TAS	7	1.0	12	1.2	2	0.4
NT	10	1.4	15	2.0	2	0.9
OECD average	**9**	**0.1**	**11**	**0.1**	**3**	**0.0**

Jurisdiction	Students who expect to work in science-related occupations at age 30: Science-related technicians and associate professionals %	SE	Students who expect to work in non-Science related occupations at age 30 %	SE	Students with vague career expectations* %	SE
ACT	1	0.4	50	1.9	27	1.5
NSW	1	0.2	57	1.1	15	0.7
VIC	1	0.2	54	1.2	14	1.0
QLD	1	0.3	55	1.2	17	0.9
SA	2	0.3	56	1.5	14	1.0
WA	1	0.2	55	1.4	14	1.2
TAS	2	0.5	55	1.8	22	1.6
NT	0	0.1	56	2.8	16	2.2
OECD average	**1**	**0.0**	**55**	**0.1**	**21**	**0.1**

Note: * Students with vague career expectations include those whose answer is missing or invalid (undecided, does not know)

Table 7.3 shows students' science-related career expectations at age 30 by sex. In Australia, a similar proportion of males and females reported career aspirations in science-related careers at age 30. However, three times as many males as females reported expecting to work in *science and engineering professions*, while over twice as many females than males reported aspiring to work in *health-related careers*. Slightly more females than males reported expecting to work in non-science related careers at age 30.

TABLE 7.3 Students' career expectations at age 30, by sex

Sex	Students who expect to work in science-related occupations at age 30: Science and Engineering professionals %	SE	Health professionals %	SE	Information and communication technology professionals %	SE
Females	5	0.3	22	0.5	0‡	0.1
Males	15	0.6	9	0.4	5	0.3
OECD average	**9**	**0.1**	**11**	**0.1**	**3**	**0.0**

Sex	Students who expect to work in science-related occupations at age 30: Science-related technicians and associate professionals %	SE	Students who expect to work in non-Science related occupations at age 30 %	SE	Students with vague career expectations* %	SE
Females	1	0.1	57	0.7	15	0.6
Males	1	0.2	54	0.7	16	0.6
OECD average	**1**	**0.0**	**55**	**0.1**	**21**	**0.1**

Note: * Students with vague career expectations include those whose answer is missing or invalid (undecided, does not know)
‡ Less than 1%

Table 7.4 shows students' perceptions about the usefulness of studying school science and their career aspirations at age 30. In Australia, a significantly higher proportion of females than males who want to work in science related technicians and associated professions agreed that making an effort in school science subjects is useful for the work they want to do later on. Meanwhile, students (69% males; 62% females) who want to work in ICT professions perceive school science to be useful for their career.

TABLE 7.4 Instrumental motivation to learn science among students aspiring to work in a science-related occupation at age 30, by sex

	Percentage of students who 'agree' or strongly agree' that "making an effort in my science subject(s) is worth it because this will help in the work I want to do later on", among...											
	...students who expect to work in science-related occupations at age 30								...students who expect to work in other occupations at age 30		...students with vague career expectations or whose answer is missing or invalid (undecided, does not know...) *	
	Science and Engineering professionals		Health professionals		Information and communication technology professionals		Science-related technicians and associate professionals		Non-science-related professional and technical occupations			
Sex	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Females	85	2.2	91	1.0	62	9.1	91	3.9	59	0.9	67	2.0
Males	87	1.3	94	1.1	69	2.6	73	6.0	63	1.0	71	1.7
OECD average	**84**	**0.3**	**90**	**0.2**	**67**	**0.8**	**81**	**1.0**	**63**	**0.2**	**67**	**0.3**

Note: * Students with vague career expectations include those whose answer is missing or invalid (undecided, does not know)

These findings should be interpreted with caution as when students think about what they learn in their science subjects at school, they may be thinking about the content knowledge and facts they have learned in biology, chemistry physics or earth science rather than thinking about the procedural or epistemic knowledge that can be applied outside of science-related careers.

Career expectations among high and low performers

Table 7.5 shows the percentage of students in Australia with science-related career expectations at age 30 by their proficiency in science. In Australia, students' expectation of pursuing a career in science is strongly related to their scientific proficiency. On average, only 14% of students who achieve below the PISA proficiency Level 2 in science expected to work in a science-related career; this increases to 27% for those performing at Level 2 or 3, and again to 38% for those students performing at Level 4. Just under 50% of students performing at Level 5 or above expected to be working in a science-related career at age 30.

TABLE 7.5 Percentage of students, by scientific literacy proficiency scale and science-related career at age 30 – Australia

	Low achievers in science (students performing below Level 2)		Moderate performers in science (students performing at Level 2 or 3)		Strong performers in science (students performing at Level 4)		Top perfomers in science (students performing at Level 5 or above)	
Career expectation	%	SE	%	SE	%	SE	%	SE
Science and Engineering professionals	4	0.5	8	0.4	14	0.9	23	1.5
Health professionals	8	0.7	15	0.5	19	1.1	19	1.6
Information and communication technology professionals	1	0.3	2	0.2	3	0.4	4	0.7
Science-related technicians and associate professionals	0	0.2	1	0.2	2	0.3	2	0.5
Science-related professions (Total)	**14**	**1.0**	**27**	**0.7**	**38**	**1.5**	**48**	**1.7**
OECD average	**13**	**0.2**	**23**	**0.2**	**33**	**0.4**	**41**	**0.6**

Note: Total numbers do not sum to science-related professions (Total) due to rounding.

Nearly 25% of high performers (performing at Level 5 or above) expected to pursue a career in science and engineering disciplines, while 19% of students performing at Level 4 or Level 5 or above expected to pursue a career in a health profession. Nearly 10% of low performing students in science (performing below Level 2) expected to pursue a career in a health field. Irrespective of student proficiency in science, there was a similar proportion of students who expected to work in ICT professions.

CHAPTER 8

The school learning environment

Key findings

- School leaders may need to show more active leadership when the learning environment deteriorates and student problems arise. Many of the top-performing PISA countries reported levels of educational leadership lower than the OECD average, whereas levels for Australia were, on average, substantially higher than across the OECD.
- Within Australia, levels of educational leadership were highest for Tasmania and the Northern Territory and lowest for the Australian Capital Territory. Educational leadership levels were also significantly higher for low socioeconomic background (disadvantaged) schools.
- Principals judged student-related behaviours, such as truancy and skipping classes, to occupy their time and hinder instruction, particularly in the Northern Territory and in disadvantaged schools.
- Teacher-related behaviours such as absenteeism, not being prepared for class and not meeting individual students' needs were also seen by a significant proportion of principals to hinder instruction, and this was again most apparent in disadvantaged schools.
- While staffing was not perceived to be a problem for principals in general, around two-thirds of principals in the Northern Territory reported that a lack of, or inadequate or poorly qualified teaching staff hindered instruction. Socioeconomic differences were also apparent, with a much greater proportion of principals of disadvantaged schools identifying such issues compared to advantaged schools.
- Many principals reported that inadequate or poor quality physical infrastructure hindered their capacity to provide instruction, 34% of principals of students from disadvantaged schools compared with 12% of principals of students from advantaged schools identified this as an issue.
- Australian students were generally positive about how much support their science teachers provided; however, while the differences were small, a significantly lower percentage of students at disadvantaged schools than affluent schools reported the teacher showing interest in every student's learning, teacher providing extra help, and the teacher helping students with their learning.

- Student reports indicated that many Australian schools have a poor climate of classroom discipline. Australia scored significantly lower than the OECD average on this index, indicating a more problematic situation than across the OECD. About one-third of the students in advantaged schools, and about half of those in disadvantaged schools, reported that in most or every class there was noise and disorder, students didn't listen to what the teacher said, and that students found it difficult to learn. This was particularly an issue in Tasmania and New South Wales.

The school learning environment influences student engagement and performance, as well as teachers' desire to continue working at the school. This chapter examines the learning environment at the school, classroom and student level, from the perspectives of principals and students. Results for Australian schools and students were investigated at national and jurisdictional levels, and according to socioeconomic background. In addition, results for the same nine countries selected in Chapter 7 (Estonia, Finland, Hong Kong (China), Japan, Singapore, Canada, New Zealand, the United Kingdom and the United States) are also reported on, in order to put Australian schools and students' responses in an international context.

The principal's perspective

School principals play a significant role in the management of their school. Böhlmark, Gronqvist and Vlachos (2016) reported that principals can have a substantive impact on school policies, working conditions and student outcomes. Principals can shape teachers' professional development, define the school's educational goals and ensure that instructional practice is directed towards achieving these goals. In addition, good leadership involves suggesting modifications to improve teaching practices and helping to solve problems that may rise within the classroom or among teachers.

The PISA school questionnaire focuses on how school leaders create a positive learning environment by building effective teacher–principal relationships. However, it should be noted that some of the responses given by principals may be based on social desirability and, as such, care should be taken when interpreting the findings, particularly those relating to leadership styles that are positively viewed by others.

School leadership

Principals or their nominated designate were asked to respond to a series of statements about their management of their school. They were asked to indicate the frequency with which 13 activities and behaviours, related to school management, occurred in their school in the previous academic year on a six-point scale (did not occur; 1–2 times during the year; 3–4 times during the year; once a month; once a week; more than once a week). These items were used to create an overarching educational leadership index and four sub-indices. Each separate index was standardised to have a mean of 0 and a standard deviation of 1, with positive values indicating higher levels on the relevant index when compared to the OECD average. The first part of this chapter focuses on the overarching index of educational leadership and the sub-indices of curricular development and instructional leadership.

Curricular development

School principals play a key role in curricular development. Principals can both shape teachers' professional development and define their school's educational goals to ensure that instructional practice is directed towards achieving these goals. These functions and many more are essential in promoting teacher–student development and teachers' lifelong teaching and learning capabilities.

To examine the extent to which principals engaged in these activities in their school, the following four items together defined the index of curricular development. They were drawn from the 13 items measuring educational leadership:

- I use student performance results to develop the school's educational goals
- I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school
- I ensure that teachers work according to the school's educational goals
- I discuss the school's academic goals with teachers at faculty meetings.

Figure 8.1 shows principals' curricular development index scores for Australia and for selected comparison countries. Principals in the United Kingdom and the United States reported the highest levels of engagement in curricular development with mean index scores of 1.04 and 0.94 respectively, Australia followed with a mean index score of 0.71. These results were significantly higher than the OECD average of –0.01. Principals in schools in Japan reported significantly lower levels of engagement in their schools curricular development with a mean index score of –1.12, followed by Finland with a mean index score of –0.40.

	All students	
Country	Mean index	SE
Australia	**0.71**	**0.0**
Hong Kong (China)	-0.19	0.1
Singapore	0.36	0.0
Japan	-1.12	0.1
Finland	-0.40	0.1
Estonia	0.00	0.0
New Zealand	0.49	0.1
Canada	0.42	0.0
United Kingdom	1.04	0.1
United States	0.94	0.1

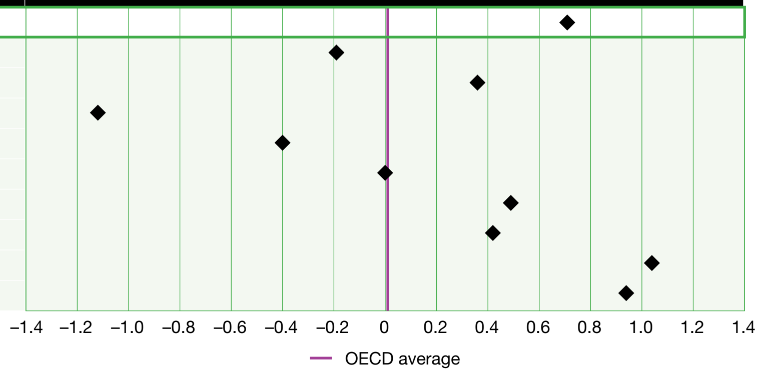


FIGURE 8.1 Index of curricular development: Australian and international results

Figure 8.2 shows principals' index scores in curricular development within Australian schools by jurisdiction. On average, principals across Australia reported levels of engagement in curricular development that were significantly higher than the OECD average. Principals in the Northern Territory and Victoria reported the equal highest mean index scores of 0.92 followed by those in Tasmania with a mean index score of 0.80. Principals in the Australian Capital Territory reported the lowest level of engagement with curricular development in their schools.

	All students	
Jurisdiction	Mean index	SE
ACT	0.36	0.0
NSW	0.60	0.1
VIC	0.92	0.1
QLD	0.74	0.1
SA	0.50	0.1
WA	0.65	0.1
TAS	0.80	0.1
NT	0.92	0.0

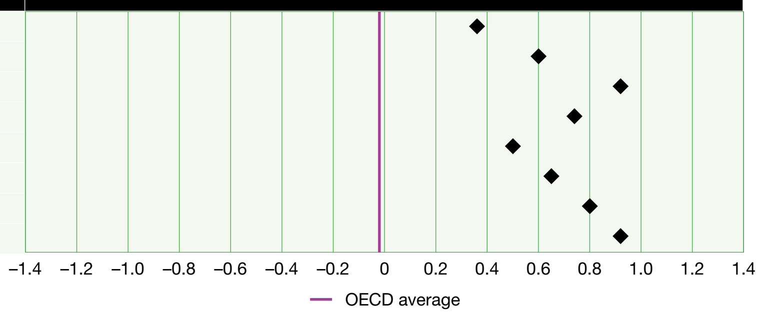


FIGURE 8.2 Curricular development, by jurisdiction

Figure 8.3 shows that, on average, principals of Australian schools at all levels of socioeconomic background score higher on the index of curricular develpment by socioeconomic quartile than the OECD average. However, principals at schools within the lowest socioeconomic quartile (disadvantaged schools) scored significantly higher on this index than principals from schools in any other socioeconomic quartile.

Socioeconomic background	All students	
	Mean index	SE
Lowest quartile	0.99	0.1
Second quartile	0.74	0.1
Third quartile	0.49	0.1
Highest quartile	0.65	0.1

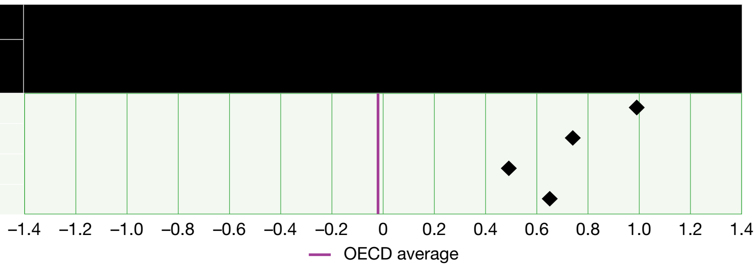


FIGURE 8.3 Curricular development, by socioeconomic quartile

Instructional leadership

PISA also examined instructional leadership. According to Blase and Blase (1999) 'Instructional leadership strategies have strong enhancing effects on teachers emotionally, cognitively, and behaviourally.' Effective instructional leadership plays an important role in enhancing school communities and not only enact school improvement and reform, but also supports collaborative efforts among teachers.

To examine instructional leadership, an index was defined comprising the following three items of instructional leadership:

- I promote teaching practices based on recent educational research
- I praise teachers whose students are actively participating in learning
- I draw teachers' attention to the importance of pupils' development of critical and social capacities.

Figure 8.4 shows the principals' instructional leadership index scores for Australia and the comparison countries. Principals in the United States and the United Kingdom reported the highest levels of participation in instructional leadership with mean index scores of 0.97 and 0.82 respectively followed by Australia with a mean index score of 0.63. These results were significantly higher than the OECD average of –0.01. Principals in Japan reported significantly lower levels of particiption in instructional leadership with a mean index score of –1.26, followed by Hong Kong (China) with a mean index score of –0.54.

Country	All students	
	Mean index	SE
Australia	**0.63**	**0.0**
Hong Kong (China)	–0.54	0.1
Singapore	0.28	0.0
Japan	–1.26	0.1
Finland	–0.24	0.1
Estonia	–0.08	0.0
New Zealand	0.36	0.1
Canada	0.55	0.0
United Kingdom	0.82	0.1
United States	0.97	0.1

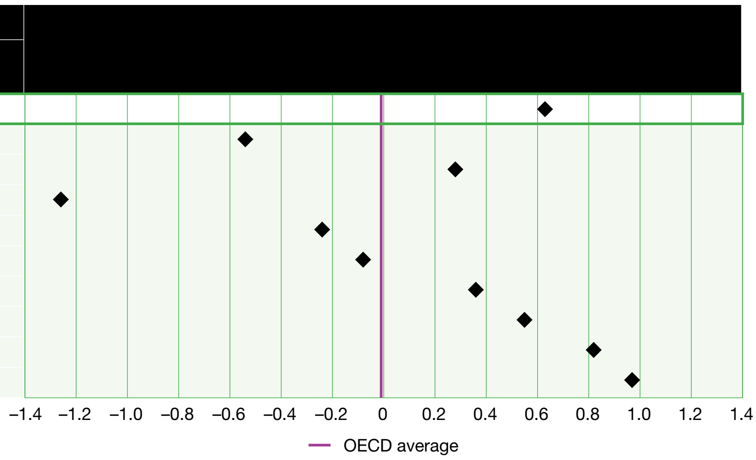


FIGURE 8.4 Index of instructional leadership: Australian and international results

Figure 8.5 shows the principals' index scores on use of instructional leadership strategies within Australian schools by jurisdiction. On average, principals across Australia reported using instructional leadership strategies to a greater extent than across the OECD.

Principals in the Northern Territory reported the highest mean index scores of 0.92. Principals in South Australia and Western Australia reported the lowest levels of use of instructional leadership strategies in their schools, which were, however, still significantly higher than the OECD average.

	All students	
Jurisdiction	Mean index	SE
ACT	0.57	0.0
NSW	0.71	0.1
VIC	0.73	0.1
QLD	0.70	0.1
SA	0.43	0.1
WA	0.41	0.1
TAS	0.68	0.1
NT	0.92	0.0

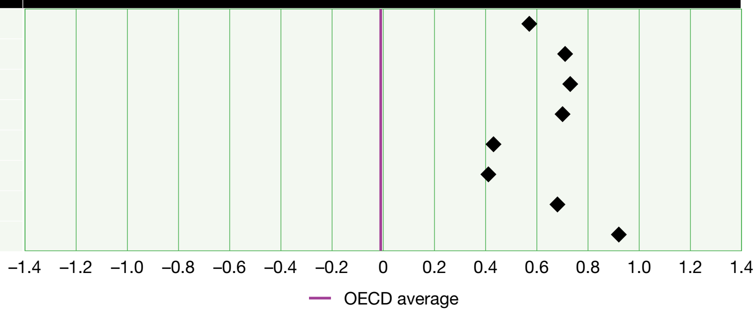


FIGURE 8.5 Instructional leadership, by jurisdiction

As can be seen in Figure 8.6, the pattern of results by socioeconomic background is similar to that for curricular development. Principals of disadvantaged schools scored significantly higher on this index than those from more advantaged schools, and all were significantly higher than the OECD average.

	All students	
Socioeconomic background	Mean index	SE
Lowest quartile	0.84	0.1
Second quartile	0.62	0.1
Third quartile	0.54	0.1
Highest quartile	0.65	0.1

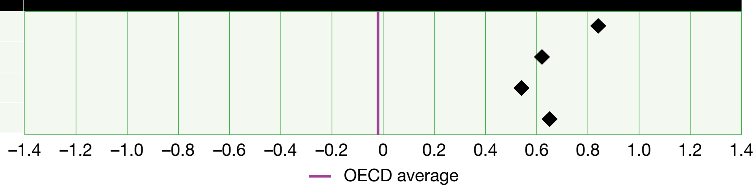


FIGURE 8.6 Instructional leadership, by socioeconomic quartile

Educational leadership

The overarching index of educational leadership comprised 13 items, which included those that defined the indices of curricular development and instructional leadership, as well as the following items:

- When a teacher has problems in his/her classroom, I take the initiative to discuss matters.
- I pay attention to disruptive behaviour in classrooms.
- I provide staff with opportunities to participate in school decision-making.
- I engage teachers to help build a school culture of continuous improvement.
- I ask teachers to participate in reviewing management practices.
- When a teacher brings up a classroom problem, we solve the problem together.

Figure 8.7 shows the principals' results for Australia and comparison countries for the overarching index of school leadership. Principals in the United States and the United Kingdom reported the highest levels of educational leadership with mean index scores of 1.00 and 0.91 respectively followed by Australia with a mean index score of 0.62. These results were significantly higher than the OECD average of –0.01. Principals in Japan reported significantly lower levels of educational leadership with a mean index of –0.96.

Country	All students	
	Mean index	SE
Australia	**0.62**	**0.0**
Hong Kong (China)	–0.49	0.1
Singapore	0.24	0.0
Japan	–0.96	0.1
Finland	–0.18	0.1
Estonia	–0.13	0.0
New Zealand	0.24	0.1
Canada	0.56	0.1
United Kingdom	0.91	0.1
United States	1.00	0.1

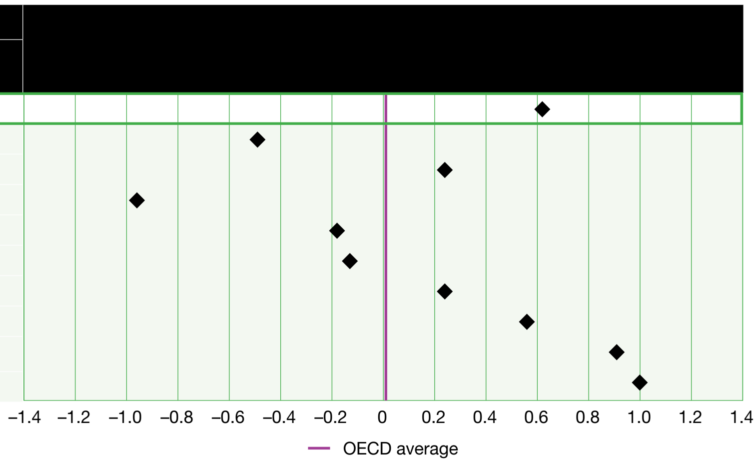


FIGURE 8.7 Index of educational leadership: Australian and international results

Figure 8.8 illustrates the scores on the index of educational leadership by jurisdiction. Principals in all jurisdictions reported significantly higher levels of educational leadership than the OECD average. Principals in Victoria and the Northern Territory reported the highest mean index scores of 0.84 and 0.83 respectively, and principals in South Australia and the Australian Capital Territory reported the lowest mean index scores with 0.26 and 0.21 respectively.

Jurisdiction	All students	
	Mean index	SE
ACT	0.21	0.0
NSW	0.57	0.1
VIC	0.84	0.1
QLD	0.61	0.1
SA	0.26	0.1
WA	0.46	0.1
TAS	0.74	0.1
NT	0.83	0.0

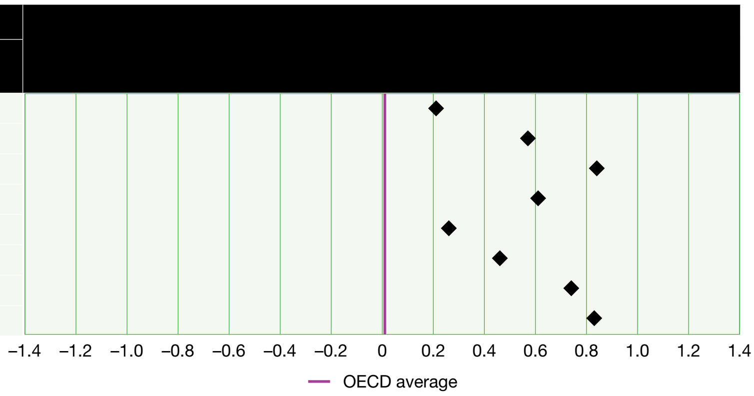


FIGURE 8.8 Educational leadership, by jurisdiction

Figure 8.9 shows the mean scores on the educational leadership index by socioeconomic background. Principals in schools from the lowest socioeconomic quartile (disadvantaged schools) scored significantly higher on this index than principals from schools in any other socioeconomic group.

Socioeconomic background	All students	
	Mean index	SE
Lowest quartile	0.96	0.1
Second quartile	0.61	0.1
Third quartile	0.42	0.1
Highest quartile	0.49	0.1

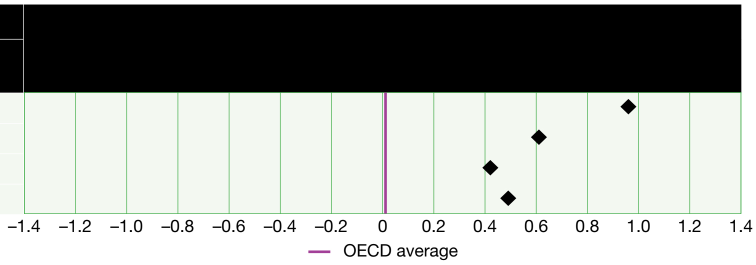


FIGURE 8.9 Educational leadership, by socioeconomic quartiles

Some of the findings in this chapter might seem quite counterintuitive. For example, on average across the OECD, the indices on school leadership are negatively related to scientific literacy performance. And why would it be that principals from disadvantaged schools might score higher on the educational leadership index than principals from advantaged schools?

The answer is that higher scores on the index reflect that the behaviours occur more frequently. Principals are asked to assess how frequently they, for example, *pay attention to disruptive behaviour in classrooms*. In a school in which there is little disruptive behaviour, a principal may *respond 1–2 times during the year*. This principal will score lower on this index than a principal in a school in which there is a great deal of disruptive behaviour and in which they may have to respond *more than once a week*. The patterns of findings described here and elsewhere indicate that school leaders may need to show more active leadership when the learning environment deteriorates and student problems arise, such as in schools that suffer from economic disadvantage.

Table 8.1 provides the 13 statements to which principals were asked to respond for the educational leadership index, along with the percentage of principals who reported undertaking each activity at least once a month[60] during the last academic year, for Australia and comparison countries.

For all but one statement, the percentage of principals who reported the activity occurring at least once a month was greater for Australia compared to the average across OECD countries. About 80% of principals both in Australia and, on average, across the OECD regularly report that *When a teacher brings up a classroom problem, we solve the problem together*. This was similar to the percentage of principals in Singapore and Finland, and occurred to an even greater extent for principals in the United States, the United Kingdom and Canada.

Conversely, there were a number of items on which the responses of Australian principals varied substantially from the OECD average. In particular, students in Australian schools, along with those in the United States, were more likely to have principals that frequently *promote teaching practices based on recent educational research* than the OECD average. Around 70% of Australian students, along with a similar proportion in the United States and New Zealand, have principals who say they *tailor professional development activities in accordance with the teaching goals of the school*.

The leadership activity principals reported doing the least often was *using student performance results to develop the school's educational goals* – only 37% of Australian students attend schools in which the principals report engaging in such activities on a frequent basis compared to an average of 23% of students across the OECD. Countries that undertook this sort of activity more often included Canada (59%) and the United States (56%).

60 Principals were asked to respond to each question on a six-point scale, ranging from 'did not occur' through to occurring 'more than once a week'. Table 8.1 presents the percentage of teachers who ticked one of the top three categories ('once a month', 'once a week' or 'more than once a week')

TABLE 8.1 Principals' participation in educational leadership behaviours

Country	Percentage of students whose principal reported behaviours occurring at least once a month							
	I use student performance results to develop the school's educational goals		I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school		I ensure that teachers work according to the school's educational goals		I promote teaching practices based on recent educational research	
	%	SE	%	SE	%	SE	%	SE
Australia	37	2.1	69	2.2	71	1.9	76	1.8
Hong Kong (China)	12	2.8	15	3.4	32	4.2	13	3.3
Singapore	16	0.7	51	1.0	61	1.1	44	1.0
Japan	3	1.2	6	1.5	11	2.2	12	2.5
Finland	11	2.6	20	2.8	36	4.2	34	3.3
Estonia	22	2.3	31	2.3	49	2.7	25	2.2
New Zealand	39[1]	3.7	68[1]	3.7	57[1]	4.4	69[1]	4.1
Canada	27[1]	2.5	53[1]	2.7	67[1]	2.6	64[1]	2.3
United Kingdom	59[1]	3.3	60[1]	3.8	85[1]	2.7	65[1]	3.5
United States	56	3.4	74	3.5	90	2.3	84	2.8
OECD average	**23**	**0.5**	**33**	**0.5**	**53**	**0.6**	**41**	**0.5**

Country	Percentage of students whose principal reported behaviours occurring at least once a month							
	I praise teachers whose students are actively participating in learning		When a teacher has problems in his/her classroom, I take the initiative to discuss matters		I draw teachers' attention to the importance of pupils' development of critical and social capacities		I pay attention to disruptive behaviour in classrooms	
	%	SE	%	SE	%	SE	%	SE
Australia	87	1.4	80	1.6	78	1.7	88	1.3
Hong Kong (China)	46	3.9	40	4.6	33	4.3	65	4.9
Singapore	72	0.7	80	0.6	82	0.6	90	0.6
Japan	6	1.6	33	3.6	12	2.3	72	3.3
Finland	48	4.3	53	4.1	55	3.6	71	3.3
Estonia	68	2.5	72	2.4	51	2.8	70	2.7
New Zealand	76[1]	4.0	60[1]	4.3	63[1]	4.4	86[1]	2.5
Canada	85[1]	1.8	88[1]	1.8	72[1]	2.7	94[1]	1.3
United Kingdom	93[1]	1.6	86[1]	2.3	77[1]	2.9	92[1]	1.8
United States	95	1.7	92	2.2	87	2.6	97	1.2
OECD average	**63**	**0.5**	**68**	**0.5**	**56**	**0.6**	**82**	**0.4**

Country	Percentage of students whose principal reported behaviours occurring at least once a month									
	I provide staff with opportunities to participate in school decision-making		I engage teachers to help build a school culture of continuous improvement		I ask teachers to participate in reviewing management practices		When a teacher brings up a classroom problem, we solve the problem together		I discuss the school's academic goals with teachers at faculty meetings	
	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	80	1.5	88	1.4	54	2.1	80	1.6	67	1.9
Hong Kong (China)	63	4.1	60	4.3	37	3.9	51	4.8	22	3.9
Singapore	67	0.7	78	0.6	33	1.3	81	0.9	50	1.1
Japan	70	2.8	39	3.7	54	3.8	72	3.0	26	3.2
Finland	94	1.9	86	2.9	21	3.5	83	2.6	56	4.1
Estonia	71	2.8	78	2.3	20	2.4	75	2.5	43	2.7
New Zealand	77[1]	3.5	82[1]	2.7	40[1]	3.9	68[1]	4.0	59[1]	3.9
Canada	86[1]	2.0	85[1]	1.8	46[1]	3.1	89[1]	1.8	82[1]	2.2
United Kingdom	67[1]	3.4	85[1]	2.4	46[1]	3.7	87[1]	2.0	68[1]	3.0
United States	93	2.0	95	1.7	71	3.5	90	2.4	80	3.2
OECD average	**72**	**0.5**	**73**	**0.5**	**34**	**0.5**	**78**	**0.5**	**51**	**0.5**

[1] The item response rate is below 85%. Missing data have not been explicitly accounted for.

School climate

School climate refers to the quality and character of school life. Kutsyuruba et al. (2016) report that school climate influences how a student feels in their school environment and is an important precursor of academic achievement. However, they report that an individual's experiences of school climate is influenced by their subjective perceptions of the environment and personal characteristics which influences individual outcomes and behaviours.

Student-related factors affecting school climate

Student behaviour hindering learning

To examine the impact of student behaviour factors on school climate, principals were asked to report the extent to which the learning of students was hindered by a series of 10 items using a four-point scale (not at all; very little; to some extent; a lot). Using these items, two indices were constructed, the first was index of student behaviour hindering learning and the second an index of teacher behaviour hindering learning. The index of student behaviour hindering learning comprised the following five items:

- student truancy
- students skipping classes
- students lacking respect for teachers
- student use of alcohol or illegal drugs
- students intimidating or bullying other students.

Principals' responses to these questions were likely to reflect both how frequently these phenomena happen in their schools and, when they do occur, how much they affect student learning. Positive values on this index reflect principals' perceptions that student behaviour hinders learning to a greater extent, and negative values reflect principals' perceptions that student behaviour hinders learning to a lesser extent than, on average across the OECD.

In Australia, there was a moderate negative relationship between student behaviour hindering learning and scientific literacy performance ($r = -0.28$). Higher scores on the index were reflected in lower scores on scientific literacy achievement.

Figure 8.10 presents principals' index scores for Australia and selected comparison countries. Principals in Australia had a mean index score significantly lower than the OECD average of 0.01, which indicates that, on average, these behaviours were seen as less of a problem in Australia than on average across the OECD. The OECD average masks wide variations of scores on this index. For example, principals in Canadian schools reported the highest levels on this index with a mean index score of 0.47, followed by Finland (mean index score: 0.27) and the United States (mean index score: 0.24). Principals in Hong Kong (China) and Singapore reported the lowest mean scores on the index, which were both significantly lower than the OECD average.

Country	All students: Mean index	All students: SE
Australia	**−0.13**	**0.0**
Hong Kong (China)	−0.74	0.1
Singapore	−0.65	0.0
Japan	−0.52	0.1
Finland	0.27	0.1
Estonia	−0.01	0.0
New Zealand	0.14	0.1
Canada	0.47	0.1
United Kingdom	−0.49	0.1
United States	0.24	0.1

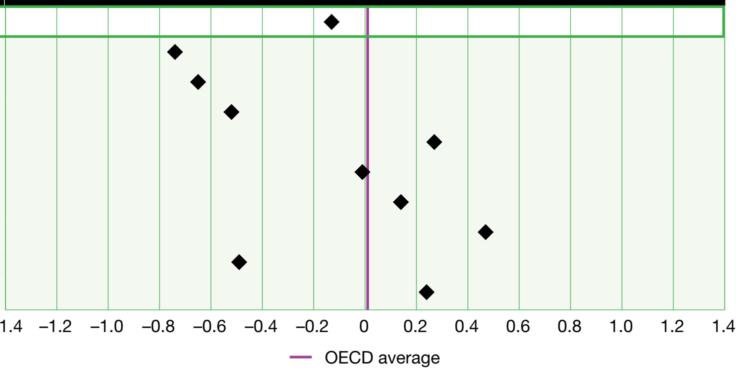


FIGURE 8.10 Student-related behaviour hindering learning: Australian and international results

Table 8.2 shows principals' responses to the individual items comprising the index. On the whole, the most commonly reported problems according to principals were *student truancy* and *students skipping classes*. On average, across OECD countries, 34% of students attended schools in which principals perceived that student learning was hindered by *student truancy*. This was more evident in some countries than others – such as Canada and the United States, and less so in Hong Kong (China) and Singapore. In Australia, just over one-quarter of students attended schools in which the principal perceived student learning to be hindered by *student truancy*.

In Canada, 28% of students attended schools in which principals reported that *student use of alcohol or illegal drugs* hindered learning; however, this was only the case for 8% of Australian students. One-third of students in Finland attended schools in which principals perceived *students lacking respect for teachers* hindered students' learning, and this was nearly one-fifth of Australian students.

Students intimidating or bullying other students was perceived to be a problem in Finland, Estonia and Australia more so than in other countries. In Australia, 18% of students attended schools in which this was seen as an issue by principals, which was significantly higher than the OECD average of 11%.

TABLE 8.2 Student-related behaviour hindering learning, by Australia and international comparisons

	Percentage of students whose principal reported behaviours occurring at least once a month									
	Student truancy		Students skipping classes		Students lacking respect for teachers		Student use of alcohol or illegal drugs		Students intimidating or bullying other students	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**28**	**1.3**	**22**	**1.3**	**19**	**1.6**	**8**	**1.1**	**18**	**1.6**
Hong Kong (China)	8	2.6	4	2.0	17	3.8	‡	‡	4	1.8
Singapore	9	0.1	5	0.1	6	0.1	1	0.0	9	0.1
Japan	14	2.3	11	2.3	18	2.4	1	0.5	5	1.2
Finland	44	3.8	32	4.2	33	3.5	4	1.4	23	2.9
Estonia	37	2.6	37	2.6	17	2.2	3	1.1	18	2.3
New Zealand	41	3.4	39	3.1	8	1.9	7	1.4	10	2.3
Canada	56	2.7	51	2.5	12	1.9	28	2.5	13	1.7
United Kingdom	10	2.2	6	1.7	13	2.3	1	0.6	4	1.4
United States	46	3.2	31	3.6	18	3.2	19	3.1	14	2.8
OECD average	**34**	**0.5**	**33**	**0.5**	**20**	**0.5**	**9**	**0.3**	**11**	**0.4**

‡ reporting standards not met

Figure 8.11 shows principals' perceptions of student behaviour hindering learning by jurisdiction. It shows that student behaviour was a greater problem in the Northern Territory, with a mean index of 0.57, which was significantly higher than the OECD average of 0.01. To a lesser extent, this was also true of Tasmanian schools. Principals in all other jurisdictions reported scores on the index that were significantly lower than the OECD average.

Jurisdiction	All students: Mean index	SE
ACT	−0.03	0.0
NSW	−0.13	0.1
VIC	−0.29	0.1
QLD	−0.03	0.1
SA	−0.16	0.1
WA	−0.04	0.1
TAS	0.04	0.1
NT	0.57	0.0

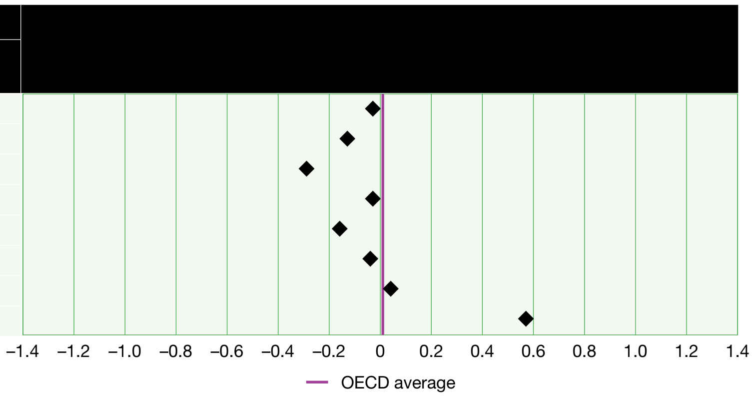


FIGURE 8.11 Student-related behaviour hindering learning, by jurisdiction

Table 8.3 shows principals' responses to the individual items comprising the index, by jurisdiction. Nearly 60% of students in the Northern Territory attended schools in which *student truancy* was perceived to hinder learning. This was seen as a similar issue for about 40% of students in Tasmania and Queensland.

TABLE 8.3 Student-related behaviours hindering learning, by jurisdiction

	Percentage of students whose principal reported behaviours occurring at least once a month									
	Student truancy		Students skipping classes		Students lacking respect for teachers		Student use of alcohol or illegal drugs		Students intimidating or bullying other students	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	15	0.6	16	0.6	13	0.5	6	0.1	4	0.0
NSW	27	2.9	24	2.6	24	3.4	6	1.9	23	3.7
VIC	18	2.8	16	2.8	13	2.8	7	2.2	13	2.7
QLD	36	4.1	23	3.9	19	3.5	8	2.7	16	3.5
SA	27	4.0	17	2.9	15	3.3	7	2.3	11	3.4
WA	34	3.8	30	3.6	22	3.2	13	3.4	21	4.1
TAS	39	2.9	16	2.6	19	3.1	6	1.7	29	3.3
NT	58	1.7	56	1.7	23	1.6	17	1.5	15	1.6
OECD average	**34**	**0.5**	**33**	**0.5**	**20**	**0.5**	**9**	**0.3**	**11**	**0.4**

Nearly 60% of students in the Northern Territory attended schools in which principals reported that *students skipping classes* hindered learning. While less problematic in other jurisdictions, it was still an issue for 30% of students in Western Australia and almost 25% of students in each of New South Wales and Queensland.

Across levels of socioeconomic background, Figure 8.12 shows that the highest level of student behaviour hindering learning was perceived by principals of disadvantaged schools and the lowest level of student behaviour hindering learning from principals of advantaged schools. The mean index scores for principals of advantaged schools were significantly lower than the OECD average, while those for disadvantaged schools were significantly higher.

Socioeconomic background	All students: Mean index	SE
Lowest quartile	0.60	0.1
Second quartile	0.26	0.1
Third quartile	−0.43	0.1
Highest quartile	−0.90	0.1

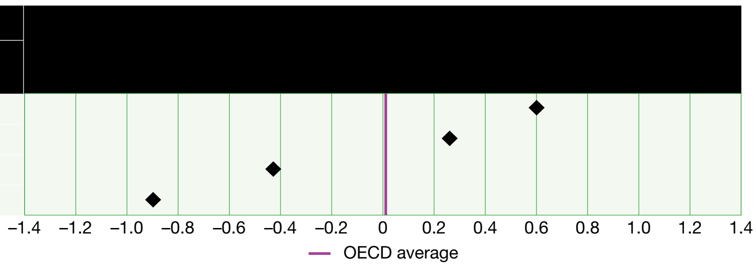


FIGURE 8.12 Student-related behaviour hindering learning, by socioeconomic background

Table 8.4 shows principals' responses to the individual items comprising the index, by socioeconomic background. Of all the student behaviours that potentially hinder learning, students in disadvantaged schools were far more likely than those in advantaged schools to have their principal report that these issues were a problem.

None of the student behaviours occurred to any great extent in the advantaged schools: in contrast more than half of the disadvantaged students attended schools in which the principal reported that *student truancy* and *students skipping classes* were issues. Almost 40% of disadvantaged students attended schools in which there was a *lack of respect for teachers*, and almost 30% of students attended schools in which *intimidation or bullying* was a problem.

TABLE 8.4 Student-related behaviour hindering learning, by socioeconomic background

Socioeconomic background	Percentage of students whose principal reported behaviour occurring 'To some extent' or 'A lot'									
	Student truancy		Students skipping classes		Students lacking respect for teachers		Student use of alcohol or illegal drugs		Students intimidating or bullying other students	
	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	59	4.3	52	4.2	37	4.3	15	3.0	29	4.1
Second quartile	36	3.9	28	3.1	32	3.9	9	2.0	26	3.4
Third quartile	15	2.6	8	2.5	7	2.1	3	1.1	11	2.7
Highest quartile	3	1.2	1	0.6	2	0.9	4	1.8	5	1.8
OECD average	**34**	**0.5**	**33**	**0.5**	**20**	**0.5**	**9**	**0.3**	**11**	**0.4**

Teacher-related factors affecting school climate

Teacher behaviour hindering learning

School principals were also asked to report the extent to which they believed that student learning in their schools was hindered by teacher behaviours. The index of teacher behaviour hindering learning was constructed with the following five items:

- teachers not meeting individual students' needs
- teacher absenteeism
- staff resisting change
- teachers being too strict with students
- teachers not being well prepared for classes.

Again, items comprising this index were standardised to have a mean of 0 and a standard deviation of 1, with positive values reflecting principals' perceptions that these teacher-related behaviours hinder learning to a greater extent compared to the OECD average.

In Australia, there was a weak negative relationship between teacher behaviour hindering learning and scientific literacy performance ($r = -0.11$). Higher scores on the teacher-behaviour index were reflected in lower average science scores.

Figure 8.13 presents principals' responses for Australia and selected comparison countries. Principals in Japan reported the highest levels of perceived teacher-related behaviours hindering learning with a mean index score of 0.34, followed by Australia (mean index score: 0.32) and Hong Kong (China) (mean index score: 0.31). Principals in Estonia and Finland reported the lowest levels of teacher-related behaviours hindering learning (mean index score: –0.19 and 0.03 respectively).

The mean index score for Australia was significantly higher than the OECD average of 0.05. Overall, principals in Australia perceived that teacher-related behaviours were more likely to hinder student learning in their schools than student-related behaviours.

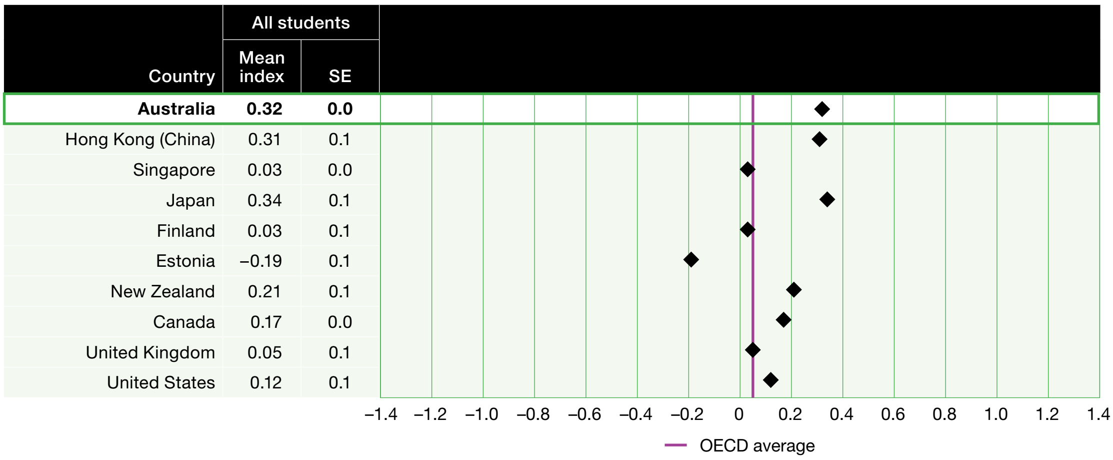


FIGURE 8.13 Teacher-related behaviours hindering learning: Australian and international results

Table 8.5 shows principals' responses to the individual items comprising the index of teacher behaviour hindering learning. On average across OECD countries, 30% of students attended schools in which the principal perceived that student learning was hindered by *teachers resisting change*. This was seen as an issue in: Hong Kong (China), Japan and Canada; in Australia, New Zealand and the United States more than one-third of students attended schools in which principals reported teachers resisting change as problematic.

In Australia, a larger issue was *teachers not meeting individual students' needs*; nearly two-fifths of students attended schools in which principals perceived student learning was hindered by this problem. This result was significantly higher than the OECD average of 23%.

TABLE 8.5 Teacher-related behaviours hindering learning, by Australia and international comparisons

	Percentage of students whose principal reported behaviour occurring 'To some extent' or 'A lot'									
	Teachers not meeting individual students' needs		Teacher absenteeism		Staff resisting change		Teachers being too strict with students		Teachers not being well prepared for class	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**38**	**2.3**	**17**	**1.6**	**35**	**2.2**	**7**	**1.0**	**14**	**1.6**
Hong Kong (China)	35	3.7	10	2.8	38	4.3	15	3.1	13	3.1
Singapore	26	0.7	3	0.1	20	0.8	15	0.7	11	0.1
Japan	23	3.0	9	2.0	38	3.4	26	3.1	29	2.8
Finland	25	3.4	16	3.1	27	3.5	3	1.1	6	1.9
Estonia	28	2.4	10	1.5	26	2.2	16	1.7	6	1.2
New Zealand	32	3.8	6	1.9	33	3.6	7	2.3	9	1.9
Canada	21	2.3	10	1.9	38	2.8	11	1.7	9	1.9
United Kingdom	28	3.4	24	3.7	18	2.9	5	1.6	11	2.3
United States	28	3.4	17	3.3	33	3.5	15	2.9	13	2.8
OECD average	**23**	**0.5**	**16**	**0.4**	**30**	**0.5**	**13**	**0.4**	**12**	**0.4**

Figure 8.14 starkly contrasts with Figure 8.11 which shows principals' perceptions of student-related behaviours hindering learning across the Australian jurisdictions. Principals in the Australian Capital Territory reported the highest perceived levels of teacher-related behaviours hindering learning in their schools with a mean index score of 0.46, followed equally by Tasmania and Western Australia with a mean index score of 0.44. Principals from schools in South Australia and the Northern Territory reported the lowest levels of perceived teacher-related behaviours hindering learning in their schools; however, in all jurisdictions the average index score was significantly higher than the OECD average of 0.05.

Jurisdiction	All students: Mean index	All students: SE
ACT	0.46	0.0
NSW	0.31	0.1
VIC	0.31	0.1
QLD	0.32	0.1
SA	0.20	0.1
WA	0.44	0.1
TAS	0.44	0.1
NT	0.13	0.0

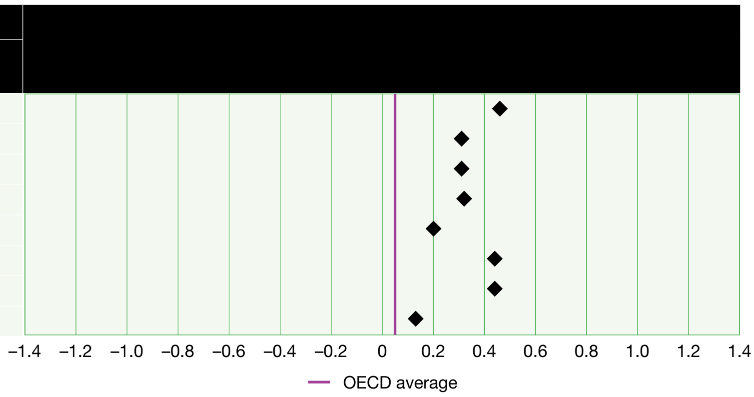


FIGURE 8.14 Teacher-related behaviours hindering learning, by jurisdiction

Table 8.6 provides principals' responses to the individual items comprising the index by jurisdiction. In Tasmania and the Australian Capital Territory, nearly 50% of students attended schools at which principals perceived *teachers resisting change* as hindering student learning. *Teacher absenteeism* was most problematic in the Australian Capital Territory and least problematic in the Northern Territory. More than 40% of students in the Australian Capital Territory, Victoria, Western Australia and Tasmania attended schools at which principals reported that *teachers not meeting individual students' needs* was a problem, yet this was only an issue for 13% of students in the Northern Territory.

TABLE 8.6 Teacher-related behaviours hindering learning, by jurisdiction

	Percentage of students whose principal reported behaviour occurring 'To some extent' or 'A lot'									
	Teachers not meeting individual students' needs		Teacher absenteeism		Staff resisting change		Teachers being too strict with students		Teachers not being well prepared for class	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	41	0.6	30	0.5	46	0.5	5	0.1	16	0.4
NSW	35	4.0	20	3.5	32	4.1	10	2.4	18	3.4
VIC	46	4.6	13	2.5	40	4.7	6	2.1	12	3.2
QLD	28	5.0	16	3.7	33	4.7	2	1.3	10	3.2
SA	34	3.9	14	3.3	28	4.0	8	2.5	7	2.5
WA	47	5.0	18	4.0	38	4.7	11	3.0	13	3.3
TAS	44	2.5	18	0.8	48	3.8	14	1.8	14	1.7
NT	13	1.4	8	1.1	41	1.8	7	1.1	7	0.4
OECD average	**23**	**0.5**	**16**	**0.4**	**30**	**0.5**	**13**	**0.4**	**12**	**0.4**

Figure 8.15 shows mean index scores for teacher-related behaviours hindering learning by socioeconomic background. While index scores for all socioeconomic quartiles other than the highest were significantly higher than the OECD average, principals of students in the lowest two quartiles of socioeconomic background reported issues about teacher-related issues to a far greater extent than did principals of students in more advantaged schools.

Socioeconomic background	All students: Mean index	All students: SE
Lowest quartile	0.43	0.1
Second quartile	0.55	0.1
Third quartile	0.29	0.1
Highest quartile	0.04	0.1

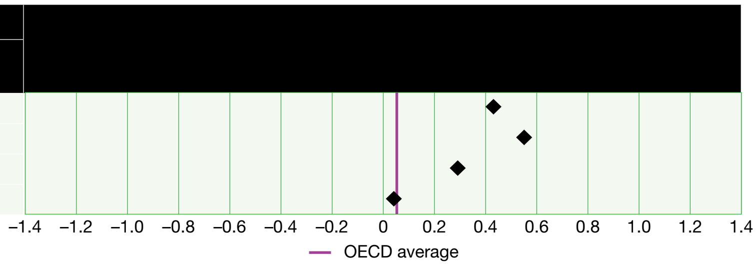


FIGURE 8.15 Teacher-related behaviours hindering learning, by socioeconomic background

Table 8.7 provides principals' responses to the individual items comprising the index by socioeconomic background. As seen in Figure 8.15, to some extent this appears to be a binary distribution, with principals from schools with a lower-than-average socioeconomic background having a different perception of teachers than those principals from schools with a higher-than-average socioeconomic background.

Around 40% of the students who attended the most disadvantaged schools and half of the students who attended lower-than-average socioeconomic background schools faced problems caused by *teachers not meeting individual students' needs*, compared to just under one-quarter of the students in more advantaged schools. Around one-quarter of lower socioeconomic background students attended schools in which the principal expressed concerns about *teacher absenteeism*, compared to just 6% of students in advantaged schools. The only other item on which there were significant differences was *teachers not being well prepared for class*. Around one fifth of students from the lowest two quartiles of socioeconomic background, compared to just 5% of advantaged students, attended schools in which the principal cited this as a problem.

TABLE 8.7 Teacher-related behaviours hindering learning, by socioeconomic background

Socioeconomic background	Percentage of students whose principal reported behaviour occurring 'To some extent' or 'A lot'									
	Teachers not meeting individual students' needs		Teacher absenteeism		Staff resisting change		Teachers being too strict with students		Teachers not being well prepared for class	
	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	42	4.1	23	3.4	29	3.7	10	2.5	22	3.9
Second quartile	50	4.2	26	3.2	42	4.3	9	2.0	20	3.6
Third quartile	36	4.8	15	2.9	37	4.3	6	2.0	8	2.3
Highest quartile	23	3.8	6	1.7	33	3.8	4	1.7	5	1.9
OECD average	**23**	**0.5**	**16**	**0.4**	**30**	**0.5**	**13**	**0.4**	**12**	**0.4**

School resources

Shortage of teaching staff and assistants

Access to school resources was examined by asking principals to report whether their schools' capacity to provide instruction was hindered by a shortage of resources across eight items, with responses on a four-point scale (not at all; very little; to some extent; a lot). Using these items, two indices were constructed, the first an index of shortage of educational staff and the second an index of shortage of educational materials including physical infrastructure. The index of shortage of educational staff comprised the following four items:

- a lack of teaching staff
- inadequate or poorly qualified teaching staff
- a lack of assisting staff
- inadequate or poorly qualified assisting staff.

When interpreting these findings, it should be kept in mind that school principals did not provide an objective measure of the condition of educational resources, but rather they provided their perceptions of whether a shortage or inadequacy of educational resources hindered the capacity to provide lessons in their schools. Therefore caution is needed when comparing responses across countries and schools.

In Australia, there was a moderate negative relationship between shortage of educational staff and scientific literacy performance ($r = -0.18$). A greater reported shortage of educational staff was reflected in lower levels of scientific literacy performance.

Figure 8.16 presents the mean index scores for Australia and comparison countries. Principals in Japan reported the highest levels of perceived shortage of educational staff in their schools, while principals in Singapore and New Zealand reported the lowest levels of perceived shortage of educational staff. Australian principals reported a mean index score of –0.35 which was significantly lower than the OECD average of –0.02.

Country	All students: Mean index	All students: SE
Australia	**–0.35**	**0.0**
Hong Kong (China)	–0.20	0.1
Singapore	–0.48	0.0
Japan	0.49	0.0
Finland	0.07	0.1
Estonia	0.00	0.1
New Zealand	–0.42	0.1
Canada	–0.20	0.1
United Kingdom	–0.12	0.1
United States	–0.29	0.1

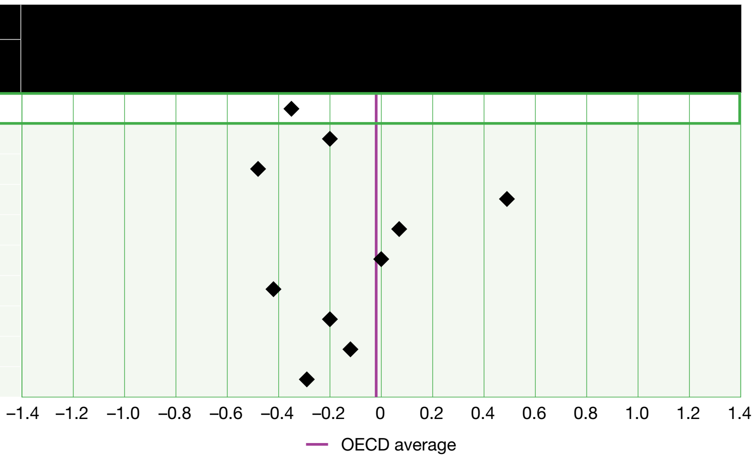


FIGURE 8.16 Shortage of educational staff: Australian and international results

Table 8.8 provides the principals' responses to the items that comprised the scale. On average across OECD countries, 37% of students attended schools in which principals reported a *lack of assistant staff* hindered schools' capacity to provide instruction. This was particularly perceived to be the case in Finland (46%) and Estonia (38%). More than one-half (55%) of the students in Japan attended schools in which there was a perceived *lack of teaching staff* while 44% of students in Japan attended schools in which principals also reported *inadequate or poorly qualified teaching staff*. In contrast, just 3% of students in Finland attended schools in which lack of teaching staff was reported to be a problem and just 4% attended schools in which principals reported *inadequate or poorly qualified teaching staff*.

The negative score on the index shown in Figure 8.16 was reflected in the responses to the individual items shown in Table 8.8: Australian principals had more positive views about the amount and quality of both teaching staff and assistants than, on average, across the OECD. Principals in Japan, the United Kingdom and Estonia scored significantly higher on this index than the OECD average, indicating that teacher quality in these countries was perceived to be more of an issue.

TABLE 8.8 Shortage of educational staff: Australia and international comparisons

	Percentage of students whose principal reported issue is a problem 'To some extent' or 'A lot'							
	A lack of teaching staff		Inadequate or poorly qualified teaching staff		A lack of assisting staff		Inadequate or poorly qualified assisting staff	
Country	%	SE	%	SE	%	SE	%	SE
Australia	**21**	**1.4**	**18**	**1.6**	**18**	**1.5**	**13**	**1.4**
Hong Kong (China)	22	3.5	11	2.7	25	3.4	7	2.4
Singapore	11	0.1	12	0.1	13	0.7	8	0.7
Japan	55	3.3	44	3.6	36	3.4	18	2.8
Finland	3	1.2	4	1.6	46	3.7	25	3.7
Estonia	35	2.9	27	2.6	38	2.5	16	2.0
New Zealand	21	3.1	16	3.0	19	3.5	8	2.3
Canada	19	2.2	13	2.0	32	2.6	15	2.3
United Kingdom	43	4.0	20	3.4	19	2.6	12	2.5
United States	24	3.1	14	3.0	24	3.4	12	2.2
OECD average	**29**	**0.5**	**20**	**0.5**	**37**	**0.5**	**19**	**0.4**

Figure 8.17 shows that principals in Northern Territory schools reported the highest level of perceived shortage of educational staff with a mean index score of 0.66. Tasmanian principals held similar views as the OECD average, with a mean index score of 0.03. Principals in all other jurisdictions were significantly less likely than across the OECD to report problems with the quality and number of teachers in their schools.

Jurisdiction	All students: Mean index	All students: SE
ACT	−0.29	0.0
NSW	−0.51	0.1
VIC	−0.37	0.1
QLD	−0.13	0.1
SA	−0.32	0.1
WA	−0.43	0.1
TAS	0.03	0.1
NT	0.66	0.0

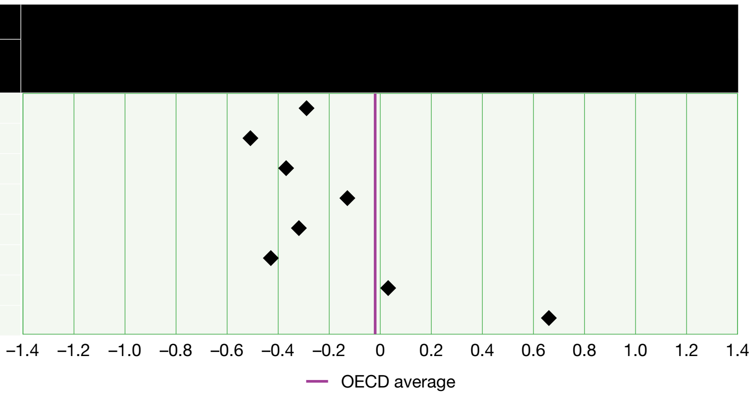


FIGURE 8.17 Shortage of educational staff by jurisdiction

Table 8.9 shows principals' responses to the individual items that comprised the index of shortage of educational staff. Nearly 70% of students in Northern Territory schools had principals who reported *a lack of teaching staff*, followed by 37% of students in Tasmania and 35% in Queensland. Nearly 60% of students in Northern Territory schools reported *inadequate or poorly qualified teaching staff* in contrast to only 3% of students in the Australian Capital Territory and 7% in New South Wales.

TABLE 8.9 Shortage of educational staff, by jurisdiction

	Percentage of students' principals reporting 'To some extent' or 'A lot'							
	A lack of teaching staff		Inadequate or poorly qualified teaching staff		A lack of assisting staff		Inadequate or poorly qualified assisting staff	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	13	0.4	3	0.2	5	0.2	5	0.3
NSW	18	3.3	7	2.3	18	2.7	7	2.1
VIC	15	2.7	23	3.3	17	3.5	15	2.8
QLD	35	3.9	28	4.2	16	3.3	17	3.5
SA	12	3.3	17	4.3	17	3.3	17	3.8
WA	14	3.6	14	3.4	25	4.4	12	2.7
TAS	37	3.4	23	3.3	27	3.0	18	3.4
NT	69	1.4	58	1.5	44	1.9	42	1.8
OECD average	**29**	**0.5**	**20**	**0.5**	**37**	**0.5**	**19**	**0.4**

Figure 8.18 shows Australian principals' mean index scores for shortage of educational staff by socioeconomic background. It clearly illustrates the disparity schools have in access to qualified teaching staff according to their socioeconomic background. The index score for disadvantaged schools was significantly higher than the OECD average, whereas for all other socioeconomic quartiles the index was significantly lower.

Socioeconomic background	All students: Mean index	All students: SE
Lowest quartile	0.08	0.1
Second quartile	−0.07	0.1
Third quartile	−0.44	0.1
Highest quartile	−0.92	0.1

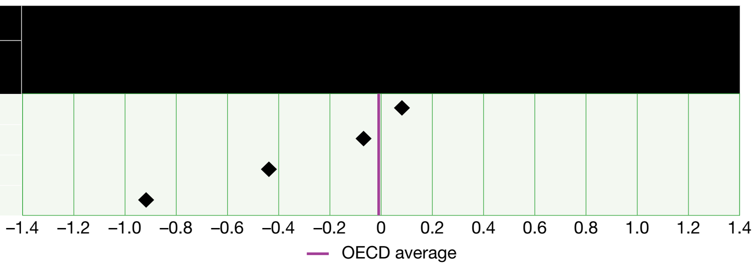


FIGURE 8.18 Shortage of educational staff, by socioeconomic background

Table 8.10 also illustrates the extent principals perceived that a shortage of educational staff hindered their school's capacity to provide educational instruction by socioeconomic background. On every item comprising this index, students who attended disadvantaged schools were more likely to have principals who reported that the statement was an issue compared to those from more advantaged schools.

TABLE 8.10 Shortage of educational staff, by socioeconomic background

Socioeconomic background	Percentage of students whose principal reported issue is a problem 'To some extent' or 'A lot'							
	A lack of teaching staff		Inadequate or poorly qualified teaching staff		A lack of assisting staff		Inadequate or poorly qualified assisting staff	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	36	3.8	31	3.8	28	4.0	22	3.5
Second quartile	29	3.5	20	3.4	21	3.0	14	2.8
Third quartile	13	3.0	15	3.3	17	2.9	11	2.9
Highest quartile	6	2.2	5	1.9	8	2.2	5	1.6
OECD average	**29**	**0.5**	**20**	**0.5**	**37**	**0.5**	**19**	**0.4**

Shortage of educational materials including physical infrastructure

A further aspect of school resourcing specifically related to physical infrastructure and supply of educational resources was explored, as the absence of such resources could negatively affect student learning. The second index in this section, the index of shortage of educational material including physical infrastructure, was constructed using the following items:

- lack of educational material (e.g. textbooks, IT equipment, library or lab material)
- inadequate or poor quality educational material (e.g. textbooks, IT equipment)
- lack of physical infrastructure (building, grounds, heating/cooling, lighting)
- inadequate/poor quality physical infrastructure (building, grounds, heating/cooling).

Positive values on the index reflected principals' perceptions that the shortage of educational material hindered learning to a greater extent than the OECD average.

In Australia, there was a weak negative relationship between a shortage of educational materials and scientific literacy performance (*r* = –0.14). A greater reported shortage of educational materials including physical infrastructure was reflected in the lower levels of science performance.

Figure 8.19 presents the mean index scores for principals in Australia and comparison countries. Principals in Japan reported the highest levels of perceived shortage of educational materials in their schools with a mean of 0.72, which far exceeded the OECD average of –0.01, while principals in Singapore and Canada reported the lowest levels of perceived shortage of educational staff (mean index scores: –0.73 and –0.46 respectively). Australian principals reported a mean index score of –0.39, which was significantly lower than the OECD average.

Country	All students	
	Mean index	SE
Australia	**–0.39**	**0.0**
Hong Kong (China)	–0.24	0.1
Singapore	–0.73	0.0
Japan	0.72	0.1
Finland	0.05	0.0
Estonia	0.09	0.1
New Zealand	–0.09	0.1
Canada	–0.46	0.0
United Kingdom	0.04	0.1
United States	–0.33	0.1

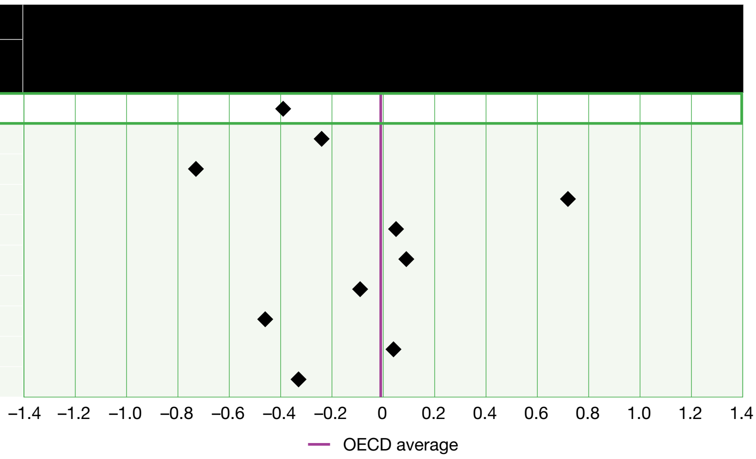


FIGURE 8.19 Shortage of educational material including physical infrastructure: Australian and international results

Table 8.11 illustrates principals' responses to the individual items making up the index. On average across OECD countries, 36% of students attended schools in which the principal reported that a *lack of physical infrastructure* hindered learning. In Japan, principals reported the highest level of perceived hindrance to student learning was due to a *lack of physical infrastructure* (69%) and *inadequate or poor quality educational material* (65%).

In Australia and similarly in New Zealand, around 10% of principals perceived students learning was hindered by a *lack of educational materials*, while a similar proportion of principals reported *inadequate or poor quality educational material* hindered student learning.

For principals in Australia, the factor most likely to be perceived as hindering student learning was *inadequate or poor quality physical infrastructure*. One-quarter of Australian students attended schools in which principals reported this was the case, but this contrasts with nearly three-fifths of students in Japan. Australia's average was significantly lower than the OECD average of 34%.

TABLE 8.11 Shortage of educational material including physical infrastructure: Australia and international comparisons

	Percentage of students' principals reporting 'To some extent' or 'A lot'							
	Lack of educational material		Inadequate or poor quality educational material		Lack of physical infrastructure		Inadequate/poor quality physical infrastructure	
Country	%	SE	%	SE	%	SE	%	SE
Australia	**11**	**1.3**	**10**	**1.2**	**24**	**1.8**	**25**	**1.8**
Hong Kong (China)	15	3.1	20	3.6	22	3.5	22	3.5
Singapore	‡	‡	‡	‡	11	0.1	11	0.1
Japan	65	3.6	57	3.6	69	3.4	58	3.4
Finland	41	3.8	40	3.5	38	4.0	41	3.7
Estonia	48	2.8	40	2.7	34	2.3	37	2.4
New Zealand	13	2.7	11	2.5	39	3.8	36	3.8
Canada	17	2.1	13	2.0	17	1.9	18	2.1
United Kingdom	29	3.2	26	3.0	46	3.8	44	3.3
United States	18	3.2	17	3.0	24	3.3	21	3.5
OECD average	**34**	**0.5**	**30**	**0.5**	**36**	**0.5**	**34**	**0.5**

‡ reporting standards not met

Figure 8.20 shows that in all Australian jurisdictions the value of the index was significantly lower than the OECD average of −0.02.

	All students	
Jurisdiction	Mean index	SE
ACT	−0.33	0.0
NSW	−0.22	0.1
VIC	−0.48	0.1
QLD	−0.49	0.1
SA	−0.38	0.1
WA	−0.50	0.1
TAS	−0.22	0.1
NT	−0.39	0.0

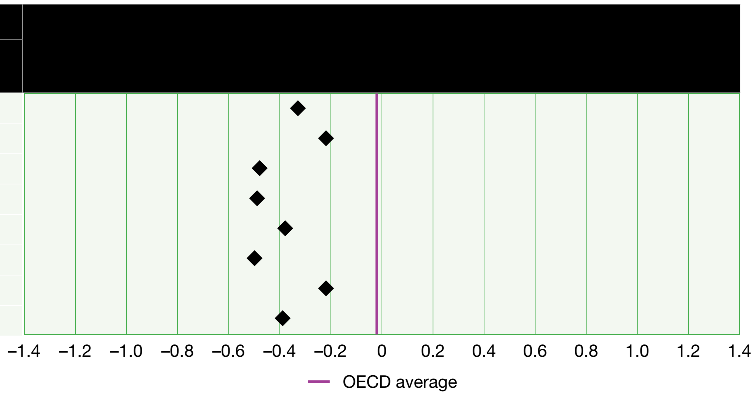


FIGURE 8.20 Shortage of educational material including physical infrastructure, by jurisdiction

Table 8.12 shows principals' perceptions for each of the items that contributed to the shortage of educational materials index by jurisdiction. While Figure 8.20 indicates that all jurisdictions were more satisfied than on average across the OECD, the table provides additional information that shows that these averages can hide disparities.

While in general *lack of and inadequate or poor quality educational material* were not issues in Australian schools, the exception was Tasmania, where 21% of students attended schools in which the principal reported these as hindering capacity to provide instruction. *Lack of physical infrastructure* was more of a problem, with between 20% and 30% of students across Australia attending schools where this was rated as an issue, and over 30% of students in New South Wales and Tasmania attended schools in which the principal deemed *poor quality or inadequate physical infrastructure* to hinder capacity to provide instruction.

TABLE 8.12 Shortage of educational material including physical infrastructure, by jurisdiction

	Percentage of students whose principal reported behaviour occurring 'To some extent' or 'A lot'							
	Lack of educational material		Inadequate or poor quality educational material		Lack of physical infrastructure		Inadequate/poor quality physical infrastructure	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	11	0.4	10	0.3	22	0.6	27	0.7
NSW	11	2.8	11	2.6	30	3.6	32	3.6
VIC	12	2.9	10	2.6	20	4.0	25	3.7
QLD	9	3.2	6	2.3	21	4.1	19	4.1
SA	8	2.5	12	3.5	26	4.3	22	3.7
WA	11	3.1	14	3.5	21	3.2	19	3.6
TAS	21	3.3	21	3.4	25	3.1	32	3.5
NT	6	0.8	1	0.7	27	1.7	11	1.2
OECD average	**34**	**0.5**	**30**	**0.5**	**36**	**0.5**	**34**	**0.5**

Figure 8.21 shows the mean index scores for this index by socioeconomic background. While still significantly lower than the OECD average, principals in disadvantaged schools were much more likely than principals of schools from any other socioeconomic background to perceive that a shortage of educational materials hindered their capacity to provide instruction.

	All students	
Socioeconomic background	Mean index	SE
Lowest quartile	−0.11	0.1
Second quartile	−0.22	0.1
Third quartile	−0.44	0.1
Highest quartile	−0.74	0.1

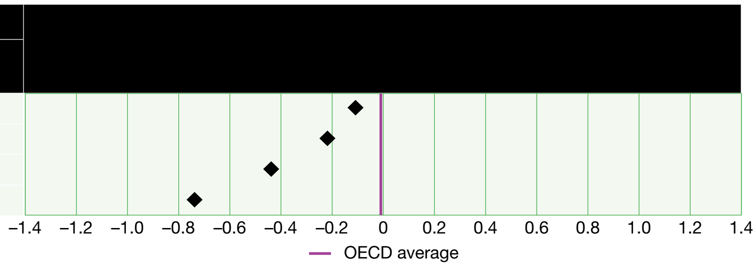


FIGURE 8.21 Shortage of educational material including physical infrastructure, by socioeconomic background

Table 8.13 provides principals' responses to the items that comprise this index, by socioeconomic background. Principals in the lowest socioeconomic quartile were again much more likely than those in higher quartiles to report a lack of educational material as hindering capacity to provide instruction.

TABLE 8.13 Shortage of educational material including physical infrastructure, by socioeconomic background

	Percentage of students whose principal reported issue is a problem 'To some extent' or 'A lot'							
	Lack of educational material		Inadequate or poor quality educational material		Lack of physical infrastructure		Inadequate/poor quality physical infrastructure	
Socioeconomic background	%	SE	%	SE	%	SE	%	SE
Lowest quartile	23	3.6	22	3.8	33	4.4	34	4.2
Second quartile	12	2.5	12	2.8	31	3.7	36	3.7
Third quartile	6	2.1	4	1.6	20	3.2	20	3.6
Highest quartile	4	1.6	3	0.9	14	2.8	12	3.2
OECD average	**34**	**0.5**	**30**	**0.5**	**36**	**0.5**	**34**	**0.5**

School science learning

Science-specific resources

PISA asked school principals to respond to statements about the resources available to their school's science department. Principals responded on a dichotomous scale (yes or no). Using these items the index of science-specific resources was created which comprised the following eight statements:

- Compared to other departments, our school's science department is well equipped.
- If we ever have some extra funding, a big share goes into improvement of our science teaching.
- School science teachers are among our best educated staff members.
- Compared to similar schools, we have a well-equipped laboratory.
- The material for hands-on activities in science is in good shape.
- We have enough laboratory material that all courses can regularly use it.
- We have extra laboratory staff that help support science teaching.
- Our school spends extra money on up-to-date science equipment.

The index of science-specific resources describes the number of these statements that the principal reported to be true for their school. Index scores ranged from 0 to 8; higher scores represented science departments that were well-equipped and staffed.

Figure 8.22 presents the mean index scores for Australia and comparison countries. Principals in Singapore reported the highest levels of perceived science-specific resources with a mean index score of 6.37, followed by Australia with a mean index score of 6.26 and Hong Kong (China) with a mean index score of 6.10, which were significantly higher than the OECD average of 4.58. In contrast, principals in Japan reported the lowest mean index score of 2.48, followed by Estonia and Finland (mean index score: 3.84 and 3.65 respectively).

	All students	
Country	Mean index	SE
Australia	**6.26**	**0.1**
Hong Kong (China)	6.10	0.1
Singapore	6.37	0.0
Japan	2.48	0.1
Finland	3.65	0.1
Estonia	3.84	0.1
New Zealand	6.05	0.1
Canada	5.59	0.1
United Kingdom	5.80	0.1
United States	5.44	0.1

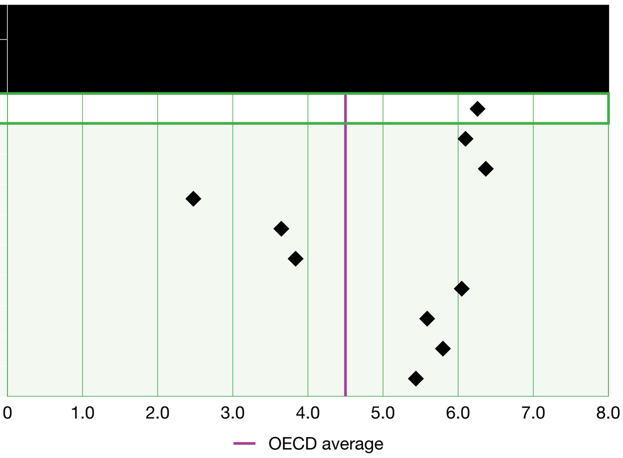


FIGURE 8.22 Sum of science specific resources: Australian and International results

Table 8.14 provides principals' responses, to the individual items that comprised the scale. These responses should be interpreted with a degree of caution given school principals' judgements may be based on very different benchmarks, usually influenced by their local or national context.

On average, across OECD countries, principals reported their science departments were well-equipped, for example, nearly three-quarters of students attended schools in which principals reported their *science department was well equipped compared to other departments*. In Australia, Singapore, New Zealand, Canada and Hong Kong (China) over 90% students attended schools where the principals reported this was the case. These reported values were all significantly higher than the OECD average. In contrast, less than 50% of students in Japan attended schools at which principals reported their *science department was well equipped compared to other departments*.

TABLE 8.14 Science-specific resources: Australia and international comparisons

Country	Compared to other departments, our school's science department is well equipped %	SE	If we ever have some extra funding, a big share goes into improvement of our science teaching %	SE	School science teachers are among our best educated staff members %	SE	Compared to similar schools, we have a well equipped laboratory %	SE
Australia	**94**	**0.8**	**28**	**1.9**	**69**	**1.9**	**88**	**1.4**
Hong Kong (China)	91	2.7	33	3.8	74	4.3	76	4.2
Singapore	95	0.1	39	0.5	75	0.2	88	0.1
Japan	47	3.5	14	2.7	22	2.9	32	3.2
Finland	69	3.9	21	3.5	57	3.6	40	4.0
Estonia	69	2.4	32	2.6	82	2.1	35	2.5
New Zealand	93	2.2	26	3.4	73	3.2	82	3.1
Canada	93	1.4	34	2.6	73	2.6	88	2.0
United Kingdom	86	2.7	35	3.7	69	3.3	78	3.0
United States	89	2.5	42	4.1	86	2.5	81	2.7
OECD average	**74**	**0.5**	**39**	**0.5**	**65**	**0.5**	**62**	**0.5**

Percentage of students whose principal reported that the statement was true for the school's science department

Country	The material for hands-on activities in science is in good shape %	SE	We have enough laboratory material that all courses can regularly use it %	SE	We have extra laboratory staff that helps support science teaching %	SE	Our school spends extra money on up-to-date science equipment %	SE
Australia	**95**	**0.9**	**92**	**1.4**	**95**	**1.0**	**69**	**1.8**
Hong Kong (China)	97	1.6	98	1.2	75	4.0	69	4.0
Singapore	99	0.0	100	✧	75	0.2	69	0.3
Japan	31	3.1	30	3.4	63	3.2	9	2.3
Finland	75	3.3	77	3.6	3	1.5	24	3.4
Estonia	66	2.7	42	2.6	17	2.1	46	2.8
New Zealand	91	2.0	89	2.7	93	2.3	64	3.9
Canada	94	1.3	90	1.5	39	1.9	52	2.6
United Kingdom	85	2.8	91	1.8	91	2.2	57	3.5
United States	89	2.1	80	3.0	23	3.4	56	4.3
OECD average	**78**	**0.4**	**66**	**0.5**	**34**	**0.4**	**48**	**0.5**

✧ represents less than 1%.

Figure 8.23 shows principals in all jurisdictions generally reported their science departments were well-equipped and staffed. Irrespective of jurisdiction, principals reported that between six and seven of the eight statements about the resources of their science departments were true.

Principals in the Australian Capital Territory and Western Australia reported the highest perceived index of science-specific resources with mean index scores of 6.59 and 6.58 respectively. The results for each Australian jurisdiction were all significantly higher than the OECD average of 4.58.

Jurisdiction	All students: Mean index	SE
ACT	6.59	0.0
NSW	6.14	0.1
VIC	6.11	0.1
QLD	6.42	0.1
SA	6.30	0.1
WA	6.58	0.1
TAS	6.40	0.1
NT	6.25	0.1

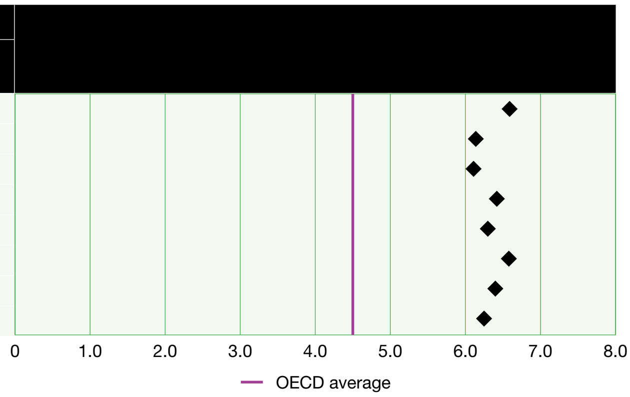


FIGURE 8.23 Science-specific resources, by jurisdiction

Table 8.15 shows that overall, Australian principals reported they perceived the science departments at their schools to be well-equipped and staffed. In particular, across all jurisdictions, more than 95% of students attended schools for which the principal reported that their school had *extra laboratory staff that helps support science teaching*, compared to 34%, on average, across the OECD.

Funding to improve science teaching was a lesser priority for principals either in Australia or across the OECD, probably highlighting the many claims on resources that principals have to juggle. Around 40% of students across the OECD have principals who report that they spend extra funding on improving science teaching. This is similar to the situation in the Northern Territory and the Australian Capital Territory, but in other states less so.

TABLE 8.15 Science-specific resources, by jurisdiction

	Percentage of students whose principal reported that the statement was true for the school's science department							
	Compared to other departments, our school's science department is well equipped		If we ever have some extra funding, a big share goes into improvement of our science teaching		School science teachers are among our best educated staff members		Compared to similar schools, we have a well equipped laboratory	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	93	0.3	39	0.7	83	0.7	92	0.4
NSW	93	2.1	24	3.7	67	3.9	88	2.6
VIC	94	2.2	28	4.6	62	4.6	83	3.8
QLD	96	1.4	32	4.7	72	4.1	93	2.5
SA	91	3.0	33	4.2	80	4.5	83	3.8
WA	97	0.3	32	4.5	78	4.4	92	2.2
TAS	90	3.0	29	3.5	80	2.5	84	3.0
NT	94	1.0	42	1.8	67	1.8	87	1.4
OECD average	**74**	**0.5**	**39**	**0.5**	**65**	**0.5**	**62**	**0.5**

	Percentage of students whose principal reported that the statement was true for the school's science department							
	The material for hands-on activities in science is in good shape		We have enough laboratory material that all courses can regularly use it		We have extra laboratory staff that helps support science teaching		Our school spends extra money on up-to-date science equipment	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	96	0.3	93	0.4	96	0.3	69	0.7
NSW	94	1.7	91	2.7	93	2.2	66	3.6
VIC	91	2.6	92	2.6	100	0.5	65	4.3
QLD	97	1.5	89	3.2	93	2.4	74	4.1
SA	96	1.4	94	2.8	93	2.7	69	3.5
WA	99	0.9	95	2.4	94	2.5	79	4.1
TAS	95	1.9	95	1.7	93	2.1	75	3.1
NT	97	1.2	86	1.4	95	0.9	55	1.6
OECD average	**78**	**0.4**	**66**	**0.5**	**34**	**0.4**	**48**	**0.5**

Figure 8.24 illustrates that socioeconomic background is not a barrier to schools having adequate science-specific resources in Australia. There were some small significant differences between groups which will be investigated in the next section.

	All students	
Socioeconomic background	Mean index	SE
Lowest quartile	6.19	0.1
Second quartile	5.92	0.1
Third quartile	6.40	0.1
Highest quartile	6.53	0.1

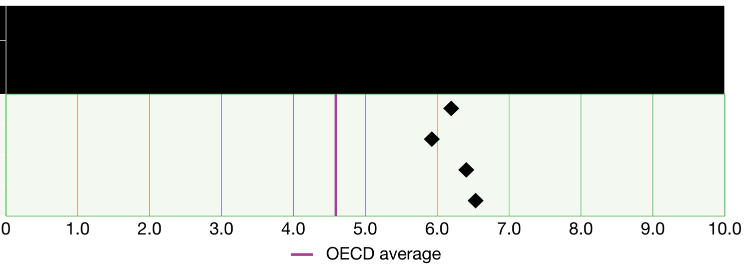


FIGURE 8.24 Science-specific resources, by socioeconomic background

Table 8.16 provides the principals' responses to the items underlying the index, by socioeconomic background. Irrespective of socioeconomic level, principals were fairly positive about the resources available for their science departments. The only place where there were substantial and significant differences was in principals' assessment of where extra funding would go. Students attending schools in the top half of the socioeconomic distribution are more than twice as likely to have additional funding directed into improving science learning than students in the bottom half of the distribution.

TABLE 8.16 Science-specific resources, by socioeconomic background

Socioeconomic background	Percentage of students whose principal reported that the statement was true for the school's science department							
	Compared to other departments, our school's science department is well equipped		If we ever have some extra funding, a big share goes into improvement of our science teaching		School science teachers are among our best educated staff members		Compared to similar schools, we have a well equipped laboratory	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	94	1.9	27	3.3	66	3.9	91	2.3
Second quartile	93	2.1	25	3.4	63	3.9	82	3.4
Third quartile	94	1.8	69	4.1	73	3.6	88	2.7
Highest quartile	95	1.7	70	3.9	74	4.1	90	2.7
OECD average	**74**	**0.5**	**39**	**0.5**	**65**	**0.5**	**62**	**0.5**

Socioeconomic background	Percentage of students whose principal reported that the statement was true for the school's science department							
	The material for hands-on activities in science is in good shape		We have enough laboratory material that all courses can regularly use it		We have extra laboratory staff that helps support science teaching		Our school spends extra money on up-to-date science equipment	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	94	1.9	95	1.9	92	2.3	68	4.2
Second quartile	92	2.4	86	3.5	94	2.0	58	3.9
Third quartile	96	1.7	92	2.7	95	1.8	74	3.8
Highest quartile	97	1.5	93	2.3	99	0.8	76	3.5
OECD average	**78**	**0.4**	**66**	**0.5**	**34**	**0.4**	**48**	**0.5**

Students' perspectives

Classroom environment

PISA examined the influence of supportive teacher practices and the disciplinary climate in science lessons on student performance, from the perspective of students.

Teacher support

Students who were studying a science subject reported the frequency with which the following teaching practices occurred in their science lessons. Students responded on a five-point scale (every lesson; most lessons; some lessons; never or hardly ever).

- The teacher shows interest in every student's learning.
- The teacher gives extra help.
- The teacher helps students with their learning.
- The teacher continues teaching until all students understand.
- The teacher gives students an opportunity to express opinions.

These items were inverted and standardised to have a mean of 0 and a standard deviation of 1 and together defined the index of teacher support. Positive values on this index indicated that students perceived that their science teachers support their learning.

In Australia, there was a weak positive relationship between teacher support in science lessons and scientific literacy performance (*r* = 0.10), which indicates that higher levels of perceived teacher support in science lessons were reflected in higher levels of science performance.

Figure 8.25 shows that students in Singapore, Canada and New Zealand reported the highest levels of teacher support, with mean index scores of 0.31, 0.27 and 0.25 respectively. In comparison, students in Estonia and Japan reported the lowest levels of teacher support (–0.05 and –0.14 respectively). Australian students' mean index score of 0.23 was significantly higher than the OECD average of –0.02.

Country	All students: Mean index	All students: SE
Australia	**0.23**	**0.0**
Hong Kong (China)	0.00	0.0
Singapore	0.31	0.0
Japan	–0.14	0.0
Finland	0.20	0.0
Estonia	–0.05	0.0
New Zealand	0.25	0.0
Canada	0.27	0.0
United Kingdom	0.21	0.0
United States	0.12	0.1

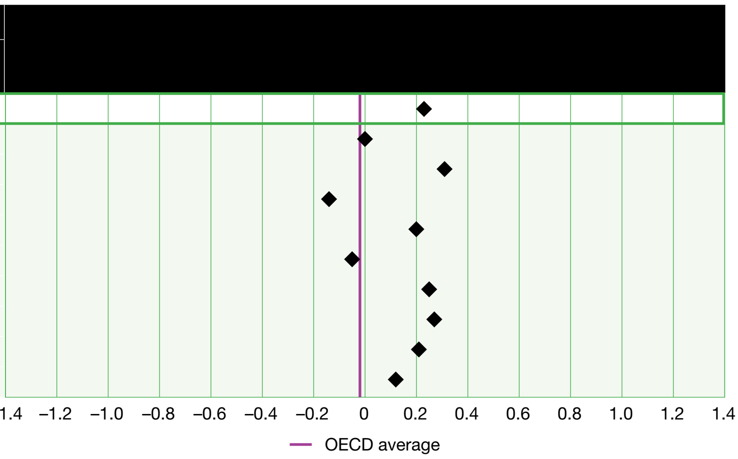


FIGURE 8.25 Teacher support: Australia and international results

Table 8.17 shows students were generally positive about how much support their science teachers provided. On average across OECD countries, about two-thirds of students answered 'most lessons' or 'some lessons' to the five items on teacher support. On average, Australian students were significantly more positive than students across the OECD on all items reflecting teacher support.

TABLE 8.17 Teacher support, by Australia and international comparisons

	Percentage of students reporting behaviour occurs 'Most lessons' or 'Every lesson'									
	The teacher shows interest in every students learning		The teacher gives extra help		The teacher helps students with their learning		The teacher continues teaching until all students understand		The teacher gives students an opportunity to express opinions	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**77**	**0.6**	**81**	**0.5**	**84**	**0.5**	**75**	**0.5**	**72**	**0.6**
Hong Kong (China)	72	0.8	75	0.7	78	0.8	72	0.9	71	0.9
Singapore	80	0.5	86	0.4	89	0.4	82	0.5	76	0.6
Japan	63	0.9	76	0.8	77	0.8	69	0.8	53	1.3
Finland	75	0.8	84	0.7	87	0.6	74	0.8	77	0.8
Estonia	63	0.9	73	0.8	74	0.8	65	1.0	70	0.8
New Zealand	77	0.7	83	0.7	85	0.6	75	0.8	70	0.8
Canada	76	0.6	82	0.5	84	0.5	75	0.6	73	0.6
United Kingdom	76	0.7	81	0.7	85	0.6	74	0.7	65	0.9
United States	80	0.8	81	0.7	85	0.6	75	0.8	71	0.9
OECD average	**69**	**0.1**	**73**	**0.1**	**71**	**0.1**	**69**	**0.2**	**68**	**0.1**

Figure 8.26 shows that students in all scored significantly higher on the index of teacher support than the OECD average across jurisdictions. Students in Queensland reported the highest levels of teacher support in science lessons with a mean index score of 0.28. Students in New South Wales and the Australian Capital Territory reported the lowest levels of teacher support in science lessons (mean index score: 0.18 and 0.14 respectively), although these were both still significantly higher than the OECD average.

Jurisdiction	All students: Mean index	All students: SE
ACT	0.14	0.0
NSW	0.18	0.0
VIC	0.26	0.0
QLD	0.28	0.0
SA	0.21	0.0
WA	0.26	0.0
TAS	0.24	0.0
NT	0.27	0.1

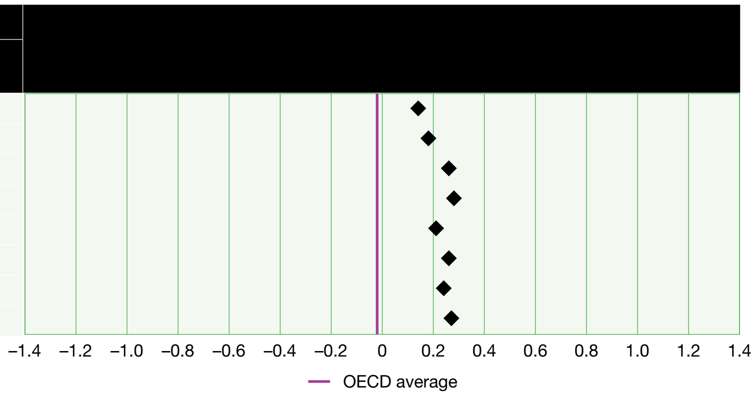


FIGURE 8.26 Teacher support, by jurisdiction

Table 8.18 shows that, in general, students' perceptions about teacher support in science did not differ across the jurisdictions. On all items, Australian students within each jurisdiction at least matched the OECD average.

TABLE 8.18 Teacher support, by jurisdiction

	Percentage of students reporting behaviour occurs 'Most lessons' or 'Every lesson'									
	The teacher shows interest in every students learning		The teacher gives extra help		The teacher helps students with their learning		The teacher continues teaching until all students understand		The teacher gives students an opportunity to express opinions	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	75	2.0	78	1.5	82	1.6	70	1.9	72	2.0
NSW	75	1.1	78	1.0	81	1.0	72	1.1	72	1.2
VIC	79	1.1	83	1.2	85	1.1	76	1.3	72	1.4
QLD	78	1.1	82	1.1	86	1.2	77	1.2	73	1.4
SA	77	1.5	79	1.3	84	1.2	76	1.4	71	1.5
WA	78	1.2	81	1.3	85	1.1	76	1.3	68	1.4
TAS	75	1.7	81	1.6	84	1.5	73	1.8	70	1.7
NT	79	2.9	83	2.5	85	1.9	75	3.1	73	2.6
OECD average	**69**	**0.1**	**73**	**0.1**	**71**	**0.1**	**69**	**0.2**	**68**	**0.1**

Figure 8.27 shows Australian students' mean index scores for perceived teacher support in science lessons by socioeconomic background. There were significant differences between each quartile of socioeconomic background, with those from the most disadvantaged schools reporting lower levels of teacher support than any other group.

Socioeconomic background	All students: Mean index	All students: SE
Lowest quartile	0.14	0.0
Second quartile	0.18	0.0
Third quartile	0.28	0.0
Highest quartile	0.31	0.0

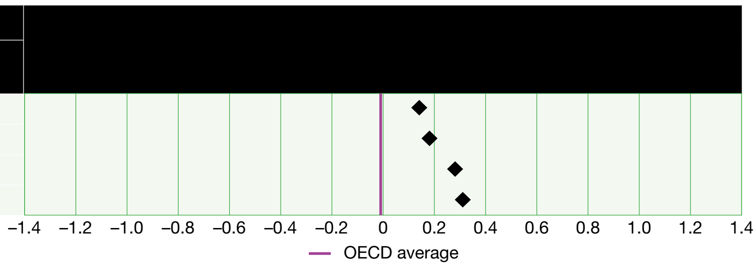


FIGURE 8.27 Teacher support, by socioeconomic background

Table 8.19 shows that students at all socioeconomic levels were fairly positive about the level of teacher support in science, with even students in disadvantaged schools enjoying similar or better levels of support than the OECD average. While the differences were small, a significantly lower percentage of students at disadvantaged schools than advantaged schools reported the *teacher showing interest in every students' learning, teacher providing extra help*, and the *teacher helping students with their learning.*

TABLE 8.19 Teacher support, by socioeconomic background

Socioeconomic background	Percentage of students reporting behaviour occurs 'Most lessons' or 'Every lesson'									
	The teacher shows interest in every students learning		The teacher gives extra help		The teacher helps students with their learning		The teacher continues teaching until all students understand		The teacher gives students an opportunity to express opinions	
	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	75	1.1	77	1.0	80	1.0	72	1.0	69	1.3
Second quartile	75	1.0	79	1.1	81	1.0	74	0.9	69	1.2
Third quartile	79	1.2	82	1.1	85	1.0	76	1.2	73	1.2
Highest quartile	79	1.0	83	1.0	87	1.0	76	1.1	74	1.2
OECD average	**69**	**0.1**	**73**	**0.1**	**71**	**0.1**	**69**	**0.2**	**68**	**0.1**

Student truancy

Student truancy was another important factor that impacted on overall performance. Students' attitudes toward school and their engagement with school and learning play a significant part in influencing their desire to learn. Pandey (2016) states habitual or intentional failure to attend school impacts on students' social and academic skills, they miss important social interaction with their peers, which leads to low self-esteem, social isolation and dissatisfaction about the future.

Students were asked how often in the last two weeks of school had they either skipped a whole school day and or skipped some classes. Students responded to the two items on a four-point scale (never; once or two times; three or four times; or five or more times).

Table 8.20 shows the percentage of students who reported having skipped a day of school or skipped some classes in the two weeks prior to the PISA assessment. On average, across OECD countries, 20% of students reported they had skipped at least one day of school and 26% of students reported that they had skipped classes at least once. About 40% of students in Finland and the United States, and nearly 30% of Australian students reported that they had skipped at least one day of school. Nearly 50% students in Finland and just over 42% of students in the United States had skipped classes at least once. In Australia, nearly 16% of students reported skipping classes at least once in the two weeks prior to the PISA assessment.

In contrast, 3% of students in Hong Kong (China) and 1% of students in Japan reported having skipped at least one day of school, 6% of students in Hong Kong (China) and 2% of students in Japan reported having skipped class at least once in the two weeks prior to the PISA assessment.

TABLE 8.20 Student truancy: Australia and international comparisons

Country	Percentage of students who reported having skipped a day of school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
Australia	**71**	**0.6**	**22**	**0.5**	**4**	**0.2**	**3**	**0.2**
Hong Kong (China)	96	0.2	2	0.2	✧	✧	1	0.2
Singapore	86	0.5	12	0.4	2	0.2	1	0.1
Japan	98	0.2	1	0.2	✧	✧	✧	✧
Finland	63	0.9	27	0.7	6	0.3	4	0.3
Estonia	77	0.8	17	0.7	3	0.3	3	0.2
New Zealand	75	0.7	19	0.6	3	0.2	3	0.3
Canada	82	0.5	14	0.4	2	0.2	2	0.1
United Kingdom	75	0.6	21	0.6	3	0.2	2	0.2
United States	63	0.8	31	0.7	4	0.3	2	0.2
OECD average	**80**	**0.1**	**15**	**0.1**	**3**	**0.0**	**3**	**0.0**

Country	Percentage of students who reported having skipped some classes in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
Australia	**84**	**0.4**	**12**	**0.3**	**2**	**0.1**	**2**	**0.1**
Hong Kong (China)	95	0.3	4	0.3	1	0.1	1	0.2
Singapore	86	0.5	12	0.4	1	0.2	1	0.1
Japan	97	0.3	2	0.3	0	0.1	✧	✧
Finland	52	0.9	38	0.8	6	0.4	4	0.3
Estonia	65	0.8	27	0.7	5	0.4	3	0.3
New Zealand	77	0.7	16	0.6	4	0.2	3	0.3
Canada	73	0.7	20	0.5	4	0.2	2	0.2
United Kingdom	66	0.8	27	0.7	4	0.3	2	0.2
United States	58	1.1	35	1.0	5	0.3	2	0.2
OECD average	**74**	**0.1**	**19**	**0.1**	**4**	**0.0**	**3**	**0.0**

✧ represents less than 1%.

Table 8.21 shows the percentage of students who reported having skipped a day of school or skipped some classes, by jurisdiction. Truancy seemed to be more of an issue in the Northern Territory and Tasmania, with more than one-third of students in each jurisdiction reporting skipping at least one day of school in the two weeks prior to the PISA assessment.

In general, Australian students were less likely to have skipped some classes compared to the OECD average. Students in the Northern Territory were most likely to say they had skipped some classes compared to other jurisdictions, with just under one-quarter of students reporting skipping at least one class during the previous two weeks.

TABLE 8.21 Student truancy, by jurisdiction

Jurisdiction	Percentage of students who reported having skipped a day of school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
ACT	82	1.7	13	1.6	2	0.6	2	0.6
NSW	71	1.1	22	0.9	4	0.4	3	0.3
VIC	70	1.4	23	1.2	4	0.4	3	0.4
QLD	69	1.3	23	1.2	5	0.4	3	0.5
SA	73	1.5	21	1.5	3	0.5	2	0.4
WA	73	1.5	22	1.3	3	0.4	3	0.5
TAS	66	1.8	24	1.9	5	0.8	5	0.8
NT	64	2.6	26	2.4	4	1.1	5	1.3
OECD average	**80**	**0.1**	**15**	**0.1**	**3**	**0.0**	**3**	**0.0**

Jurisdiction	Percentage of students who reported having skipped some classes in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
ACT	84	1.5	11	1.2	2	0.6	3	0.7
NSW	85	0.7	11	0.7	2	0.3	2	0.2
VIC	82	0.9	15	0.9	3	0.4	1	0.3
QLD	85	0.9	11	0.8	2	0.3	2	0.3
SA	83	1.2	13	1.1	3	0.5	1	0.3
WA	86	1.0	11	1.0	2	0.3	2	0.3
TAS	84	1.3	10	1.0	2	0.5	4	0.7
NT	77	2.1	17	1.7	4	1.4	2	0.6
OECD average	**74**	**0.1**	**19**	**0.1**	**4**	**0.0**	**3**	**0.0**

Table 8.22 shows the influence of socioeconomic background on student truancy. Nearly one-quarter of students in advantaged schools and just under one-third of students in disadvantaged schools reported having skipped a day of school in the two weeks prior to the PISA assessment. Less than one-fifth of students across all quartiles reported having skipped some classes during the reference period, which was significantly lower than the OECD average; however, skipping classes was significantly more prevalent for students from disadvantaged schools.

TABLE 8.22 Student truancy, by socioeconomic background

Socioeconomic background	Percentage of students who reported having skipped a day of school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	67	1.2	24	1.0	5	0.3	4	0.5
Second quartile	69	1.0	24	1.0	4	0.4	3	0.3
Third quartile	72	1.1	22	1.0	3	0.4	3	0.4
Highest quartile	76	1.2	19	1.0	3	0.4	2	0.2
OECD average	**80**	**0.1**	**15**	**0.1**	**3**	**0.0**	**3**	**0.0**

Socioeconomic background	Percentage of students who reported having skipped some classes in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	80	0.9	14	0.7	3	0.4	3	0.4
Second quartile	85	0.9	11	0.7	2	0.3	2	0.2
Third quartile	86	0.6	11	0.5	2	0.3	1	0.2
Highest quartile	86	0.8	11	0.7	2	0.2	1	0.2
OECD average	**74**	**0.1**	**19**	**0.1**	**4**	**0.0**	**3**	**0.0**

Arrived late for school

Arriving late for school was another factor that was examined for its impact on student learning. Students were asked how often they had arrived late for school in the last two weeks. Students responded to this item on a four-point scale (never; one or two times; three or four times; or five or more times).

Table 8.23 shows that, on average across the OECD, about 50% of the students surveyed had arrived late for school in the two weeks prior to the PISA assessment. Similar proportions of students in Canada, New Zealand and Estonia reported arriving late for school at least once during that period (48%, 45% and 43% respectively). In Australia, about 41% of students reported arriving late for school, which was significantly lower than the OECD average. In comparison, just over 10% of students in Japan reported they arrived late for school on one or more occasions.

TABLE 8.23 Students arriving late for school: Australia and international results

	Percentage of students who reported having arrived late for school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
Country	%	SE	%	SE	%	SE	%	SE
Australia	**59**	**0.6**	**27**	**0.5**	**8**	**0.3**	**6**	**0.3**
Hong Kong (China)	76	0.7	19	0.6	3	0.2	2	0.3
Singapore	76	0.6	18	0.6	3	0.2	2	0.2
Japan	88	0.6	9	0.5	1	0.2	1	0.2
Finland	64	0.9	26	0.7	7	0.4	4	0.3
Estonia	57	0.9	29	0.7	8	0.4	6	0.4
New Zealand	55	1.0	28	0.7	10	0.4	8	0.5
Canada	52	0.8	30	0.5	10	0.4	8	0.4
United Kingdom	67	0.9	24	0.7	5	0.4	4	0.3
United States	65	1.1	26	0.8	6	0.3	3	0.4
OECD average	**56**	**0.2**	**29**	**0.1**	**8**	**0.1**	**7**	**0.1**

Table 8.24 illustrates the extent to which Australian students reported arriving late for school by jurisdiction. Overall, students in the Northern Territory were most likely to report arriving late for school, with more than 50% of students reporting they arrived late more than once. On average, just under 30% of students across Australia reported arriving late for school on one or two occasions in the two weeks prior to the PISA assessment. Just over 26% of students in the Northern Territory reported arriving late for school at least three or more times, while nearly 20% of students in the Australian Capital Territory and South Australia reporting arriving late at least three or more times.

TABLE 8.24 Students arriving late for school, by jurisdiction

	Percentage of students who reported having arrived late for school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
Jurisdiction	%	SE	%	SE	%	SE	%	SE
ACT	54	2.0	29	1.9	9	1.2	8	1.2
NSW	60	1.1	27	0.8	8	0.6	5	0.4
VIC	59	1.3	26	1.1	9	0.7	5	0.6
QLD	60	1.1	28	1.0	7	0.6	5	0.5
SA	52	1.6	30	1.2	10	0.8	8	0.9
WA	60	1.4	27	1.4	8	0.6	6	0.5
TAS	58	1.6	28	1.5	7	1.0	7	1.0
NT	47	3.0	27	2.9	16	2.3	10	1.5
OECD average	**56**	**0.2**	**29**	**0.1**	**8**	**0.1**	**7**	**0.1**

Table 8.25 also shows that there was little difference between students based on socioeconomic background. Students from advantaged schools only slightly more frequently reported no occasions of late arrival during the reference period than students from disadvantaged schools. Overall, just over 10% of students from advantaged schools compared to 18% of students from disadvantaged schools reported arriving late at school on three or more occasions. While the proportion of students is low, there is a difference in students arriving late at school on five or more occasions, with students from disadvantaged schools twice as likely to arrive late as students from advantaged schools.

TABLE 8.25 Students arriving late for school, by socioeconomic background

Socioeconomic background	Percentage of students who reported having arrived late for school in the two weeks prior to the PISA assessment							
	No times		One or two times		Three or four times		Five or more times	
	%	SE	%	SE	%	SE	%	SE
Lowest quartile	53	1.2	29	0.9	9	0.6	9	0.6
Second quartile	61	1.1	26	0.9	8	0.6	5	0.5
Third quartile	60	1.2	28	1.0	8	0.6	5	0.4
Highest quartile	63	1.1	26	0.9	7	0.6	4	0.5
OECD average	**56**	**0.2**	**29**	**0.1**	**8**	**0.1**	**7**	**0.1**

Classroom disciplinary climate

Disciplinary climate has been found to have a strong impact on student learning in class. McMahon et al (2009) report that student perceptions of classroom climate including disciplinary climate and teacher support have an effect on student motivation and academic achievement.

Students were asked to respond to five statements to ascertain the frequency of their occurrence in their science classes on a four-point scale (every lesson; most lessons; some lessons; never or hardly ever):

- Students don't listen to what the teacher says.
- There is noise and disorder.
- The teacher waits long for students to quiet down.
- Students cannot work well.
- Students don't start working for a long time after the lesson begins.

These items were inverted and standardised to have a mean of 0 and a standard deviation of 1 and together defined the index of disciplinary climate in science classes. Positive values on this index indicate more positive levels of disciplinary climate in science classes.

Figure 8.28 presents the mean index scores for Australia and selected comparison countries. Students in Japan had the highest levels of positive disciplinary climate in science classes with a mean index score of 0.83, followed by students from Hong Kong (China) (mean index score: 0.35). Students in Australia and New Zealand reported the lowest levels of positive disciplinary climate in their science classes with mean index scores of –0.19 and –0.15 respectively, which were significantly lower than the OECD average of 0.00.

Country	All students	
	Mean index	SE
Australia	**–0.19**	**0.0**
Hong Kong (China)	0.35	0.0
Singapore	0.20	0.0
Japan	0.83	0.0
Finland	–0.04	0.0
Estonia	–0.10	0.0
New Zealand	–0.15	0.0
Canada	–0.01	0.0
United Kingdom	–0.08	0.0
United States	0.29	0.0

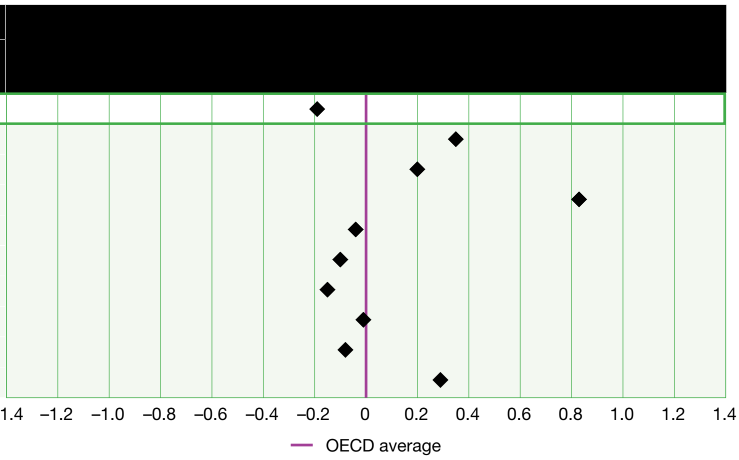


FIGURE 8.28 Disciplinary climate in science classes: Australia and international results

Table 8.26 shows, across all OECD countries, the most common disciplinary problems were *students don't listen to what the teacher says* and *there is noise and disorder* with nearly one-in-four students reporting this occurs in most or every lesson. Students from Australia and New Zealand most frequently reported *students don't listen to what the teacher says* (40% and 39% respectively). In contrast, less than 10% of students in Japan reported *students don't listen to what the teacher says* in most or every lesson. *There is noise and disorder* was similarly reported most frequently by students from Australia (43%) and New Zealand (42%). In Australia, *students cannot work well* was the least frequently cited disciplinary problem in science classes.

Overall for each item, Australian students reported a significantly higher level of disciplinary problems in science classes than the OECD average.

TABLE 8.26 Disciplinary climate in science classes by Australian and international comparisons

	Percentage of students' reporting 'Most lessons' or Every lessons'									
	Students don't listen to what the teacher says		There is noise and disorder		The teacher waits long for students to quiet down		Students cannot work well		Students don't start working for a long time after the lesson begins	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**40**	**0.7**	**43**	**0.7**	**34**	**0.7**	**24**	**0.6**	**28**	**0.6**
Hong Kong (China)	15	0.9	14	0.8	13	0.7	13	0.8	14	0.8
Singapore	18	0.5	27	0.6	21	0.6	11	0.4	13	0.4
Japan	9	0.7	11	1.0	8	0.8	13	0.7	9	0.8
Finland	31	1.0	38	1.1	29	1.0	19	0.8	27	1.1
Estonia	37	1.0	30	1.0	26	1.0	24	0.9	21	0.8
New Zealand	39	0.8	42	0.8	33	0.9	23	0.9	27	0.8
Canada	32	0.6	36	0.7	27	0.8	20	0.6	27	0.6
United Kingdom	36	0.9	39	0.9	33	0.8	21	0.7	24	0.8
United States	24	0.8	24	0.9	19	0.8	14	0.6	17	0.7
OECD average	**32**	**0.2**	**33**	**0.2**	**29**	**0.2**	**22**	**0.1**	**26**	**0.1**

Figure 8.29 shows the extent to which students reported the level of disciplinary climate in science classes by jurisdiction. Western Australia reported the highest level with a mean index of –0.09, followed by Victoria with mean index score of –0.10. Students from schools in Tasmania reported the lowest level of positive disciplinary climate (–0.44) followed by New South Wales (–0.32). In all jurisdictions, mean index scores were significantly lower than the OECD average.

Jurisdiction	All students: Mean index	All students: SE
ACT	–0.24	0.0
NSW	–0.32	0.0
VIC	–0.10	0.0
QLD	–0.11	0.0
SA	–0.24	0.0
WA	–0.09	0.0
TAS	–0.44	0.0
NT	–0.11	0.1

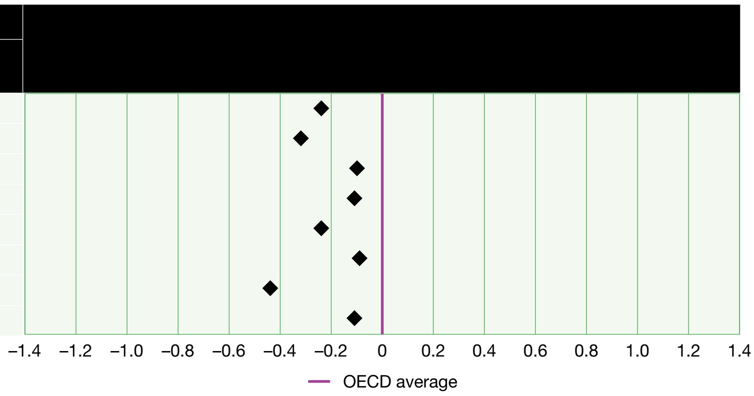


FIGURE 8.29 Disciplinary climate in science classes, by jurisdiction

Table 8.27 presents the five items that comprised the disciplinary climate in science lessons index, and displays the proportions of students who reported each disciplinary problem occurring in most or every lesson by jurisdiction.

On average, just over 40% of students in the Australian Capital Territory indicated *there is noise and disorder*; 50% of students in Tasmania and 48% of students in New South Wales reported this problem occurring most frequently. Students in Tasmania most frequently reported *students don't listen to what the teacher says* (48%). In contrast, students in each of Victoria and Western Australia (30%) and the Northern Territory (29%) were least likely to report *the teacher waits long for students to quiet down*.

TABLE 8.27 Disciplinary climate in science classes, by jurisdiction

	Percentage of students' reporting 'Most lessons' or Every lessons'									
	Students don't listen to what the teacher says		There is noise and disorder		The teacher waits long for students to quiet down		Students cannot work well		Students don't start working for a long time after the lesson begins	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	41	2.2	44	2.1	36	2.0	22	1.7	28	1.9
NSW	44	1.2	48	1.4	38	1.4	28	1.1	33	1.2
VIC	36	1.3	39	1.4	30	1.2	20	1.0	25	1.1
QLD	38	1.6	41	1.5	32	1.1	22	1.3	25	1.2
SA	40	1.4	46	1.4	35	1.7	25	1.6	30	1.5
WA	34	1.6	40	1.6	30	1.5	22	1.5	24	1.5
TAS	48	2.1	50	2.1	44	2.0	30	1.9	34	1.9
NT	34	2.9	41	3.0	29	2.9	21	2.8	28	2.9
OECD average	**32**	**0.2**	**33**	**0.2**	**29**	**0.2**	**22**	**0.1**	**26**	**0.1**

Figure 8.30 presents Australian students' views about the disciplinary climate in science lessons by socioeconomic background. Students in advantaged schools scored at around the OECD average for positive disciplinary climate. For students in disadvantaged schools (the lowest two quartiles), scores were well below the OECD average.

Socioeconomic background	All students: Mean index	All students: SE
Lowest quartile	−0.38	0.0
Second quartile	−0.30	0.0
Third quartile	−0.18	0.0
Highest quartile	0.03	0.0

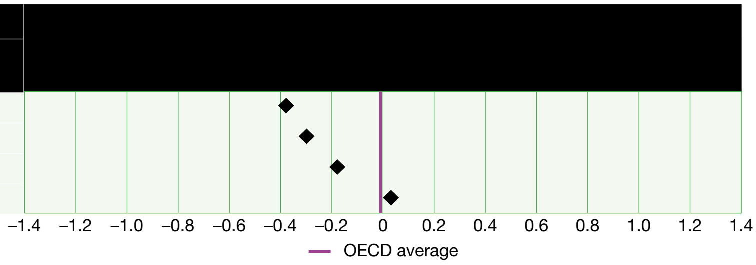


FIGURE 8.30 Disciplinary climate in science by socioeconomic background

Table 8.28 presents Australian students' perceptions of the prevalence of disciplinary problems in science classes by socioeconomic background.

Even in the more advantaged schools, almost one-third of students reported that in most or every lesson, *students don't listen to what the teacher says*. One-third of students in more advantaged schools and one-half of the students in lower socioeconomic schools also reported that *there is noise and disorder* in the classroom.

TABLE 8.28 Disciplinary climate in science classes, by socioeconomic background

	Percentage of students reporting 'Most lessons' or Every lessons'									
	Students don't listen to what the teacher says		There is noise and disorder		The teacher waits long for students to quiet down		Students cannot work well		Students don't start working for a long time after the lesson begins	
Socioeconomic background	%	SE	%	SE	%	SE	%	SE	%	SE
Lowest quartile	46	1.5	50	1.7	42	1.7	32	1.3	35	1.3
Second quartile	44	1.4	48	1.4	37	1.4	26	1.2	30	1.3
Third quartile	38	1.5	42	1.5	33	1.6	22	1.3	28	1.3
Highest quartile	32	1.0	34	1.3	25	1.0	17	0.9	21	0.8
OECD average	**32**	**0.2**	**33**	**0.2**	**29**	**0.2**	**22**	**0.1**	**26**	**0.1**

Learning time and curriculum

Learning time in school

The research literature shows there is a strong association between learning time and academic performance. According to Carroll (1989 cited in OECD, 2011), effective learning ultimately depends on the way in which time is organised, the proportion of time dedicated to student's perseverance or full engagement in learning, and the time students with varying aptitudes and motivation levels require to internalise concepts and elaborate on ideas.

In order to establish the amount of learning students participated in at school, students were asked the total number of class periods they were required to attend in a normal full week at school. Students were also asked to identify how many class periods per week they were typically required to attend for the study of science, mathematics and language.[61] In addition, students were asked to indicate how many minutes, on average, there were in a class period. Note, there was a degree of variability in students' responses regarding the average length of their class periods, therefore these data should be interpreted with a degree of caution. As Australian PISA students were drawn

61 In Australia, a language class period is English.

from different year levels, their participation time in subjects such as mathematics and science may have been affected by their elective-subject choices if mathematics and science were no longer compulsory core subjects.

Table 8.29 shows that the number of class periods in a normal full week of school varied across the comparison countries. On average across all OECD countries, students had 33.7 class periods per week. Students in Singapore and Hong Kong (China) reported the highest number of class periods per week (44.4 and 43.1 respectively). In contrast, students in New Zealand, the United States and Australia reported the lowest number of class periods in a normal school week (28.4, 29.2 and 29.4 respectively).

Table 8.29 also shows there was variability in the amount of time per week students spent learning regular science, mathematics and English. However, results should be interpreted with a degree of caution given students participating in PISA come from different year levels, some in which science is still a compulsory subject (general science) and others where the amount of time spent studying science is dependent on subject-elective choices (biology, chemistry, physics).

There appears to be no indication that there is a relationship between hours of instruction in school and average scientific, mathematical or reading literacy scores.

On average across OECD countries, students spent about 3.5 hours a week attending science lessons. Students in Singapore reported spending the most time in science lessons, on average nearly 5.5 hours a week, followed by students in Canada who reported spending nearly 5 hours. In contrast, students in Finland reported spending the least amount of time in science lessons a week (nearly 3 hours), with students in Australia reporting spending about 3.5 hours a week. The time Australian students spent in science lessons was similar to the OECD average.

TABLE 8.29 Learning time in school: Australian and international comparisons

	Number of class periods in a normal full week of school (class periods)		Time per week spent learning (minutes)					
			Regular Science lessons		Regular language lessons		Regular Mathematics lessons	
Country	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Australia	**29**	**0.2**	**211**	**1.5**	**236**	**1.1**	**238**	**1.2**
Hong Kong (China)	43	0.4	229	4.5	304	3.8	286	3.4
Singapore	44	0.2	328	2.6	256	1.6	308	2.0
Japan	33	0.2	174	3.3	219	2.4	240	2.5
Finland	31	0.2	170	2.8	150	1.2	173	2.1
Estonia	35	0.1	219	2.7	190	1.1	212	1.4
New Zealand	28	0.3	251	2.8	247	2.2	244	2.0
Canada	24	0.2	291	3.1	311	3.2	297	3.2
United Kingdom	30	0.3	284	2.6	243	2.6	235	2.2
United States	29	0.5	237	3.7	258	4.4	243	3.8
OECD average	**34**	**0.0**	**210**	**0.6**	**216**	**0.4**	**219**	**0.4**

On average across OECD countries, students spent about 3.75 hours a week studying language. Students in Canada reported spending the most time in language classes, on average nearly 5.25 hours a week, followed by students in Hong Kong (China) who reported spending about 5 hours a week. In contrast, students in Finland reported spending the least amount of time in language classes a week (about 2.5 hours), and students in Australia reported to spend nearly 4 hours a week in language classes. This was significantly higher than the OECD average.

On average across OECD countries, students reported spending about 3.75 hours a week attending mathematics classes. Students in Singapore reported spending the most time in mathematics classes, on average nearly 5.25 hours a week, followed by students in Hong Kong (China) who reported spending about 5 hours a week. In contrast, students in Finland reported spending the least amount of time in mathematics classes a week (about 2.75 hours), with students in Australia reporting to spend nearly 4 hours a week. The time Australian students spent in language classes was significantly higher than the OECD average.

Table 8.30 shows that the number of class periods in a normal full week of school varied across Australia. Students in South Australia reported the highest number of class periods per week (33.3 classes); in contrast, students in Queensland and the Australian Capital Territory reported the fewest class periods in a normal school week (26.9 and 28.4). Table 8.30 also shows there was variability in the amount of time per week students spent learning regular science, mathematics and English lessons.

Students in Western Australia and South Australia reported spending the most time in science classes, on average nearly 3.75 hours a week. In contrast, students in Queensland reported spending about 3 hours in science classes. The time students in the Australian Capital Territory, New South Wales, South Australia and Western Australia spent in science classes was significantly higher than the OECD average.

Students in Tasmania reported spending just over 4.25 hours a week in mathematics classes, which was significantly more than that of students in Victoria who spent just over 4 hours a week. In contrast, students in the Australian Capital Territory reported spending the least amount of time in mathematics classes (nearly 3.75 hours). In the other jurisdictions, students reported spending about 4 hours a week in mathematics classes.

In all jurisdictions except the Australian Capital Territory, students reported spending significantly more time in mathematics classes a week than the OECD average.

TABLE 8.30 Learning time in school, by jurisdiction

	Number of class periods in a normal full week of school (class periods)		Time per week spent learning (minutes)					
			Regular Science lessons		Regular language lessons		Regular Mathematics lessons	
Jurisdiction	Mean	SE	Mean	SE	Mean	SE	Mean	SE
ACT	28	0.5	220	2.8	230	4.3	220	2.4
NSW	30	0.4	225	2.2	240	2.3	240	2.4
VIC	29	0.5	199	4.2	243	2.6	244	2.6
QLD	27	0.5	185	3.7	222	2.1	228	2.1
SA	33	0.4	227	3.4	231	2.8	239	3.9
WA	30	0.4	232	2.9	240	2.3	239	2.2
TAS	30	0.5	212	4.3	245	5.3	252	3.8
NT	30	0.7	216	5.5	243	3.1	238	3.0
OECD average	**34**	**0.0**	**210**	**0.6**	**216**	**0.4**	**219**	**0.4**

Appendices

Appendix A: PISA procedures

To assist readers to understand the scope and operations of PISA, a brief account of some of its procedures is provided in this Appendix. A thorough account will be available in the OECD's PISA 2015 Technical Report (forthcoming).

Most of PISA's operational procedures have both international and national components; information on how the 2015 assessment was implemented internationally is given first, followed by details of its national implementation.

PISA internationally

International consortium

PISA 2015 was implemented through an international consortium managed by Educational Testing Service (ETS), which is a company based in the United States. Other members of this consortium were:

- Deutches Institut für Internationale Pädagogische Forschung (DIPF) (Gemany)
- Westat Inc. (United States)
- Pearson (United States)
- cApStAn Linguistic Quality Control (Belgium).

Collaborative development

PISA is an international assessment that has been jointly developed by participating OECD countries. Countries have been able to contribute to the survey, through their national project managers and national advisory committees, by providing sample assessment material to the consortium and offering comment on many aspects of the project to the international bodies described below, the PISA Governing Board (PGB) and Functional Expert Groups.

Each OECD country participating in PISA has one member, usually from an education ministry, as a representative on the PGB. This group sets the policy objectives of the assessment and the policy priorities for the implementation of the assessment. This includes endorsing the assessment frameworks, approving the bank of items developed for the assessment, and agreeing to the plans for international reporting of results. The PGB also considers advice and endorses recommendations from the PISA Technical Advisory Group (TAG) on technical aspects of design, for example, the balance of multiple choice and open-ended items, the number of assessment forms or the design for rotation of material in the assessment booklets.

The three Subject Matter Expert Groups (SMEGs) for PISA 2015 consisted of subject matter and technical experts from participating countries. Each of the assessment domains – scientific, reading and mathematical literacy – had its own SMEG. These groups, together with the TAG, linked the policy objectives specified by the PGB with expertise in the field of international comparative assessment to provide input into the frameworks for the assessment and to monitor the quality of assessment items prepared. A SMEG typically contains between eight and ten members. The members are not intended to represent individual countries but to provide a cross-section of the world's most renowned experts in each area. A smaller group of consultants assisted with the PISA 2015 questionnaire development. All of these groups provide advice and recommendations to the consortium, and, through the international consortium, to the PGB.

Operational stages

Very high standards are set for sampling, assessment materials and operational procedures in PISA to ensure that the data will be comparable across countries. Many of the operational steps are briefly referred to here. More detail is provided on how the various procedures worked in Australia further on in this appendix.

Framework and item review

The development of the assessment frameworks has been a continuous effort since the inception of PISA. In PISA 2015, an expanded framework for the assessment of scientific literacy as a major domain was undertaken. The assessment framework was circulated for comment, with the aim of reaching consensus on the nature and detail of the assessment domains. Similarly, drafts of assessment items were sent to each country, for review by local experts. Countries had the opportunity to provide feedback and suggestions on the items, which were then revised and subjected to a field trial. The reading and mathematical literacy frameworks developed in 2009 and 2012 respectively remained essentially the same for PISA 2015.

Field trial

The field trial played an integral part in the preparations for the PISA main study becoming a computer-based assessment. The field trial provided an opportunity to refine the assessment materials, trial new items for the major assessment domain (scientific literacy), trial items for the innovative domain (collaborative problem solving), and also to rehearse the operational procedures. These included assessing how well the new computer platform functioned and undertaking a mode effects study. Internationally, thousands of students took part in the field trial, including approximately 2400 Australian students (approximately 52 students per school).

Each school was randomly assigned to one of three groups in which students were randomly allocated to complete either a paper-and-pencil form, a computer-based form or a combination of both hard copy and electronic..

In addition, the principal or a nominated designate at participating schools completed a web-based School Questionnaire and up to 10 science teachers and up to 15 non-science teachers completed a web-based Teacher Questionnaire. The field trial in schools took place from 26 May to 20 June 2014.

Main study

For most countries, the PISA main study was administered between March and August 2015. For many Northern Hemisphere countries, where the academic year begins in September and ends in June, the assessment was conducted between March and May. For countries in the Southern Hemisphere, where the academic year typically extends from early February until December, the assessment was conducted between the end of July and the start of September. The international requirement was that the assessment had to be conducted within a 42-day window, which is referred to as the testing period.

Within the majority of countries, between 4000 and 9000 students were tested. Some countries oversampled their age-eligible 15-year-olds. These countries were Australia, Argentina, Belgium, Brazil, Canada, China, Colombia Czech Republic, Denmark, Italy, Malaysia, Portugal, United Arab Emirates, the United Kingdom. In addition, some countries had a school census (Cyprus, Iceland, Luxembourg, Macao (China), Malta, Trinidad, and Tobago and Qatar).

Details of Australia's field trial and main study are provided later in this appendix. The remainder of this section describes some of the more technical features of PISA's assessment design.

Design aspects

Computer forms

In PISA 2015, forms were prepared for the computer-based assessment. Both 'closed' and 'open-ended' assessment items were used. Closed items have only one correct answer and open-ended items require students to construct their own response. Open-ended items allow a wider range of skills to be assessed.

Each PISA assessment task provides some stimulus material followed by a series of questions (items) that relate to the stimulus. The stimulus material and its items are called a unit. Each unit I is allocated to a test cluster. Each cluster typically contains about four units and is designed to take 30 minutes to complete. In PISA 2015, the assessment design was based on 18 clusters of trend items from previous cycles – six clusters each of reading, mathematical and scientific literacy – plus six clusters of new scientific materials developed for 2015. PISA 2015 also offered an optional international assessment of financial literacy that comprised two clusters, which Australia participated in. In all, there was a total of 184 science items, 103 reading items, 81 mathematics items, 135 collaborative problem-solving items and 43 financial literacy items. This design allowed a large amount of material to be covered and for different students to complete different combinations of items. The computer-based forms were allocated to students, from a random starting point in each school.

Questionnaires

As well as the computer-based forms, there were three context questionnaires. Principals each completed a School Questionnaire; a sample of up to 10 science teachers and up to 15 non-science teachers completed a Teacher Questionnaire; and students each completed a Student Questionnaire. The questionnaires were designed to enable achievement data to be analysed in relation to these respondents' different backgrounds, living conditions, educational programs and other factors that might an impact their performance.

As well as gathering information about students and their family background, academic environments and self-regulated learning, the Student Questionnaire also included optional sections to assess students' educational career paths and familiarity with information technology. These optional components were placed at the end of the Student Questionnaire. There was also an opportunity for countries to include additional items of national interest. In Australia, as part of a national option, students were asked to provide their contact details to become the next cohort for the Longitudinal Surveys of Australian Youth (LSAY).

Ensuring a high quality assessment

Quality monitoring is an integral part of PISA and the implementation of checking and verification procedures within all components and stages of the assessment has ensured that PISA has produced data of a very high standard. The quality monitoring procedures have been reviewed and endorsed by the PGB.

The international contractors, set up by ETS, were appointed to manage the implementation of PISA internationally and were always available to give advice to countries as requested, monitored countries' progress continuously and were proactive in offering assistance with procedures if it was warranted.

Translation procedures

Experts in translation procedures ensured that the materials to be translated were as equivalent in meaning and level of complexity as possible. Translation of the computer-based assessment forms, questionnaires and manuals involved extensive and thorough processes. Materials from the international contractors were provided to countries in both English and French. In countries where the language is neither English nor French, the countries were required to translate the assessment materials separately from both versions. A reconciliation of these independent translations then took place at country level and the resulting translation was then reviewed by the team of tri-lingual verifiers working for the international contractors.

Sampling procedures

Ensuring the quality of sampling in PISA was the responsibility of Westat Inc who appointed a senior staff member to be the international sampling referee for the project. A team of sampling experts at Westat Inc. employed rigorous procedures for the random selection of schools and students to represent their country. Countries were assisted in the preparation of a series of sampling forms, which included the school sampling frame (i.e. a list of all schools containing students in the PISA target population). Countries were required to use the KeyQuest sampling software developed by the international consortium for the selection of the student sample within schools. Stringent criteria for adequate response rates were specified at the school and student level. Participating countries agreed to meet the international criteria for response rates; otherwise their data could not be included fully in reports. The sampling procedures helped to ensure that the data would be of a high standard in order to make valid comparisons of results between countries.

Test administration procedures

Criteria for test administrators were set internationally. Test administrators could not be the reading, mathematics, or science instructor of any student in any session they would be administering. Test administrators could not be a staff member of any school within the PISA sample. These criteria were set partly to minimise the burden on schools but mostly to establish PISA as a valid and unbiased assessment with uniformly administered test sessions. Standardised administration procedures were developed by the consortium and provided in a test administrator's manual. Comprehensive training sessions were held covering administration procedures, both for the field trial and again for the main study. Training sessions were held firstly for a country's national project managers (NPMs) or their designated staff, who were then responsible for training the test administrators in their country. These methods were established to achieve standardised administration of the PISA tests.

Monitoring of procedures

During the main study, PISA Quality Monitors (PQMs), were nominated by national project teams, but were employed by and worked on behalf of the international consortium. They were not allowed to be connected in any way to a national centre, the national centre being the organisation conducting PISA in their country. PQMs were used to observe testing sessions to ensure that testing procedures were being implemented according to the specifications in the test administrator's manual. They were also trained in PISA's procedures by the international contractors and then were sent unannounced to a subset of schools during the assessment sessions.

Coding of responses to open-ended items

Approximately 44 per cent of items in total across the three domains (scientific, reading and mathematical items) and 12 per cent of items from the financial literacy assessment were open-ended constructed response items and required coding.

Coding was undertaken using open-ended coding system (OECS) software. Standardised coding guides were developed by consortium staff and reviewed by PISA national project staff before they were finalised. These guides required translation in countries where languages other than English or French were spoken. The same method of training coders was used as for test administrators, in that NPMs or their designated staff first attended international training sessions and then trained the coders in their country.

The OECS software generated a set of PDF files with responses for each item, which was provided to each coder. The set included one PDF file per item and each PDF file included a set of responses to that item. Coders worked on an item-by-item basis and coded responses directly into the individual files by completing a small form for each response.

For the main study, the OECS coding design for each country was developed to meet the intended sample size. In Australia, the coding design required 12 science coders, 9 reading coders, 16 maths coders and 16 financial literacy coders required to code all of the items in their subject area from their assigned open-ended responses. The OECS software enabled daily reliability reports to be generated to ensure that coders were applying the criteria consistently and to quantify any variation between coders. Monitoring the consistency of applying the coding criteria was required daily so that systematic errors could be corrected. Reliability reports identified the proportion of agreement between coders, the distribution of codes assigned to each item and the identification of items that may have been deferred, un-coded or missing codes. The goal in coding was to reach an inter-rater reliability of 92% agreement across all items, with at least 85% agreement for each item.

Each PDF file assigned to each coder contained all the responses to an item as well as some responses that only required single coding – meaning by one coder only – while other responses were required to be re-coded by other coders. In addition, anchor responses (in English) were used to assess reliability across countries. The OECS software organises data in a way that meets all requirements for generating reports displaying within- and cross-country reliability.

Data entry procedures

Another step that ensured the high quality of PISA data was the provision to countries of specially developed software for entering and validating data. All data files that form the complete Australian PISA datasets were contained in the Data Management Expert (DME) Database. It was integral that data were submitted to the international contractors in a standard format in order to combine into a single international data set. Many data cleaning integration and data verification procedures were carried out before the data were considered ready for analysis.

PISA nationally

Project management

Each country appoints a National Project Manager (NPM) to ensure that the survey is implemented according to the international timeline and that all duties are carried out according to the specified procedures and standards. NPMs play a critical role in evaluating assessment results in a national context and a large role in ensuring the operational success of the assessment in their country. Countries are encouraged by the OECD to set up one or more committees to monitor the progress of the project, assist with reviewing materials, and to provide a forum for discussion of issues of implementation at the national level. In Australia, the International Assessments Joint National Advisory Committee (IAJNAC) guides all aspects related to the implementation of PISA. The IAJNAC's members are from many areas of Australian education and include subject-matter experts to advise the NPM and the national PGB representative on the content and methods of the assessment. The education department of each jurisdiction in Australia has a representative on the IAJNAC.

The Committee's involvement in policy decisions that relate to international and national options, commenting on frameworks, and providing input into assessment materials and dissemination of results, ensures that any issues of concern in Australia are not overlooked by the consortium.

Item review

Members of the IAJNAC reviewed items for their relevance and appropriateness for Australian 15-year-old students.

Field trial

In Australia, the field trial took place between 26 May and 20 June 2014. A summary of its scope is presented here. Australia also participated in the assessment of financial literacy, which was offered as an international option.

For the field trial, the prescribed sample design allocated schools to different combinations of the ways in which the assessment was administered.

- Schools in Group 1 allocated one-third of students to complete the paper-based assessment (PBA) and two-thirds of students to complete the computer-based assessment (CBA).
- Schools in Group 2 allocated all students to complete the CBA.
- Schools in Group 3 allocated one-third of students to complete the PBA and the paper-based financial literacy assessment, and two-thirds of students to complete the CBA. Between six and twelve students also completed the computer-based financial literacy assessment.
- Schools in Group 4 followed the same allocation as Group 3; however, students were assigned different assessment forms.
- Schools in Group 5 allocated one-third of students to complete the paper-based trend items of which between six and twelve students were also sampled to complete the computer-based financial literacy assessment. The remaining two-thirds of students completed the CBA new items.
- Schools in Group 6 followed the same model as Group 5; however, students were assigned different assessment forms. All students completing the CBA completed the Student Questionnaire while students who completed the PBA completed a shorter version of the Student Questionnaire.

Students who completed the computer-based assessment used school desktop computers, class sets of laptops or attended schools with a bring-your-own device (BYOD) policy.

Schools

The selection of schools for the field trial was much less rigorous the selection of schools for the main study. Schools were chosen by convenience sampling and were representative of schools from a range of communities and socioeconomic areas. In all, 59 schools from the jurisdictions of New South Wales, Victoria and Queensland took part in the field trial.

Students

The target population for the field trail was students born between 1 March 1998 and 28 February 1999. At each sampled school the nominated school contact person who ACER liaised with was asked to provide a list of all age-eligible students, regardless of year level. In accordance with the international sampling manual, ACER staff randomly sampled 52 students from each participating school.

For the PISA 2015 field trial assessment, of the approximate 3068 age-eligible students sampled, 2388 students participated; 567 students participated in the PBA and 1821 students completed the computer-based assessment.

Adaptations to manuals, assessment booklets and questionnaires

All countries participating in PISA were required to undertake a translation and verification process of all documentation used in the conduct of PISA. Minimal adaptations for Australia were required to the administrative manuals, coding guides, assessment booklets and questionnaires. Amendments to assessment booklets, such as vocabulary, were submitted to and approved for use by the international contractors.

Test administration

The assessment sessions took place in the morning. Each student, irrespective of whether they were completing the PBA or the CBA, was asked to complete an assessment booklet or form (consisting of multiple choice and open-ended items) plus a questionnaire.

- Students allocated the PBA were allowed two hours, plus administration time, to complete the PBA and given an extra 8 to 10 minutes for the questionnaire. There was provision for two short breaks; the first taken after students had worked for one hour on the cognitive assessment, and the second (5 to 10 minutes) taken before they started the questionnaire. In total, about three hours was required to complete the paper-based assessment
- Students allocated to the CBA had to first complete an approximate 20-minute tutorial to allow them to become familiar with the testing environment. They were then allowed two hours plus administration time. The questionnaire required an additional 35 minutes.

Students sampled to participate in the financial literacy assessment returned to the testing room in the afternoon to complete their allocated paper-based or computer-based version of the financial literacy assessment. The time taken to complete it, including administration time, was about one hour and thirty minutes.

ACER employed 16 experienced teachers to administer the field trial sessions. The test administrators administered the paper-based and the computer-based assessment in their allocated schools. Training the test administrators took place at the ACER office in Melbourne in mid-April 2014, which included trainers becoming familiar with the computer-based assessment and in administering PISA.

Coding

Almost half of the field trial items were open-ended and required coders to code the students' responses to the scientific literacy items. Training of the coding procedures, using internationally prepared coding guides, which were adapted for national purposes, was conducted during July 2014 at ACER, and involved 16 experienced coders. Coders were required to hand-code the paper-based booklets in readiness for data entry and code computer–based forms using the OECS software. The coding process also included multiple coding from three assessment booklets and three assessment forms, as specified internationally.

Data entry

All data entry of the paper-based assessment booklets, once coded, were entered using Data Management Expert (DME) software, specially developed and provided to national centres by the international contractors. Once the coding of the computer-based forms using the OECS software was complete, the files were imported into the DME software.

Main study

Assessment dates in Australia

In Australia, the main study assessment took place from late July to early September in 2015.

Schools and students

Full details of the Australian school and student samples are presented in Appendix B. Australia satisfied the international response rate criteria fully, with 94.9% of the selected schools and 83.9% of the selected students taking part.

Obtaining the school sample

PISA is one of a suite of assessments of Australia's National Assessment Program (NAP). Liaison officers were appointed from each jurisdiction's education department, Catholic education offices and associations of independent schools to inform schools that they had been sampled to participate in PISA. Schools were approached in late November 2014 and were sent an information package about PISA. Response rates and the sampling of students are discussed in Appendix B.

Contact persons in schools

Each participating school was asked to nominate an experienced staff member to take on the role of PISA school coordinator. School coordinators were ACER's main point of contact in assisting with making administrative arrangements for the assessment session in their school – for example, setting the date for the session, finding a room in which the session could be conducted, arranging for lists of age-eligible students to be sent to the national centre, and so on.

In addition, each school was asked to nominate a member of staff who was a member of their school's IT department to act in the role of PISA IT coordinator. The IT coordinator was ACER's main point of call in establishing the computer resources available in their school, testing the compatibility of the school's computers with the PISA assessment software using a systems diagnostic tool and providing IT support to the test administrator if necessary.

National options

Countries were permitted to introduce additional aspects of national relevance into PISA, subject to approval from the international contractors. Australia chose to include optional material to the Student Questionnaire, as described in the following paragraphs.

Additional questionnaire items

Information was sought on students' Indigenous background. The questions on language spoken at home and on parents' and respondent's countries of birth were adapted in the Australian questionnaire. It was felt, for example, that responses to the international format question of 'Were you born in Australia?' (Yes/No) would not accurately indicate ethnic background.

Students were also asked to provide their contact details so they could be contacted for the Longitudinal Surveys of Australian Youth (LSAY) to follow their career and educational pathways.

Test administrators

Approximately one hundred test administrators, external to the schools, administered the assessment sessions.[62] All were employed by ACER casually and many had been involved in previous PISA cycles. All test administrators were highly experienced teachers, many of whom were also experienced in conducting test sessions according to standardised procedures.

The test administrators undertook compulsory training using online training modules that had been developed by ACER. During their training, they had to view and complete a series of short tests, and could not move onto the next section unless all questions had been answered correctly. Test administrators also participated in a teleconference, which provided them with an opportunity to ask questions or clarify any part of the test administration process.

The training modules were made available to the test administrators in mid-June and remained open until the end of the testing period in early September. The extended access to the modules allowed test administrators to re-watch the modules leading up to and during the testing period (if needed). The teleconferences were conducted during the first two weeks of July 2015.

62 In a small number of remote schools, the test administrator was a member of staff. This enabled more flexibility in setting the date of the assessment session in order to maximise student participation.

Scheduling of sessions: logistics

For the PISA main study, Australia only used the computer-based assessment.

The number of assessment sessions scheduled in one school depended on how many school computers were available to run the PISA software, the number of computers in an area, for example, a computer laboratory, and the number of sampled students. Altogether, around 950 regular and 170 follow-up sessions took place. In around 20% of schools, more than one regular assessment session was required to be scheduled because of the number of available computers and to accommodate the larger number of sampled students. A very small number of schools had some variations to the assessment sessions, which included two test administrators administering sessions at the same time in one school, the morning and the afternoon sessions being held across two days, and only one session being able to take place even though more students had been sampled.

Assessment sessions were mostly carried out in classrooms, although the school library, the school hall, or areas such as common or meeting rooms or the computer laboratory were also used as an assessment venue.

In about two per cent of schools, the assessment session had to be rescheduled because of technical issues (no administrative rights to run the software, USB drive not loading and a no-USB drive policy), test administrators falling ill, and bad weather.

In the majority of schools, the administration was carried out in computer labs or in classrooms (with students using their BYOD laptops). About five schools had a mini-lab of 10 computers brought into the school.

In schools where the PISA assessment was completed in one day, the PISA cognitive assessment and the student questionnaire were administered in the morning and the financial literacy assessment was completed in the afternoon. The amount of time required to conduct the assessment was five hours, which included breaks.

Coding processes

Twelve science coders, nine reading coders, 16 maths coders, and 16 financial literacy coders were employed for the whole duration of the coding. All coders were experienced secondary teachers but were employed as teachers. The coders were trained in the use of the coding guide and undertook an initial training session in mid-September 2015.

Following the procedures specified by the international contractors, coding was done by cluster. Further training and practice on coding the clusters new to 2015 was carried out. Within clusters, coding was done by item. The OECS software that handled the open-ended responses randomly allocated items to the coders.

Three table leaders[63] (one for each literacy assessment domain) were used to field queries from individual coders, to review with individual coders any issues, to document difficulties that needed resolution from the international contractors and to monitor the coding process generally.

Reliability analyses were carried out to ensure that coders applied the criteria consistently, and quantified any variations between coders. Monitoring the consistency in applying the coding criteria was required daily so that systematic errors could be corrected.

The coding across all literacy assessment domains was completed in approximately four weeks.

Data entry

After the assessment sessions, the test administrators returned materials to ACER for processing. The student data was extracted from the USB drives and imported into the DME software.

63 very experienced coders

The administration forms, which listed the sampled students, provided details about student participation and details about the assessment sessions data entered into the DME and KeyQuest software packages.

Although the Teacher and School Questionnaires were originally intended to be delivered online, because of some access difficulties experienced by some teachers and principals, a PDF file was provided. In all, about 2000 teachers completed the questionnaire in this format. When these completed PDFs were returned to ACER, the responses were data entered. All Teacher and School Questionnaire data were imported into DME software.

Preliminary data checks on the sampling data began while the data entry of administration forms was still taking place. The sampling data was submitted to the international contractors six weeks after the end of the testing period. Further data checks, verification and cleaning of the data continued to be carried out up until the Australian datasets were submitted to the international contractors in November 2015.

The School Questionnaire and Teacher Questionnaire (science teacher and non-science teacher) were administered as web-based questionnaires and their returned data was later imported into DME software. Checking and cleaning of data, data verification steps, which took approximately four weeks, were then undertaken prior to submission of the Australian datasets to the international contractors.

Ensuring quality in national operations

Monitoring of operations and procedures was built into every stage of PISA in Australia, from the selection of the school and student samples, initiating and maintaining contact with schools, through to the preparation of materials, printing, packing, mailing, receiving and tallying returns, through to the reliability of the open-ended responses and coding of occupations. Other aspects of quality assurance included detailed training and monitoring, according to the internationally defined procedures, of test administrators, coders and data entry.

PQMs, on behalf of the international contractors, visited a sample of 15 Australian schools when the testing was taking place to ensure that procedures were followed accurately and instructions were adhered to.

Appendix B: Sampling

Australian sampling results

Sampling in PISA was carried out in two stages in most countries, including Australia. First, schools were selected using the latest available data in ACER's sampling frame based on a probability that was proportional to the school's enrolment of 15-year-olds. Thus, large schools had a greater chance than small schools of being selected.

Stratification of the sample ensured that the PISA sample represented the Australian population of 15-year-olds. Stratification variables used in Australia for sampling purposes were state and territory, school sector (government, Catholic and Independent), geographic location, sex of students at the school, and a socioeconomic background variable (based on SEIFA).

To define the PISA population, estimates of the number of 15-year-olds were provided by Australian state and territory education departments or based on previous PISA data on the proportion of 15-year-old students.

As schools were sampled, where possible, replacement schools were simultaneously identified in case a sampled school was unable to participate in PISA 2015 due to extenuating circumstances. The school sample selection process was undertaken by sampling experts at Westat Inc. who were part of the international consortium.

Internationally, the minimum required sample for each country was 150 schools and 5250 assessed students. In Australia, a larger sample was drawn to enable results to be reported at the jurisdictional levels and be disaggregated to give results by Indigenous status. Table B.1 provides the details of the Australian school sample design.

TABLE B.1 Designed PISA school sample by jurisdiction and school sector

Jurisdiction	Sector			Total
	Government	Catholic	Independent	
ACT	28	8	10	46
NSW	110	45	29	184
VIC	75	31	25	131
QLD	84	27	26	137
SA	61	22	22	105
WA	60	22	23	105
TAS	36	14	10	60
NT	37	7	12	56
Australia	**491**	**176**	**157**	**824**

The second stage of the selection process sampled students within sampled schools. Each participating school was asked to prepare a list of their age-eligible students (students born between 1 May 1999 and 30 April 2000). From this list, the student sample was drawn with equal probability. In each of the states, 20 students in each school were sampled; in the Australian Capital Territory, 30 students in each school; and in the Northern Territory, 27 students in each school were sampled. In addition, all age-eligible students who were identified as being of an Indigenous background on the school enrolment records were also sampled. If there were fewer than the required number of students, all eligible students were selected.

Permission was granted from the international sampling referee to exclude a number of categories of schools from the sample. These included hospital and correctional schools, remote off-shore and very remote mainland schools and schools instructing in a language other than English. In addition, institutions in the Technical and Further Education (TAFE) sector were also excluded, because there was a very small percentage of 15-year-olds enrolled.

Of the 824 schools sampled for the PISA 2015 main study, 36 schools were ineligible (on the basis that there were two or fewer age-eligible students[64] or the school had closed) and therefore, were not included in the school sample. Thirty schools became non-participants due to varying reasons including non-compliance, technical issues on the scheduled day of testing and extenuating circumstances at the school. In addition, data from schools with a student participation rate lower than 25% were removed from all datasets, and these schools were considered non-participants.

Table B.2 shows the final number of schools who participated in the PISA main study.

TABLE B.2 Achieved school sample by jurisdiction and school sector

Jurisdiction	Sector			Total
	Government	Catholic	Independent	
ACT	25	8	9	42
NSW	105	44	28	177
VIC	75	30	25	130
QLD	81	27	25	130
SA	55	22	21	98
WA	57	20	21	98
TAS	33	12	8	53
NT	15	5	7	27
Total	446	168	144	758

The 758 participating schools in PISA 2015 represented a weighted response rate of 94.9% after replacements and the weighted student participation rate after replacements was 84.0%. Both these figures met the international standards on response rates as specified by the Technical Advisory Group.

Indigenous sample

The International Assessments Joint National Advisory Committee (IAJNAC) again recommended oversampling Indigenous students to reliably report results for this minority group in PISA 2015. To achieve this, all age-eligible Indigenous students in the sampled PISA schools were invited to participate in the assessment.

All age-eligible Indigenous students were sampled by inviting any additional Indigenous students if they had not been sampled within the initial sampling of students per school, which resulted in 5420 Indigenous students sampled in PISA 2015.

Non-participants

Overall, of the total number of students sampled to participate in PISA (20,718 students), 6188 sampled students did not participate in PISA. Non-participation was due to a variety of reasons such as students no longer being enrolled at their school, absenteeism on the day of the assessment or falling within one or more of the PISA-defined exclusion categories. Table B.3 provides a breakdown, by jurisdiction, of the numbers of students in each category who were non-participants.

64 Schools with two or fewer students are considered ineligible and do not participate in PISA in Australia.

TABLE B.3 Student non-participation in Australia, by jurisdiction

Jurisdiction	No longer enrolled at the school	Special education need exclusion	Absentees	Total
ACT	31	62	252	345
NSW	161	173	852	1 186
VIC	78	90	450	618
QLD	249	172	714	1 135
SA	104	65	526	695
WA	166	24	644	834
TAS	47	43	325	415
NT	86	60	487	633
Total	922	689	4250	5861

No longer enrolled at the school

Nationally, school coordinator's identified 922 students who at the time of the assessment were no longer enrolled at their respective school.

Exclusions

Nationally there were 689 students excluded by the school coordinator from the PISA 2015 assessment. The special education need exclusion categories were equivalent to those in the international PISA manual, though the wording was changed to reflect current terminology in Australia. Students were excluded on the basis of:

- *a functional disability* (exclusion 1): student has a moderate to severe permanent physical disability
- *a cognitive, behavioural or emotional disability* (exclusion 2): student has a mental or emotional disability and has either been tested as cognitively delayed or is considered in the professional opinion of qualified staff to be cognitively delayed
- *limited assessment language experience* (exclusion 3): student is not a native speaker of any of the languages of the assessment in the country and has limited proficiency in these languages.

Exclusions at the student level accounted for fewer than 2% of the designed sample. Students with exclusions were spread throughout the country.

Absentees

Of the eligible students participating in PISA, 4250 students were absent on the day of the assessment session.

International sampling results

Internationally, the desired minimum number of students to be assessed per country was specified as 5250 assessed students. Some countries, including Australia, sampled more students so that language groups or regions within countries could be adequately represented.

Population coverage[65]

All countries and economies attempt to maximise the coverage of eligible 15-year-old students in their national sample.

According to the PISA standards, countries and economies are permitted to exclude a total of 5% of the total relevant population either by excluding schools or by excluding students within schools. Eligible school-level exclusions included geographically inaccessibility or where the administration of the PISA assessment was not considered feasible. Student-level exclusions included students with an intellectual disability, students with a functional disability, students with limited assessment language proficiency or other (a category defined by the national centres and approved by the international centre). Twelve countries did not meet the school exclusion rate: the United Kingdom (8.2%), Luxembourg (8.2%), Canada (7.5%), Norway (6.8%), New Zealand (6.5%), Sweden (5.7%), Estonia (5.5%), Australia (5.3%), Montenegro (5.2%), Lithuania (5.1%), Latvia (5.1%), and Denmark (5.0%).

Table B.4 describes the target population of the countries and economies participating in PISA 2015. Further information on the target population and the implementation of PISA sampling standards can be found in the PISA 2015 Technical Report (forthcoming).

- **Column 1** shows the *total number of 15-year-olds* according to the most recent available information, which in most countries/economies means the year 2014 as the year before the assessment.
- **Column 2** shows the number of 15-year-olds who were enrolled in schools in Year 7 or above, which is referred to as the *eligible population*.
- **Column 3** shows the *national desired target population*. As part of the school-level exclusions, countries/economies were allowed to exclude up to 0.5% of students *a priori* from the eligible population, essentially for practical reasons. (The following *a priori* exclusions exceed this limit but were agreed with the PISA international consortium: Belgium excluded 0.21% of its population for a particular type of student educated while working; Canada excluded 1.22% of its population from Territories and Aboriginal reserves;, Chile excluded 0.04% of its students who live in Easter Island, Juan Fernandez Archipelago and Antarctica; and the United Arab Emirates excluded 0.04% of its students who had no information available.
- **Column 4** shows the number of students enrolled in schools that were excluded from the national desired target population, either from the sampling frame or later in the field during data collection.
- **Column 5** shows the size of the national desired target population after subtracting the students enrolled in excluded schools. This is obtained by subtracting Column 4 from Column 3.
- **Column 6** shows the percentage of students enrolled in excluded schools. This is obtained by dividing Column 4 by Column 3 and multiplying by 100.
- **Column 7** shows the number of *students participating in PISA 2015*. Note that in some cases this number does not account for 15-year-olds assessed as part of additional national options.
- **Column 8** shows the weighted number of participating students, that is, the number of students in the nationally defined target population that the PISA sample represents. Each country/economy attempted to maximise the coverage of PISA's target population within the sampled schools. In the case of each sampled school, all eligible students, namely those 15 years of age, regardless of grade, were first listed. Sampled students who were to be excluded had still to be included in the sampling documentation, and a list drawn up stating the reason for their exclusion.

65 Information about population coverage has been taken from Annex A2 in *PISA 2015 Results (Volume I): Excellence and Equity in Education* (OECD, 2016b).

- **Column 9** indicates the total number of *excluded students*.
- **Column 10** indicates the *weighted number of excluded students*, that is, the overall number of students in the nationally defined target population represented by the number of students excluded from the sample.
- **Column 11** shows the percentage of students excluded within schools. This is calculated as the weighted number of excluded students (Column 10), divided by the weighted number of excluded and participating students (Column 8 plus Column 10), then multiplied by 100.
- **Column 12** shows the *overall exclusion rate*, which represents the weighted percentage of the national desired target population excluded from PISA either through school-level exclusions or through the exclusion of students within schools. It is calculated as the school-level exclusion rate (Column 6 divided by 100) plus within-school exclusion rate (Column 11 divided by 100 multiplied by 1 minus the school-level exclusion rate). This result is then multiplied by 100.
- **Column 13** presents an index of the *extent to which the national desired target population is covered by the PISA sample*. Australia, Canada, Denmark, Estonia, Latvia, Lithuania, Luxembourg, Montenegro, New Zealand, Norway, Sweden and the United Kingdom were the only countries where the coverage was below 95%.
- **Column 14** presents an index of the *extent to which 15-year-olds enrolled in schools are covered by the PISA sample*. The index measures the overall proportion of the national enrolled population that is covered by the non-excluded portion of the student sample. The index takes into account both school-level and student-level exclusions. Values close to 100 indicate that the PISA sample represents the entire education system as defined for PISA 2015. The index is the weighted number of participating students (Column 8) divided by the weighted number of participating and excluded students (Column 8 plus Column 10), times the nationally defined target population (Column 5) divided by the eligible population (Column 2) multiplied by 100.
- **Column 15** presents an index of the *coverage of the 15-year-old population*. This index is the weighted number of participating students (Column 8) divided by the total population of 15-year-old students (Column 1).

TABLE B.4 PISA target populations and samples

	Population and sample information							
	Total population of 15-year-olds	Total enrolled population of 15-year-olds at grade 7 or above	Total in national desired target population	Total school-level exclusions	Total in national desired target population after all school exclusions and before within-school exclusions	School-level exclusion rate (%)	Number of participating students	Weighted number of participating students
Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Albania	48 610	45 163	45 163	10	45 153	0.02	5 215	40 896
Algeria	389 315	354 936	354 936	0	354 936	0.00	5 519	306 647
Argentina	718 635	578 308	578 308	2 617	575 691	0.45	6 349	394 917
Australia	282 888	282 547	282 547	6 940	275 607	2.46	14 530	256 329
Austria	88 013	82 683	82 683	790	81 893	0.96	7 007	73 379
Belgium	123 630	121 954	121 694	1 597	120 097	1.31	9 651	114 902
Brazil	3 430 255	2 853 388	2 853 388	64 392	2 788 996	2.26	23 141	2 425 961
B-S-J-G (China)	2 084 958	1 507 518	1 507 518	58 639	1 448 879	3.89	9 841	1 331 794
Bulgaria	66 601	59 397	59 397	1 124	58 273	1.89	5 928	53 685
Canada	396 966	381 660	376 994	1 590	375 404	0.42	20 058	331 546
Chile	255 440	245 947	245 852	2 641	243 211	1.07	7 053	203 782
Chinese Taipei	295 056	287 783	287 783	1 179	286 604	0.41	7 708	251 424
Colombia	760 919	674 079	674 079	37	674 042	0.01	11 795	567 848
Costa Rica	81 773	66 524	66 524	0	66 524	0.00	6 866	51 897
Croatia	45 031	35 920	35 920	805	35 115	2.24	5 809	40 899
Cyprus	9 255	9 255	9 253	109	9 144	1.18	5 571	8 785
Czech Republic	90 391	90 076	90 076	1 814	88 262	2.01	6 894	84 519
Denmark	68 174	67 466	67 466	605	66 861	0.90	7 161	60 655
Dominican Republic	193 153	139 555	139 555	2 382	137 173	1.71	4 740	132 300
Estonia	11 676	11 491	11 491	416	11 075	3.62	5 587	10 834
Finland	58 526	58 955	58 955	472	58 483	0.80	5 882	56 934
France	807 867	778 679	778 679	28 742	749 937	3.69	6 108	734 944
FYROM1	16 719	16 717	16 717	259	16 458	1.55	5 324	15 847
Georgia	48 695	43 197	43 197	1 675	41 522	3.88	5 316	38 334
Germany	774 149	774 149	774 149	11 150	762 999	1.44	6 522	743 969
Greece	105 530	105 253	105 253	953	104 300	0.91	5 532	96 157
Hong Kong (China)	65 100	61 630	61 630	708	60 922	1.15	5 359	57 662
Hungary	94 515	90 065	90 065	1 945	88 120	2.16	5 658	84 644
Iceland	4 250	4 195	4 195	17	4 178	0.41	3 374	3 966
Indonesia	4 534 216	3 182 816	3 182 816	4 046	3 178 770	0.13	6 513	3 092 773
Ireland	61 234	59 811	59 811	72	59 739	0.12	5 741	59 082
Israel	124 852	118 997	118 997	2 310	116 687	1.94	6 598	117 031
Italy	616 761	567 268	567 268	11 190	556 078	1.97	11 583	495 093
Japan	1 201 615	1 175 907	1 175 907	27 323	1 148 584	2.32	6 647	1 138 349
Jordan	126 399	121 729	121 729	71	121 658	0.06	7 267	108 669
Kazakhstan	211 407	209 555	209 555	7 475	202 080	3.57	7 841	192 909
Korea	620 687	619 950	619 950	3 555	616 395	0.57	5 581	569 106
Kosovo	31 546	28 229	28 229	1 156	27 073	4.10	4 826	22 333
Latvia	17 255	16 955	16 955	677	16 278	3.99	4 869	15 320
Lebanon	64 044	62 281	62 281	1 300	60 981	2.09	4 546	42 331
Lithuania	33 163	32 097	32 097	573	31 524	1.79	6 525	29 915
Luxembourg	6 327	6 053	6 053	162	5 891	2.68	5 299	5 540
Macao (China)	5 100	4 417	4 417	3	4 414	0.07	4 476	4 507
Malaysia	540 000	448 838	448 838	2 418	446 420	0.54	8 861	412 524
Malta	4 397	4 406	4 406	63	4 343	1.43	3 634	4 296
Mexico	2 257 399	1 401 247	1 401 247	5 905	1 395 342	0.42	7 568	1 392 995
Moldova	31 576	30 601	30 601	182	30 419	0.59	5 325	29 341
Montenegro	7 524	7 506	7 506	40	7 466	0.53	5 665	6 777
Netherlands	201 670	200 976	200 976	6 866	194 110	3.42	5 385	191 817
New Zealand	60 162	57 448	57 448	681	56 767	1.19	4 520	54 274
Norway	63 642	63 491	63 491	854	62 637	1.35	5 456	58 083
Peru	580 371	478 229	478 229	6 355	471 874	1.33	6 971	431 738
Poland	380 366	361 600	361 600	6 122	355 478	1.69	4 478	345 709
Portugal	110 939	101 107	101 107	424	100 683	0.42	7 325	97 214
Qatar	13 871	13 850	13 850	380	13 470	2.74	12 083	12 951
Romania	176 334	176 334	176 334	1 823	174 511	1.03	4 876	164 216
Russia	1 176 473	1 172 943	1 172 943	24 217	1 148 726	2.06	6 036	1 120 932
Singapore	48 218	47 050	47 050	445	46 605	0.95	6 115	46 224
Slovak Republic	55 674	55 203	55 203	1 376	53 827	2.49	6 350	49 654
Slovenia	18 078	17 689	17 689	290	17 399	1.64	6 406	16 773
Spain	440 084	414 276	414 276	2 175	412 101	0.53	6 736	399 935
Sweden	97 749	97 210	97 210	1 214	95 996	1.25	5 458	91 491
Switzerland	85 495	83 655	83 655	2 320	81 335	2.77	5 860	82 223
Thailand	895 513	756 917	756 917	9 646	747 271	1.27	8 249	634 795
Trinidad and Tobago	17 371	17 371	17 371	0	17 371	0.00	4 692	13 197
Tunisia	122 186	122 186	122 186	679	121 507	0.56	5 375	113 599
Turkey	1 324 089	1 100 074	1 100 074	5 746	1 094 328	0.52	5 895	925 366
United Arab Emirates	51 687	51 518	51 499	994	50 505	1.93	14 167	46 950
United Kingdom	747 593	746 328	746 328	23 412	722 916	3.14	14 157	627 703
United States	4 220 325	3 992 053	3 992 053	12 001	3 980 052	0.30	5 712	3 524 497
Uruguay	53 533	43 865	43 865	4	43 861	0.01	6 062	38 287
Vietnam	1 803 552	1 032 599	1 032 599	6 557	1 026 042	0.63	5 826	874 859

TABLE B.4 (continued)

	Population and sample information				Coverage indices		
Country	Number of excluded students (9)	Weighted number of excluded students (10)	Within-school exclusion rate (%) (11)	Overall exclusion rate (%) (12)	Coverage Index 1: Coverage of national desired population (13)	Coverage Index 2: Coverage of national enrolled population (14)	Coverage Index 3: Coverage of 15-year-old population (15)
Albania	0	0	0.00	0.02	1.000	1.000	0.841
Algeria	0	0	0.00	0.00	1.000	1.000	0.788
Argentina	21	1 367	0.34	0.80	0.992	0.992	0.550
Australia	681	7 736	2.93	5.31	0.947	0.947	0.906
Austria	84	866	1.17	2.11	0.979	0.979	0.834
Belgium	39	410	0.36	1.66	0.983	0.981	0.929
Brazil	119	13 543	0.56	2.80	0.972	0.972	0.707
B-S-J-G (China)	33	3 609	0.27	4.15	0.959	0.959	0.639
Bulgaria	49	433	0.80	2.68	0.973	0.973	0.806
Canada	1,830	25 340	7.10	7.49	0.925	0.914	0.835
Chile	37	1 393	0.68	1.75	0.983	0.982	0.798
Chinese Taipei	22	647	0.26	0.67	0.993	0.993	0.852
Colombia	9	507	0.09	0.09	0.999	0.999	0.746
Costa Rica	13	98	0.19	0.19	0.998	0.998	0.635
Croatia	86	589	1.42	3.63	0.964	0.964	0.908
Cyprus	228	292	3.22	4.36	0.956	0.956	0.949
Czech Republic	25	368	0.43	2.44	0.976	0.976	0.935
Denmark	514	2 644	4.18	5.04	0.950	0.950	0.890
Dominican Republic	4	106	0.08	1.79	0.982	0.982	0.685
Estonia	116	218	1.97	5.52	0.945	0.945	0.928
Finland	124	1 157	1.99	2.78	0.972	0.972	0.973
France	35	3 620	0.49	4.16	0.958	0.958	0.910
FYROM1	8	19	0.12	1.67	0.983	0.983	0.948
Georgia	35	230	0.60	4.45	0.955	0.955	0.787
Germany	54	5 342	0.71	2.14	0.979	0.979	0.961
Greece	58	965	0.99	1.89	0.981	0.981	0.911
Hong Kong (China)	36	374	0.65	1.79	0.982	0.982	0.886
Hungary	55	1 009	1.18	3.31	0.967	0.967	0.896
Iceland	131	132	3.23	3.62	0.964	0.964	0.933
Indonesia	0	0	0.00	0.13	0.999	0.999	0.682
Ireland	197	1 825	3.00	3.11	0.969	0.969	0.965
Israel	115	1 803	1.52	3.43	0.966	0.966	0.937
Italy	246	9 395	1.86	3.80	0.962	0.962	0.803
Japan	2	318	0.03	2.35	0.976	0.976	0.947
Jordan	70	1 006	0.92	0.97	0.990	0.990	0.860
Kazakhstan	0	0	0.00	3.57	0.964	0.964	0.912
Korea	20	1 806	0.32	0.89	0.991	0.991	0.917
Kosovo	50	174	0.77	4.84	0.952	0.952	0.708
Latvia	70	174	1.12	5.07	0.949	0.949	0.888
Lebanon	0	0	0.00	2.09	0.979	0.979	0.661
Lithuania	227	1 050	3.39	5.12	0.949	0.949	0.902
Luxembourg	331	331	5.64	8.16	0.918	0.918	0.876
Macao (China)	0	0	0.00	0.07	0.999	0.999	0.884
Malaysia	41	2 344	0.56	1.10	0.989	0.989	0.764
Malta	41	41	0.95	2.36	0.976	0.976	0.977
Mexico	30	6 810	0.49	0.91	0.991	0.991	0.617
Moldova	21	118	0.40	0.99	0.990	0.990	0.929
Montenegro	300	332	4.66	5.17	0.948	0.948	0.901
Netherlands	14	502	0.26	3.67	0.963	0.963	0.951
New Zealand	333	3 112	5.42	6.54	0.935	0.935	0.902
Norway	345	3 366	5.48	6.75	0.933	0.933	0.913
Peru	13	745	0.17	1.50	0.985	0.985	0.744
Poland	34	2 418	0.69	2.38	0.976	0.976	0.909
Portugal	105	860	0.88	1.29	0.987	0.987	0.876
Qatar	193	193	1.47	4.17	0.958	0.958	0.934
Romania	3	120	0.07	1.11	0.989	0.989	0.931
Russia	13	2 469	0.22	2.28	0.977	0.977	0.953
Singapore	25	179	0.39	1.33	0.987	0.987	0.959
Slovak Republic	114	912	1.80	4.25	0.957	0.957	0.892
Slovenia	114	247	1.45	3.07	0.969	0.969	0.928
Spain	200	10 893	2.65	3.16	0.968	0.968	0.909
Sweden	275	4 324	4.51	5.71	0.943	0.943	0.936
Switzerland	107	1 357	1.62	4.35	0.956	0.956	0.962
Thailand	22	2 107	0.33	1.60	0.984	0.984	0.709
Trinidad and Tobago	0	0	0.00	0.00	1.000	1.000	0.760
Tunisia	3	61	0.05	0.61	0.994	0.994	0.930
Turkey	31	5 359	0.58	1.10	0.989	0.989	0.699
United Arab Emirates	63	152	0.32	2.25	0.978	0.977	0.908
United Kingdom	870	34 747	5.25	8.22	0.918	0.918	0.840
United States	193	109 580	3.02	3.31	0.967	0.967	0.835
Uruguay	6	32	0.08	0.09	0.999	0.999	0.715
Vietnam	0	0	0.00	0.63	0.994	0.994	0.485

Sampling procedures and response rates

The accuracy of any assessment results depends on the quality of the information on which national samples are based as well as on the sampling procedures. Quality standards, procedures, instruments, and verification mechanisms have been developed for PISA that ensured that national samples yielded comparable data and that the results could be compared with confidence.

Statistics in this report are, however, associated with standard errors that reflect the uncertainty associated with sample survey statistics. Where confidence intervals are provided, these indicate that the true value is, in 95 out of 100 replications of the study, within the interval indicated. Experts from the international contractors monitored the sample selection process in each participating country.

Data quality standards in PISA required minimum participation rates for schools as well as for students. These standards were established to minimise the potential for response biases. In the case of countries meeting these standards, it is likely that any bias resulting from non-response will be negligible, that is, typically smaller than the sampling error.

A minimum response rate of 85% was required for the schools initially selected. If the initial response rate of schools was between 65% and 85%, an acceptable school-response rate could still be achieved through the use of replacement schools. This procedure brought with it a risk of increased response bias. Participating countries were, therefore, encouraged to persuade as many of the schools in the original sample as possible to participate. Schools with a student participation rate between 25% and 50% were not regarded as participating schools, but data from these schools were included in the database and contributed to the various estimations. Data from schools with a student participation rate lower than 25% were excluded from the database.

PISA 2015 also required a minimum participation rate of 80% of students within participating schools (original sample). This minimum participation rate had to be met at the national level, not necessarily by each participating school. Follow-up sessions were required in schools in which too few students had participated in the original assessment sessions. Student participation rates were calculated over all original schools, and over all schools whether original or replacement schools, and from the participation of students in both the original assessment and any follow-up sessions.

Appendix C: Scientific literacy multiple comparison table for the jurisdictions and PISA 2015 countries/economies

These comparisons show that:

- the Australian Capital Territory performed significantly lower than 2 countries and not significantly different to 8 countries
- Western Australia performed significantly lower than 6 countries and not significantly different to 6 countries
- Victoria performed significantly lower than 9 countries and not significantly different to 8 countries
- New South Wales, South Australia and Queensland performed significantly lower than 9 countries and not significantly different to 13 countries
- the Northern Territory performed significantly lower than 20 countries and not significantly different to 15 countries
- Tasmania performed significantly lower than 29 countries and not significantly different to 8 countries.

TABLE C.1 Scientific literacy multiple comparison table for the Australian jurisdictions and PISA 2015 countries/economies

		Country/ economy	Singapore	Japan	Estonia	Chinese Taipei	Finland	Macao (China)	Canada	Vietnam
		Avg. score	556	538	534	532	531	529	528	525
Jurisdiction	Avg. score	SE	1.2	3.0	2.1	2.7	2.4	1.1	2.1	3.9
ACT	527	3.8	▼	▼	●	●	●	●	●	●
WA	521	3.7	▼	▼	▼	▼	▼	▼	●	●
VIC	513	3.3	▼	▼	▼	▼	▼	▼	▼	▼
NSW	508	3.0	▼	▼	▼	▼	▼	▼	▼	▼
SA	508	3.9	▼	▼	▼	▼	▼	▼	▼	▼
QLD	507	3.3	▼	▼	▼	▼	▼	▼	▼	▼
NT	489	5.9	▼	▼	▼	▼	▼	▼	▼	▼
TAS	483	4.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Hong Kong (China)	B-S-J-G (China)	Korea	New Zealand	Slovenia	United Kingdom	Germany	Netherlands
		Avg. score	523	518	516	513	513	509	509	509
Jurisdiction	Avg. score	SE	2.5	4.6	3.1	2.4	1.3	2.6	2.7	2.3
ACT	527	3.8	●	●	▲	▲	▲	▲	▲	▲
WA	521	3.7	●	●	●	●	▲	▲	▲	▲
VIC	513	3.3	▼	●	●	●	●	●	●	●
NSW	508	3.0	▼	●	●	●	●	●	●	●
SA	508	3.9	▼	●	●	●	●	●	●	●
QLD	507	3.3	▼	●	●	●	●	●	●	●
NT	489	5.9	▼	▼	▼	▼	▼	▼	▼	▼
TAS	483	4.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Switzerland	Ireland	Belgium	Denmark	Poland	Portugal	Norway	United States
		Avg. score	506	503	502	502	501	501	498	496
Jurisdiction	Avg. score	SE	2.9	2.4	2.3	2.4	2.5	2.4	2.3	3.2
ACT	527	3.8	▲	▲	▲	▲	▲	▲	▲	▲
WA	521	3.7	▲	▲	▲	▲	▲	▲	▲	▲
VIC	513	3.3	●	▲	▲	▲	▲	▲	▲	▲
NSW	508	3.0	●	●	●	●	●	●	▲	▲
SA	508	3.9	●	●	●	●	●	●	▲	▲
QLD	507	3.3	●	●	●	●	●	●	▲	▲
NT	489	5.9	▼	▼	▼	▼	●	●	●	●
TAS	483	4.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Austria	France	Sweden	OECD average	Czech Republic	Spain	Latvia	Russian Federation
		Avg. score	495	495	493	**493**	493	493	490	487
Jurisdiction	Avg. score	SE	2.4	2.1	3.6	**0.4**	2.3	2.1	1.6	2.9
ACT	527	3.8	▲	▲	▲	▲	▲	▲	▲	▲
WA	521	3.7	▲	▲	▲	▲	▲	▲	▲	▲
VIC	513	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NSW	508	3.0	▲	▲	▲	▲	▲	▲	▲	▲
SA	508	3.9	▲	▲	▲	▲	▲	▲	▲	▲
QLD	507	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NT	489	5.9	●	●	●	●	●	●	●	●
TAS	483	4.0	▼	▼	●	▼	▼	▼	●	●

		Country/ economy	Luxembourg	Italy	Hungary	Lithuania	Croatia	Iceland	Israel	Malta
		Avg. score	483	481	477	475	475	473	467	465
Jurisdiction	Avg. score	SE	1.1	2.5	2.4	2.7	2.5	1.7	3.4	1.6
ACT	527	3.8	▲	▲	▲	▲	▲	▲	▲	▲
WA	521	3.7	▲	▲	▲	▲	▲	▲	▲	▲
VIC	513	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NSW	508	3.0	▲	▲	▲	▲	▲	▲	▲	▲
SA	508	3.9	▲	▲	▲	▲	▲	▲	▲	▲
QLD	507	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NT	489	5.9	●	●	●	▲	▲	▲	▲	▲
TAS	483	4.0	●	●	●	●	●	▲	▲	▲

		Country/ economy	Slovak Republic	Greece	Chile	Bulgaria	United Arab Emirates	Uruguay	Romania	Cyprus
		Avg. score	461	455	447	446	437	435	435	433
Jurisdiction	Avg. score	SE	2.6	3.9	2.4	4.4	2.4	2.2	3.2	1.4
ACT	527	3.8	▲	▲	▲	▲	▲	▲	▲	▲
WA	521	3.7	▲	▲	▲	▲	▲	▲	▲	▲
VIC	513	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NSW	508	3.0	▲	▲	▲	▲	▲	▲	▲	▲
SA	508	3.9	▲	▲	▲	▲	▲	▲	▲	▲
QLD	507	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NT	489	5.9	▲	▲	▲	▲	▲	▲	▲	▲
TAS	483	4.0	▲	▲	▲	▲	▲	▲	▲	▲

		Country/ economy	Moldova	Albania	Turkey	Trinidad and Tobago	Thailand	Costa Rica
		Avg. score	428	427	425	425	421	420
Jurisdiction	Avg. score	SE	2.0	3.3	3.9	1.4	2.8	2.1
ACT	527	3.8	▲	▲	▲	▲	▲	▲
WA	521	3.7	▲	▲	▲	▲	▲	▲
VIC	513	3.3	▲	▲	▲	▲	▲	▲
NSW	508	3.0	▲	▲	▲	▲	▲	▲
SA	508	3.9	▲	▲	▲	▲	▲	▲
QLD	507	3.3	▲	▲	▲	▲	▲	▲
NT	489	5.9	▲	▲	▲	▲	▲	▲
TAS	483	4.0	▲	▲	▲	▲	▲	▲

		Country/ economy	Qatar	Colombia	Mexico
		Avg. score	418	416	416
Jurisdiction	Avg. score	SE	1.0	2.4	2.1
ACT	527	3.8	▲	▲	▲
WA	521	3.7	▲	▲	▲
VIC	513	3.3	▲	▲	▲
NSW	508	3.0	▲	▲	▲
SA	508	3.9	▲	▲	▲
QLD	507	3.3	▲	▲	▲
NT	489	5.9	▲	▲	▲
TAS	483	4.0	▲	▲	▲

Note: Read across the row to compare a jurisdiction's performance with the performance of each country/economy listed in the column heading.

▲ Average performance statistically significantly higher than in comparison country/economy
● No statistically significant difference from comparison country/economy
▼ Average performance statistically significantly lower than in comparison country/economy

Appendix D: Reading literacy multiple comparison table for the jurisdictions and PISA 2015 countries/economies

These comparisons show that:

- the Australian Capital Territory performed significantly lower than 4 countries and not significantly different to 9 countries
- Western Australia performed significantly lower than 6 countries and not significantly different to 17 countries
- Victoria performed significantly lower than 7 countries and not significantly different to 15 countries
- South Australia and New South Wales performed significantly lower than 9 countries and not significantly different to 17 countries
- Queensland performed significantly lower than 11 countries and not significantly different to 16 countries
- Tasmania performed significantly lower than 31 countries and not significantly different to 9 countries
- the Northern Territory performed significantly lower than 26 countries and not significantly different to 15 countries.

TABLE D.1 Reading literacy multiple comparison table for the Australian jurisdictions and PISA 2015 countries/economies

		Country/economy	Singapore	Hong Kong (China)	Canada	Finland	Ireland	Estonia	Korea	Japan
		Avg. score	535	527	527	526	521	519	517	516
Jurisdiction	Avg. score	SE	1.6	2.7	2.3	2.5	2.5	2.2	3.5	3.2
ACT	516	4.5	▼	▼	▼	▼	●	●	●	●
WA	507	4.2	▼	▼	▼	▼	▼	▼	●	●
VIC	507	3.7	▼	▼	▼	▼	▼	▼	▼	●
SA	503	3.8	▼	▼	▼	▼	▼	▼	▼	▼
NSW	502	3.0	▼	▼	▼	▼	▼	▼	▼	▼
QLD	500	3.7	▼	▼	▼	▼	▼	▼	▼	▼
TAS	476	4.4	▼	▼	▼	▼	▼	▼	▼	▼
NT	474	9.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/economy	Norway	New Zealand	Germany	Macao (China)	Poland	Slovenia	Netherlands	Sweden
		Avg. score	513	509	509	509	506	505	503	500
Jurisdiction	Avg. score	SE	2.5	2.4	3.0	1.3	2.5	1.5	2.4	3.5
ACT	516	4.5	●	●	●	●	●	▲	▲	▲
WA	507	4.2	●	●	●	●	●	●	●	●
VIC	507	3.7	●	●	●	●	●	●	●	●
SA	503	3.8	▼	●	●	●	●	●	●	●
NSW	502	3.0	▼	●	●	●	●	●	●	●
QLD	500	3.7	▼	▼	●	▼	●	●	●	●
TAS	476	4.4	▼	▼	▼	▼	▼	▼	▼	▼
NT	474	9.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Denmark	France	Belgium	Portugal	United Kingdom	Chinese Taipei	United States	Spain
		Avg. score	500	499	499	498	498	497	497	496
Jurisdiction	Avg. score	SE	2.5	2.5	2.4	2.7	2.8	2.5	3.4	2.4
ACT	516	4.5	▲	▲	▲	▲	▲	▲	▲	▲
WA	507	4.2	●	●	●	●	●	▲	●	▲
VIC	507	3.7	●	●	●	●	●	▲	●	▲
SA	503	3.8	●	●	●	●	●	●	●	●
NSW	502	3.0	●	●	●	●	●	●	●	●
QLD	500	3.7	●	●	●	●	●	●	●	●
TAS	476	4.4	▼	▼	▼	▼	▼	▼	▼	▼
NT	474	9.0	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Russian Federation	B-S-J-G (China)	OECD average	Switzerland	Latvia	Czech Republic	Croatia	Vietnam
		Avg. score	495	494	**493**	492	488	487	487	487
Jurisdiction	Avg. score	SE	3.1	5.1	**0.5**	3.0	1.8	2.6	2.7	3.7
ACT	516	4.5	▲	▲	▲	▲	▲	▲	▲	▲
WA	507	4.2	▲	●	▲	▲	▲	▲	▲	▲
VIC	507	3.7	▲	▲	▲	▲	▲	▲	▲	▲
SA	503	3.8	●	●	▲	▲	▲	▲	▲	▲
NSW	502	3.0	●	●	▲	▲	▲	▲	▲	▲
QLD	500	3.7	●	●	▲	●	▲	▲	▲	▲
TAS	476	4.4	▼	▼	▼	▼	▼	▼	▼	●
NT	474	9.0	▼	●	▼	●	●	●	●	●

		Country/ economy	Austria	Italy	Iceland	Luxembourg	Israel	Lithuania	Hungary	Greece
		Avg. score	485	485	482	481	479	472	470	467
Jurisdiction	Avg. score	SE	2.8	2.7	2.0	1.4	3.8	2.7	2.7	4.3
ACT	516	4.5	▲	▲	▲	▲	▲	▲	▲	▲
WA	507	4.2	▲	▲	▲	▲	▲	▲	▲	▲
VIC	507	3.7	▲	▲	▲	▲	▲	▲	▲	▲
SA	503	3.8	▲	▲	▲	▲	▲	▲	▲	▲
NSW	502	3.0	▲	▲	▲	▲	▲	▲	▲	▲
QLD	500	3.7	▲	▲	▲	▲	▲	▲	▲	▲
TAS	476	4.4	●	●	●	●	●	●	●	●
NT	474	9.0	●	●	●	●	●	●	●	●

		Country/ economy	Chile	Slovak Republic	Malta	Cyprus	Uruguay	Romania	United Arab Emirates	Bulgaria
		Avg. score	459	453	447	443	437	434	434	432
Jurisdiction	Avg. score	SE	2.6	2.8	1.8	1.7	2.5	4.1	2.9	5.0
ACT	516	4.5	▲	▲	▲	▲	▲	▲	▲	▲
WA	507	4.2	▲	▲	▲	▲	▲	▲	▲	▲
VIC	507	3.7	▲	▲	▲	▲	▲	▲	▲	▲
SA	503	3.8	▲	▲	▲	▲	▲	▲	▲	▲
NSW	502	3.0	▲	▲	▲	▲	▲	▲	▲	▲
QLD	500	3.7	▲	▲	▲	▲	▲	▲	▲	▲
TAS	476	4.4	▲	▲	▲	▲	▲	▲	▲	▲
NT	474	9.0	●	▲	▲	▲	▲	▲	▲	▲

		Country/ economy	Turkey	Costa Rica	Trinidad and Tobago	Montenegro	Colombia	Mexico
		Avg. score	428	427	427	427	425	423
Jurisdiction	Avg. score	SE	4.0	2.6	1.5	1.6	2.9	2.6
ACT	516	4.5	▲	▲	▲	▲	▲	▲
WA	507	4.2	▲	▲	▲	▲	▲	▲
VIC	507	3.7	▲	▲	▲	▲	▲	▲
SA	503	3.8	▲	▲	▲	▲	▲	▲
NSW	502	3.0	▲	▲	▲	▲	▲	▲
QLD	500	3.7	▲	▲	▲	▲	▲	▲
TAS	476	4.4	▲	▲	▲	▲	▲	▲
NT	474	9.0	▲	▲	▲	▲	▲	▲

Note: Read across the row to compare a jurisdiction's performance with the performance of each country/economy listed in the column heading.

▲ Average performance statistically significantly higher than in comparison country/economy
● No statistically significant difference from comparison country/economy
▼ Average performance statistically significantly lower than in comparison country/economy

Appendix E: Mathematical literacy multiple comparison table for the jurisdictions and PISA 2015 countries/ economies

These comparisons show that:

- the Australian Capital Territory performed significantly lower than 10 countries and not significantly different to 11 countries
- Western Australia performed significantly lower than 10 countries and not significantly different to 12 countries
- Victoria performed significantly lower than 15 countries and not significantly different to 13 countries
- New South Wales performed significantly lower than 19 countries and not significantly different to 12 countries
- South Australia performed significantly lower than 19 countries and not significantly different to 15 countries
- Queensland performed significantly lower than 21 countries and not significantly different to 13 countries
- the Northern Territory performed significantly lower than 25 countries and not significantly different to 16 countries
- Tasmania performed significantly lower than 36 countries and not significantly different to 5 countries.

TABLE E.1 Mathematical literacy multiple comparison table for the Australian jurisdictions and PISA 2015 countries/economies

		Country/ economy	Singapore	Hong Kong (China)	Macao (China)	Chinese Taipei	Japan	B-S-J-G (China)	Korea	Switzerland
		Avg. score	564	548	544	542	532	531	524	521
Jurisdiction	Avg. score	SE	1.5	3.0	1.1	3.0	3.0	4.9	3.7	2.9
ACT	505	3.6	▼	▼	▼	▼	▼	▼	▼	▼
WA	504	3.9	▼	▼	▼	▼	▼	▼	▼	▼
VIC	499	3.1	▼	▼	▼	▼	▼	▼	▼	▼
NSW	494	3.0	▼	▼	▼	▼	▼	▼	▼	▼
SA	489	4.2	▼	▼	▼	▼	▼	▼	▼	▼
QLD	486	3.3	▼	▼	▼	▼	▼	▼	▼	▼
NT	478	6.9	▼	▼	▼	▼	▼	▼	▼	▼
TAS	469	4.1	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Estonia	Canada	Netherlands	Denmark	Finland	Slovenia	Belgium	Germany
		Avg. score	520	516	512	511	511	510	507	506
Jurisdiction	Avg. score	SE	2.0	2.3	2.2	2.2	2.3	1.3	2.4	2.9
ACT	505	3.6	▼	▼	●	●	●	●	●	●
WA	504	3.9	▼	▼	●	●	●	●	●	●
VIC	499	3.1	▼	▼	▼	▼	▼	▼	▼	●
NSW	494	3.0	▼	▼	▼	▼	▼	▼	▼	▼
SA	489	4.2	▼	▼	▼	▼	▼	▼	▼	▼
QLD	486	3.3	▼	▼	▼	▼	▼	▼	▼	▼
NT	478	6.9	▼	▼	▼	▼	▼	▼	▼	▼
TAS	469	4.1	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Poland	Ireland	Norway	Austria	New Zealand	Vietnam	Russian Federation	Sweden
		Avg. score	504	504	502	497	495	495	494	494
Jurisdiction	Avg. score	SE	2.4	2.1	2.2	2.9	2.3	4.5	3.1	3.2
ACT	505	3.6	●	●	●	●	▲	●	▲	▲
WA	504	3.9	●	●	●	●	●	●	▲	▲
VIC	499	3.1	●	●	●	●	●	●	●	●
NSW	494	3.0	▼	▼	▼	●	●	●	●	●
SA	489	4.2	▼	▼	▼	●	●	●	●	●
QLD	486	3.3	▼	▼	▼	▼	▼	●	●	●
NT	478	6.9	▼	▼	▼	▼	▼	▼	▼	▼
TAS	469	4.1	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	France	United Kingdom	Czech Republic	Portugal	OECD average	Italy	Iceland	Spain
		Avg. score	493	492	492	492	**490**	490	488	486
Jurisdiction	Avg. score	SE	2.1	2.5	2.4	2.5	**0.4**	2.8	2.0	2.2
ACT	505	3.6	▲	▲	▲	▲	▲	▲	▲	▲
WA	504	3.9	▲	▲	▲	▲	▲	▲	▲	▲
VIC	499	3.1	●	●	●	●	▲	▲	▲	▲
NSW	494	3.0	●	●	●	●	●	●	●	▲
SA	489	4.2	●	●	●	●	●	●	●	●
QLD	486	3.3	●	●	●	●	●	●	●	●
NT	478	6.9	▼	●	●	●	●	●	●	●
TAS	469	4.1	▼	▼	▼	▼	▼	▼	▼	▼

		Country/ economy	Luxembourg	Latvia	Malta	Lithuania	Hungary	Slovak Republic	Israel	United States
		Avg. score	486	482	479	478	477	475	470	470
Jurisdiction	Avg. score	SE	1.3	1.9	1.7	2.3	2.5	2.7	3.6	3.2
ACT	505	3.6	▲	▲	▲	▲	▲	▲	▲	▲
WA	504	3.9	▲	▲	▲	▲	▲	▲	▲	▲
VIC	499	3.1	▲	▲	▲	▲	▲	▲	▲	▲
NSW	494	3.0	▲	▲	▲	▲	▲	▲	▲	▲
SA	489	4.2	●	●	▲	▲	▲	▲	▲	▲
QLD	486	3.3	●	●	▲	▲	▲	▲	▲	▲
NT	478	6.9	●	●	●	●	●	●	●	●
TAS	469	4.1	▼	▼	▼	▼	●	●	●	●

		Country/ economy	Croatia	Greece	Romania	Bulgaria	Cyprus	United Arab Emirates	Chile	Turkey
		Avg. score	464	454	444	441	437	427	423	420
Jurisdiction	Avg. score	SE	2.8	3.8	3.8	4.0	1.7	2.4	2.5	4.1
ACT	505	3.6	▲	▲	▲	▲	▲	▲	▲	▲
WA	504	3.9	▲	▲	▲	▲	▲	▲	▲	▲
VIC	499	3.1	▲	▲	▲	▲	▲	▲	▲	▲
NSW	494	3.0	▲	▲	▲	▲	▲	▲	▲	▲
SA	489	4.2	▲	▲	▲	▲	▲	▲	▲	▲
QLD	486	3.3	▲	▲	▲	▲	▲	▲	▲	▲
NT	478	6.9	●	▲	▲	▲	▲	▲	▲	▲
TAS	469	4.1	●	▲	▲	▲	▲	▲	▲	▲

		Country/ economy	Moldova	Uruguay	Montenegro	Trinidad and Tobago	Thailand	Albania	Mexico
		Avg. score	420	418	418	417	415	413	408
Jurisdiction	Avg. score	SE	2.5	2.5	1.5	1.4	3.0	3.4	2.2
ACT	505	3.6	▲	▲	▲	▲	▲	▲	▲
WA	504	3.9	▲	▲	▲	▲	▲	▲	▲
VIC	499	3.1	▲	▲	▲	▲	▲	▲	▲
NSW	494	3.0	▲	▲	▲	▲	▲	▲	▲
SA	489	4.2	▲	▲	▲	▲	▲	▲	▲
QLD	486	3.3	▲	▲	▲	▲	▲	▲	▲
NT	478	6.9	▲	▲	▲	▲	▲	▲	▲
TAS	469	4.1	▲	▲	▲	▲	▲	▲	▲

Note: Read across the row to compare a jurisdiction's performance with the performance of each country/economy listed in the column heading.

▲ Average performance statistically significantly higher than in comparison country/economy
● No statistically significant difference from comparison country/economy
▼ Average performance statistically significantly lower than in comparison country/economy

Appendix F: Link to online statistical tables

The data underlying the figures in this report are provided in Excel spreadsheets and available from the ACER PISA National website: www.acer.org/ozpisa.

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