Programme for International Student Assessment (PISA)

PISA 2012: How Australia measures up

The PISA 2012 assessment of students' mathematical, scientific and reading literacy

Sue Thomson
Lisa De Bortoli
Sarah Buckley

ACER
Australian Council *for* Educational Research

Programme for International Student Assessment (PISA)

PISA 2012: How Australia measures up

The PISA 2012 assessment of students' mathematical, scientific and reading literacy

Sue Thomson
Lisa De Bortoli
Sarah Buckley

ACER

Australian Council *for* Educational Research

First published 2013
by Australian Council *for* Educational Research Ltd
19 Prospect Hill Road, Camberwell, Victoria, 3124, Australia

www.acer.edu.au
www.acer.edu.au/ozpisa/reports/

Cover design, text design and typesetting by ACER Creative Services
Edited by Amanda Coleiro

National Library of Australia Cataloguing-in-Publication entry

Author:	Thomson, Sue, 1958- author.
Title:	PISA 2012 : how Australia measures up / Sue Thomson, Lisa De Bortoli, Sarah Buckley.
ISBN:	9781742862330 (paperback)
Subjects:	Programme for International Student Assessment. Education--Australia. Educational evaluation--Australia.
Other Authors/Contributors:	De Bortoli, Lisa Jean, 1968- author. Buckley, Sarah, author. Australian Council for Education Research.
Dewey Number:	370.994

The views expressed in this report are those of the authors and not necessarily those of the Commonwealth, State and Territory governments.

Contents

Executive Summary — *vii*
List of Figures — *xxv*
List of Tables — *xxix*
Acknowledgements — *xxxii*
Reader's Guide — *xxxiii*

CHAPTER 1 Introduction — **1**

The main goals of PISA — 1
What PISA assesses — 2
Features of PISA 2012 — 2
  How results are reported — 3
What participants did — 3
  Cognitive assessment — 3
  Context questionnaires — 4
  Time of testing — 4
Participants in PISA 2012 — 4
  Countries — 4
  Schools — 5
  Students — 6
PISA in Australia — 11
Organisation of the report — 12
Further information — 12

CHAPTER 2 Australian students' performance in mathematical literacy — **13**

Key findings — 13
How is mathematical literacy defined in PISA? — 15
How is mathematical literacy assessed in PISA? — 16
  Mathematical content categories — 16
  Mathematical context categories — 17
  Mathematical processes — 17
  Fundamental mathematical capabilities — 17
The PISA 2012 mathematical literacy assessment structure — 18
  Item-response formats — 18
  Distribution of items — 18
  Scaling the mathematical literacy tasks — 19
How is mathematical literacy reported in PISA? — 19
  Mean scores and distribution of scores — 20
  Proficiency levels — 20
Australia's mathematical literacy performance from an international perspective — 22
  Mathematical performance across countries — 22

Mathematical literacy performance by sex across countries 27
Australia's mathematical literacy performance in a national context 29
Mathematical literacy performance across the Australian jurisdictions 29
Mathematical literacy performance by sex across the Australian jurisdictions 32
Mathematical literacy performance by Australian school sectors 33
Mathematical literacy performance by geographic location of school 35
Mathematical literacy performance by Indigenous background 36
Mathematical literacy performance by sex and Indigenous background 37
Mathematical literacy performance by socioeconomic background 38
Mathematical literacy performance by immigrant background 39
Mathematical literacy performance by language background 40
Mathematical literacy performance changes between PISA 2003 and PISA 2012 41
Mathematical literacy performance changes across countries 41
Mathematical literacy performance changes by sex across countries 48
Mathematical literacy performance changes across the Australian jurisdictions 50
Mathematical literacy performance changes for Indigenous students 52

CHAPTER 3 Australian students' performance on the mathematical literacy subscales 53

Key findings: Content subscales 53
Key findings: Process subscales 55
Students' performance on the mathematical literacy content subscales 56
Australia's performance on the content subscales from an international perspective 59
Australia's performance on the content subscales from an international perspective by sex 70
Australia's performance on the content subscales from a national perspective 77
Students' performance on the mathematical literacy process subscales 95
Australia's performance on the process subscales from an international perspective 98
Australia's performance on the process subscales from an international perspective by sex 105
Australia's performance on the process subscales from a national perspective 111

CHAPTER 4 Australian students' performance in scientific literacy 125

Key findings 125
How is scientific literacy defined in PISA? 127
How is scientific literacy assessed in PISA? 127
Situations and context 128
Scientific competencies 128
Scientific knowledge 129
Attitudes towards science 131
The PISA 2012 scientific literacy assessment structure 131
How is scientific literacy reported in PISA? 132
Mean scores and distribution of scores 132
Proficiency levels 132
Australia's scientific literacy performance from an international perspective 134
Scientific literacy performance across countries 134
Scientific literacy performance by sex across countries 139
Australia's scientific literacy performance in a national context 139
Scientific literacy performance across the Australian jurisdictions 139
Scientific literacy performance by sex across the Australian jurisdictions 142
Scientific literacy performance by Australian school sectors 143
Scientific literacy performance by geographic location of school 145

Scientific literacy performance by Indigenous background 146
Scientific literacy performance by sex and Indigenous background 147
Scientific literacy performance by socioeconomic background 147
Scientific literacy performance by immigrant background 148
Scientific literacy performance by language background 149
Scientific literacy performance changes between PISA 2006 and PISA 2012 150
Scientific literacy performance changes across countries 150
Scientific literacy performance changes by sex across countries 158
Scientific literacy performance changes across the Australian jurisdictions 160
Scientific literacy performance changes for Indigenous students 162

CHAPTER 5 Australian students' performance in reading literacy 163

Key findings 163
How is reading literacy defined in PISA? 165
How is reading literacy assessed in PISA? 165
Situations 166
Texts 167
Aspects 168
The PISA 2012 reading literacy assessment structure 169
How is reading literacy reported in PISA? 169
Mean scores and distribution of scores 169
Proficiency levels 169
Australia's reading literacy performance from an international perspective 171
Reading literacy performance across countries 171
Reading literacy performance by sex across countries 176
Australia's reading literacy performance in a national context 178
Reading literacy performance across the Australian jurisdictions 178
Reading literacy performance by sex across the Australian jurisdictions 180
Reading literacy performance by the Australian school sectors 182
Reading literacy performance by geographic location of school 184
Reading literacy performance by Indigenous background 185
Reading literacy performance by sex and Indigenous background 186
Reading literacy performance by socioeconomic background 187
Reading literacy performance by immigrant background 188
Reading literacy performance by language background 189
Reading literacy performance changes between PISA 2000 and PISA 2012 190
Reading literacy performance changes across countries 190
Reading literacy performance changes by sex across countries 197
Reading literacy performance changes across the Australian jurisdictions 199
Reading literacy performance changes for Indigenous students 201

CHAPTER 6 Australian students' performance in computer-based mathematical literacy and digital reading literacy 203

Key findings: Computer-based mathematical literacy 203
Key findings: Digital reading literacy 204
Computer-based assessments in PISA 205
Participating countries 205
Structure of the computer-based assessment 205

How are computer-based mathematical literacy and digital reading literacy reported in PISA? 205
Australia's computer-based mathematical literacy performance from an international perspective 205
Computer-based mathematical literacy performance across countries 206
Students' proficiencies in computer-based mathematics across countries 208
Computer-based mathematical literacy performance by sex across countries 209
Australia's computer-based mathematical literacy performance in a national context 210
Computer-based mathematical literacy performance across the Australian jurisdictions 210
Computer-based mathematical literacy performance by sex across the Australian jurisdictions 212
Australia's digital reading literacy performance from an international perspective 214
Digital reading literacy performance across countries 214
Students' proficiencies in digital reading literacy across countries 215
Digital reading literacy performance by sex across countries 216
Australia's digital reading literacy performance in a national context 218
Digital reading literacy performance across the Australian jurisdictions 218
Digital reading literacy performance by sex across the Australian jurisdictions 220

CHAPTER 7 Australian students' motivation to learn and succeed in mathematics 223

Key findings 223
Enjoying and valuing mathematics 224
Mathematics competency and control beliefs 230
Attributions of failure and mathematics anxiety 240
Social factors and behavioural intentions towards mathematics 246

CHAPTER 8 The Australian school environment and conditions for learning 251

Key findings 251
Order, safety and discipline 252
Academic outcomes 256
Social relationships 262
School facilities 263
School connectedness 265

CHAPTER 9 Equity in learning opportunities and outcomes 269

Key findings 269
The relationship between socioeconomic background and performance—socioeconomic gradients 271
Differences in the socioeconomic background of students and schools 280

References *285*
Appendices *286*
A PISA procedures *286*
B Sampling *294*
C Sample mathematical literacy items and responses *300*
D Mathematical literacy multiple comparison table for the jurisdictions and PISA 2012 countries *314*
E Sample scientific literacy items and responses *316*
F Scientific literacy multiple comparison table for the jurisdictions and PISA 2012 countries *326*
G Sample reading literacy items and responses *328*
H Reading literacy multiple comparison table for the jurisdictions and PISA 2012 countries *348*
I Link to online statistical tables *350*

Executive Summary

PISA seeks to measure how well young adults at age 15 (and, therefore, near the end of compulsory schooling in most participating education systems) are prepared to use their knowledge and skills in particular areas to meet real-life challenges. 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.

This report presents the results of the PISA 2012 assessment for Australia. It presents the results for Australia as a whole, for the Australian jurisdictions and (where relevant) for the other participants in the study, so that Australia's results can be viewed in an international context.

What does PISA assess?

The primary focus of PISA is on public policy issues related to education provision. Questions guiding the development of PISA are:

- How well are young adults prepared to meet the challenges of the future?
- What skills do they have that will help them adapt to change in their lives?
- Are they able to analyse, reason and communicate their arguments and ideas to others?
- 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?
- To what extent is student performance dependent on background?
- How equitable is education provision for students from all backgrounds?

Who is assessed?

PISA assesses a random sample of 15-year-old students, drawn from a nationally representative sample of schools. In 2012, 65 countries and economies (all 34 OECD countries and 31 partner countries and economies) and around half-a-million students (representing 28 million 15-year-old students) participated in the PISA assessment.

In Australia, 775 schools and a total of 14,481 students participated in PISA 2012. A larger sample was taken in Australia as smaller jurisdictions and Indigenous students were oversampled 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 each domain 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 mathematics, science and technology 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 text describing a real-life situation and a series of two or more items for students to answer about the text. For the mathematical and scientific components of the assessment, 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 2012 items were multiple-choice items, but for some items students had to construct and write their own answers.

A different domain is chosen to be the focus in each assessment cycle. Reading literacy was the major domain in PISA 2000 and PISA 2009, mathematical literacy in PISA 2003, and scientific literacy in PISA 2006. Mathematical literacy was the major domain again for PISA 2012. While the core of the PISA 2003 framework was retained, additions were made in order to integrate new developments in theory and practice and recognise changes in the world in which we learn and live.

The concept of mathematical literacy in PISA 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

» the processes that the problem solver can use to construct a solution.

In addition to the overall mathematical literacy scale, four context categories (change and relationships; space and shape; quantity; and uncertainty and data) and three processes (formulating situations mathematically; employing mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical outcomes) have been defined and reported.

What did participants need to do?

Students who participated in PISA 2012 completed a booklet with items from mathematical literacy (the major domain), and items from either scientific literacy or reading literacy, or both. Students answered a questionnaire about their background, their motivations to learn mathematics and their attitudes to school. Students also completed a computer-based assessment of mathematical literacy, reading literacy and problem solving.

School principals completed a short questionnaire that focused on information about their schools, including resources in the school, the school environment and the qualifications of staff.

How are results reported?

International comparative studies have provided an arena 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 different assessment domains.

Results are reported for mathematical, scientific and reading literacy overall, as well as for the three context category subscales and four process subscales. For each of the literacy domains, a mean score across OECD countries has been defined: 504 score points with a standard deviation of 92 for mathematical literacy; 501 score points with a standard deviation of 93 for scientific literacy; and 496 score points with a standard deviation of 94 for reading 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 2012, there are six levels of mathematical and scientific literacy proficiency and seven levels of reading literacy proficiency.

PISA 2012 in Australia

- Approximately 14,500 students from almost 800 schools participated, from all jurisdictions and all sectors of schooling.
- Data were gathered between late July and early September 2012.
- 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 were trained to code students' answers to items requiring a written response.
- Students' results were sent to their schools. Apart from this, all information in PISA at student and school levels is kept strictly confidential.

Australia's performance in PISA 2012

Overall, Australian students performed very well in PISA 2012. This section provides a summary of 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 mathematical literacy

- Australia achieved an average score of 504 points in the PISA 2012 mathematical literacy assessment, which was significantly higher than the OECD average of 494 score points.
- Australia was outperformed by 16 countries in mathematical literacy: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Switzerland, the Netherlands, Estonia, Finland, Canada, Poland, Belgium and Germany. Australia's performance was not significantly different from seven countries: Vietnam, Austria, Ireland, Slovenia, Denmark, New Zealand and the Czech Republic. All other countries performed at a level significantly lower than Australia.
- In Australia, the range of scores between the lowest performing (students in the 5th percentile) and the highest performing students (students in the 95th percentile) is comparatively wider than the OECD average for each of mathematical, scientific and reading literacy.
- There are six proficiency levels in the PISA mathematical literacy assessment, ranging from Level 6 (the highest proficiency level) to Level 1 (the lowest proficiency level).
- Fifteen per cent of Australian students were top performers (reaching proficiency Level 5 or 6) in mathematical literacy compared to 56% of students in Shanghai–China and 12% of students across the OECD.
- Level 2 has been defined internationally as a baseline proficiency level and defines the level of achievement on the PISA scale at which students begin to demonstrate the mathematical literacy competencies that will enable them to actively participate in real-life situations. One-fifth of Australian students were low performers (failing to reach Level 2) compared to 4% of students in Shanghai–China and 23% across the OECD.

- In Australia, the nationally agreed baseline[1] is Level 3. Forty-two per cent of Australian students were placed below Level 3, which was lower than the 45% of students across OECD countries and higher than the 12% of students in Shanghai–China.

On the mathematical literacy context subscales

- Australia's results on each of the mathematical literacy content subscales were above the OECD average. Australia's mean score was 509 points on the change and relationships subscale, 497 points on the space and shape subscale, 500 points on the quantity subscale and 508 points on the uncertainty and data subscale.
- The content areas of change and relationships and uncertainty and data are relative strengths for most Australian students, while the areas of space and shape and quantity are apparently areas of relative weakness.
- On the content subscales, Australia was outperformed by 13 countries on the change and relationships subscale, 17 countries on the space and shape and quantity subscales, and 14 countries on the uncertainty and data subscale.
- Eighteen per cent of Australian students were top performers on the change and relationships subscale, 14% on the space and shape subscale, 16% on the quantity subscale and 16% on the uncertainty and data subscale.
- Twenty per cent of Australian students were low performers on the change and relationships subscale, 23% on the space and shape subscale, 22% on the quantity subscale and 18% on the uncertainty and data subscale.

On the mathematical literacy process subscales

- Australia's performance on the mathematical literacy process subscales was above the OECD average. Australia's mean score was 498 points on the formulating situations mathematically subscale, 500 points on the employing mathematical concepts, facts, procedures and reasoning subscale, and 514 on the interpreting, applying and evaluating mathematical outcomes subscale.
- The interpreting, applying and evaluating mathematical outcomes process is an area of relative strength for Australian students, while formulating situations mathematically and employing mathematical concepts, facts, procedures and reasoning are seemingly processes of relative weakness.
- Australia was outperformed by 16 countries on the formulating situations mathematically subscale, by 19 countries on the employing mathematical concepts, facts, procedures and reasoning subscale, and by 12 countries on the interpreting, applying and evaluating mathematical outcomes subscale.
- Sixteen per cent of Australian students were top performers on the formulating situations mathematically subscale, 13% on the employing mathematical concepts, facts, procedures and reasoning subscale, and 18% on the interpreting, applying and evaluating mathematical outcomes subscale.
- Twenty-five per cent of Australian students were low performers the formulating situations mathematically subscale, 21% on the employing mathematical concepts, facts, procedures and reasoning subscale, and 18% on the interpreting, applying and evaluating mathematical outcomes subscale.

In scientific literacy

- Australia achieved an average score of 521 points in the PISA 2012 scientific literacy assessment, which was significantly higher than the OECD average of 501 score points.

1 As agreed in the ACARA *Measurement Framework for Schooling in Australia*.

- Australia was outperformed by seven countries in scientific literacy: Shanghai–China, Hong Kong–China, Singapore, Japan, Finland, Estonia and Korea. Australia's performance was not significantly different from 11 countries: Vietnam, Poland, Canada, Liechtenstein, Germany, Chinese Taipei, the Netherlands, Ireland, Macao–China, Switzerland and the United Kingdom. Australia performed significantly higher than all other countries.
- There are six proficiency levels in the PISA scientific literacy assessment, ranging from Level 6 (the highest proficiency level) to Level 1 (the lowest proficiency level).
- Fourteen per cent of Australian students were top performers in scientific literacy compared to 27% of students in Shanghai–China and 8% of students across OECD countries.
- Thirteen per cent of Australian students were low performers in scientific literacy compared to 2% of students in Shanghai–China and 18% of students across the OECD.
- Thirty-four per cent of Australian students were placed below Level 3, which was lower than the 43% of students across OECD countries and higher than the 12% of students in Shanghai–China.

In reading literacy

- Australia achieved an average score of 512 points in the PISA 2012 reading literacy assessment, which was significantly higher than the OECD average of 496 score points.
- Australia was outperformed by nine countries in reading literacy: Shanghai–China, Hong Kong–China, Singapore, Japan, Korea, Finland, Ireland, Chinese Taipei and Canada. Australia's performance was not significantly different from 11 countries: Poland, Estonia, Liechtenstein, New Zealand, the Netherlands, Belgium, Switzerland, Macao–China, Vietnam, Germany and France. All other countries performed significantly lower than Australia.
- There are seven proficiency levels in the PISA reading literacy assessment, ranging from Level 6 (the highest proficiency level) to Level 1b (the lowest proficiency level).
- Twelve per cent of Australian students were top performers in reading literacy compared to 25% students in Shanghai–China and 8% of students across OECD countries.
- Fourteen per cent of Australian students were low performers in reading literacy compared to 3% in Shanghai–China and 17% of students across OECD countries.

Results for the Australian jurisdictions

In mathematical literacy

- The Australian Capital Territory, Western Australia, New South Wales and Queensland performed significantly higher than the OECD average. Victoria and South Australia achieved at a level not significantly different from the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.
- The Australian Capital Territory, Western Australia and New South Wales performed at a level not significantly different from one another. The Australian Capital Territory and Western Australia performed significantly higher than the other jurisdictions, while New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and Victoria performed significantly higher on average than South Australia, Tasmania and the Northern Territory. South Australia scored significantly higher than Tasmania and the Northern Territory, while Tasmania scored significantly higher than the Northern Territory. The Northern Territory was the only jurisdiction that was significantly outperformed by all other jurisdictions.

In scientific literacy

- The performances of Tasmania and the Northern Territory were not significantly different from the OECD average, while all other jurisdictions performed at a significantly higher level.
- Western Australia, the Australian Capital Territory and New South Wales performed at a statistically similar level, with Western Australia and the Australian Capital Territory significantly outperforming all other jurisdictions, while New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and Victoria achieved statistically similar scores, while the performance for Tasmania and the Northern Territory was significantly lower than the other jurisdictions, but not significantly different from each other.
- On average, there were 52 score points between the highest and lowest performing jurisdictions, the equivalent of one-and-a-half years of schooling.

In reading literacy

- The Australian Capital Territory, Western Australia, Victoria, New South Wales and Queensland performed significantly higher than the OECD average in reading literacy, while South Australia's score was not significantly different from the OECD average. Tasmania and the Northern Territory achieved at a significantly lower level than the OECD average.
- Students in the Australian Capital Territory performed at a level not significantly different from students in Western Australia and Victoria, and significantly outperformed students in all other jurisdictions. Western Australia performed significantly higher than Queensland, South Australia, Tasmania and the Northern Territory; while Victoria and New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and South Australia performed significantly higher than Tasmania and the Northern Territory. Tasmania performed significantly higher than the Northern Territory.
- On average, there were 59 score points between the highest and lowest performing jurisdictions, the equivalent of more than one-and-a-half years of schooling.

Results for females and males

In mathematical literacy

- Significant sex differences were found in 29 countries, with males performing significantly higher than females in mathematical literacy by 10 score points on average across OECD countries. Three countries reported sex differences in favour of females.
- In Australia, males achieved a mean score of 510 points, which was significantly higher than the mean score achieved by females of 498 points. This difference is equivalent to about one-third of a school year.
- Twelve per cent of Australian females and 17% of Australian males were top performers compared to 10% of females and 14% of males across OECD countries.
- Twenty-one per cent of Australian females and 18% of Australian males were low performers compared to 24% of females and 22% of males across OECD countries.
- Sex differences were also evident in favour of males across the four content subscales and the three process subscales. On the content subscales, Australian males outperformed Australian females by 12 score points on the change and relationships subscale, by 20 score points on the space and shape subscale, and by 10 score points on the quantity, and uncertainty and data subscales. On the process subscales, Australian males performed significantly higher than Australian females by 17 score points on the formulating situations mathematically subscale, by 10 score points on the employing mathematical concepts, facts, procedures and reasoning subscale and by 10 score points on the interpreting, applying and evaluating mathematical outcomes subscale.
- Males achieved significantly higher in mathematical literacy than females in Victoria, South Australia and Western Australia.

In scientific literacy

- Internationally, there were significant sex differences in scientific literacy in 22 countries: 13 in favour of females and ten in favour of males.
- Australian females and males performed at a level that was not significantly different in scientific literacy, while across OECD countries males outperformed females (by 2 score points on average).
- In Australia, 12% of females and 15% of males were top performers compared to 8% of females and 9% of males across OECD countries.
- In Australia, 13% of females and 14% of males were low performers compared to 17% of females and 18% of males across OECD countries.
- Within each jurisdiction, no significant differences between the sexes were found in scientific literacy.

In reading literacy

- Internationally, females significantly outperformed males in reading literacy in all participating countries. Females scored 37 score points on average higher than males across OECD countries.
- In Australia, the mean performance for females was 530 score points and the mean performance for males was 495 score points. This difference represents one year of schooling.
- Fourteen per cent of Australian females and 9% of Australian males were top performers in reading literacy compared to 10% of females and 6% of males on average across OECD countries.
- Nine per cent of Australian females and 18% of Australian males were low performers in reading literacy compared to 12% of females and 23% of males across OECD countries.
- Females achieved significantly higher in reading literacy than males across all jurisdictions.

Changes over time

In mathematical literacy (between PISA 2003 and PISA 2012)

- The OECD average for mathematical literacy has not changed significantly between 2003 and 2012. Nine countries have significantly improved their mathematical literacy performance over this time, while 13 countries (including Australia) have declined significantly.
- Australia's mean mathematical literacy performance declined significantly between PISA 2003 and PISA 2012 (by 20 score points on average).
- There has been a significant decline in the performance of Australian top performers, average performers and low performers (i.e., there have been significant declines at the 10th, 25th, 75th and 90th percentiles between PISA 2003 and PISA 2012).
- Between PISA 2003 and PISA 2012, the proportion of Australian low performers significantly increased (by 5%) and the proportion of Australian top performers significantly decreased (by 5%).
- The proportion of students in Australia performing at each mathematical literacy proficiency level in PISA 2003, PISA 2006, PISA 2009 and PISA 2012 illustrate a shift in performance at either end of the proficiency scale.
- All jurisdictions, except Victoria, showed a significant decline in their mathematical literacy performance between PISA 2003 and PISA 2012. The largest changes were in South Australia and the Northern Territory with a decrease of 46 and 45 score points on average respectively, followed by Western Australia, Tasmania and the Australian Capital Territory with a decrease of around 30 score points on average, and New South Wales and Queensland with a decrease of around 16 score points on average.
- In four jurisdictions (South Australia, Western Australia, Tasmania and the Northern Territory), there was a significant increase in the proportion of low performers and a significant decrease

in the proportion of top performers between PISA 2003 and PISA 2012. There were 12% more students in South Australia, 8% in Western Australia, 9% in Tasmania and 14% in the Northern Territory who had not reached Level 2 in PISA 2012 compared to PISA 2003. There were 13% fewer students in South Australia, 10% in Western Australia, 5% in Tasmania and 8% in the Northern Territory who had not reached Level 5 or 6 in PISA 2012 than in PISA 2003.

» In the Australian Capital Territory, the proportion of top performers decreased significantly (by 9%) between PISA 2003 and PISA 2012; while in New South Wales, the proportion of low performers significantly increased (by 6%).

» Significant differences between sexes, in favour of males, were also found in PISA 2006 (with 14 score points difference), PISA 2009 (with 10 score points difference) and PISA 2012 (with 12 score points difference).

» The mean mathematical literacy performance for Australian females and males declined significantly between PISA 2003 and PISA 2012. The mean performance for females decreased by 24 score points on average, while the mean performance for males decreased by 17 score points.

» Mathematical literacy performance for females declined significantly in all jurisdictions, except Victoria; while for males, it declined significantly in five jurisdictions (South Australia, the Northern Territory, the Australian Capital Territory, Tasmania and Western Australia) between PISA 2003 and PISA 2012.

In scientific literacy (between PISA 2006 and PISA 2012)

» Although the OECD average for scientific literacy has not changed significantly between PISA 2006 and PISA 2012, 14 countries have seen a significant improvement in their scientific literacy performance, while seven countries showed a significant decline between PISA 2006 and PISA 2012.

» Australia's mean score in scientific literacy has not changed significantly between PISA 2006 and PISA 2012.

» Between PISA 2006 and PISA 2012, the proportions of top performers and low performers have remained stable with no significant change between the cycles.

» Between PISA 2006 and PISA 2012, there was a significant decline in the mean scientific literacy performance for students in the Australian Capital Territory (by 15 score points on average) and in South Australia (by 19 score points on average).

» Between PISA 2006 and PISA 2012, there was a significant increase in the proportion of low performers in New South Wales (by 3%) and in South Australia (by 4%).

» In South Australia, average scientific literacy performance declined significantly for females (a difference of 20 score points on average) and for males (a difference of 18 score points on average) between PISA 2006 and PISA 2012.

In reading literacy (between PISA 2000 and PISA 2012)

» The OECD average for reading literacy has not changed significantly between PISA 2000 and PISA 2012. Eleven countries have seen a significant improvement in their reading literacy performance, while six countries showed a significant decline between PISA 2006 and PISA 2012.

» Australia's mean reading literacy performance declined significantly from PISA 2000 to PISA 2012 (by 16 score points on average). There was a significant decline in the performance of students at the 75th and 90th percentiles.

» The proportion of Australian top performers declined significantly (by 5%) between PISA 2000 and PISA 2012, while the proportion of Australian low performers did not change significantly between PISA 2000 and PISA 2012.

» Five jurisdictions (the Australian Capital Territory, New South Wales, South Australia, Tasmania and the Northern Territory) showed a significant decline in reading literacy performance between PISA 2000 and PISA 2012. The decline in performance ranged from 23 score points in the Northern Territory to 37 score points in South Australia.
» Between PISA 2000 and PISA 2012, the proportion of top performers in the Australian Capital Territory, South Australia, Western Australia and Tasmania decreased significantly; while the proportion of low performers in the Australian Capital Territory, New South Wales and South Australia increased significantly.
» There was a significant decline in the reading literacy performance of males in three jurisdictions (the Australian Capital Territory, New South Wales and South Australia), while there was a significant decline in the performance of females in four jurisdictions (New South Wales, South Australia, Western Australia and the Northern Territory).

Results for Indigenous students

Altogether, 1,991 Indigenous students were assessed in PISA 2012.

In mathematical literacy

» Indigenous students achieved a mean mathematical literacy score of 417 points, which was significantly lower than the OECD average (494 score points) and non-Indigenous students (507 score points). The mean score difference of 90 points between Indigenous and non-Indigenous students equates to more than two-and-a-half years of schooling.
» There was no significant difference between the performances of Indigenous females and males in mathematical literacy.
» The results indicate that there is an under representation of Indigenous students at the higher end of the mathematical literacy proficiency scale and an over representation of Indigenous students at the lower end of the scale.
» Only 2% of Indigenous students were top performers in mathematical literacy compared to 15% of non-Indigenous students.
» Half of the Indigenous students were low performers compared to 18% of non-Indigenous students.
» Average mathematical literacy performance declined significantly for Indigenous students (by 23 score points on average) and for non-Indigenous students (by 19 score points on average) between PISA 2003 and PISA 2012.
» Between PISA 2003 and PISA 2012, the proportion of Indigenous top performers fell significantly (by 2%), while the proportion of Indigenous low performers remained constant. The proportion of non-Indigenous top performers decreased (by 5%) between PISA 2003 and PISA 2012, and the proportion of non-Indigenous low performers increased significantly (by 5%).

In scientific literacy

» In scientific literacy, Indigenous students achieved a mean score of 440 points compared to a mean score of 524 points for non-Indigenous students. The difference of 84 score points equates to about two-and-a-half years of schooling.
» There was no significant difference between the performances of Indigenous females and males in scientific literacy.
» Two per cent of Indigenous students were top performers in scientific literacy compared to 14% of non-Indigenous students.
» Thirty-seven per cent of Indigenous students were low performers in scientific literacy compared to 13% of non-Indigenous students.
» There were no significant changes in the mean scientific literacy score of Indigenous students between PISA 2006 and PISA 2012.

In reading literacy

- Indigenous students recorded a mean score of 428 points compared to a mean score of 515 points for non-Indigenous students. This difference of 87 score points equates to two-and-a-half years of schooling.
- The mean reading literacy score for Indigenous females was 450 points, which was significantly different to the mean score for Indigenous males of 405 points. This mean difference of 45 score points indicates Indigenous males are performing about one-and-a-third years of schooling below Indigenous females.
- Two per cent of Indigenous students were top performers in reading literacy compared to 12% of non-Indigenous students.
- Thirty-nine per cent of Indigenous students were low performers in reading literacy compared to 14% of non-Indigenous students.
- Reading literacy performance declined significantly for Indigenous students (by 20 score points) and for non-Indigenous students (by 16 score points) between PISA 2000 and PISA 2012.

Results for the Australian school sectors

- Comparing the unadjusted mean mathematical literacy scores for these three groups of students reveals that, on average, students in the independent school sector achieved significantly higher than students in the Catholic or government school sectors, and students in Catholic schools scored significantly higher than students in government schools. These findings are also applicable to scientific and reading literacy.
- 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 in performance across school sectors are not significant.

In mathematical literacy

- Students in independent schools scored, on average, 52 score points higher than students in government schools and 27 score points higher than students in Catholic schools. Students in Catholic schools scored, on average, 25 points higher than students in government schools.
- There were similar proportions of top performers in mathematical literacy in government and Catholic schools (13 and 14% respectively), while there were almost twice as many top performers (23%) in independent schools.
- One-quarter of students in government schools were low performers in mathematical literacy, compared to 14% of students in Catholic schools and 9% of students in independent schools.

In scientific literacy

- Students in independent schools scored, on average, 53 score points higher than students in government schools. The mean score difference between students in Catholic and independent schools, and Catholic and government schools was around 27 score points.
- Twenty-one per cent of students from independent schools were top performers compared to 13% of students in Catholic schools and 11% of students in government schools.
- Eighteen per cent of students in government schools were low performers compared to 9% of students in Catholic schools and 5% of students in independent schools.

In reading literacy

- Students in independent schools scored, on average, 56 score points higher than students in government schools. The mean score difference between students in Catholic and independent schools, and Catholic and government schools was 28 score points.
- Twenty per cent of students from independent schools were top performers compared to 11% of students in Catholic schools and 10% of students in government schools.
- Eighteen per cent of students in government schools were low performers compared to 9% of students in Catholic schools and 5% of students in independent schools.

Results for geographic location of schools

The geographic location of schools was classified using the broad categories (metropolitan, provincial and remote) defined in the MCEECDYA *Schools Geographic Location Classification*.[2]

In mathematical literacy

- Students who attended schools in metropolitan areas achieved significantly higher scores (511 points on average) in mathematical literacy than those in provincial (486 points on average) or remote schools (444 points on average), and students in provincial schools performed significantly higher than students in remote schools.
- Students in metropolitan schools scored on average 25 points higher (the equivalent of almost three-quarters of a school year) than students attending provincial schools. The mean score difference between students attending metropolitan schools and students attending remote schools was even larger at 67 points on average (the equivalent of almost two years of schooling). Students in provincial schools scored on average 42 points higher than students in remote schools (the equivalent of almost one-and-a-quarter years of schooling).
- Seventeen per cent of students in metropolitan schools, 10% of students in provincial schools and 6% of students in remote schools were top performers.
- Eighteen per cent of students in metropolitan schools, 23% of students in provincial schools and 39% of students in remote schools were low performers.

In scientific literacy

- In scientific literacy, students attending metropolitan schools performed at a significantly higher level (527 score points on average), than students in schools from provincial areas (509 score points on average) and remote areas (470 score points on average), and students in provincial areas significantly outperformed students in remote schools.
- The mean difference between students attending schools in metropolitan areas and provincial areas was equivalent to half-a-year of schooling. The difference in mean scores between schools in metropolitan areas and schools in remote areas was around one-and-a-half years of schooling, while the mean score difference between schools in provincial areas and schools in remote areas equates to about one year of schooling.

In reading literacy

- In reading literacy, students attending metropolitan schools performed at a significantly higher level (520 score points on average) than students in schools from provincial areas (490 score points on average), who in turn performed at a significantly higher level than students attending schools in remote areas (452 score points on average).

2 Refer to the Reader's Guide for details about the MCEECDYA *Schools Geographic Location Classification.*

» The mean score difference between students in metropolitan schools and provincial schools represents almost one year of schooling. The difference in mean scores between students in metropolitan and remote schools equates to about two years of schooling, while the mean score difference between students in provincial and remote schools equates to more than one year of schooling.

Results for socioeconomic background

Socioeconomic background in PISA is measured by an index of Economic, Social and Cultural Status (ESCS).[3]

» Across all literacy domains, the results show the higher the level of socioeconomic background, the higher the level of students' performance.

In mathematical literacy

» In mathematical literacy, students in the highest socioeconomic quartile achieved a mean score of 550 points, which was 29 score points higher than the average score of students in the third quartile, 58 score points higher than students in the second quartile and 87 score points higher than students in the lowest quartile. The gap between students in the highest and lowest quartiles equates to around two-and-a-half years of schooling.

» Twenty-seven per cent of students in the highest quartile were top performers compared to 5% of students in the lowest quartile.

» Eight per cent of students in the highest quartile were low performers compared to 33% of students in the lowest quartile.

In scientific literacy

» In scientific literacy, students in the highest socioeconomic quartile achieved a mean score of 567 points, which was on average 88 score points higher than those students in the lowest quartile. The mean score difference between students in the lowest and highest socioeconomic quartiles represents around two-and-a-half years of schooling.

» Twenty-four per cent of students in the highest socioeconomic quartile were top performers compared to 5% of students in the lowest quartile.

» Five per cent of students in the highest socioeconomic quartile were low performers compared to 23% of students in the lowest quartile.

In reading literacy

» In reading literacy, students in the highest socioeconomic quartile achieved a mean score of 557 points, compared to a mean score of 471 points for students in the lowest quartile. The mean score difference of 86 points on average equates to about two-and-a-half years of schooling.

» Twenty-three per cent of students in the highest socioeconomic quartile were top performers in compared to 4% of students in the lowest quartile.

» Five per cent of students in the highest socioeconomic quartile were low performers compared to 23% of students in the lowest quartile.

3 Refer to the Reader's Guide for details about the ESCS index.

Results for immigrant background

Immigrant background was measured on students' self-report of where they and their parents were born.[4]

In mathematical literacy

- Australian-born students achieved a mean score of 500 points in mathematical literacy, which was significantly lower than the mean score for foreign-born students (508 points) and first-generation students (518 points). First-generation students scored significantly higher than foreign-born students.
- Around one-fifth of first-generation students were top performers, a similar proportion to foreign-born students (17%) and a higher proportion than Australian-born students (13%).
- Approximately one-fifth of Australian-born and foreign-born students were low performers, while for first-generation students this proportion was slightly lower at 17%.

In scientific literacy

- In scientific literacy, the mean score of 533 points for first-generation students was significantly higher than that of Australian-born students (521 points) and that of foreign-born students (516 points).
- Twelve per cent of Australian-born students, 17% of first-generation students and 14% of foreign-born students were top performers.
- Thirteen per cent of Australian-born students, 11% of first-generation students and 16% of foreign-born students were low performers.

In reading literacy

- In reading literacy, Australian-born students achieved a mean score of 508 points, which was significantly lower than the mean score for first-generation students (526 points) and not significantly different from foreign-born students (515 points).
- Ten per cent of Australian-born students, 15% of first-generation students and 14% of foreign-born students were top performers.
- Fourteen per cent of Australian-born students, 10% of first-generation students and 17% of foreign-born students were low performers.

Results for language background

Language background was based on students' responses regarding the main language spoken at home—English or another language.

In mathematical literacy

- In mathematical literacy, students who spoke English at home scored 506 points on average, which was not significantly different from the 509 score points on average for those students who spoke a language other than English at home.
- The proportion of students who were top performers was lower for students who spoke English at home (14%) than for students who spoke a language other than English at home (21%).
- The proportion of students who were low performers was lower for students who spoke English at home (18%) than for students who spoke a language other than English at home (23%).

4 Refer to the Reader's Guide for details about the definitions of immigrant background.

In scientific literacy

- In scientific literacy, students who spoke English at home performed significantly higher (mean score of 525 points) than those students who spoke a language other than English at home (mean score of 508 points).
- Around 14 per cent of students who spoke English at home and students who spoke a language other than English at home were top performers.
- Twelve per cent of students who spoke English at home and 20% of students who spoke a language other than English at home were low performers.

In reading literacy

- In reading literacy, students who spoke English at home achieved a mean score of 515 points, which was significantly higher than students who spoke a language other than English at home (mean score of 506 points).
- Twelve per cent of students who spoke English at home and 14% of students who spoke a language other than English at home were top performers.
- Nineteen per cent of students who spoke English at home and 14% of students who spoke a language other than English at home were low performers.

Australian students' motivation to learn and succeed in mathematics

Students' motivation and engagement can have a profound impact on their classroom performance in the short term and can affect the quality of their learning in the long term. In the national report, Australia's results in this area were compared to Shanghai–China, Hong Kong–China, Singapore, Canada, New Zealand, the United States and the United Kingdom. These are referred to as comparison countries.

- Australian students, on average, demonstrated a higher level of intrinsic motivation (or higher levels of enjoyment or interest in mathematics) than the OECD average. This was similar to levels reported by students in the United States, New Zealand and Canada, but below the levels of enjoyment reported by the high-performing countries of Shanghai–China and, in particular, Singapore.
- The percentages of Australian students who agreed that learning mathematics would enhance employment, career and study opportunities were higher than the OECD average. Approximately one-third of females in Australia reported that they did not think that mathematics was important for later study compared to one-fifth of males.
- Australian students' average level of self-concept (how competent they perceived themselves to be in mathematics) was just above the OECD average. Australia and all comparison countries had a significant difference by sex in reported self-concept in favour of males, with the biggest gap being found in Shanghai–China.
- Of the countries selected for comparison, students from New Zealand had the lowest levels of self-efficacy, whereas students from Shanghai–China reported levels of self-efficacy almost a standard deviation higher than the OECD average. Students from Australia and the United Kingdom scored at a similar level, just above the OECD average. Females scored significantly lower than males on the self-efficacy index in all countries, with Australia and New Zealand having the largest gap between the sexes.
- In Australia and all comparison countries, there was a pattern for students to take responsibility for failure in mathematics, rather than attribute it to external factors. In Australia, male and Indigenous students reported more of a tendency to attribute failure in mathematics to their own efforts compared to females and non-Indigenous students, who were more likely to attribute failure to factors beyond their control.

The Australian school environment and conditions for learning

School climate shapes the environment of students' learning. PISA's examination of school climate was considered in relation to five domains: order, safety and discipline; academic outcomes; social relationships; school facilities; and school connectedness.

- Australian students, on average, reported a higher frequency of students not listening, noise and disorder, and teachers needing to wait a long time for students to quieten down compared to the OECD average and all other comparison countries, except New Zealand.
- Australian students were more likely than students from all comparison countries to report skipping days of school in the two weeks prior to the PISA assessment. Australian students were less likely than the OECD average to report skipping classes.
- Australia's jurisdictions, in general, had access to a high quality of resources compared to the OECD average. However, 38% of Northern Territory principals reported that a lack of access to science laboratory equipment affected learning 'to some extent' or 'a lot', while 52% of principals in the Australian Capital Territory and 30% of Tasmanian principals reported learning being affected 'to some extent' or 'a lot' by inadequate internet connections. Thirty-two per cent of principals in the Australian Capital Territory and 29% of principals in the Northern Territory reported problems with a shortage or inadequacy of instructional materials.
- Principals from the United Kingdom and New Zealand reported the highest levels of teacher morale. While teacher morale is perceived by principals to be highest in Australian Capital Territory schools, it is below the OECD average in Northern Territory schools.
- On average, over 20% of Australian students felt that they did not belong, were not happy or were not satisfied at school.

Quality and equity in Australian schools

- The terms socioeconomic gradient or social gradient refer to the relationship between an outcome and socioeconomic background. In the case of PISA, the outcome is students' performance and the measure of socioeconomic background is the ESCS index. PISA data show that there is a significant relationship between students' performance and their socioeconomic background as measured by ESCS. This relationship is 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.
- 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.
- The slope of the socioeconomic gradient is steeper than on average across the OECD; in Australia, the effect of socioeconomic background on performance in mathematical literacy is greater than on average across the OECD.
- In PISA 2003, Australia's overall performance in mathematical literacy was described as high quality–high equity (as the overall scores in mathematical literacy were higher than the OECD average and the impact of socioeconomic background was lower than the OECD average). In PISA 2012, Australia was also categorised as high quality–high equity in mathematical literacy.
- The amount of variance between schools is lower than the OECD average, while the amount of variance within schools (79%) is higher than the OECD average. With 31% of the variance between schools though, it still matters which school a child attends.
- A large proportion of the between-schools variance is due to socioeconomic background.

- The highest and the narrowest range of socioeconomic levels was found in the Australian Capital Territory. The average socioeconomic background of students in Tasmania was the lowest of all Australian jurisdictions and the largest range was found in Tasmania and the Northern Territory.
- Socioeconomic levels of students and schools in the independent and Catholic school sectors were much higher than those of students and schools in the government sector.
- Regardless of their own socioeconomic background, students enrolled in a school with a high-average socioeconomic background tend to perform better than when they are enrolled in a school with a low-average socioeconomic background.
- Students in socioeconomically disadvantaged schools in Western Australia performed better than students in similar schools elsewhere in Australia. The gap between socioeconomically advantaged and disadvantaged schools was highest in New South Wales and was the equivalent of more than 3 years of schooling.
- Socioeconomically average schools in the Australian Capital Territory performed at about the same level as similar schools in Victoria, South Australia and Tasmania; while students in socioeconomically average and advantaged schools in the Australian Capital Territory performed at a lower level than students in similar schools in New South Wales, Queensland and Western Australia.

The PISA 2012 computer-based assessment

Thirty-two of the 65 countries who participated in PISA 2012 also undertook an additional computer-based assessment of mathematical literacy, digital reading literacy and problem solving.

Results from an international perspective

In computer-based mathematical literacy

- Australia achieved an average score of 508 points on the computer-based mathematical literacy assessment, which was significantly higher than the OECD average of 497 score points.
- Australia was significantly outperformed by nine countries: Singapore, Shanghai–China, Korea, Hong Kong–China, Macao–China, Japan, Chinese Taipei, Canada and Estonia. Australia's performance was not significantly different from four countries: Belgium, Germany, France and Austria. All other countries performed at a level significantly lower than Australia.
- In Australia, the ranges of scores between the lowest performing (students in the 5th percentile) and the highest performing students (students in the 95th percentile) are comparatively wider than the OECD.
- For Australia, the mean score on computer-based mathematical literacy was not significantly different from the mean score on mathematical literacy.
- Thirteen per cent of Australian students were top performers, a similar proportion to students across OECD countries (12%).
- Almost one-fifth (17%) of Australian students were low performers compared to 20% of students across the OECD.
- Almost 40% of Australian students were placed below Level 3, which was lower than the OECD average of 43%.

In digital reading literacy

- Australia achieved an average score of 521 points in digital reading literacy, which was significantly higher than the OECD average of 497 score points.
- Australia was significantly outperformed by six countries: Singapore, Korea, Hong Kong–China, Japan, Canada and Shanghai–China. Australia's performance was not significantly different

from four countries: Estonia, Ireland, Chinese Taipei and the United States. All other countries performed at a level significantly lower than Australia.

- In Australia, the ranges of scores between the lowest performing (students in the 5th percentile) and the highest performing students (students in the 95th percentile) are comparatively wider than the OECD.
- Australia's mean score for digital reading literacy was significantly higher than Australia's mean score for reading literacy by 9 score points.
- Thirteen per cent of Australian students were top performers, which was a higher proportion than the OECD average (8%).
- Thirteen per cent of Australian students were low performers compared to 17% of students across the OECD.
- Thirty-three per cent of students failed to reach Level 3, which was lower than the 39% of students across the OECD.

Results for the Australian jurisdictions

In computer-based mathematical literacy

- Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland performed significantly higher than the OECD average. South Australia achieved at a level not significantly different from the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.
- Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland performed at a level not significantly different from one another. Western Australia, the Australian Capital Territory and Victoria performed significantly higher than South Australia, Tasmania and the Northern Territory. New South Wales and Queensland performed at a level not significantly different from South Australia, and performed significantly higher than Tasmania and the Northern Territory. Tasmania and the Northern Territory performed significantly lower than the other jurisdictions, but were not significantly different from one another.

In digital reading literacy

- The Australian Capital Territory, Western Australia, New South Wales, Victoria, Queensland and South Australia achieved significantly higher than the OECD average. The Northern Territory achieved at a level equal to the OECD average, while Tasmania achieved significantly lower than the OECD average.
- The mean scores for the Australian Capital Territory, Western Australia, New South Wales and Victoria were not significantly different from one another. The Australian Capital Territory, Western Australia and New South Wales outperformed Queensland, South Australia, Tasmania and the Northern Territory. Victoria outperformed South Australia, Tasmania and the Northern Territory, while South Australia and Queensland outperformed the Northern Territory and Tasmania.

Results for females and males

In computer-based mathematical literacy

- In almost all countries, differences between the sexes were found to be in favour of males. In Australia, males performed significantly higher than females by 9 score points.
- In Australia, 15% of male students and 11% of female students were top performers compared to 13% of male students and 9% of female students across the OECD.

- In Australia, 16% of males and 17% of females were low performers compared to 19% of males and 21% of females across the OECD.

In digital reading literacy

- In all except two countries, sex differences were found to be significantly in favour of females than males. In Australia, females performed significantly higher than males by 30 score points.
- In Australia, 17% of females and 11% of males were top performers compared to 9% of females and 7% of males across the OECD.
- In Australia, 8% of females and 17% of males were low performers compared to 13% of females and 22% of males across the OECD.

Figures

Figure 1.1	Countries participating in PISA 2012	5
Figure 2.1	Main features of the PISA 2012 mathematical literacy assessment framework	16
Figure 2.2	Categories describing the items constructed in the PISA 2012 mathematical literacy assessment	18
Figure 2.3	The relationship between items and students on the PISA mathematical literacy scale	19
Figure 2.4	Summary descriptions of the six proficiency levels on the overall mathematical literacy scale	21
Figure 2.5	Mean scores and distribution of students' performance on the mathematical literacy scale, by country	24
Figure 2.6	Percentage of students across the mathematical literacy proficiency scale, by country	26
Figure 2.7	Mean scores and differences between sexes in students' performance on the mathematical literacy scale, by country	28
Figure 2.8	Percentage of students across the mathematical literacy proficiency scale by sex, for Australia and the OECD average	29
Figure 2.9	Mean scores and distribution of students' performance on the mathematical literacy scale, by jurisdiction	30
Figure 2.10	Percentage of students across the mathematical literacy proficiency scale, by jurisdiction	31
Figure 2.11	Mean scores and differences in students' performance on the mathematical literacy scale, by jurisdiction and sex	32
Figure 2.12	Percentage of students across the mathematical literacy proficiency scale, by jurisdiction and sex	33
Figure 2.13	Mean scores and distribution of students' performance on the mathematical literacy scale, unadjusted for student and school background, by school sector	34
Figure 2.14	Percentage of students across the mathematical literacy proficiency scale, by school sector	35
Figure 2.15	Mean scores and distribution of students' performance on the mathematical literacy scale, by geographic location	36
Figure 2.16	Percentage of students across the mathematical literacy proficiency scale, by geographical location	36
Figure 2.17	Mean scores and distribution of students' performance on the mathematical literacy scale, by Indigenous background	37
Figure 2.18	Percentage of students across the mathematical literacy proficiency scale, by Indigenous background	37
Figure 2.19	Mean scores and sex differences in students' performance on the mathematical literacy scale, by Indigenous background	38
Figure 2.20	Percentage of students across the mathematical literacy proficiency scale, by Indigenous background and sex	38
Figure 2.21	Mean scores and distribution of students' performance on the mathematical literacy scale, by socioeconomic background	39
Figure 2.22	Percentage of students across the mathematical literacy proficiency scale, by socioeconomic background	39
Figure 2.23	Mean scores and distribution of students' performance on the mathematical literacy scale, by immigrant background	40
Figure 2.24	Percentage of students across the mathematical literacy proficiency scale, by immigrant background	40
Figure 2.25	Mean scores and distribution of students' performance on the mathematical literacy scale, by language background	41
Figure 2.26	Percentage of students across the mathematical literacy proficiency scale, by language background	41
Figure 2.27	Means and percentiles on the mathematical literacy scale for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, for Australia	44
Figure 2.28	Percentage of students performing at Level 5 or above on mathematical literacy in PISA 2003 and PISA 2012, by country	46
Figure 2.29	Percentage of students performing below Level 2 on mathematical literacy in PISA 2003 and PISA 2012, by country	47
Figure 2.30	Percentage of students across the mathematical literacy proficiency scale for PISA 2003, PISA 2006, PISA 2009 and PISA 2012 in Australia	48
Figure 3.1	Summary descriptions of the six proficiency levels on the change and relationships and space and shape subscales	57
Figure 3.2	Summary descriptions of the six proficiency levels on the quantity and uncertainty and data subscales	58
Figure 3.3	Percentage of students across the change and relationships proficiency level subscale, by country	64
Figure 3.4	Percentage of students across the space and shape proficiency level subscale, by country	66
Figure 3.5	Percentage of students across the quantity proficiency level subscale, by country	67
Figure 3.6	Percentage of students across the uncertainty and data proficiency level subscale, by country	69
Figure 3.7	Mean scores and differences by sex in students' performance on the content subscales, by country	72
Figure 3.8	Percentage of students across the content proficiency level subscales by sex, for Australia and the OECD average	77
Figure 3.9	Percentage of students across the change and relationships proficiency level subscale, by jurisdiction	81
Figure 3.10	Percentage of students across the space and shape proficiency level subscale, by jurisdiction	82
Figure 3.11	Percentage of students across the quantity proficiency level subscale, by jurisdiction	82

Figure 3.12	Percentage of students across the uncertainty and data proficiency level subscale, by jurisdiction	83
Figure 3.13	Mean scores and differences by sex in students' performance on the content subscales, by jurisdiction	84
Figure 3.14	Percentage of students across the change and relationships proficiency level subscale, by jurisdiction and sex	85
Figure 3.15	Percentage of students across the space and shape proficiency level subscale, by jurisdiction and sex	86
Figure 3.16	Percentage of students across the quantity proficiency level subscale, by jurisdiction and sex	87
Figure 3.17	Percentage of students across the uncertainty and data proficiency level subscale, by jurisdiction and sex	88
Figure 3.18	Percentage of students across the content proficiency level subscales, by geographic location of school	91
Figure 3.19	Percentage of students across the content proficiency level subscales, by Indigenous background	93
Figure 3.20	Percentage of students across the content proficiency level subscales, by socioeconomic quartiles	95
Figure 3.21	Summary descriptions of the six proficiency levels for the mathematical literacy process subscales	96
Figure 3.22	Percentage of students across the formulating proficiency level subscale, by country	102
Figure 3.23	Percentage of students across the employing proficiency level subscale, by country	104
Figure 3.24	Percentage of students across the interpreting proficiency level subscale, by country	106
Figure 3.25	Mean scores and differences by sex in students' performance on the process subscales, by country	108
Figure 3.26	Percentage of students across the three process proficiency level subscales by sex, for Australia and the OECD average	110
Figure 3.27	Percentage of students across the formulating proficiency level subscale, by jurisdiction	114
Figure 3.28	Percentage of students across the employing proficiency level subscale, by jurisdiction	114
Figure 3.29	Percentage of students across the interpreting proficiency level subscale, by jurisdiction	115
Figure 3.30	Mean scores and differences by sex in students' performance on the process subscales, by jurisdiction	116
Figure 3.31	Percentage of students across the formulating proficiency level subscale, by jurisdiction and sex	117
Figure 3.32	Percentage of students across the employing proficiency level subscale, by jurisdiction and sex	118
Figure 3.33	Percentage of students across the interpreting proficiency level subscale, by jurisdiction and sex	119
Figure 3.34	Percentage of students across the process proficiency level subscales, by geographic location of school	121
Figure 3.35	Percentage of students across the process proficiency level subscales, by Indigenous background	122
Figure 3.36	Percentage of students across the process proficiency level subscales, by socioeconomic background	124
Figure 4.1	Aspects of the PISA scientific literacy framework	127
Figure 4.2	PISA scientific literacy competencies	129
Figure 4.3	PISA categories of knowledge of science	130
Figure 4.4	PISA categories of knowledge about science	131
Figure 4.5	Summary descriptions of the six proficiency levels on the scientific literacy scale	132
Figure 4.6	Mean scores and distribution of students' performance on the scientific literacy scale, by country	135
Figure 4.7	Percentage of students across the scientific literacy proficiency scale, by country	137
Figure 4.8	Mean scores and sex differences in students' performance on the scientific literacy scale, by country	138
Figure 4.9	Percentage of students across the scientific literacy proficiency scale by sex, for Australia and the OECD average	139
Figure 4.10	Mean scores and distribution of students' performance on the scientific literacy scale, by jurisdiction	140
Figure 4.11	Percentage of students across the scientific literacy proficiency scale, by jurisdiction	141
Figure 4.12	Mean scores and differences in students' performance on the scientific literacy scale, by jurisdiction and sex	142
Figure 4.13	Percentage of students across the scientific literacy proficiency scale, by jurisdiction and sex	143
Figure 4.14	Mean scores and distribution of students' performance on the scientific literacy scale, unadjusted for student and school background, by school sector	144
Figure 4.15	Percentage of students across the scientific literacy proficiency scale, by school sector	144
Figure 4.16	Mean scores and distribution of students' performance on the scientific literacy scale, by geographic location	145
Figure 4.17	Percentage of students across the scientific literacy proficiency scale, by geographical location	146
Figure 4.18	Mean scores and distribution of students' performance on the scientific literacy scale, by Indigenous background	146
Figure 4.19	Percentage of students across the scientific literacy proficiency scale, by Indigenous background	146
Figure 4.20	Mean scores and sex differences in students' performance on the scientific literacy scale, by Indigenous background	147
Figure 4.21	Percentage of students across the scientific literacy proficiency scale, by Indigenous background and sex	147
Figure 4.22	Mean scores and distribution of students' performance on the scientific literacy scale, by socioeconomic background	148
Figure 4.23	Percentage of students across the scientific literacy proficiency scale, by socioeconomic background	148
Figure 4.24	Mean scores and distribution of students' performance on the scientific literacy scale, by immigrant background	149
Figure 4.25	Percentage of students across the scientific literacy proficiency scale, by immigrant background	149
Figure 4.26	Mean scores and distribution of students' performance on the scientific literacy scale, by language background	150
Figure 4.27	Percentage of students across the scientific literacy proficiency scale, by language background	150
Figure 4.28	Percentiles on the scientific literacy scale for PISA 2006, PISA 2009 and PISA 2012 for Australia	155
Figure 4.29	Percentage of students performing at Level 5 or 6 on scientific literacy in PISA 2006 and PISA 2012, by country	156

Figure 4.30	Percentage of students performing below Level 2 on scientific literacy in PISA 2006 and PISA 2012, by country	157
Figure 4.31	Percentage of students across the scientific literacy proficiency scale for PISA 2006, PISA 2009 and PISA 2012 in Australia	157
Figure 5.1	Main features of the reading literacy framework	166
Figure 5.2	Relationship between the reading framework and the aspect subscales	168
Figure 5.3	Summary descriptions of the seven proficiency levels on the reading literacy scale	170
Figure 5.4	Mean scores and distribution of students' performance on the reading literacy scale, by country	173
Figure 5.5	Percentage of students across the reading literacy proficiency scale, by country	175
Figure 5.6	Mean scores and differences in students' performance on the reading literacy scale, by country and sex	177
Figure 5.7	Percentage of students across the reading literacy proficiency scale by sex, for Australia and the OECD average	178
Figure 5.8	Mean scores and distribution of students' performance on the reading literacy scale, by jurisdiction	179
Figure 5.9	Percentage of students across the reading literacy proficiency scale, by jurisdiction	180
Figure 5.10	Mean scores and differences by sex in students' performance on the reading literacy scale, by jurisdiction	181
Figure 5.11	Percentage of students across the reading literacy proficiency scale, by jurisdiction and sex	182
Figure 5.12	Mean scores and distribution of students' performance on the reading literacy scale, unadjusted for student and school background, by school sector	183
Figure 5.13	Percentage of students across the reading literacy proficiency scale, by school sector	184
Figure 5.14	Mean scores and distribution of students' performance on the reading literacy scale, by geographic location	184
Figure 5.15	Percentage of students across the reading literacy proficiency scale, by geographical location	185
Figure 5.16	Mean scores and distribution of students' performance on the reading literacy scale, by Indigenous background	185
Figure 5.17	Percentage of students across the reading literacy proficiency scale, by Indigenous background	186
Figure 5.18	Mean scores and differences by sex in students' performance on the reading literacy scale, by Indigenous background	186
Figure 5.19	Percentage of students across the reading literacy proficiency scale, by Indigenous background and sex	187
Figure 5.20	Mean scores and distribution of students' performance on the reading literacy scale, by socioeconomic background	187
Figure 5.21	Percentage of students across the reading literacy proficiency scale, by socioeconomic background	188
Figure 5.22	Mean scores and distribution of students' performance on the reading literacy scale, by immigrant background	188
Figure 5.23	Percentage of students across the reading literacy proficiency scale, by immigrant background	189
Figure 5.24	Mean scores and distribution of students' performance on the reading literacy scale, by language background	189
Figure 5.25	Percentage of students across the reading literacy proficiency scale, by language background	189
Figure 5.26	Means and percentiles on the reading literacy scale for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, for Australia	194
Figure 5.27	Percentage of students performing at Level 5 or above on reading literacy in PISA 2000 and PISA 2012, by country	195
Figure 5.28	Percentage of students performing below Level 2 on reading literacy in PISA 2000 and PISA 2012, by country	196
Figure 5.29	Percentage of students across the reading literacy proficiency scale for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, in Australia	197
Figure 6.1	Mean scores and distribution of students' performance on the computer-based mathematical literacy scale, by country	207
Figure 6.2	Percentage of students across the computer-based mathematical literacy proficiency scale, by country	208
Figure 6.3	Mean scores and differences between the sexes in students' performance on the computer-based mathematical literacy scale, by country	209
Figure 6.4	Percentage of students across the computer-based mathematical literacy proficiency scale by sex, for Australia and the OECD average	210
Figure 6.5	Mean scores and distribution of students' performance on the computer-based mathematical literacy scale, by jurisdiction	211
Figure 6.6	Percentage of students across the computer-based mathematical literacy proficiency scale, by jurisdiction	212
Figure 6.7	Mean scores and differences in students' performance on the computer-based mathematical literacy scale, by jurisdiction and sex	212
Figure 6.8	Percentage of students across the computer-based mathematical literacy proficiency scale, by jurisdiction and sex	213
Figure 6.9	Mean scores and distribution of students' performance on the digital reading literacy scale, by country	215
Figure 6.10	Percentage of students across the digital reading literacy proficiency scale, by country	216
Figure 6.11	Mean scores and differences between the sexes in students' performance on the digital reading literacy scale, by country	217
Figure 6.12	Percentage of students across the digital reading literacy proficiency scale by sex, for Australia and the OECD average	218
Figure 6.13	Mean scores and distribution of students' performance on the digital reading literacy scale, by jurisdiction	219
Figure 6.14	Percentage of students across the digital reading literacy proficiency scale, by jurisdiction	220

Figure 6.15	Mean scores and differences between the sexes in students' performance on the digital reading literacy scale, by jurisdiction	220
Figure 6.16	Percentage of students across the digital reading literacy proficiency scale, by jurisdiction and sex	221
Figure 7.1	Relationship between students' intrinsic motivation to learn mathematics and mathematical literacy performance for Australian students and the OECD average	226
Figure 7.2	Relationship between students' instrumental motivation to learn mathematics and mathematical literacy performance for Australian students and the OECD average	229
Figure 7.3	Relationship between students' self-concept in mathematics and mathematical literacy performance for Australian students and the OECD average	232
Figure 7.4	Relationship between students' self-efficacy in mathematics and mathematical literacy performance for Australian students and the OECD average	235
Figure 7.5	Relationship between students' self-responsibility for failure in mathematics and mathematical literacy performance for Australian students and the OECD average	242
Figure 7.6	Relationship between students' mathematics anxiety and mathematical literacy performance for Australian students and the OECD average	245
Figure 7.7	Relationship between students' subjective norms in mathematics and mathematical literacy performance for Australian students and the OECD average	248
Figure 9.1	Socioeconomic gradients for Australia and the OECD	271
Figure 9.2	Socioeconomic gradients for Australia and comparison countries	273
Figure 9.3	Socioeconomic gradients for Australia and the jurisdictions	274
Figure 9.4	Socioeconomic gradients for Victoria and the Northern Territory	275
Figure 9.5	Quality and equity of performance in mathematical literacy internationally	276
Figure 9.6	Variation in mathematical literacy performance between and within schools by country and jurisdiction	277
Figure 9.7	Performance differences between and within schools explained by students' and schools' socioeconomic background	279
Figure 9.8	Range of students' socioeconomic backgrounds	280
Figure 9.9	Range of schools' socioeconomic backgrounds	281
Figure 9.10	Performance of students in socioeconomically disadvantaged, average and advantaged schools internationally	282
Figure 9.11	Performance of Australian students in socioeconomically disadvantaged, average and advantaged schools	283

Tables

Table 1.1	Summary of the assessment areas in PISA	2
Table 1.2	Number of Australian PISA 2012 schools, by jurisdiction and school sector	6
Table 1.3	Number of Australian PISA 2012 students, by jurisdiction and school sector	7
Table 1.4	Percentage of Australian PISA 2012 students, by jurisdiction and year level	8
Table 1.5	Number and percentage of Australian PISA 2012 students, by geographic location	8
Table 1.6	Number and percentage of Australian PISA 2012 students, by Indigenous background	9
Table 1.7	Number and percentage of Australian 2012 students, by Indigenous background and geographic location	9
Table 1.8	Number and percentage of Australian PISA 2012 students, by Indigenous background and socioeconomic quartiles	10
Table 1.9	Number and percentage of Australian PISA 2012 students, by geographic location of school and socioeconomic quartiles	10
Table 1.10	Number and percentage of Australian PISA 2012 students, by immigrant background	10
Table 1.11	Number and percentage of Australian PISA 2012 students, by language background	11
Table 2.1	Multiple comparisons of mean mathematical literacy performance, by jurisdiction	30
Table 2.2	Differences in mean mathematical literacy scores after adjustment for student and school socioeconomic background	35
Table 2.3	Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by country	43
Table 2.4	Relative trends in mathematical literacy performance, by country	45
Table 2.5	Mean mathematical literacy scores for PISA 2003 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by country	49
Table 2.6	Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012 on the mathematical literacy scale for Australia, by sex	49
Table 2.7	Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by jurisdiction	50
Table 2.8	Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by jurisdiction and sex	51
Table 2.9	Percentage of students performing below Level 2 and at Level 5 or above on mathematical literacy in PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012, by jurisdiction	51
Table 2.10	Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by Indigenous background	52
Table 2.11	Percentage of students performing below Level 2 and at Level 5 or above on mathematical literacy in PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012, by Indigenous background	52
Table 3.1	Mean scores in students' performance on the content subscales, by country	60
Table 3.2	Multiple comparisons of mean performance on the change and relationships subscale, by jurisdiction	78
Table 3.3	Multiple comparisons of mean performance on the space and shape subscale, by jurisdiction	78
Table 3.4	Multiple comparisons of mean performance on the quantity subscale, by jurisdiction	79
Table 3.5	Multiple comparisons of mean performance on the uncertainty and data subscale, by jurisdiction	79
Table 3.6	Mean scores and distribution of students' performance on the content subscales, by jurisdiction	80
Table 3.7	Mean scores in students' performance on the content subscales, by geographic location of school	90
Table 3.8	Mean scores in students' performance on the content subscales, by Indigenous background	92
Table 3.9	Mean scores in students' performance on the content subscales, by socioeconomic background	94
Table 3.10	Mean scores in students' performance on the process subscales, by country	100
Table 3.11	Multiple comparisons of mean performance on the formulating subscale, by jurisdiction	111
Table 3.12	Multiple comparisons of mean performance on the employing subscale, by jurisdiction	111
Table 3.13	Multiple comparisons of mean performance on the interpreting subscale, by jurisdiction	112
Table 3.14	Mean scores and distribution of students' performance on the three process subscales, by jurisdiction	112
Table 3.15	Mean scores in students' performance on the process subscales, by geographic location of school	120
Table 3.16	Mean scores in students' performance on the process subscales, by Indigenous background	122
Table 3.17	Mean scores in students' performance on the process subscales, by socioeconomic background	123

Table 4.1	Contexts for the PISA scientific literacy assessment	128
Table 4.2	Multiple comparisons of mean scientific literacy performance, by jurisdiction	140
Table 4.3	Differences in mean scientific literacy scores after adjustment for student and school socioeconomic background	144
Table 4.4	Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by country	152
Table 4.5	Relative trends in scientific literacy performance, by country	154
Table 4.6	Mean scientific literacy scores and differences in PISA 2006 and PISA 2012 on the scientific literacy scale, by country and sex	159
Table 4.7	Mean scores for PISA 2006, PISA 2009 and PISA 2012 on the scientific literacy scale for Australia	160
Table 4.8	Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by jurisdiction	160
Table 4.9	Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by jurisdiction and sex	161
Table 4.10	Percentage of students performing below Level 2 and at Level 5 or above on the PISA 2006, PISA 2009 and PISA 2012 scientific literacy scale, and differences in the percentages between PISA 2006 and PISA 2012, by jurisdiction	161
Table 4.11	Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by Indigenous background	162
Table 4.12	Percentage of students performing below Level 2 and at Level 5 or above on the PISA 2006, PISA 2009 and PISA 2012 scientific literacy scale, and differences in the percentages between PISA 2006 and PISA 2012, by Indigenous background	162
Table 5.1	Multiple comparisons of mean reading literacy performance, by jurisdiction	179
Table 5.2	Differences in mean reading literacy scores after adjustment for student and school socioeconomic background	183
Table 5.3	Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by country	191
Table 5.4	Relative trends in reading literacy performance, by country	193
Table 5.5	Mean reading literacy scores for PISA 2000 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by country	198
Table 5.6	Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012 for Australia	199
Table 5.7	Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by jurisdiction	199
Table 5.8	Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by jurisdiction and sex	200
Table 5.9	Percentage of students performing below Level 2 and at Level 5 or above on reading literacy in PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2000 and PISA 2012, by jurisdiction	200
Table 5.10	Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by Indigenous background	201
Table 5.11	Percentage of students performing below Level 2 and at Level 5 or above on reading literacy in PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by Indigenous background	202
Table 6.1	Multiple comparisons of mean computer-based mathematical literacy performance, by jurisdiction	211
Table 6.2	Multiple comparisons of mean digital reading literacy performance, by jurisdiction	219
Table 7.1	Students' intrinsic motivation to learn mathematics: Australian and international results	225
Table 7.2	Index of intrinsic motivation to learn mathematics: Australian and international results	226
Table 7.3	Students' intrinsic motivation to learn mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	227
Table 7.4	Students' instrumental motivation to learn mathematics: Australian and international results	228
Table 7.5	Index of instrumental motivation to learn mathematics: Australian and international results	229
Table 7.6	Students' instrumental motivation to learn mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	230
Table 7.7	Students' self-concept in mathematics: Australian and international results	231
Table 7.8	Index of mathematics self-concept: Australian and international results	232
Table 7.9	Students' self-concept in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	233
Table 7.10	Students' self-efficacy in mathematics: Australian and international results	234
Table 7.11	Index of self-efficacy mathematics: Australian and international results	234

Table 7.12	Students' self-efficacy in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	236
Table 7.13	Students' perceived control in school: Australian and international results	237
Table 7.14	Students' perceived control in school: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	238
Table 7.15	Students' perceived control in mathematics: Australian and international results	239
Table 7.16	Students' perceived control in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	240
Table 7.17	Students' self-responsibility for failing in mathematics: Australian and international results	241
Table 7.18	Index of self-responsibility for failure in mathematics: Australian and international results	241
Table 7.19	Students' self-responsibility for failure in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	243
Table 7.20	Students' mathematics anxiety: Australian and international results	244
Table 7.21	Index of mathematics anxiety: Australian and international results	244
Table 7.22	Students' mathematics anxiety: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	246
Table 7.23	Students' subjective norms in mathematics: Australian and international results	247
Table 7.24	Index of subjective norms in mathematics: Australian and international results	248
Table 7.25	Students' subjective norms in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex	249
Table 8.1	Index of disciplinary climate: Australian and international results	253
Table 8.2	Disciplinary climate by jurisdiction	253
Table 8.3	Student truancy: Australian and international results	254
Table 8.4	Student truancy by jurisdiction	254
Table 8.5	Student-related factors affecting school climate: Australian and international results	255
Table 8.6	Student-related factors affecting school climate by jurisdiction	256
Table 8.7	Attitudes towards school (learning activities): Australian and international results	257
Table 8.8	Attitudes towards school (learning activities) by jurisdiction	257
Table 8.9	Attitudes towards school (learning outcomes): Australian and international results	258
Table 8.10	Attitudes towards school (learning outcomes) by jurisdiction	258
Table 8.11	Learning time in school: Australian and international results	259
Table 8.12	Learning time in school by jurisdiction	260
Table 8.13	Learning time out of school: Australian and international results	261
Table 8.14	Learning time out of school by jurisdiction	261
Table 8.15	Teacher–student relations: Australian and international results	262
Table 8.16	Teacher–student relations by jurisdiction	263
Table 8.17	Quality of schools' educational resources: Australian and international results	264
Table 8.18	Quality of schools' educational resources by jurisdiction	264
Table 8.19	Class size: Australian and international results	265
Table 8.20	Class size by jurisdiction	265
Table 8.21	Sense of belonging: Australian and international results	266
Table 8.22	Sense of belonging by jurisdiction	266
Table 8.23	Teacher morale: Australian and international results	267
Table 8.24	Teacher morale by jurisdiction	267
Table 9.1	Socioeconomic relationships for Australia and selected countries	274

Acknowledgements

The Commonwealth, state and territory governments provided the funding for the Australian component of the 2012 PISA assessment. All of Australia's share of the international overheads and half of the basic funding for PISA within Australia was contributed by the Australian Government Department of Education, while each state and territory government school system provided funding in proportion to the numbers of 15-year-old students enrolled in their schools.

In Australia, PISA is guided by the International Assessments Joint National Advisory Committee (IAJNAC). ACER wishes to thank the IAJNAC members for their interest and commitment throughout every phase of the project. Their involvement included reviewing the frameworks and assessment items, assisting with the implementation of PISA in schools from their state and territory, and providing valuable information to ensure the success of PISA in Australia.

The undertaking of PISA 2012 was a collaborative effort. A national survey such as PISA could not be successful without the cooperation of school systems, principals, teachers, students and parents. For high-quality data, a high-participation rate of the randomly selected schools and students is essential, and it is thanks to this level of cooperation that Australia was able to satisfy the internationally set response criteria fully for PISA 2012. 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.

Within ACER, the authors also wish to extend their thanks to the team that worked on the data collection, analysis and reporting of PISA

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 who were 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 in an educational institution that they were attending full-time 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.

OECD average

An OECD average was calculated for most indicators in this report and is presented for comparative purposes. The OECD average represents OECD countries as a single entity and each country contributes to the average with equal weight. The OECD average is equivalent to the arithmetic mean of the respective country statistics.

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 publications, student achievement is often described by a mean score. For PISA, each mean score is calculated from the sample of students who undertook the PISA assessment and is referred to as the sample mean. These sample means are an approximation of the actual mean score (known as the population mean) that would have been obtained had all students in a country actually sat the PISA assessment.

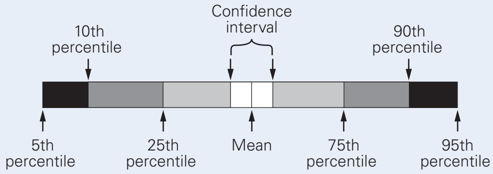
Since the sample mean is just one point along the range of student achievement scores, more information is needed to gauge whether the sample mean is an under estimation or over estimation of the population mean. The calculation of confidence intervals can assist assessment of a sample mean's precision as a population mean. Confidence intervals provide a range of scores within which we are confident that the population mean actually lies.

In this report, sample means are 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 mean lies within plus or minus 1.96 standard errors of the sample mean.

Mean performance

Mean 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 details show 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.



Proficiency levels

To summarise data from responses to the PISA assessment, 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 performance levels. The described performance levels are known as proficiency levels.

This publication uses top performers as shorthand for those students proficient at Level 5 or 6 of the assessment and low performers for those students proficient below Level 2 of the assessment.

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., instrumental motivation to learn mathematics or disciplinary climate), scales were constructed on which the average OECD student was given an index value of 0,[1] and about two-thirds of the OECD population were given values between –1 and +1 (i.e., 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 four categories for each item, whereas the reported percentages are collapsed into two 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.

Bonferroni correction

The Bonferroni correction states that if an experimenter is testing *n* independent hypotheses on a set of data, then the statistical significance level that should be used for each hypothesis separately is 1/*n* times what it would be if only one hypothesis was tested. The Bonferroni correction was used in the multiple-comparison tables in earlier PISA publications (for PISA 2000 and PISA 2003). It is widely acknowledged

1 For the school-based indices, the OECD average may not be 0.

that there are technical issues with using the Bonferroni correction for such a large group of countries and its results are conservative. As such, the Bonferroni correction has not been used in PISA 2012.

Definitions 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 publication, data for the two groups are presented together under the term Indigenous Australian 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 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 (HEDRES), and books in the home.

Geographic location

In Australia, participating schools were coded with respect to the MCEECDYA *Schools Geographic Location Classification*. 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—Remote areas and very remote areas. Remote: very restricted accessibility of goods, services and opportunities for social interaction (e.g., Coolabah, Mallacoota, Capella, Mt Isa, Port Lincoln, Port Hedland, Swansea, Alice Springs). Very remote: very little accessibility of goods, services and opportunities for social interaction (e.g., Bourke, Thursday Island, Yalata, Condingup, Nhulunbuy).

Immigrant background

For the analysis in this report, immigrant background has been 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.

Sample surveys

PISA is a sample survey and, as such, a random sample of students was selected to represent the population of 15-year-old students. The PISA sample was designed as a two-stage stratified sample. The first stage involves the sampling of schools in which 15-year-old students could be enrolled. The second stage of the selection process sampled students within the sampled schools.

The following variables were used in the stratification of the school sample: jurisdiction; school sector; geographic location (based on the MCEECDYA's *Schools Geographic Location Classification*); sex of students at the school; a socioeconomic background variable (based on the Australian Bureau of Statistics' Socio-economic Indexes for Areas—SEIFA; the SEIFA consists of four indexes that rank geographic areas across Australia in terms of their relative socioeconomic advantage and disadvantage); and an achievement variable (based on a Year 9 NAPLAN numeracy school-level score).

CHAPTER 1

Introduction

The main goals of PISA

PISA seeks to measure how well young adults, at age 15[1] and near the end of compulsory schooling in most participating education systems, are prepared to use knowledge and skills in particular areas to meet real-life 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.

As part of the PISA process, students complete an assessment of reading literacy, mathematical literacy and scientific literacy, as well as an extensive background student questionnaire. School principals complete a school questionnaire describing the context of education at their school, including the level of resources in the school and qualifications of staff. From this, the reporting of PISA findings is able to focus on:

» How well are young adults prepared to meet the challenges of the future? Can they analyse, reason and communicate their ideas effectively? What skills do they possess that will facilitate their capacity to adapt to rapid societal change?

» Are some ways of organising schools or 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 or across countries?

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

What PISA assesses

Since 2000, PISA has been conducted every 3 years, assessing reading literacy, mathematical literacy and scientific literacy. In each cycle the assessment areas are rotated so that one literacy domain is the major focus (the major domain), with a large amount of the assessment time being devoted to this domain compared to the other two literacy domains (the minor domains, Table 1.1).

PISA 2012 was the fifth cycle of PISA and mathematical literacy was the major domain, which allowed an in-depth analysis of mathematical literacy and the reporting of results by subscale to be undertaken.

Table 1.1 Summary of the assessment areas in PISA

PISA 2000	PISA 2003	PISA 2006	PISA 2009	PISA 2012
Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy
Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical 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 2003, problem solving was assessed. In PISA 2012, problem solving was once again assessed as a computer-based assessment. Countries also had the option of participating in a computer-based assessment of mathematical and reading literacy and a paper-based assessment of financial literacy. Results on the performance of Australian students in problem solving and financial literacy will be released in two separate reports in 2014.

Features of PISA 2012

Common to each cycle is the assessment of the three literacy domains (reading, mathematics and science); however, each new cycle brings innovation to assess students' capabilities in new domains. What sets PISA 2012 apart from other cycles?

In PISA 2012:

» the mathematical literacy assessment framework was updated to integrate new developments in theory and practice. This included the introduction of three new mathematical literacy processes (formulating situations mathematically; employing mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical outcomes), and the content category uncertainty scale was re-named as uncertainty and data for improved clarity.

» mathematical literacy was revisited as a major domain, allowing for reporting on the overall mathematical literacy scale and on the process and content subscales.

» changes in mathematical literacy performance from PISA 2003 could be examined.

» the assessment methodologies were expanded to include a computer-based assessment of problem solving and an optional computer-based assessment of mathematics.

» financial literacy was offered as an optional assessment.

» information was collected about students' motivation, beliefs and learning, specifically in relation to mathematics.

» the student questionnaire used a rotated test design to increase the content coverage.

How results are 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 competencies, in different assessment domains, that are considered to be essential to an individual's ability to participate in and contribute to society.

Similar to other international studies, PISA results are reported as mean scores that indicate average performance and various statistics that reflect the distribution of performance. School and student variables further enhance the understanding of student performance. PISA also attaches meaning to the performance scale by providing a profile of what skills and knowledge students have achieved. 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. For the domain of mathematical literacy, six proficiency levels have been defined to describe the scale. Six levels of proficiency have been defined for the domain of scientific literacy. In the 2009 cycle of PISA, reading literacy was the major domain and the proficiency levels were expanded to seven for this domain. Further details on the proficiency levels for each literacy domain can be found in Chapters 2, 4 and 5.

What participants did

Students who participated in PISA 2012 completed a paper-based assessment booklet that contained questions about mathematical literacy and questions from either reading literacy, scientific literacy or both. Students also completed a student questionnaire and a computer-based assessment that assessed one or more of problem solving, mathematical and reading literacy.

Cognitive assessment

For the 2-hour paper-based assessment, students were randomly assigned one of 13 assessment booklets that contained items of varying difficultly. Each booklet comprised four clusters allocated according to a rotated test design among the seven mathematical literacy clusters, three scientific literacy clusters and three reading literacy clusters. There were at least two mathematical literacy clusters in each booklet. Reading and science clusters only appeared in some of the booklets.

For the 40-minute computer-based assessment, students completed a practice test before responding to one of 24 forms. Each form consisted of two clusters (of 20 minutes each) allocated according to a rotated test design among four clusters of computer problem-solving items, four clusters of computer mathematical literacy items and two clusters of computer reading literacy items.

In the cognitive assessment, students were presented with units that required them to construct responses to a stimulus and a series of questions (or items). Context was represented in each unit by the stimulus material, which was typically a brief written passage or text accompanying a table, chart, graph, photograph or diagram. Each unit then contained several items related to the stimulus material.

A range of item-response formats was employed to cover the full range of cognitive abilities and knowledge identified in the assessment frameworks. There were five types of item format: multiple-choice and complex multiple-choice items, in which students selected from among several possible answers; closed constructed-response items, in which students were required to provide an unambiguous single word, a number or diagrammatic answer; and open constructed-response and short-response items, in which students provided a written response, showing the methods and thought processes they had used.

Context questionnaires

PISA 2012 collected contextual information from students and principals. The internationally standardised student questionnaire sought information on students and their family background, aspects of motivation, learning and instruction in mathematics, and context of instruction including instructional time and class size. Students were randomly assigned one of three questionnaires. Each questionnaire comprised questions about the student and their family background and a selection of questions from the remaining pool of questions.

Australia also participated in the two additional student questionnaires that were offered as international options: an information and communications technology (ICT) familiarity questionnaire (that collected information on the availability and use of ICT, students' competence in completing tasks and their attitudes towards computer use); and an educational career questionnaire (that gathered information about students' interruptions of schooling and their preparation for their future career). The ICT familiarity and educational career questionnaires were placed after the student questionnaire in each of the three questionnaire forms.

Students were allowed up to 40 minutes to complete the student questionnaire, which they responded to after the completion of the paper-based assessment and before the completion of the computer-based assessment.

The school questionnaire was completed by the principal (or the principal's delegate). It provides 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. In Australia, the school questionnaire was administered online and took around 30 minutes to complete.

Time of testing

PISA standards stipulate that testing should take place in the second half of the academic year. In Australia, the PISA assessment took place in a six-week period from late July to early September 2012. For most countries in the Northern Hemisphere, the testing period took place between March and May 2012. 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 2012.

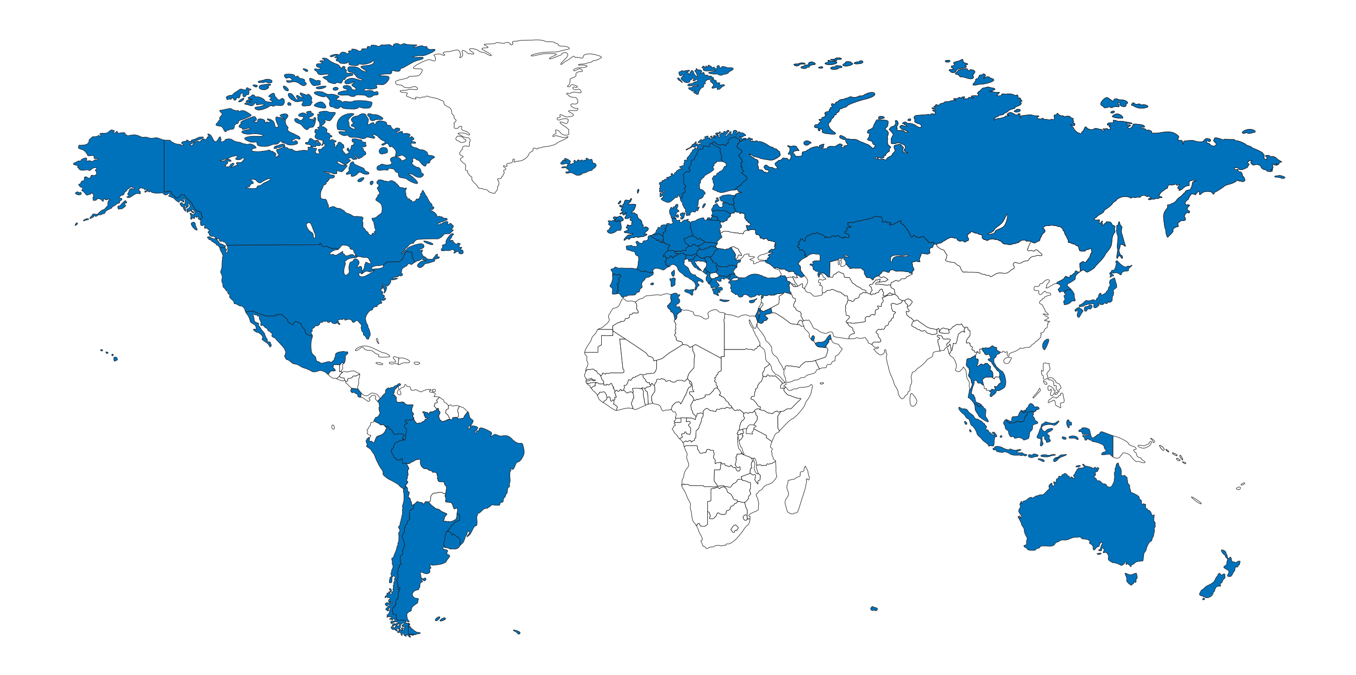
Participants in PISA 2012

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. Since the first assessment in 2000, when PISA was implemented in 32 OECD countries, it has expanded to include non-OECD countries, referred to as partner countries and economies.[2] Sixty-five countries and economies participated in PISA 2012, including 34 OECD countries and 31 partner countries or economies[3] (Figure 1.1).

2 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.

3 Although Chinese Taipei, Hong Kong–China, Macao–China and Shanghai–China are economic regions, for convenience they will be referred to throughout this report as countries.



OECD countries			Partner countries/economies		
Australia	Hungary	Poland	Albania	Kazakhstan	Shanghai–China
Austria	Iceland	Portugal	Argentina	Latvia	Singapore
Belgium	Ireland	Slovak Republic	Brazil	Liechtenstein	Thailand
Canada	Israel	Slovenia	Bulgaria	Lithuania	Tunisia
Chile	Italy	Spain	Chinese Taipei	Macao–China	United Arab Emirates
Czech Republic	Japan	Sweden	Colombia	Malaysia	Uruguay
Denmark	Korea	Switzerland	Costa Rica	Montenegro	Vietnam
Estonia	Luxembourg	Turkey	Croatia	Peru	
Finland	Mexico	United Kingdom	Cyprus	Qatar	
France	Netherlands	United States	Hong Kong–China	Romania	
Germany	New Zealand		Indonesia	Russian Federation	
Greece	Norway		Jordan	Serbia	

Figure 1.1 Countries participating in PISA 2012[4]

Forty-four countries participated in the computer-based assessment of problem solving, with 32 of these countries also participating in the computer-based assessment of mathematical and reading literacy.

Schools

In most countries, 150 schools and 35 students in 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.

4 Although 65 countries/economies participated in PISA 2012, only those countries with a mean score higher than the lowest scoring OECD country, Mexico, have been reported in this publication.

In Australia, a larger sample of schools and students participated in PISA to produce reliable estimates representative for:

- » each of the Australian jurisdictions[5]
  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.
- » Indigenous students
  A sufficiently large sample of Australia's Indigenous students was required so that valid and reliable separate analyses could be co°nducted.

The Australian PISA 2012 school sample consisted of 775 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 15-year-old population. Several variables were used in the stratification of the school sample including jurisdiction, school sector, geographic location, sex of students at the school, a socioeconomic background variable[6] and an achievement variable.[7]

Table 1.2 Number of Australian PISA 2012 schools, by jurisdiction and school sector

Jurisdiction	Sector			Total
	Government	Catholic	Independent	
ACT	26	8	11	45
NSW	113	43	28	184
VIC	77	31	26	134
QLD	83	24	25	132
SA	56	18	18	92
WA	51	18	21	90
TAS	47	12	12	71
NT	17	5	5	27
Australia	**470**	**159**	**146**	**775**

Note: These numbers are based on unweighted data.

Of the Australian PISA schools, 85% were coeducational. Eight per cent of schools catered for all-female students, while 7% catered for all-male students. Of the PISA schools that were single-sex schools, 2% (17 schools) were government schools, almost 8% (62 schools) were Catholic and 4% (34 schools) were independent schools.

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. An age-based sample focusing on students nearing the end of compulsory schooling was chosen over a grade-based sample because of the complexities of defining an internationally comparable sample based on grade. There are many

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

6 Based on the Australian Bureau of Statistic's Socio-Economic Indexes for Areas (SEIFA).

7 Based on a NAPLAN numeracy school-level score.

differences between the countries with regard to the nature of preschool education and the age at which formal education commences. These differences also exist within Australia.

Internationally, the desired minimum number of students to be assessed per country is 4,500. In each country, a random sample of 35 students is selected with equal probability from each of the randomly selected schools using a list of all 15-year-old students submitted by the school. In some countries (including Australia, Belgium, Brazil, Canada, Colombia, Italy, Mexico, Spain, Switzerland and the United Kingdom), the PISA sample size was increased so that particular groups or regions could be adequately represented or for other agreed purposes. In a few small countries (such as Iceland, Liechtenstein and Luxembourg), the whole cohort of age-eligible students was assessed. Around 510,000 students, representing 28 million 15-year-old students, took part in PISA 2012.

In PISA 2012, the Australian school and student sample[8] was refined to improve sampling methodologies. This resulted in 20 students and all age-eligible Indigenous students being sampled per school.

The Australian PISA 2012 sample of 14,481 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 2012 students, by jurisdiction and school sector

	Jurisdiction								
	ACT	NSW	VIC	QLD	SA	WA	TAS	NT	Total
Government									
N students	501	2133	1362	1769	931	1020	869	256	8841
Weighted N	2386	47964	35446	30539	10268	15363	3842	1341	147149
Catholic									
N students	209	828	571	497	306	330	235	81	3057
Weighted N	1500	19389	15636	10200	3691	5742	1221	210	57589
Independent									
N students	198	486	473	456	336	388	154	92	2583
Weighted N	827	12155	11312	10044	3668	6431	832	703	45972
Australia									
N students	**908**	**3447**	**2406**	**2722**	**1573**	**1738**	**1258**	**429**	**14481**
Weighted N	**4713**	**79508**	**62394**	**50783**	**17627**	**27536**	**5895**	**2254**	**250710**

Notes: 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, 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.

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

Table 1.4 Percentage of Australian PISA 2012 students, by jurisdiction and year level

Jurisdiction	Year level					
	7	8	9	10	11	12
ACT		^	12	84	3	
NSW		^	11	83	6	
VIC	^	^	21	77	1	^
QLD		^	2	49	49	^
SA		^	6	86	8	^
WA			^	42	57	^
TAS		^	30	69	^	
NT		^	7	82	11	
Australia	**^**	**^**	**11**	**70**	**19**	**^**

Notes: The percentages are based on unweighted data.
The symbol ^ denotes a percentage ≤ 1.
The jurisdiction totals have been calculated without rounding off decimal places but are presented as whole numbers.

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).[9]

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 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 of less than 50% were not regarded as a participating school. Australia successfully achieved the required response rates.

PISA 2012 students and geographic location of schools

The locations of schools in PISA were classified using the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA) *Schools Geographic Location Classification*.[10] In PISA 2012, almost three-quarters (73%) of students attended schools that were located in metropolitan areas, one-quarter (26%) were from provincial areas and the remaining students (1%) attended schools in remote areas (Table 1.5).

Table 1.5 Number and percentage of Australian PISA 2012 students, by geographic location

Geographic location	N students	Weighted N	Weighted %
Metropolitan	9962	183646	73
Provincial	4163	64216	26
Remote	356	2849	1

Notes: 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.

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

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

PISA 2012 students and Indigenous background

The Australian Indigenous students in PISA 2012 were identified from information provided by the school, which was taken from school records. All students who were identified as Indigenous from participating schools were sampled for PISA. The number of participating Australian Indigenous and non-Indigenous students in PISA 2012 is shown in Table 1.6.

Table 1.6 Number and percentage of Australian PISA 2012 students, by Indigenous background

Indigenous background	N students	Weighted N	Weighted %
Indigenous	1991	8733	3
Non-Indigenous	12490	241978	97

Notes: 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 non-Indigenous students by geographic location was similar to the data reported in Table 1.5: 74% of students were from metropolitan schools, 25% 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, 45% from provincial schools and 9% from remote schools (Table 1.7).

Table 1.7 Number and percentage of Australian PISA 2012 students, by Indigenous background and geographic location

	Indigenous students			Non-Indigenous students		
Geographic location	N students	Weighted N	Weighted %	N students	Weighted N	Weighted %
Metropolitan	1070	4028	46	8892	179618	74
Provincial	800	3914	45	3363	60302	25
Remote	121	791	9	235	2059	1

Notes: 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 2012 students and socioeconomic background

Information about the socioeconomic background of students 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).[11] Using this index, participating students were distributed into quartiles of socioeconomic background.

The distribution of Australian Indigenous and non-Indigenous students by overall socioeconomic quartiles is provided in Table 1.8. Almost 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.

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

Table 1.8 Number and percentage of Australian PISA 2012 students, by Indigenous background and socioeconomic quartiles

Socioeconomic background	Indigenous students			Non-Indigenous students			Total weighted % of PISA population
	N students	Weighted N	Weighted %	N students	Weighted N	Weighted %	
Lowest quartile	856	3874	48	3047	57495	24	25
Second quartile	543	2361	29	3025	59102	25	25
Third quartile	298	1218	15	3096	60155	25	25
Highest quartile	180	634	8	3065	60807	26	25

Notes: 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 quartiles—less than half in the two lowest quartiles (46%) and slightly more than one-quarter (28%) in the highest quartile. In contrast, in provincial schools, 60% of students were in the two lowest quartiles and less than 20% of students were in the highest quartile. Remote schools were even more skewed in terms of socioeconomic background, with 43% of students in the lowest quartile and just 12% of students in the highest socioeconomic quartile. The distribution of students in schools from different geographic locations by socioeconomic quartiles is provided in Table 1.9.

Table 1.9 Number and percentage of Australian PISA 2012 students, by geographic location of school and socioeconomic quartiles

Socioeconomic background	Metropolitan			Provincial			Remote			Total weighted % of PISA population
	N students	Weighted N	Weighted %	N students	Weighted N	Weighted %	N students	Weighted N	Weighted %	
Lowest quartile	2274	40107	22	1502	20208	32	127	1054	43	25
Second quartile	2347	43061	24	1135	17758	28	86	644	26	25
Third quartile	2515	47054	26	818	13840	22	61	478	19	25
Highest quartile	2606	50366	28	601	10792	17	38	283	12	25

Notes: 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 % is calculated without rounding off decimal places but are presented as whole numbers.

PISA 2012 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.[12] Almost 60% of students were Australian-born, approximately 30% were first-generation and 10% of students were foreign-born (Table 1.10).

Table 1.10 Number and percentage of Australian PISA 2012 students, by immigrant background

Immigrant background	N students	Weighted N	Weighted %
Australian-born	8499	136308	59
First-generation	3944	77210	27
Foreign-born	1471	29318	10

Notes: 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 add up to 100% as 4% of students didn't provide these details.

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

PISA 2012 students and language spoken at home

In the student questionnaire, students were asked what 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, almost 90% of students who participated in PISA indicated English was spoken at home most of the time; while 10% of students indicated they spoke a language other than English at home (Table 1.11).

Table 1.11 Number and percentage of Australian PISA 2012 students, by language background

Language background	N students	Weighted N	Weighted %
English spoken at home	12822	219917	88
Language other than English spoken at home	1310	25746	10

Notes: 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 add up 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).[13] PISA complements other NAP assessments, in that it assesses the application of students' knowledge in new situations and measures how well these young adults will be prepared to meet the challenges of the future. The collection of data at the student and school level facilitates the identification of key factors that are effective in shaping education systems.

Unlike the National Assessment Program – Literacy and Numeracy (NAPLAN), which is conducted annually for every student in Years 3, 5, 7 and 9, PISA assesses a nationally representative sample of 15-year-olds, providing national and group estimates rather than providing individual student results.

Together with two other tests administered by the International Association for the Evaluation of Educational Achievement (IEA)—the Trends in International Mathematics and Science Study (TIMSS) and the Progress in International Reading Literacy Study (PIRLS)—PISA provides data from internationally standardised tests, which enables Australia to compare its performance relative to that of other countries and to compare its absolute performance over time.

The results from these assessments allow for nationally comparable reporting of student outcomes against the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008), which aims to provide high-quality schooling in Australia that will secure for students the necessary knowledge, understanding, skills and values for a productive and rewarding life. The Australian Curriculum, Assessment and Reporting Authority (ACARA) annually reports on these assessments in their *National Report on Schooling*.

PISA's focus on testing students nearing the completion of compulsory schooling is particularly appropriate for reporting against the national goals. PISA enables reporting on comparable performance data every three years and, as required by the Council of Australian Governments (COAG) for the national goals, student outcomes are reported disaggregated by sex, geographic location, Indigenous background, socioeconomic background and (since PISA 2009) school sector at the national level.

13 Although PISA and NAPLAN are both part of the NAP, PISA is not a curriculum-based assessment (as is NAPLAN) and the assessments have different age-based cohorts, so they cannot be compared.

Organisation of the report

This report focuses on Australian students' performance in PISA 2012. Chapter 2 provides a brief overview of the PISA mathematical literacy framework and presents results on the performance of Australian students in mathematical literacy. Results are compared to other participating countries, across jurisdictions and for social groups of interest. Changes in mathematical literacy are also examined. Chapter 3 presents results for Australian students' performance on the mathematical literacy process and content subscales. Chapters 4 and 5 are devoted to student performance in scientific literacy and reading literacy. Chapter 6 focuses on the performance of Australian students in the computer-based assessment of mathematical and reading literacy. Chapter 7 examines students' motivation in learning mathematics. Chapter 8 presents details of the Australian school environment and conditions for learning. Chapter 9 considers the relationship between socioeconomic background and performance.

Further information

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

CHAPTER 2

Australian students' performance in mathematical literacy

Key findings[1]

- Australia achieved an average score of 504 points in the PISA 2012 mathematical literacy assessment, which was significantly higher than the OECD average of 494 score points.
- Australia was significantly outperformed by 16 countries in mathematical literacy: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Switzerland, the Netherlands, Estonia, Finland, Canada, Poland, Belgium and Germany. Australia's performance was not significantly different from seven countries: Vietnam, Austria, Ireland, Slovenia, Denmark, New Zealand and the Czech Republic. All other countries performed at a level significantly lower than Australia.
- Fifteen per cent of Australian students were top performers in mathematical literacy (reaching proficiency Level 5 or 6) compared to 12% of students across the OECD.
- One-fifth of Australian students were low performers in mathematical literacy (failing to reach Level 2, the international baseline proficiency level) compared to almost one-quarter (23%) of students across the OECD.
- Differences between the sexes were found to be in favour of males in more countries than females. In Australia, males performed significantly higher than females (by 12 score points, representing about one-third of a school year).
- Seventeen per cent of Australian males and 12% of Australian females were top performers in mathematical literacy compared to 14% of males and 10% of females across the OECD.
- Eighteen per cent of Australian males and 21% of Australian females were low performers in mathematical literacy compared to 22% of males and 24% of females across the OECD.
- The Australian Capital Territory, Western Australia and New South Wales performed at a level not significantly different to one another. The Australian Capital Territory and Western Australia performed significantly higher than the other jurisdictions, while New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and Victoria performed significantly higher on average than South Australia, Tasmania and the Northern Territory. South Australia scored significantly higher than

1 Throughout this report, the mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Tasmania and the Northern Territory, while Tasmania scored significantly higher than the Northern Territory. The Northern Territory was the only jurisdiction that was significantly outperformed by all other jurisdictions.

- The Australian Capital Territory, Western Australia, New South Wales and Queensland performed significantly higher than the OECD average. Victoria and South Australia achieved at a level not significantly different to the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.
- Males achieved significantly higher than females in Victoria, South Australia and Western Australia.
- Once a student's individual socioeconomic background and the socioeconomic background of their peers at school were taken into account, there were no significant differences for mathematical literacy performance between school sectors (government, Catholic and independent).
- The mathematical literacy performance of students attending metropolitan schools was significantly higher than students in provincial (the difference representing almost three-quarters of a school year) or remote schools (the difference representing almost two years of schooling). Students attending schools in provincial areas performed significantly higher than students in remote schools (the difference representing almost one-and-a-quarter years of schooling).
- Seventeen per cent of students in metropolitan schools, 10% of students in provincial schools and 6% of students in remote schools were top performers.
- Eighteen per cent of students in metropolitan schools, 23% of students in provincial schools and 39% of students in remote schools were low performers.
- Indigenous students performed significantly lower than non-Indigenous students, with a difference of 90 score points on average, equating to more than two-and-a-half years of schooling.
- Two per cent of Indigenous students were top performers in mathematical literacy compared to 15% of non-Indigenous students.
- Half of the Indigenous students were low performers compared to 18% of non-Indigenous students.
- In general, the higher the level of a student's socioeconomic background, the better the student's performance in mathematical literacy. Students in the highest socioeconomic quartile performed 87 score points on average higher than students in the lowest socioeconomic quartile. This difference equates to around two-and-a-half years of schooling.
- Twenty-seven per cent of students in the highest socioeconomic quartile were top performers compared to 5% of students in the lowest socioeconomic quartile.
- Eight per cent of students in the highest socioeconomic quartile were low performers compared to 33% of students in the lowest socioeconomic quartile.
- Foreign-born students and first-generation students achieved at significantly higher levels than Australian-born students in mathematical literacy.
- Language at home was not found to be a significant factor in achievement, with the scores of students who spoke English at home not significantly different to those of students who spoke a language other than English at home.
- Australia's mean mathematical literacy performance declined significantly between PISA 2003 and PISA 2012 (by 20 score points on average). There has been a significant decline in the performance of top performers, average performers and low performers (i.e., there have been significant declines at the 10th, 25th, 75th and 90th percentiles between PISA 2003 and PISA 2012).
- Between PISA 2003 and PISA 2012, the proportion of low-performing Australian students (those students who failed to reach Level 2) significantly increased (by 5%) and the proportion of top-performing Australian students (those students who reached Level 5 or above) significantly decreased (by 5%).

- All jurisdictions, except Victoria, showed a significant decline in their mathematical literacy performance between PISA 2003 and PISA 2012.
- Mathematical literacy performance for females declined significantly in all jurisdictions, except Victoria; while mathematical literacy performance for males declined significantly in South Australia, the Northern Territory, the Australian Capital Territory, Tasmania and Western Australia between PISA 2003 and PISA 2012.
- Between PISA 2003 and PISA 2012, there was a significant increase in the proportion of low-performing students and a significant decrease in the proportion of top-performing students in South Australia, Western Australia, Tasmania and the Northern Territory; while there was a significant decrease in the proportion of top-performing students in the Australian Capital Territory and a significant increase in the proportion of low-performing students in New South Wales.
- Average mathematical literacy performance declined significantly for Indigenous students (by 23 score points on average) and for non-Indigenous students (by 19 score points on average) between PISA 2003 and PISA 2012.
- Between PISA 2003 and PISA 2012, the proportion of top-performing Indigenous students fell significantly (by 2%).
- The proportion of top-performing non-Indigenous students decreased (by 5%) between PISA 2003 and PISA 2012, and the proportion of low-performing non-Indigenous students increased significantly (by 5%) between PISA 2003 and PISA 2012.

The rotation of the literacy domains in each PISA cycle enables a domain to be assessed in detail every 9 years. Mathematical literacy was first assessed as a major domain in PISA 2003 and is once again being assessed as a major domain in this cycle of PISA. Revisiting mathematical literacy as a major domain allows reporting on the overall mathematical literacy scale, reporting by subscale and comparisons to be made over time. It is also 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.

In PISA 2012, Australia participated in an optional computer-based assessment in mathematical literacy. This chapter presents results for the paper-based assessment, while Chapter 6 presents the results for students' performance on the computer-based assessment.

The first section provides a summary of the PISA mathematical literacy framework, including a definition of mathematical literacy, an overview of the assessment framework and a description of how mathematical literacy is reported.[2] The second section examines the overall mathematical literacy performance of Australian students compared to other participating countries. It also compares the performance of students within Australia, by jurisdiction and by other subgroups (while Chapter 3 examines Australian students' performance on the mathematical literacy subscales). The last section discusses the changes in mathematical literacy performance between PISA 2003 and PISA 2012.

How is mathematical literacy defined in PISA?

In PISA, mathematical literacy has been defined as:

> *… 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 in recognising 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, 2013, p. 25)*

2 Details about the mathematical literacy framework, structure of the assessment and proficiency scale have been assembled from *PISA 2012 results: What students know and can do: Student performance in mathematics, reading and science* (Vol. 1) (OECD, forthcoming).

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; and 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. So 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 is shown in Figure 2.1. The PISA 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.

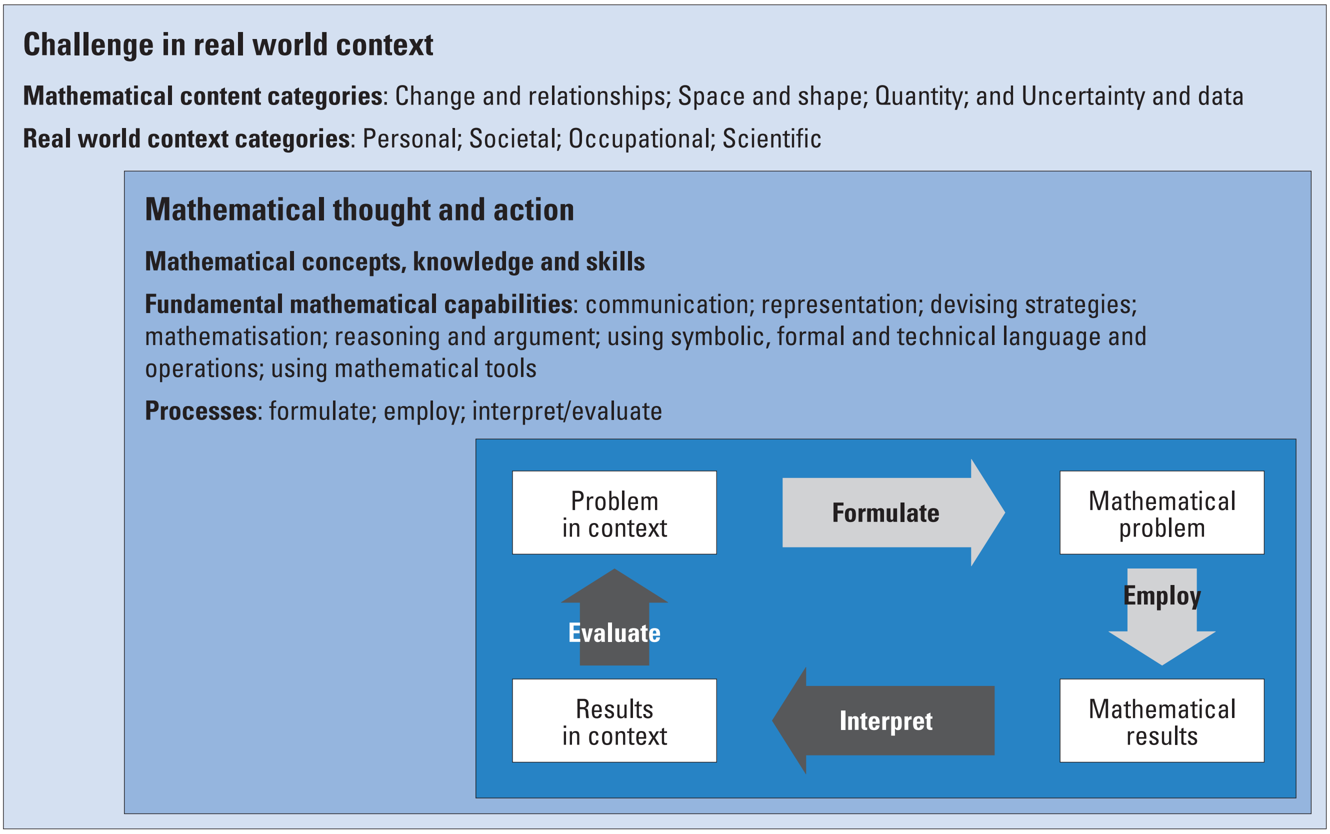


Figure 2.1 Main features of the PISA 2012 mathematical literacy assessment framework

Mathematical content categories

The PISA framework defines mathematical content into four categories of knowledge that are related to the problems posed.

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* involves the understanding of measurements, counts, magnitudes, units, indicators, relative size, and numerical trends and patterns, and the employing of number sense, multiple representations of numbers, mental calculation, estimation and assessment of reasonableness of results.
4. *Uncertainty and data* involves identifying and summarising messages that are embedded in sets of data that are presented in many ways. Uncertainty is part of scientific predictions, poll results and weather forecasts; variation occurs in manufacturing processes and survey findings; and chance is part of many recreational activities that individuals enjoy.

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, 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' and families' 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

Figure 2.1 shows the mathematical processes that students apply as they attempt to solve problems. The mathematical process involves:

» 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.

» The problem solver employs mathematical concepts, facts, procedures and reasoning to obtain the mathematical results. This usually involves mathematical manipulation, transformation and computation, with and without tools (e.g., physical and digital equipment such as software, a calculator and a ruler).

» The problem solver interprets the mathematical results considering the original problem to obtain the results in context. This involves the problem solver interpreting, applying and evaluating mathematical outcomes and their reasonableness in the context of a real-world problem.

These three processes (formulating situations mathematically; employing mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical outcomes) each draw on fundamental mathematical capabilities, which draw on the problem solver's mathematical knowledge.

Fundamental mathematical capabilities

In developing items and analysing the ways in which students respond to items, PISA has identified a set of fundamental mathematical capabilities that underpin performance in mathematics. These mathematical capabilities can be learned in order to understand and engage with the world in a mathematical way.

In PISA 2012, seven fundamental capabilities have been used in the mathematical literacy assessment. These fundamental capabilities are: 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 2012 mathematical literacy assessment structure

The PISA 2012 assessment framework serves as the conceptual basis for assessing students' proficiency in mathematical literacy. New tasks and questions were developed to reflect the concepts in the framework. PISA 2012 also included a computer-based assessment of mathematics. Details about the paper-based assessment are included in this and the next chapter. The assessment of computer-based mathematics is described in Chapter 6.

Item-response formats

Mathematical literacy was assessed through a range of item-response formats to cover the full range of cognitive abilities and knowledge identified in the PISA 2012 assessment framework. These included: multiple-choice items, where students were required to select one correct response from among four or five possible response options; complex multiple-choice items, where students were required to select the correct response to each of a number of statements or questions; closed constructed-response items, where students were to provide their own responses with a limited range of acceptable answers; short-response items, which required students to provide a brief answer similar to the closed constructed-response items, but with a wider range of possible answers; and open constructed-response items, where students wrote a short explanation or a long calculation in response to a question, showing the methods and thought processes they had used in constructing their response.

Distribution of items

Figure 2.2 provides details about the six categories used to create a balanced assessment in mathematical literacy. 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 PISA 2012 mathematical literacy assessment includes the same proportion of items from each of the categories content, context and response type. However, for the mathematical processes, a quarter of the items in the assessment reflect the process of formulating, half reflect the process of employing and a quarter reflect the process of interpreting. The set of items reflects all levels of difficulty so that the full range of student performance can be measured.

Reporting categories			Further categories to ensure balanced assessment		
Process categories	**Content categories**	**Medium categories**	**Context categories**	**Response types**	**Cognitive demand**
Formulating situations mathematically Employing mathematical concepts, facts, procedures and reasoning Interpreting, applying and evaluating mathematical outcomes	Change and relationships Shape and space Quantity Uncertainty and data	Paper-based Computer-based	Personal Societal Occupational Scientific	Multiple choice Complex multiple choice Constructed response (simple, elaborated)	Empirical difficulty (continuum) Across fundamental mathematical capabilities

Figure 2.2 Categories describing the items constructed in the PISA 2012 mathematical literacy assessment

The PISA 2012 paper-based mathematical literacy assessment was based on 110 items. This included 36 items linking to previous PISA assessments (allowing trend data to be reported) and 74 new items. Each student completed a fraction of these items, from a minimum of 12 items to a maximum of 37 items, depending on which assessment booklet they were randomly assigned from the booklet rotation design.

Scaling the mathematical literacy tasks

The assessment design, similar to those used in previous PISA assessments, allowed for a single scale of proficiency in mathematical literacy to be constructed. The scale of mathematical 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 mathematical 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 mathematical literacy that they possess.

The relationship between items and students on the mathematical literacy scale (shown in Figure 2.3) 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 mathematical 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.

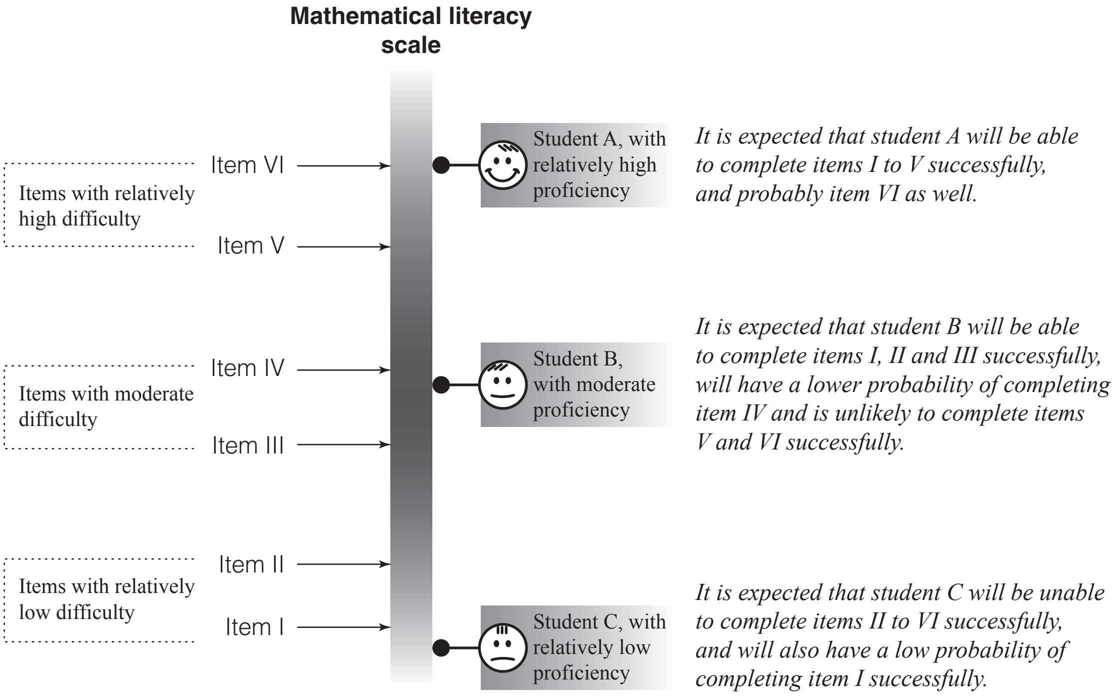


Figure 2.3 The relationship between items and students on the PISA mathematical literacy scale

The PISA 2012 mathematical literacy assessment provides an overall mathematics scale, which draws on all of the mathematical literacy items in the assessment, as well as scales for the three mathematical processes and the four mathematical content categories defined above.

Appendix C provides examples of mathematical literacy items and responses from PISA 2012.

How is mathematical literacy reported in PISA?

Statistics such as mean 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 can typically use are attached to achievement results.

Mean scores and distribution of scores

Mean scores provide a summary of student performance and allow comparisons of the relative standing between different countries and different subgroups. In PISA 2003, when mathematical literacy was a major domain for the first time, the metric for the overall mathematics scale was based on a mean across OECD countries of 500 points and a standard deviation of 100 points. The mean score on the PISA 2012 mathematical literacy scale across participating OECD countries was 494 score points, with a standard deviation of 92 points. This mean score is the benchmark against which mathematical literacy performance in PISA 2015 and PISA 2018 will be compared.

The distribution of scores along the mathematical 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 mean 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.

Although the number of proficiency levels has remained the same since PISA 2003, the descriptions have been updated to reflect the new mathematical literacy process categories in the PISA 2012 assessment framework.

The mathematical literacy proficiency scale spans from Level 1 (the lowest proficiency level) to Level 6 (the highest). Descriptions of each of these levels 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 (Figure 2.4). A difference of 62 score points represents one proficiency level on the PISA mathematical literacy scale.

Students who are placed at Level 5 or 6 (scoring 607 points or higher) were considered top-performing students who are highly proficient in mathematical literacy.

Students who are placed at Level 1 or below (scoring 420 points or lower) were considered low-performing students. 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 students to actively participate in life situations. Students who fail to reach Level 2 have not acquired the skills and knowledge to allow them to adequately participate in the 21st century workforce and contribute as productive citizens.

Students who performed below the lower boundary of Level 1 (358 score 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 baseline (as agreed in *Measurement Framework for Schooling in Australia*) is Level 3. This level has been identified as the baseline 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, 2013, p. 5).

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.

Proficiency level	What students can typically do at each level
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	
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	
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 2.4 Summary descriptions of the six proficiency levels on the overall mathematical literacy scale

In terms of proficiency levels

A difference of about 62 score 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. E.g., compare the skill set for those students who are proficient at Level 2 and those who are proficient at Level 3. Students who perform at Level 2 on the mathematical literacy scale are able to interpret and recognise situations in contexts that require no more than direct inference and 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 the 34 OECD countries in which there are a sizeable number of 15-year-olds who were enrolled in at least two different year levels in the PISA 2012 sample. Analyses of these data indicate that the difference between two year levels is, on average, 41 score points on the PISA mathematical literacy scale. This implies that one school year corresponds to an average of 41 score points across all OECD countries on the PISA mathematical literacy scale. For Australia, more precisely, one year of schooling corresponds to an average of 35 score points.

Australia's mathematical literacy performance from an international perspective

Mathematical performance across countries

In PISA 2012, Australian students achieved an average score of 504 points on the mathematical literacy scale. This was significantly higher than the OECD average of 494 score points. Australia was one of 23 countries (16 OECD and 7 partner countries or economies[3]) that achieved a mean score that was significantly higher than the OECD average. These countries were: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Switzerland, the Netherlands, Estonia, Finland, Canada, Poland, Belgium, Germany, Vietnam, Austria, Australia, Ireland, Slovenia, Denmark and New Zealand. Seven countries (the Czech Republic, France, the United Kingdom, Iceland, Latvia, Norway and Portugal) scored at a level not significantly different from the OECD average, while all other countries performed significantly lower than the OECD average.

Shanghai–China achieved the highest score on the mathematical literacy assessment with an average score of 613 score points, which was significantly higher than any other country. Shanghai–China's score was almost two proficiency levels higher than the OECD average or the equivalent of almost three years of schooling. In terms of proficiency, Shanghai–China's score was in the average range of proficiency Level 5.

Sixteen countries (10 OECD and 6 partner countries) performed significantly higher than Australia. These countries were: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Switzerland, the Netherlands, Estonia, Finland, Canada, Poland, Belgium and Germany.

The countries whose scores were not significantly different from Australia were: Vietnam, Austria, Ireland, Slovenia, Denmark, New Zealand and the Czech Republic. All other countries, including the United Kingdom and the United States, performed at a level significantly lower than Australia.

The average range of mathematical literacy scores between the 5th and 95th percentiles for the OECD countries was 301 score points. However, the difference in scores between the lowest and highest achieving students varied considerably within the different countries. Among the OECD countries, the widest spread of scores was found in Israel (347 score points), Belgium (335 score points) and the Slovak Republic (334 score points). For Australia, there were 315 score points between the 5th and 95th percentiles.

Among the partner countries, three of the four highest performing countries were found to have the largest differences between the 5th and 95th percentiles in mathematical literacy performance. These countries were Chinese Taipei (375 score points), Singapore (344 score points) and Shanghai–China (331 score points).

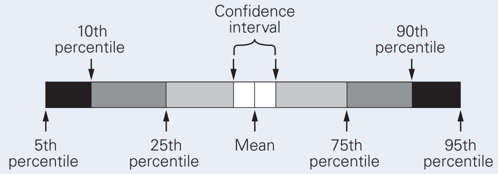
The smallest difference between the lowest and highest performers was found in a partner country, Kazakhstan, with 235 score points difference between the 5th and the 95th percentiles, followed by an OECD country, Mexico, with a spread of 245 score points between the highest and lowest achieving students.

Figure 2.5 provides the mean mathematical literacy scores, along with the standard errors, confidence intervals around the mean, and the difference between the 5th and 95th percentiles. In addition, this figure also shows the graphical distribution of student performance. Countries are shown in order from the highest to the lowest mean 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 are 65 participating countries in PISA 2012, those countries which achieved a mean score lower than Mexico, the lowest performing OECD country, have not been included.[4]

3 For ease of reading, economic regions, such as Shanghai–China, are referred to as countries.

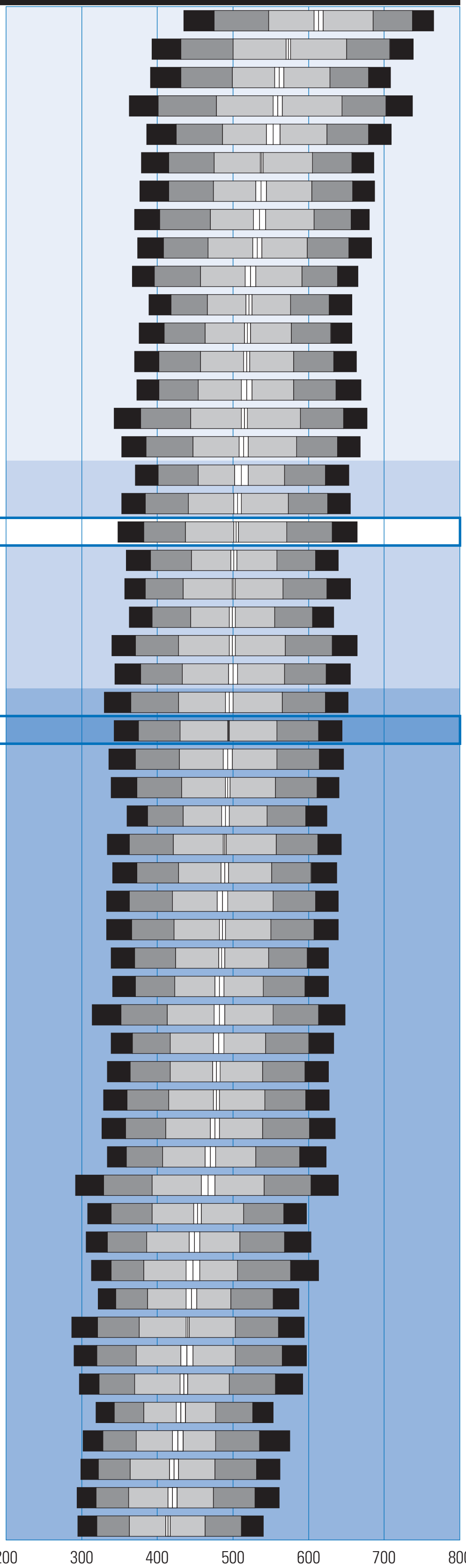
4 For brevity, results for those countries that achieved a mean score lower than Mexico (413 score points) have not been included in this chapter. These countries are: Montenegro, Uruguay, Costa Rica, Albania, Brazil, Argentina, Tunisia, Jordan, Colombia, Qatar, Indonesia and Peru.

Each country's results are represented in horizontal bars with various shading. 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.



	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	613	3.3	606–619	331
	Singapore	573	1.3	571–576	344
	Hong Kong–China	561	3.2	555–568	318
	Chinese Taipei	560	3.3	553–566	375
	Korea	554	4.6	545–563	323
	Macao–China	538	1.0	536–540	306
	Japan	536	3.6	529–543	309
	Liechtenstein	535	4.0	527–543	310
	Switzerland	531	3.0	525–537	308
	Netherlands	523	3.5	516–530	297
	Estonia	521	2.0	517–525	268
	Finland	519	1.9	515–523	281
	Canada	518	1.8	514–522	293
	Poland	518	3.6	510–525	296
	Belgium	515	2.1	511–519	335
	Germany	514	2.9	508–519	314
Not significantly different from Australia	Vietnam	511	4.8	502–521	283
	Austria	506	2.7	500–511	301
	Australia	**504**	**1.6**	**501–507**	**315**
	Ireland	501	2.2	497–506	280
	Slovenia	501	1.2	499–504	298
	Denmark	500	2.3	496–505	272
	New Zealand	500	2.2	495–504	325
	Czech Republic	499	2.9	493–505	309
Significantly lower than Australia	France	495	2.5	490–500	321
	OECD average	**494**	**0.5**	**493–495**	**301**
	United Kingdom	494	3.3	487–500	312
	Iceland	493	1.7	489–496	302
	Latvia	491	2.8	485–496	266
	Luxembourg	490	1.1	488–492	310
	Norway	489	2.7	484–495	297
	Portugal	487	3.8	480–495	307
	Italy	485	2.0	481–489	306
	Spain	484	1.9	481–488	287
	Russian Federation	482	3.0	476–488	285
	Slovak Republic	482	3.4	475–488	334
	United States	481	3.6	474–488	295
	Lithuania	479	2.6	474–484	293
	Sweden	478	2.3	474–483	298
	Hungary	477	3.2	471–483	310
	Croatia	471	3.5	464–478	289
	Israel	466	4.7	457–476	347
	Greece	453	2.5	448–458	289
	Serbia	449	3.4	442–456	296
	Turkey	448	4.8	439–457	302
	Romania	445	3.8	437–452	266
	Cyprus	440	1.1	438–442	308
	Bulgaria	439	4.0	431–447	307
	United Arab Emirates	434	2.4	429–439	294
	Kazakhstan	432	3.0	426–438	235
	Thailand	427	3.4	420–433	273
	Chile	423	3.1	417–429	264
	Malaysia	421	3.2	414–427	267
	Mexico	413	1.4	411–416	245

Distribution of scores



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

Figure 2.5 Mean scores and distribution of students' performance on the mathematical literacy scale, by country

Proficiency levels provide further meaning about students' ability in mathematical literacy. There are six proficiency levels in the PISA mathematical literacy assessment, ranging from Level 6 (the highest proficiency level) to Level 1 (the lowest proficiency level). The mean proportion of students at each mathematical literacy level from below Level 1 to Level 6 by country is shown in Figure 2.6. Countries have been ordered by the percentage of students classified as below Level 2, 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.

Students who achieved a score of 669 points were placed at proficiency Level 6. These 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. On average, just over 3% of students across the OECD countries performed at this level. Almost one-third (31%) of students in Shanghai–China performed at this level, while in Singapore and Chinese Taipei almost one-fifth (19% and 18% respectively), and in Hong Kong–China and Korea just over one-tenth (12%) of students were highly proficient in mathematical literacy. All other countries had fewer than 10% of students attaining this level. In Australia, as well as the Netherlands, Canada, Estonia and Finland, 4% of students achieved Level 6. A small number of countries (Chile, Malaysia, Kazakhstan and Mexico) had fewer than 1% of students performing at Level 6.

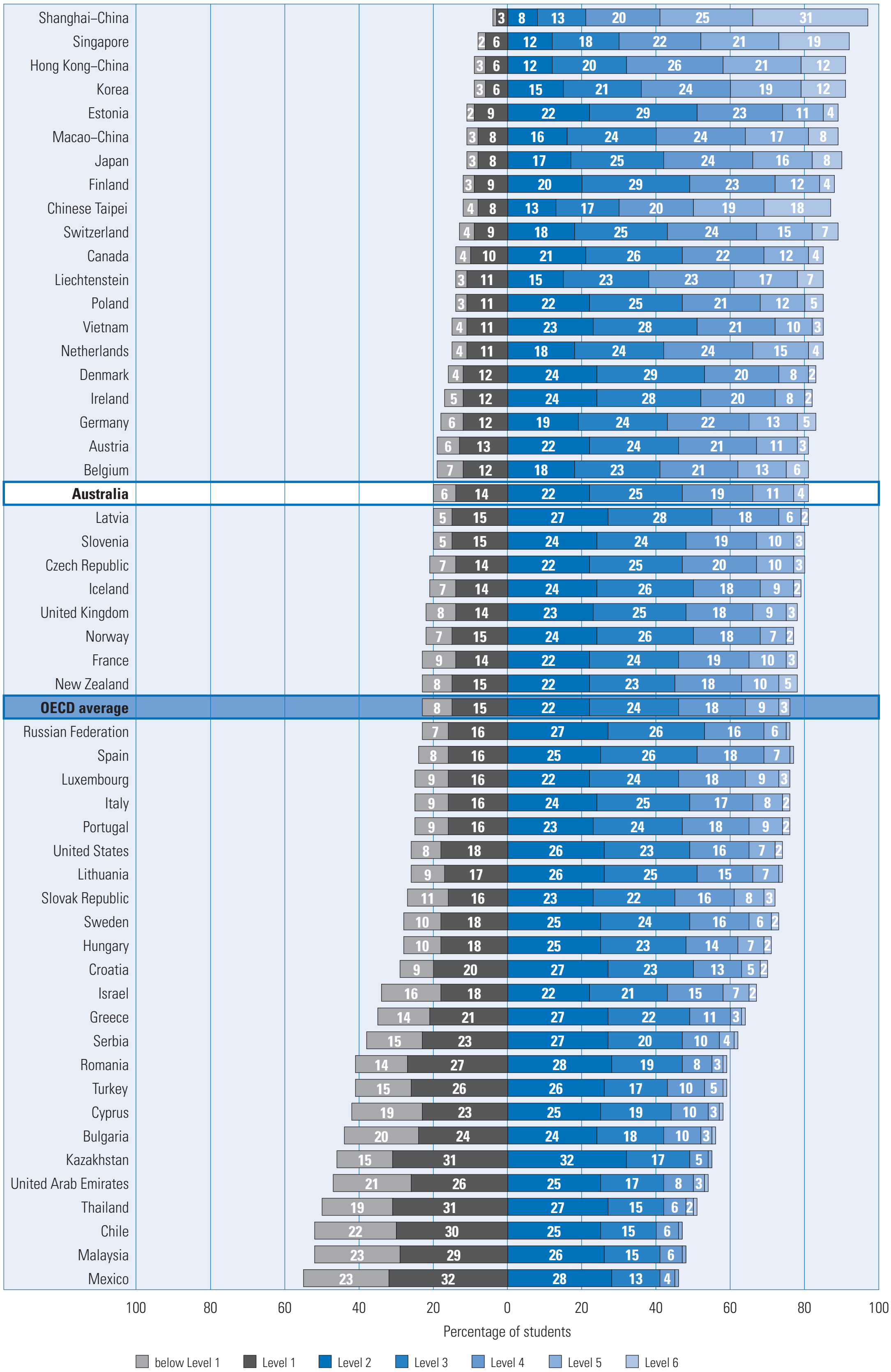
Students who were proficient at Level 5 could develop and work with models for complex situations, identify constraints and specify assumptions. Those students who achieved at Level 6 were also proficient at Level 5 tasks. Students achieving at these levels (5 and 6) are referred to as the top performers. On average, 12% of students across OECD countries were top performers.

More than half (56%) the students from Shanghai–China were top performers, followed by Singapore (40%), Chinese Taipei (37%), Hong Kong–China (33%) and Korea (31%). Around one quarter of students from Macao–China (25%), Liechtenstein (24%), Japan (24%) and Switzerland (22%) achieved Level 5 or 6, while 15% of students from Australia performed at these levels.

Students who were neither high nor low performers attained a proficiency of Level 2, 3 or 4. On average, around two-thirds (64%) of the students across OECD countries performed at these levels. More than 70% of students in Estonia, Denmark, Vietnam, Finland, Ireland and Latvia performed at these mid-region levels of the mathematical literacy proficiency scale. In Australia, two-thirds of students attained Level 2, 3 or 4.

In PISA, Level 2 is considered the baseline level of mathematical literacy proficiency. Students who do not reach this level are at serious risk of not being able to participate adequately as productive citizens in a modern society. On average, almost one-quarter (23%) of students across OECD countries did not attain Level 2. In some of the lowest performing countries, such as Mexico, Malaysia, Chile and Thailand, at least half of the students were performing below Level 2. In Australia 20% of students failed to reach Level 2, while in the top-performing countries of Shanghai–China, Singapore, Hong Kong–China and Korea fewer than 10% of students were low performers.

In Australia, Level 3 is the nationally agreed baseline level. Forty-two cent of Australian students were placed below Level 3, which was lower than the 45% of students across OECD countries. For the high-performing countries, 12% of students had not reached Level 3 in Shanghai–China, while there were around 20% of students in Singapore and Hong Kong–China, and approximately 25% of students in Korea and Chinese Taipei who had not reached Level 3.



Note: In cases in which 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 2.6 Percentage of students across the mathematical literacy proficiency scale, by country

Mathematical literacy performance by sex across countries

Across the OECD, the mean score for females was 489 score points and for males was 499 score points, a significant difference of 10 score points.

Differences between sexes were found to be in favour of males in more countries than females. Figure 2.7 shows that males significantly outperformed females in over half the countries. The largest differences were found in Luxembourg and Chile, with males scoring 25 score points higher than females, and in Liechtenstein and Austria with a difference of 23 score points. Among the highest performing countries, males in Korea and Hong Kong–China also performed at significantly higher levels than females, by more than 15 score points. In only three countries—Thailand, Malaysia and Iceland—females performed significantly higher than males (with differences of 14, 8 and 6 score points respectively).

In Australia, males achieved a mean score of 510 score points, which was significantly higher than the mean score of 498 score points for females. This difference of 12 score points equates to around one-fifth of a proficiency level or the equivalent of about one-third of a year of schooling. The significantly higher performance of males than females was also found in most other English speaking countries: New Zealand and Ireland (with a difference of 15 score points), the United Kingdom (with a difference of 12 score points) and Canada (with a difference of 10 score points), but not in the United States.

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	433	4.1	419	3.6
Malaysia	424	3.7	416	3.7
Iceland	496	2.3	490	2.3
United Arab Emirates	436	3	432	3.8
Latvia	493	3.2	489	3.4
Singapore	575	1.8	572	1.9
Finland	520	2.2	517	2.6
Sweden	480	2.4	477	3
Bulgaria	440	4.2	438	4.7
Russian Federation	483	3.1	481	3.7
Lithuania	479	3	479	2.8
Cyprus	440	1.6	440	1.5
Kazakhstan	432	3.3	432	3.4
Norway	488	3.4	490	2.8
Macao–China	537	1.3	540	1.4
Slovenia	499	2	503	2
Romania	443	4	447	4.3
Poland	516	3.8	520	4.3
United States	479	3.9	484	3.8
Estonia	518	2.2	523	2.6
Chinese Taipei	557	5.7	563	5.4
Shanghai–China	610	3.4	616	4
Belgium	512	2.6	518	2.8
Turkey	444	5.7	452	5.1
Greece	449	2.6	457	3.3
France	491	2.5	499	3.4
Hungary	473	3.6	482	3.7
Serbia	444	3.7	453	4.1
Slovak Republic	477	4.1	486	4.1
Vietnam	507	4.7	517	5.6
Canada	513	2.1	523	2.1
Netherlands	518	3.9	528	3.6
OECD average	**489**	**0.5**	**499**	**0.6**
Portugal	481	3.9	493	4.1
Croatia	465	3.7	477	4.4
Israel	461	3.5	472	7.8
Czech Republic	493	3.6	505	3.7
Australia	**498**	**2**	**510**	**2.4**
United Kingdom	488	3.8	500	4.2
Switzerland	524	3.1	537	3.5
Germany	507	3.4	520	3
Denmark	493	2.3	507	2.9
Mexico	406	1.4	420	1.6
New Zealand	492	2.9	507	3.2
Ireland	494	2.6	509	3.3
Hong Kong–China	553	3.9	568	4.6
Spain	476	2	492	2.4
Japan	527	3.6	545	4.6
Korea	544	5.1	562	5.8
Italy	476	2.2	494	2.4
Austria	494	3.3	517	3.9
Liechtenstein	523	5.8	546	6
Chile	411	3.1	436	3.8
Luxembourg	477	1.4	502	1.5

Difference in mean score

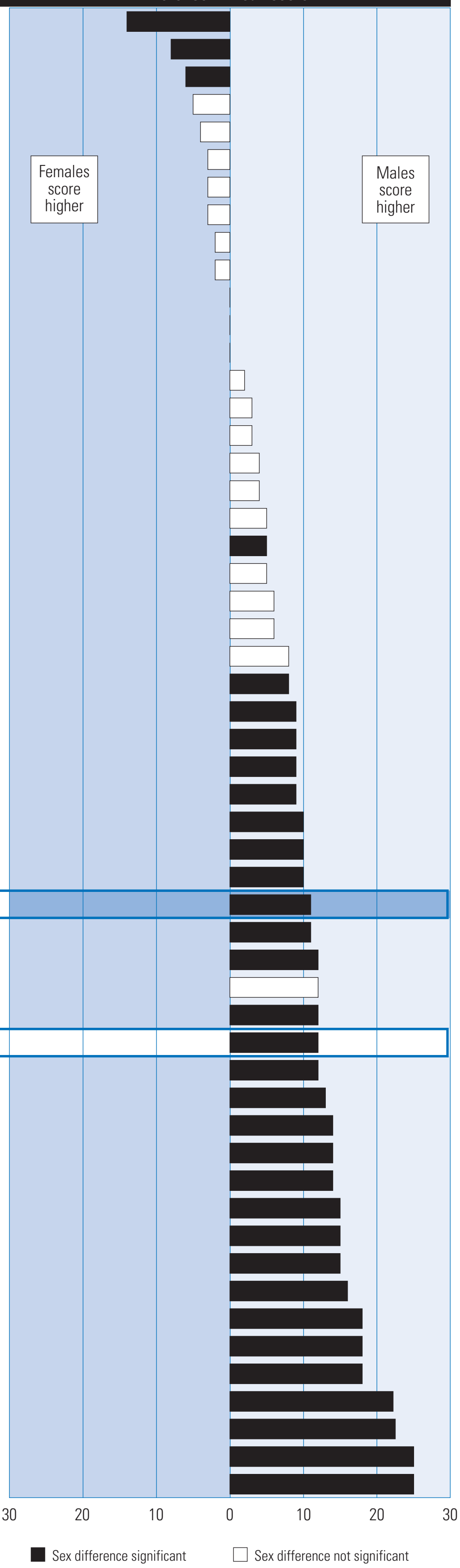


Figure 2.7 Mean scores and differences between sexes in students' performance on the mathematical literacy scale, by country

The average proportion of females and males at each level on the mathematical literacy proficiency scale for Australia and the OECD average is shown in Figure 2.8. There was a larger proportion of males than females at the higher proficiency levels in mathematical literacy. Across the OECD, 14% of males achieved Level 5 or 6 compared to 10% of females, and in Australia 17% of males compared to 12% of females achieved proficiency at these high levels.

At the lower proficiency levels, the proportion of females was larger than the proportion of males. Across the OECD, 24% of females failed to reach Level 2 compared to 22% of males, while in Australia 21% of females compared to 18% of males did not reach Level 2. In Australia, there were similar proportions of females and males (6%) who performed below Level 1.

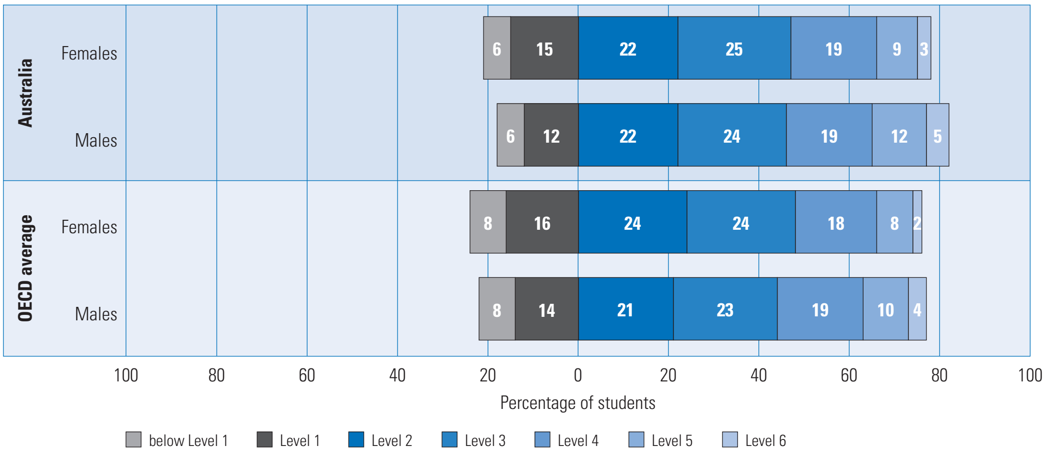


Figure 2.8 Percentage of students across the mathematical literacy proficiency scale by sex, for Australia and the OECD average

Australia's mathematical literacy performance in a national context

Mathematical literacy performance across the Australian jurisdictions

Four jurisdictions—the Australian Capital Territory (518 score points), Western Australia (516 score points), New South Wales (509 score points) and Queensland (503 score points)—performed at a significantly higher level than the OECD average (494 score points). Victoria and South Australia achieved mean scores of 501 and 489 score points respectively, which were not significantly different from the OECD average. Tasmania, with a mean score of 478 score points, and the Northern Territory, with a mean score of 452 score points, performed significantly lower than the OECD average.

The mean scores for the Australian Capital Territory and Western Australia were in the range of proficiency Level 3 and were more than one-and-a-half proficiency levels lower, or the difference of almost three years of schooling, than Shanghai–China's mean performance in mathematical literacy. The Northern Territory, the lowest performing jurisdiction, achieved a mean score in the range of proficiency Level 2. The difference between the mean score for Australian Capital Territory and the Northern Territory was 66 points, which was around one proficiency level or the equivalent of almost two years of schooling.

The Australian Capital Territory, Western Australia and New South Wales performed at a level not significantly different to one another. The Australian Capital Territory and Western Australia performed significantly higher than the other jurisdictions, while New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and Victoria performed significantly higher on average than South Australia, Tasmania and the Northern Territory. South Australia scored significantly higher than Tasmania and the Northern Territory, while Tasmania scored significantly higher than the Northern Territory. The Northern Territory was the only jurisdiction that was significantly outperformed by all other jurisdictions.

The Northern Territory had the widest spread of scores, with 368 score points between the students at the 5th and 95th percentiles, while Victoria and South Australia had the narrowest spread of scores with a range of 299 score points.

The mathematical literacy performance for students in each of the Australian jurisdictions is shown in Figure 2.9 and Table 2.1. Figure 2.9 shows the mean scores and distribution of mathematical literacy scores for each jurisdiction. The mean score and distribution for Australia, the highest performing country (Shanghai–China), and the average scores across all OECD countries have also been included for comparison. Table 2.1 is a multiple comparison table that provides further details about the performance of each jurisdiction compared to the other jurisdictions.

Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
ACT	518	3.6	511–525	319
NSW	509	3.6	502–516	336
VIC	501	3.7	497–508	299
QLD	503	2.9	498–509	305
SA	489	3.3	483–496	299
WA	516	3.4	510–523	303
TAS	478	3.4	471–484	317
NT	452	10.4	431–472	368
Australia	504	1.6	501–507	315
Shanghai–China	613	3.3	606–619	331
OECD average	494	0.5	493–495	301

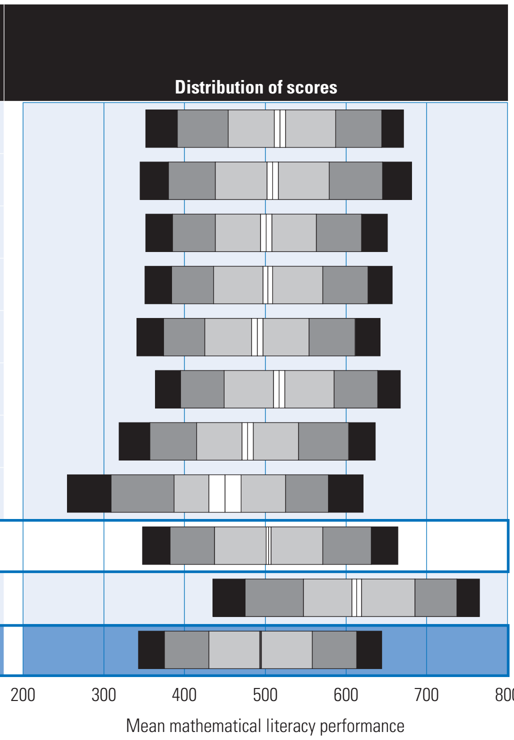


Figure 2.9 Mean scores and distribution of students' performance on the mathematical literacy scale, by jurisdiction

Table 2.1 Multiple comparisons of mean mathematical literacy performance, by jurisdiction[5]

Jurisdiction	Mean score	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	518	3.6		●	●	▲	▲	▲	▲	▲	▲
WA	516	3.4	●		●	▲	▲	▲	▲	▲	▲
NSW	509	3.6	●	●		●	●	▲	▲	▲	▲
QLD	503	2.9	▼	▼	●		●	▲	▲	▲	▲
VIC	501	3.7	▼	▼	●	●		▲	▲	▲	●
SA	489	3.3	▼	▼	▼	▼	▼		▲	▲	●
TAS	478	3.4	▼	▼	▼	▼	▼	▼		▲	▼
NT	452	10.4	▼	▼	▼	▼	▼	▼	▼		▼
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

5 Appendix D provides information about the mathematical literacy performance of each jurisdiction compared to participating countries.

Figure 2.10 shows the mean proportion of students at each of the mathematical literacy proficiency levels in each jurisdiction, together with the percentages for Australia, the OECD average and Shanghai–China.

Six per cent of students from New South Wales achieved the highest mathematical literacy proficiency level, Level 6. This was twice the proportion of students at this level on average across all OECD countries, but about five times less than the proportion of students who achieved Level 6 in Shanghai–China. In the Australian Capital Territory and Western Australia, 5% of students achieved Level 6, while in Queensland this proportion was 4%. Three per cent of students in Victoria reached the highest proficiency level, which was similar to the OECD average. The three other jurisdictions—South Australia, Tasmania and the Northern Territory—2% of students achieved Level 6.

As mentioned earlier in this chapter, those students who reached Level 5 or 6 were considered top performers. Almost one-fifth of students from the Australian Capital Territory (18%), Western Australia (18%) and New South Wales (17%) were top performers in mathematical literacy. Around 10 to 15% of students in Queensland (15%), Victoria (12%) and South Australia (10%) achieved Level 5 or 6, while fewer than 10% of students from Tasmania (9%) and the Northern Territory (7%) achieved at these levels.

Students below Level 2 are considered low performers in the PISA mathematical literacy assessment. These students have not been able to demonstrate the mathematical literacy competencies that will enable them to actively participate in society. Over one-third of students in the Northern Territory (36%), and around one-quarter of students in South Australia (23%) and Tasmania (26%)—a similar proportion to the OECD average (23%)—were low performers on this assessment. One-fifth of students in Victoria (20%), Queensland (20%) and New South Wales (19%) failed to reach Level 2, while in the Australian Capital Territory and Western Australia, 16% of students did not reach Level 2. This was about four times the proportion of students in Shanghai–China (4%).

Students who scored below 358 score 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 mathematics to benefit their future. For most jurisdictions, the proportion of students placed below Level 1 ranged from 4 to 7%, which was lower than the OECD average (8%). However, in Tasmania one in ten students and in the Northern Territory almost one in five students were placed below Level 1.

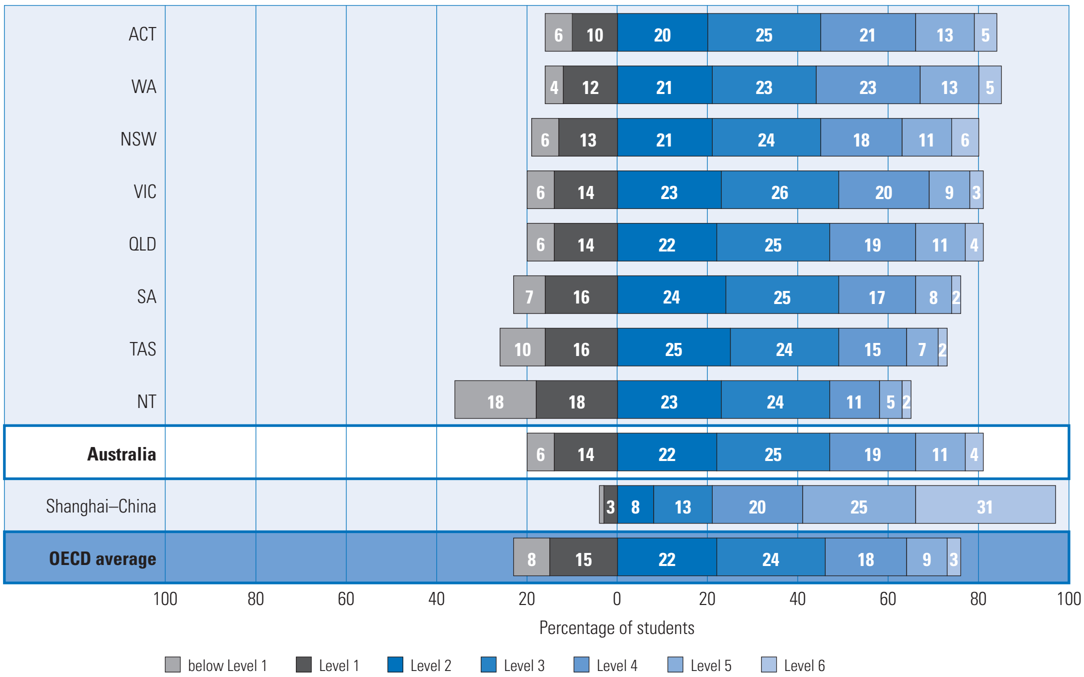


Figure 2.10 Percentage of students across the mathematical literacy proficiency scale, by jurisdiction

Mathematical literacy performance by sex across the Australian jurisdictions

A significant difference between the sexes was found in mathematical literacy for Australia overall. Figure 2.11 shows the mean mathematical literacy scores for females and males for each of the jurisdictions, along with the standard error and the difference in mean score graphically. Males performed significantly higher than females in mathematical literacy in three jurisdictions. In Western Australia, males achieved a mean score of 528 points, which was on average 24 score points higher than females. This is almost half a proficiency level or about two-thirds of a school year difference. In Victoria, males achieved a mean score of 509 points compared to a mean score of 491 for females, a difference of 18 score points. In South Australia, males achieved a mean score of 495 points, which was 12 score points higher compared to the mean score of 483 for females. This difference was similar to the difference across all OECD countries (10 score points).

	Females		Males	
Jurisdiction	Mean score	SE	Mean score	SE
WA	504	4.5	528	5.3
VIC	491	3.7	509	5.1
NT	445	15.0	459	9.9
SA	483	3.9	495	4.3
TAS	473	4.9	482	4.9
NSW	505	4.0	513	5.6
QLD	500	3.6	507	3.9
ACT	517	4.6	518	5.5

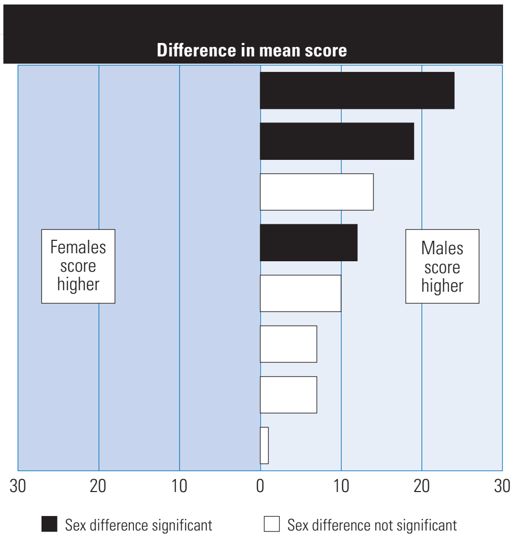


Figure 2.11 Mean scores and differences in students' performance on the mathematical literacy scale, by jurisdiction and sex

Higher proportions of males than females reached Level 5 or 6 in all jurisdictions (Figure 2.12). Around 20% of males in the Australian Capital Territory, New South Wales and Western Australia reached Level 5 or 6, which was higher than the proportion of males across OECD countries (14%). The proportion of males from Victoria and Queensland who were top performers was similar to the OECD average; whereas in South Australia, Tasmania and the Northern Territory, the proportion of males at Level 5 or 6 was lower than the OECD average. There were higher proportions of high-achieving females in the Australian Capital Territory (17%), New South Wales (15%), Western Australia (13%) and Queensland (13%) compared to the OECD average of 10%. The proportion of females who achieved Level 5 or 6 for the other jurisdictions was at the OECD average or lower: Victoria (10%); South Australia (9%); Tasmania (8%); and the Northern Territory (5%). The difference between the sexes for the top performers ranged from 2% in Tasmania to 8% in Western Australia.

The proportions of males who did not reach Level 2 in mathematical literacy was: lower than the OECD average (22%) in Western Australia (13%), the Australian Capital Territory (16%), Victoria (17%), New South Wales (19%) and Queensland (19%); around the OECD average in South Australia (21%) and Tasmania (23%); and higher than the OECD average in the Northern Territory (34%). Thirty-eight per cent of females in the Northern Territory and 30% in Tasmania did not reach Level 2, which was above the OECD average (24%). The proportion of females in other jurisdictions who performed below Level 2 ranged from 15% in the Australian Capital Territory to 25% in South Australia. The proportion of females and males who were low performers was similar in the Australian Capital Territory and New South Wales (a difference of 1%) and largest in Western Australia and Tasmania (a difference of 7%).

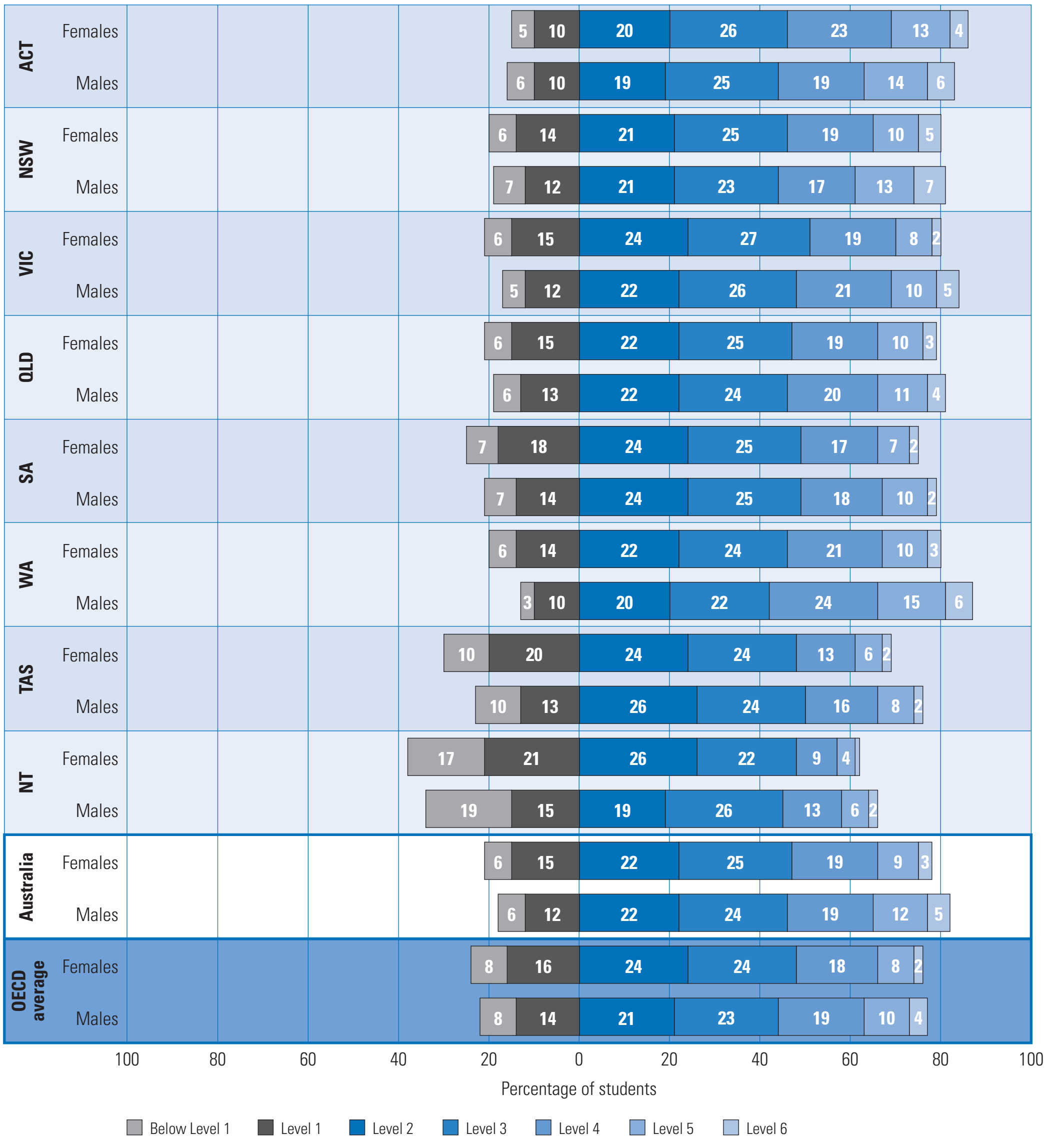


Figure 2.12 Percentage of students across the mathematical literacy proficiency scale, by jurisdiction and sex

Mathematical literacy performance by Australian school sectors

The unadjusted mean scores for mathematical literacy by school sector[6] are shown in Figure 2.13, showing that, on average, students in the independent school sector scored significantly higher than students in the Catholic or government school sectors, and students in Catholic schools scored significantly higher than students in government schools. The mean mathematical literacy scores for Catholic and independent schools were significantly higher than the OECD average, while the mean scores for government schools were significantly lower than the OECD average.

6 In the Australian education system, government and Catholic schools operate as part of a formal sector, while independent schools are not part of a formal sector, with schools operating autonomously.

Previous cycles of PISA have shown that 'on average across the countries with a significant share of private enrolment, students in private schools outperform students in public schools in 21 countries, while public schools outperform private ones in four countries' (OECD, 2007, p. 230).

The international report goes on to note that: 'In the interpretation of these results, it is important to recognise that there are many factors that affect school choice. Insufficient family wealth can, for example, be an important impediment to students wanting to attend independent private schools with a high level of tuition fees. Even government-dependent private schools that charge no tuition fees can cater for a different clientele or apply more restrictive transfer or selection practices' (OECD, 2007, p. 231).

So that the findings of student performance across the school sectors are interpreted accurately, it is necessary to include a discussion of the effect of an individual's socioeconomic status and the socioeconomic background in the reporting of sectoral data. In addition, the schools 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.

School sector	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Government	489	2.3	484–493	324	
Catholic	514	3.2	508–521	285	
Independent	541	3.6	534–548	285	

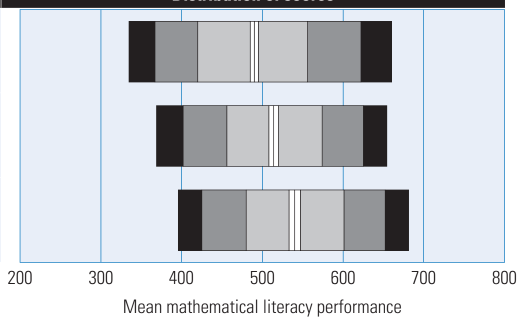


Figure 2.13 Mean scores and distribution of students' performance on the mathematical literacy scale, unadjusted for student and school background, by school sector

Catholic and independent schools had a narrower spread of students scoring between the 5th and the 95th percentiles (with 285 points) compared to students in government schools (with 324 score points). The wider spread of scores indicates that government schools cater for students with a broader range of abilities than do Catholic or independent schools.

In examining these results, an important question to ask is: To what extent are student and school characteristics deterministic of school-sector performance?

To answer this question, it is important to recognise the effect an individual student's family background or socioeconomic status[7] has on their performance, as well as the effect school-level socioeconomic background (the so-called peer effect) has on their performance. Statistically, this can be achieved using multi-level modelling to adjust or account for the differences in the student's socioeconomic background and also that of the school they attend.[8]

Table 2.2 shows the mean difference in the unadjusted score as well as the mean score differences in mathematical literacy performance once student socioeconomic background, and student- and school-level socioeconomic background are accounted for.

7 The measure of socioeconomic background in PISA is based on the ESCS index. For more information, please refer to the Reader's Guide.

8 A proxy for the socioeconomic background of the school is derived by aggregating the student-level socioeconomic background of the students to school level.

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 in performance across school sectors are not significant. In other words, students in the Catholic or independent school sectors bring with them an advantage from their socioeconomic background that is not as strongly characteristic of students in the government school sector. In previous cycles of PISA, the OECD has noted that the differences between public and private schools disappear once similar adjustments are made in most OECD countries.

Table 2.2 Differences in mean mathematical literacy scores after adjustment 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
Government – Catholic	**25**	**20**	3
Government – Independent	**52**	**35**	5
Catholic – Independent	**26**	**15**	2

Notes: Values that are statistically signifcant are indicated in bold.

Figure 2.14 shows the proportions of students at each proficiency level on the mathematical literacy scale by school sector. Students in government and Catholic schools achieved similar proportions at proficiency Level 5 or 6 (13 and 14% respectively), while almost twice as many students (23%) in independent schools reached the highest proficiency levels in mathematical literacy. A higher proportion of students in government schools (25%) failed to reach Level 2 compared to 14% of students in Catholic schools and 9% of students in independent schools.

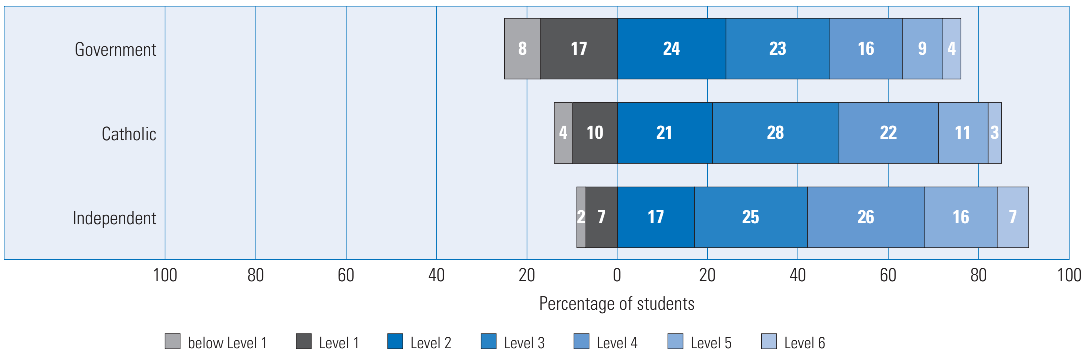


Figure 2.14 Percentage of students across the mathematical literacy proficiency scale, by school sector[9]

Mathematical literacy performance by geographic location of school

Using the MCEECDYA *Schools Geographic Location Classification*,[10] schools were categorised by their geographic location using three broad categories (metropolitan, provincial and remote). Students who attended schools in metropolitan areas achieved significantly higher scores than those in provincial or remote areas, and students who attended schools in provincial areas performed significantly higher than those in remote areas (Figure 2.15). Students in metropolitan schools scored on average 25 points higher, the equivalent of almost three-quarters of

9 The percentages reported in this figure are unadjusted. To adjust for student and school socioeconomic background requires complicated analysis that would need to take into account ESCS within each proficiency level and this is deemed impracticable. Furthermore, adjusting for ESCS at either ends of the proficiency scale adds additional uncertainty to these levels.

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

a school year, than students attending provincial schools. The mean score difference between students attending metropolitan schools and students attending remote schools was even larger, at 67 score points on average, the equivalent of almost two years of schooling. Students in provincial schools scored on average 42 points higher than students in remote schools, the equivalent of almost one-and-a-quarter years of schooling.

The range of scores between the highest and lowest performing students was wider for students in remote schools than for students in metropolitan schools or students in provincial schools. The range of scores between students in the 5th and 95th percentiles was narrowest for students in provincial schools.

Geographic location	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Metropolitan	511	2.0	508–515	317	
Provincial	486	2.4	481–491	298	
Remote	444	15.6	413–475	359	

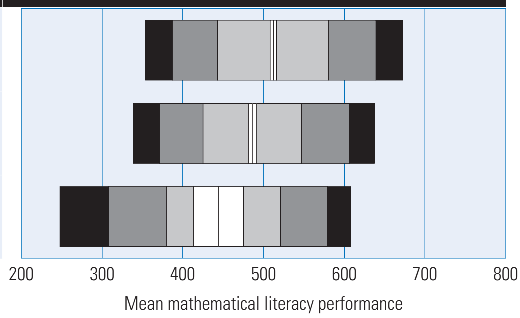


Figure 2.15 Mean scores and distribution of students' performance on the mathematical literacy scale, by geographic location

At the higher end of the proficiency scale, 17% of students in metropolitan schools were top performers in mathematical literacy (reaching Level 5 or 6), compared to 10% of students in provincial schools and 6% of students in remote schools.

At the lower end of the proficiency scale, 39% of students in remote schools failed to reach Level 2, with one-fifth of students performing below mathematical literacy proficiency Level 1. Eighteen per cent of students in metropolitan schools and 23% of students in provincial schools failed to reach Level 2 (Figure 2.16).

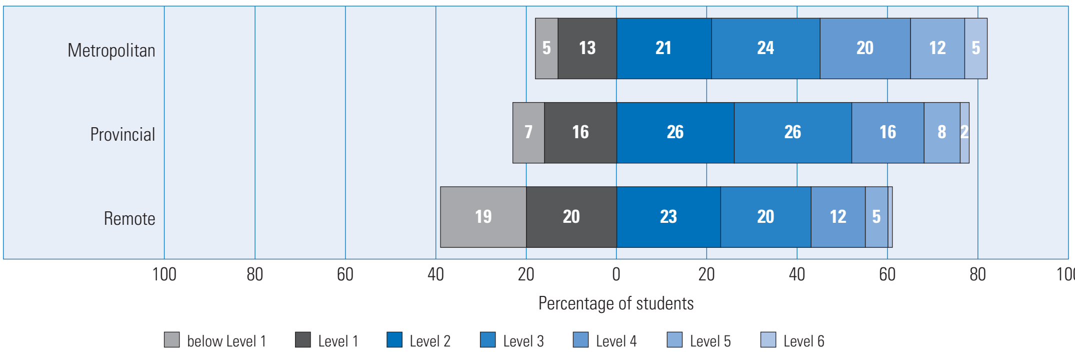


Figure 2.16 Percentage of students across the mathematical literacy proficiency scale, by geographical location

Mathematical literacy performance by Indigenous background

Indigenous background was derived from information provided by the school.[11] Figure 2.17 shows the performance by Indigenous and non-Indigenous students in mathematical literacy. Indigenous students achieved a mean score of 417 points (in the range of proficiency Level 1), which was significantly lower than both the OECD average of 494 points and the average score of 507 points for non-Indigenous

11 The Reader's Guide provides more information about the definition of Indigenous background.

students. The mean score difference of 90 points between Indigenous and non-Indigenous students equates to almost one-and-a-half proficiency levels or more than two-and-a-half years of schooling. The spread of scores between Indigenous students in the 5th and 95th percentiles was 308 points, which was similar to the range for non-Indigenous students.

Indigenous background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Indigenous	417	4.8	408–427	308
Non-Indigenous	507	1.6	504–510	311

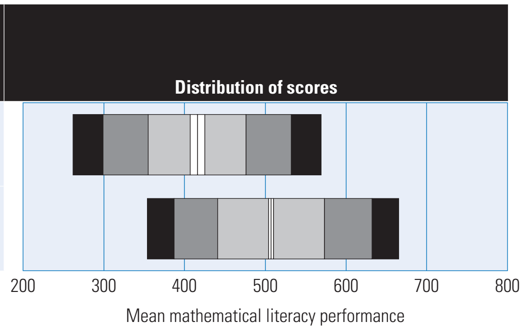


Figure 2.17 Mean scores and distribution of students' performance on the mathematical literacy scale, by Indigenous background

The results indicate that there is an under-representation of Indigenous students at the higher end of the mathematical literacy proficiency scale and an over-representation of Indigenous students at the lower proficiency levels, this can be seen in Figure 2.18. Two per cent of Indigenous students were top performers in mathematical literacy, including the 0.3% of Indigenous students who reached Level 6. The proportion of Indigenous students who reached Level 5 or 6 was substantially lower than the proportion of students across the OECD (12%) and the proportion of non-Indigenous students (15%).

Half of the Indigenous students failed to reach Level 2 and half of these students performed at below Level 1, that is, one-quarter of Indigenous students would be likely to have serious difficulties in using mathematics to prepare them in meeting future challenges. The proportion of low-performing Indigenous students (51%) was more than twice that of non-Indigenous students (18%) and the OECD average (23%).

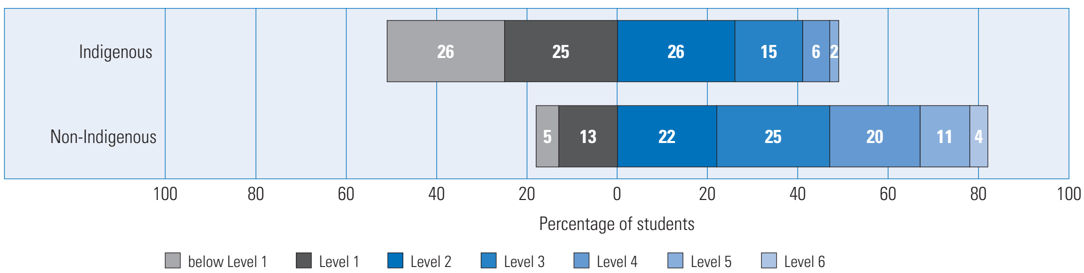


Figure 2.18 Percentage of students across the mathematical literacy proficiency scale, by Indigenous background

Mathematical literacy performance by sex and Indigenous background

Figure 2.19 shows that there was no difference in the performance of Indigenous males and females, with the mean score for Indigenous males of 417 score points not significantly different to the 418 score point average for Indigenous females. Indigenous males scored on average 96 points lower than non-Indigenous males, with the difference equating to more than one-and-a half proficiency levels or about two-and-three-quarters years of schooling. The mean score difference between Indigenous and non-Indigenous females was 83 points, the equivalent of almost one-and-a half proficiency levels or almost two-and-a-half years of schooling.

Indigenous background	Females Mean score	Females SE	Males Mean score	Males SE
Indigenous	418	4.3	417	7.5
Non-Indigenous	501	2.1	513	2.4

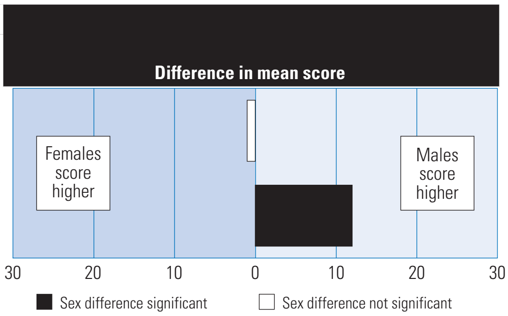


Figure 2.19 Mean scores and sex differences in students' performance on the mathematical literacy scale, by Indigenous background

There were similar proportions of Indigenous males and females who achieved Level 5 or 6 (2%). Among non-Indigenous students there were more males (18%) than females (13%) who attained the highest proficiency levels. Although the proportion of Indigenous females and males who did not reach Level 2 was similar, there was a higher proportion of Indigenous females at Level 1 (28%) than Indigenous males (22%), while there was a lower proportion of Indigenous females performing below Level 1 (23%) compared to Indigenous males (28%). The proportions of non-Indigenous females and males were similar at Level 1 and below Level 1. Figure 2.20 shows the proportions of Indigenous and non-Indigenous students at each mathematical literacy proficiency level by sex.

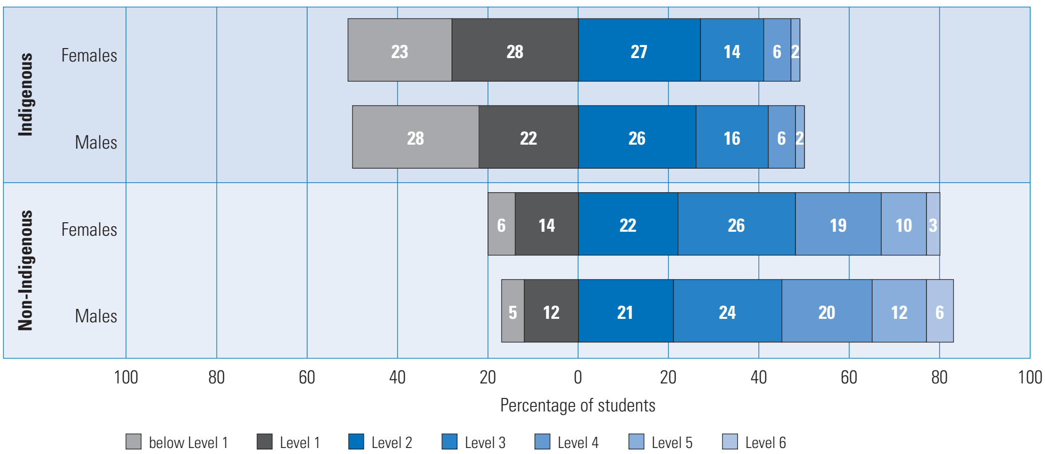


Figure 2.20 Percentage of students across the mathematical literacy proficiency scale, by Indigenous background and sex

Mathematical literacy performance by socioeconomic background

Socioeconomic background is measured by PISA's ESCS index, which is based on a number of questions about a student's family and home background.[12] The mean scores for mathematical literacy performance at each socioeconomic quartile (ESCS) are shown in Figure 2.21 and illustrate that, on average, students from higher socioeconomic backgrounds perform at a higher level than students from lower socioeconomic backgrounds.

Students in the highest socioeconomic quartile achieved a mean score of 550 points, which was substantially higher than the mean score for students in the lowest socioeconomic quartile of 463 points, a difference of 87 points on average. This equates to almost one-and-a-half proficiency levels or around two-and-a-half years of schooling. The mean score difference between one quartile and the next was significant, at around 30 points on average, which equates to about one-half of a proficiency level or almost one year of schooling.

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

Socioeconomic background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Lowest quartile	463	2.2	458–467	293	
Second quartile	492	1.9	488–495	292	
Third quartile	521	2.7	516–527	290	
Highest quartile	550	2.4	545–554	291	

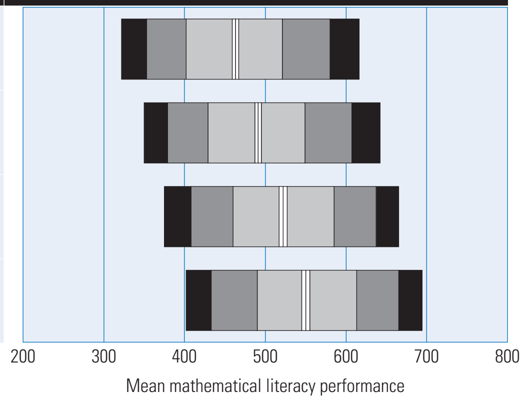


Figure 2.21 Mean scores and distribution of students' performance on the mathematical literacy scale, by socioeconomic background

The spread of scores between the highest and lowest performing students within each socioeconomic quartile was similar, at around 290 score points.

The proportion of top performers increased across each of the socioeconomic quartiles. Five per cent of students in the lowest socioeconomic quartile achieved Level 5 or 6 compared to 11% in the second socioeconomic quartile, 17% of students in the third socioeconomic quartile and 27% of students in the highest socioeconomic quartile.

The proportion of students who failed to reach Level 2 was lower with each increase in the socioeconomic quartile. One-third of students in the lowest socioeconomic quartile (33%) performed below Level 2, compared to one-fifth of students in the second socioeconomic quartile (22%), 13% of students in the third socioeconomic quartile and 8% of students in the highest socioeconomic quartile (Figure 2.22).

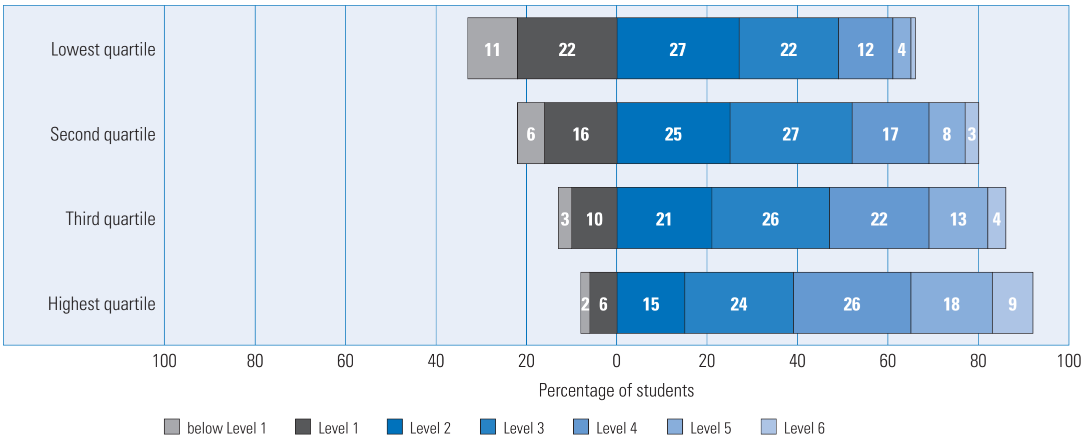


Figure 2.22 Percentage of students across the mathematical literacy proficiency scale, by socioeconomic background

Mathematical literacy performance by immigrant background

Immigrant background was measured on students' self-report of where they and their parents were born.[13] The mean mathematical literacy scores, together with the standard error, confidence intervals around the mean, the difference between the 5th and 95th percentiles and distribution of scores is shown in Figure 2.23. Australian-born students achieved a mean score of 500 points, which was significantly lower

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

than the mean score for foreign-born students (508 points) and first-generation students (518 points). First-generation students scored significantly higher than foreign-born students. The range of scores between the highest and lowest performing students was similar for foreign-born (326 score points) and first-generation students (324 score points on average), which was wider than the spread of scores for Australian-born students (298 score points).

Immigrant background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Australian-born	500	1.6	497–503	298
First-generation	518	3.0	513–524	324
Foreign-born	508	3.4	501–515	326

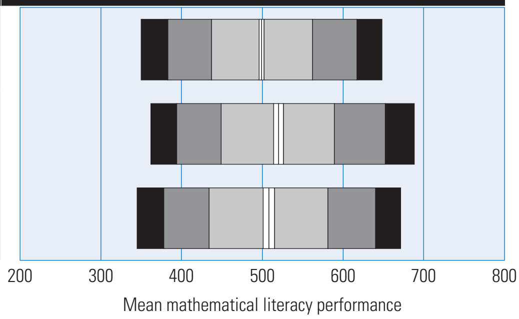


Figure 2.23 Mean scores and distribution of students' performance on the mathematical literacy scale, by immigrant background

At the higher end of the mathematical literacy proficiency scale, around one-fifth of first-generation students (19%) reached Level 5 or 6, a similar proportion for that of foreign-born students (17%), and a higher proportion than that of Australian-born students (13%).

One-fifth of Australian-born and foreign-born students failed to reach Level 2, while for first-generation students this proportion was slightly lower at 17% (Figure 2.24).

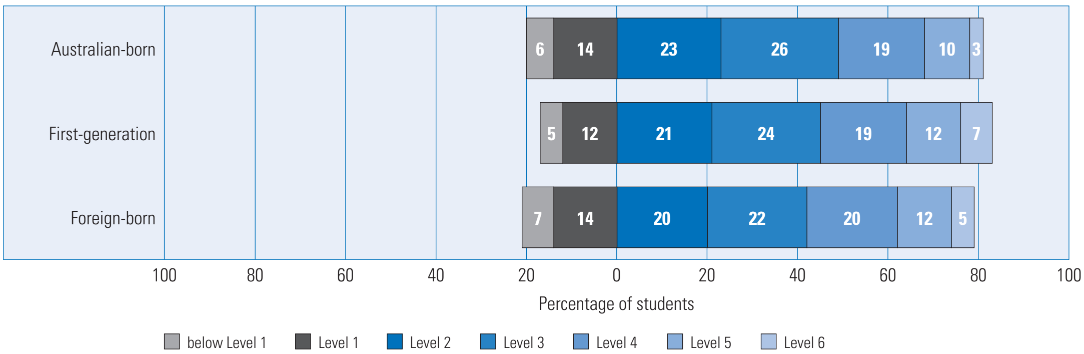


Figure 2.24 Percentage of students across the mathematical literacy proficiency scale, by immigrant background

Mathematical literacy performance by language background

Language background was measured by students' self-report about the main language spoken in their home. These details were collapsed into two categories: those students who speak English at home; and those students who speak a language other than English at home.

Students who spoke English at home scored 506 points on average, which was not significantly different from the 509 score point average for those students who spoke a language other than English at home. Figure 2.25 shows that the spread of scores for students who spoke a language other than English at home was wider (358 points) than for students who spoke English at home (306 score points).

Language background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
English spoken at home	506	1.5	503–509	306
Language other than English spoken at home	509	5.2	499–520	358

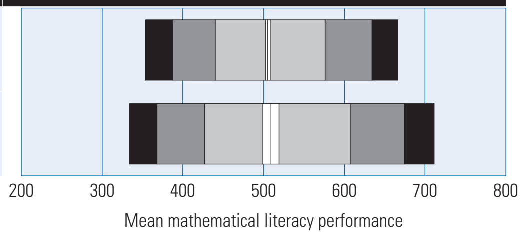


Figure 2.25 Mean scores and distribution of students' performance on the mathematical literacy scale, by language background

Figure 2.26 shows that the proportion of students who performed at Level 5 or 6 was lower for students who spoke English at home (14%) than for students who spoke a language other than English at home (21%). The proportion of students who failed to reach Level 2 was lower for students who spoke English at home (18%) than for students who spoke a language other than English at home (23%).

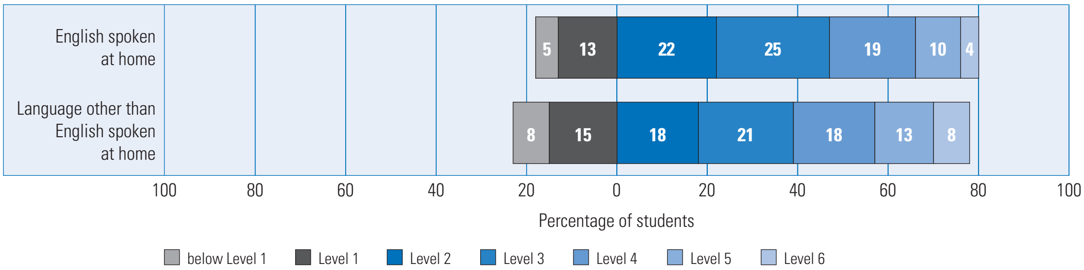


Figure 2.26 Percentage of students across the mathematical literacy proficiency scale, by language background

Mathematical literacy performance changes between PISA 2003 and PISA 2012

The first full assessment of mathematical literacy took place in PISA 2003, when mathematical literacy was the major domain. In 2012, the PISA cycle returned to assessing mathematical literacy as a major domain. This fifth cycle of PISA enables comparisons in mathematical literacy performance to be reported across the four most recent cycles of PISA.

Mathematical literacy performance changes across countries

When comparing mathematical literacy performance over time, only those countries with valid data to compare between cycles have been included. E.g., the PISA 2003 results in the United Kingdom cannot be compared to those of other cycles because they failed to meet the required response rates. Table 2.3 identifies those countries where data is not available for one or more PISA cycles.

Those countries with a mean performance in mathematical literacy that was lower than the mean performance of the lowest scoring OECD country, Mexico, have not been included for comparison in Table 2.3. The results of 12 countries have not been reported in the discussion of trends: Albania, Argentina, Brazil, Colombia, Costa Rica, Indonesia, Jordan, Montenegro, Peru, Qatar, Tunisia and Uruguay.

Table 2.3 shows the mean scores on mathematical literacy performance for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, along with the difference in mean score between PISA 2003 and PISA 2012. A number of countries have seen a significant improvement in their mathematical literacy performance between PISA 2003 and PISA 2012. Eight countries showed a significant improvement: Thailand improved by 10 score points; Germany and Macao–China by 11 score points; Italy by 20 score points;

Portugal by 21 score points; Turkey by 25 score points; Poland by 27 score points; and Mexico by 28 score points. A number of countries, all OECD countries, have seen a significant decline in their mathematical literacy performance between PISA 2003 and PISA 2012. The mean performance of Sweden declined by 31 score points, Finland by 26 score points, New Zealand by 24 score points, Iceland by 22 score points and Australia by 20 score points. Mathematical literacy performance in Hungary, Denmark, Canada, Belgium, the Netherlands, France, the Slovak Republic and the Czech Republic also declined significantly, with performance falling from 13 score points on average in Hungary to 17 score points on average in the Czech Republic.

Table 2.3 Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by country

	PISA 2003		PISA 2006		PISA 2009		PISA 2012		Mean score difference between 2003 and 2012 (PISA 2012 – PISA 2003)	
Country	**Mean score**	**SE**	**Mean score**	**SE**	**Mean score**	**SE**	**Mean score**	**SE**	**Score dif.**	**SE**
Australia	524	2.1	520	2.2	514	2.5	504	1.6	**–20**	3.3
Austria	506	3.3	505	3.7	✧	✧	506	2.7	0	4.6
Belgium	529	2.3	520	3.0	515	2.3	515	2.1	**–15**	3.6
Bulgaria	✧	✧	413	6.1	428	5.9	439	4.0	✧	✧
Canada	532	1.8	527	2.0	527	1.6	518	1.8	**–14**	3.2
Chile	✧	✧	411	4.6	421	3.1	423	3.1	✧	✧
Chinese Taipei	✧	✧	549	4.1	543	3.4	560	3.3	✧	✧
Croatia	✧	✧	467	2.4	460	3.1	471	3.5	✧	✧
Czech Republic	516	3.5	510	3.6	493	2.8	499	2.9	**–17**	4.9
Denmark	514	2.7	513	2.6	503	2.6	500	2.3	**–14**	4.1
Estonia	✧	✧	515	2.7	512	2.6	521	2.0	✧	✧
Finland	544	1.9	548	2.3	541	2.2	519	1.9	**–26**	3.3
France	511	2.5	496	3.2	497	3.1	495	2.5	**–16**	4.0
Germany	503	3.3	504	3.9	513	2.9	514	2.9	**11**	4.8
Greece	445	3.9	459	3.0	466	3.9	453	2.5	8	5.0
Hong Kong–China	550	4.5	547	2.7	555	2.7	561	3.2	11	5.9
Hungary	490	2.8	491	2.9	490	3.5	477	3.2	**–13**	4.7
Iceland	515	1.4	506	1.8	507	1.4	493	1.7	**–22**	2.9
Ireland	503	2.4	501	2.8	487	2.5	501	2.2	–1	3.8
Israel	✧	✧	442	4.3	447	3.3	466	4.7	✧	✧
Italy	466	3.1	462	2.3	483	1.9	485	2.0	**20**	4.2
Japan	534	4.0	523	3.3	529	3.3	536	3.6	2	5.7
Kazakhstan	✧	✧	✧	✧	405	3.0	432	3.0	✧	✧
Korea	542	3.2	547	3.8	546	4.0	554	4.6	12	5.9
Latvia	483	3.7	486	3.0	482	3.1	491	2.8	7	5.0
Liechtenstein	536	4.1	525	4.2	536	4.1	535	4.0	–1	6.0
Lithuania	✧	✧	486	2.9	477	2.6	479	2.6	✧	✧
Luxembourg	493	1.0	490	1.1	489	1.2	490	1.1	–3	2.4
Macao–China	527	2.9	525	1.3	525	0.9	538	1.0	**11**	3.6
Malaysia	✧	✧	✧	✧	404	2.7	421	3.2	✧	✧
Mexico	385	3.6	406	2.9	419	1.8	413	1.4	**28**	4.3
Netherlands	538	3.1	531	2.6	526	4.7	523	3.5	**–15**	5.1
New Zealand	523	2.3	522	2.4	519	2.3	500	2.2	**–24**	3.7
Norway	495	2.4	490	2.6	498	2.4	489	2.7	–6	4.1
OECD average 2003	500	0.6	498	0.5	499	0.6	496	0.5	–3	2.1
OECD average 2006			494	0.5	496	0.5	494	0.5		
OECD average 2009					496	0.5	494	0.5		
Poland	490	2.5	495	2.4	495	2.8	518	3.6	**27**	4.8
Portugal	466	3.4	466	3.1	487	2.9	487	3.8	**21**	5.5
Romania	✧	✧	415	4.2	427	3.4	445	3.8	✧	✧
Russian Federation	468	4.2	476	3.9	468	3.3	482	3.0	**14**	5.5
Serbia	✧	✧	435	3.5	442	2.9	449	3.4	✧	✧
Shanghai–China	✧	✧	✧	✧	600	2.8	613	3.3	✧	✧
Singapore	✧	✧	✧	✧	562	1.4	573	1.3	✧	✧
Slovak Republic	498	3.3	492	2.8	497	3.1	482	3.4	**–17**	5.2
Slovenia	✧	✧	504	1.0	501	1.2	501	1.2	✧	✧
Spain	485	2.4	480	2.3	483	2.1	484	1.9	–1	3.6
Sweden	509	2.6	502	2.4	494	2.9	478	2.3	**–31**	3.9
Switzerland	527	3.4	530	3.2	534	3.3	531	3.0	4	4.9
Thailand	417	3.0	417	2.3	419	3.2	427	3.4	**10**	5.0
Turkey	423	6.7	424	4.9	445	4.4	448	4.8	**25**	8.5
United Kingdom	✧	✧	495	2.1	492	2.4	494	3.3	✧	✧
United States	483	2.9	474	4.0	487	3.6	481	3.6	–2	5.0

Notes: In some cases, data is not available because they were not submitted by the country or were collected but subsequently removed for technical reasons. These cells have been denoted with the symbol ✧.
Values that are statistically signficant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

For the remaining countries with comparable data, there were no statistically significant changes in mathematical literacy performance between PISA 2003 and PISA 2012.

The position of Australia relative to other participating countries in PISA 2003 through to PISA 2012 mathematical literacy is shown in Table 2.4. Countries are shown in order of the highest to the lowest performing country in mathematical literacy in PISA 2012. In PISA 2012, 16 countries performed significantly higher than Australia in mathematics. Of these countries, seven (Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, the Netherlands and Finland) have outperformed Australia in every PISA cycle in which they have participated.

Of the other countries that significantly outperformed Australia in PISA 2012 mathematical literacy, Macao–China, Japan, Liechtenstein, Switzerland, Estonia and Canada have performed at a level statistically similar to Australia in one or more previous cycles, while Belgium had performed at a similar level to Australia since PISA 2003. Poland and Germany have both performed significantly lower than Australia in previous mathematics assessments, but performed significantly higher than Australia in PISA 2012.

To further examine Australia's mean performance across the four PISA cycles, Figure 2.27 shows the distribution of mathematical literacy performance for Australia—the mean score together with the corresponding confidence interval, and the 10th, 25th, 75th and 90th percentiles—for four cycles of PISA. In PISA 2003, Australia achieved a mean score of 524 points, which decreased by 4 score points on average in PISA 2006. In PISA 2009, the mean score for Australia was 514 points, which was significantly lower than the mean score in PISA 2003.

The percentiles provide further detail in helping to understand where the decline in Australia's mathematical literacy performance has occurred. As can be seen in Figure 2.27, the decline in mean scores can be observed among low-, average- and top-performing students alike. There has been a significant decline at each of the percentiles between PISA 2003 and PISA 2012. Mathematical literacy performance at the 10th and 25th percentiles declined significantly by 17 and 23 score points respectively, while for the 75th and 90th percentiles, the decline (again significant) was 21 and 14 score points respectively.

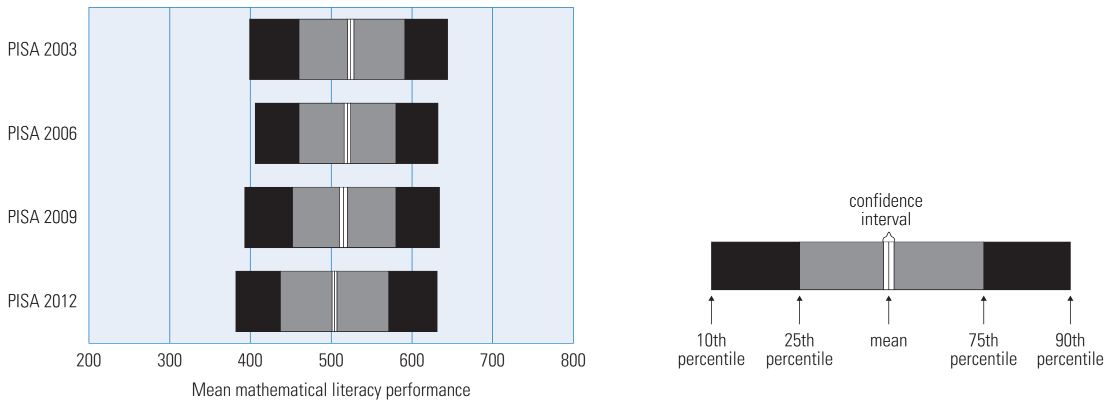


Figure 2.27 Means and percentiles on the mathematical literacy scale for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, for Australia

Figure 2.28 shows the proportion of students who performed at Level 5 or 6 in mathematical literacy for PISA 2003 and PISA 2012: the top-performing students. In this figure, countries have been ordered from the lowest to highest proportion of students at Level 5 or 6 (with countries with the lowest proportion of students at Level 5 or 6 in PISA 2012 placed at the left of the figure and countries with the highest proportion of students at Level 5 or 6 in PISA 2012 placed at the right). Across the OECD countries (for which data could be compared), there was a 2% decrease (from 15 to 13%) in the proportion of top-performing students from PISA 2003 to PISA 2012.

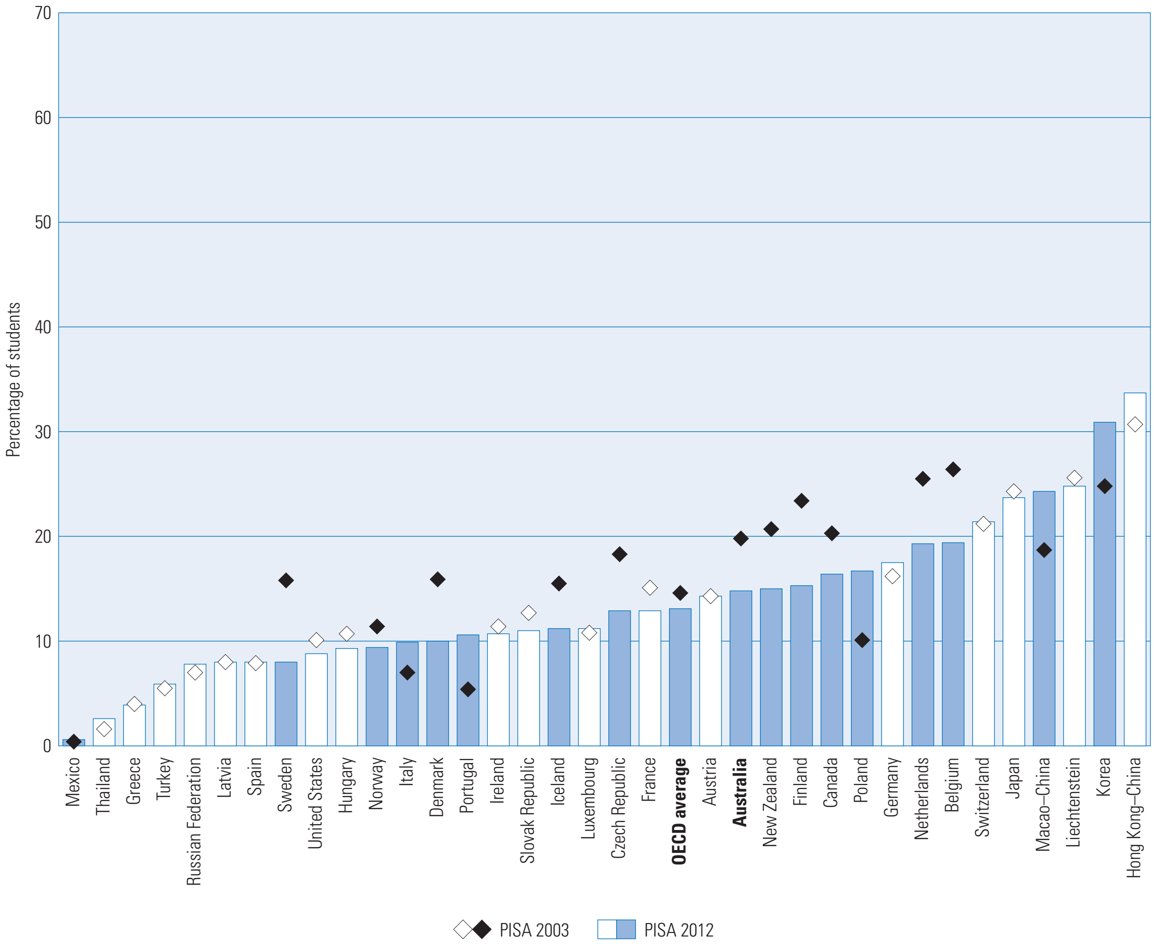
Table 2.4 Relative trends in mathematical literacy performance, by country

Country	Position relative to Australia in			
	PISA 2012	PISA 2009	PISA 2006	PISA 2003
Shanghai–China	▲	▲	–	–
Singapore	▲	▲	–	–
Hong Kong–China	▲	▲	▲	▲
Chinese Taipei	▲	▲	▲	–
Korea	▲	▲	▲	▲
Macao–China	▲	▲	▲	●
Japan	▲	▲	●	●
Liechtenstein	▲	▲	●	●
Switzerland	▲	▲	▲	●
Netherlands	▲	▲	▲	▲
Estonia	▲	●	●	–
Finland	▲	▲	▲	▲
Canada	▲	▲	▲	●
Poland	▲	▼	▼	▼
Belgium	▲	●	●	●
Germany	▲	●	▼	▼
Vietnam	●	–	–	–
Austria	●	▼	▼	▼
Australia				
Ireland	●	▼	▼	▼
Slovenia	●	▼	▼	–
Denmark	●	▼	▼	●
New Zealand	●	●	●	●
Czech Republic	●	▼	▼	●
OECD average 2009	—	▼	—	—
France	●	▼	▼	▼
OECD average 2012	▼	—	—	—
United Kingdom	▼	▼	▼	*
Iceland	▼	▼	▼	●
OECD average 2006	–	—	▼	—
Latvia	▼	▼	▼	▼
Luxembourg	▼	▼	▼	▼
Norway	▼	▼	▼	▼
Portugal	▼	▼	▼	▼
Italy	▼	▼	▼	▼
Spain	▼	▼	▼	▼
Russian Federation	▼	▼	▼	▼
Slovak Republic	▼	▼	▼	▼
OECD average 2003	—	—	—	▼
United States	▼	▼	▼	▼
Lithuania	▼	▼	▼	–
Sweden	▼	▼	▼	▼
Hungary	▼	▼	▼	▼
Croatia	▼	▼	▼	–
Israel	▼	▼	▼	–
Greece	▼	▼	▼	▼
Serbia	▼	▼	▼	▼
Turkey	▼	▼	▼	▼
Romania	▼	▼	▼	–
Cyprus	▼	–	–	–
Bulgaria	▼	▼	▼	–
United Arab Emirates	▼	▼	–	–
Kazakhstan	▼	–	▼	–
Azerbaijan	–	▼	▼	–
Thailand	▼	▼	▼	▼
Chile	▼	▼	▼	–
Malaysia	▼	–	–	–
Mexico	▼	▼	▼	▼

Notes:
- ▲ Performance statistically higher than Australia
- ● Performance not significantly different to that of Australia
- ▼ Performance statistically lower than Australia
- – Did not participate in this cycle
- — Not applicable
- * Participated in this cycle, but data cannot be compared

There were six countries that showed a significant improvement in the proportion of students who reached Level 5 or 6 from PISA 2003 to PISA 2012. In Poland, there was a 7% increase, in Korea and Macao–China, there was a 6% increase, in Portugal, there was a 5% increase, in Italy, there was a 3% increase, and in Mexico, there was a 1% increase in the proportion of students achieving the highest proficiency levels in mathematical literacy.

Eleven countries showed a significant decline in the proportion of students reaching Level 5 or above, that is, there were fewer top-performing students in PISA 2012 than in PISA 2003. These countries were: Finland and Sweden (an 8% reduction); Belgium (7%); the Netherlands, Denmark and New Zealand (6%); the Czech Republic and Australia (5%); Iceland and Canada (4%); and Norway (2%).



Note: A coloured bar and a coloured diamond indicate that the difference in the proportion of students between PISA 2003 and PISA 2012 was significant.

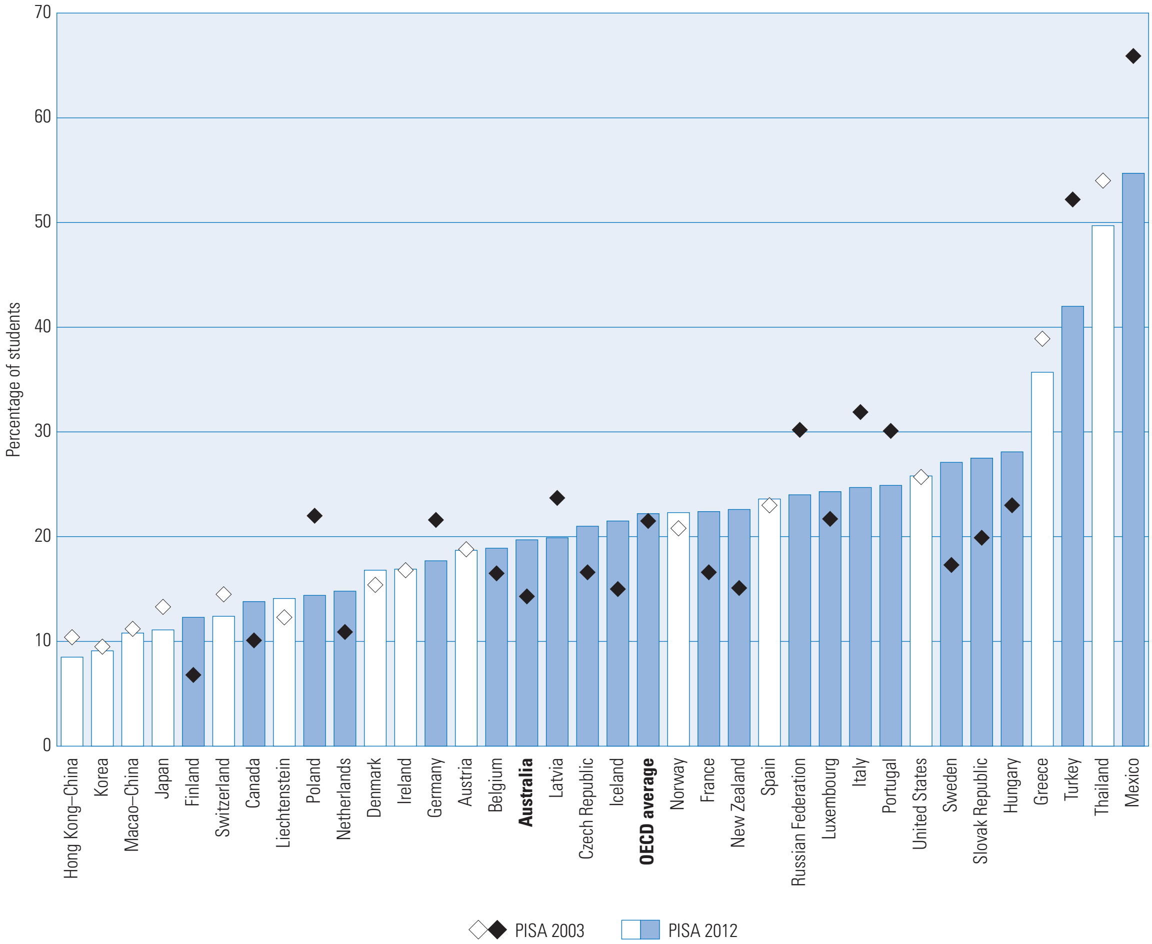
Figure 2.28 Percentage of students performing at Level 5 or above on mathematical literacy in PISA 2003 and PISA 2012, by country[14]

Figure 2.29 has a similar layout to Figure 2.28, except it shows the proportion of students who did not reach proficiency Level 2 in mathematical literacy for PISA 2003 and PISA 2012: the low performers. A number of countries lifted the performance of their low-performing students. Across the OECD countries (those for which data could be compared), there was a 0.7% increase in the proportion of low-performing students from PISA 2003 to PISA 2012.

In eight countries, the proportion of low-performing students significantly decreased from PISA 2003 to PISA 2012: Mexico (an 11% reduction); Turkey (10%); Poland (8%); Italy (7%); the Russian Federation (6%); Portugal (5%); and Germany and Latvia (4%).

14 A number of countries do not have data available for PISA 2003 and, subsequently, have not been included in this figure. These countries are: Bulgaria, Chile, Chinese Taipei, Croatia, Estonia, Israel, Kazakhstan, Lithuania, Malaysia, Romania, Serbia, Shanghai–China, Singapore, Slovenia and the United Kingdom.

There were thirteen countries in which the proportion of low-performing students significantly increased from PISA 2003 to PISA 2012. Sweden showed the largest change, with 10% more students not achieving proficiency Level 2. In New Zealand and the Slovak Republic, there was an 8% increase, in Iceland, France and Finland, a 6% increase, in Australia and Hungary, a 5% increase, in the Czech Republic, the Netherlands and Canada, a 4% increase, in Luxembourg, a 3% increase, and in Belgium, there was a 2% increase.



Note: A coloured bar and a coloured diamond indicate that the difference in the proportion of students between PISA 2003 and PISA 2012 was significant.

Figure 2.29 Percentage of students performing below Level 2 on mathematical literacy in PISA 2003 and PISA 2012, by country[15]

The mean proportion of students in Australia performing at each mathematical literacy proficiency level in PISA 2003, PISA 2006, PISA 2009 and PISA 2012 is shown in Figure 2.30 and illustrates a shift in performance at either end of the proficiency scale. From PISA 2003 to PISA 2012, there has been a decline in the proportion of top-performing students and an increase in the proportion of low-performing students. The proportion of students who achieved Level 5 or 6 in mathematical literacy was 20% in PISA 2003, 16% in PISA 2006 and 2009, and 15% in PISA 2012, while the proportion of students who failed to reach Level 2 was 14% in PISA 2003, 13% in PISA 2006, 16% in PISA 2009 and 20% in PISA 2012.

15 A number of countries do not have data available for PISA 2003 and, subsequently, have not been included in this figure. These countries are: Bulgaria, Chile, Chinese Taipei, Croatia, Estonia, Israel, Kazakhstan, Lithuania, Malaysia, Romania, Serbia, Shanghai–China, Singapore, Slovenia and the United Kingdom.

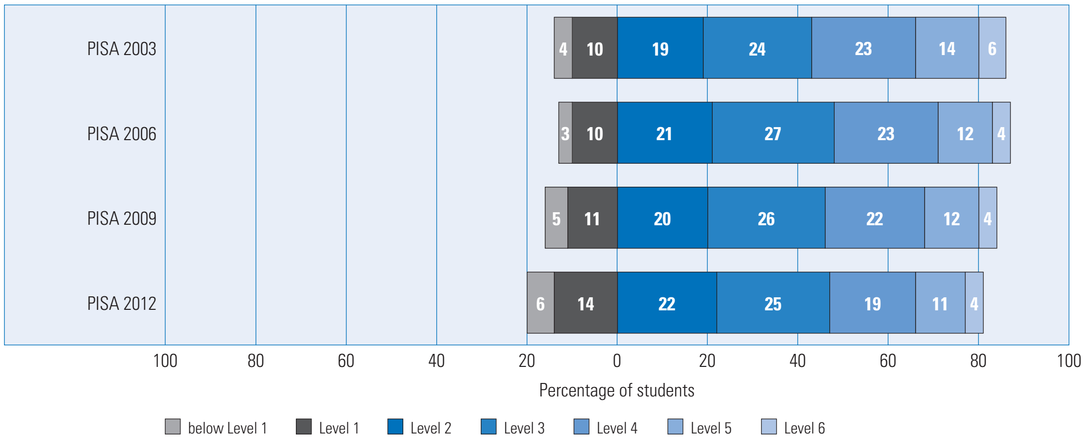


Figure 2.30 Percentage of students across the mathematical literacy proficiency scale for PISA 2003, PISA 2006, PISA 2009 and PISA 2012 in Australia

Mathematical literacy performance changes by sex across countries

Table 2.5 shows the mean mathematical literacy scores for females and males in PISA 2003 and PISA 2012, along with the mean differences for females and males. Across OECD countries, the performance for females and males declined significantly, with a mean score difference of 4 score points for both females and males.

In the majority of countries for which data can be compared between PISA 2003 and PISA 2012, there was a significant decline in the mean performance for females and for males. This included Australia, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Hungary, Iceland, the Netherlands, New Zealand, the Slovak Republic and Sweden. The decline for females, ranged from 12 score points in the Slovak Republic to 27 score points in Iceland. For males, the decline ranged from 12 score points in Hungary and the Netherlands to 35 score points in Sweden. In Australia, there was a 24 score point difference in the mathematical literacy performance for females and a 17 score point difference for males between PISA 2003 and PISA 2012.

In four countries—Mexico, Poland, Portugal and Turkey—the mean performance for females and males improved significantly by 20 score points or more.

In a number of countries, mathematical literacy performance between PISA 2003 and PISA 2012 has significantly changed for only one sex. The performance of females has significantly declined in Luxembourg, while in Greece, Italy, Korea, Latvia, Macao–China, the Russian Federation and Thailand, the performance of females has significantly improved. In Germany, the performance of males has significantly improved.

As indicated above, the mean performance for Australian females and males decreased significantly between PISA 2003 and PISA 2012. Table 2.6 shows further details of the mean scores for females and males across each PISA cycle. In PISA 2003, Australian females achieved a mean score of 522 points, an average of 24 points higher than their mean performance in PISA 2012 (498 points). For Australian males, there has been a decline of 17 score points on average from PISA 2003 (with a mean score of 527 points) to PISA 2012 (with a mean score of 510 points). Significant differences between the sexes, in favour of males, were also found in PISA 2006, with a 14 score point difference, and in PISA 2009, with a 10 score point difference.

Table 2.5 Mean mathematical literacy scores for PISA 2003 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by country

Country	PISA 2003						PISA 2012						Difference in mean score between 2003 and 2012 (PISA 2012 – 2003)			
	Females		Males		Females – Males		Females		Males		Females – Males		Females		Males	
	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score dif.	SE	Mean score dif.	SE
Australia	522	2.7	527	3.0	–5	3.8	498	2.0	510	2.4	**–12**	3.1	**–24**	3.9	**–17**	4.3
Austria	502	4.0	509	4.0	–8	4.4	494	3.3	517	3.9	**–22**	4.9	–7	5.5	7	5.9
Belgium	525	3.2	533	3.4	–8	4.8	512	2.6	518	2.8	–6	3.4	**–14**	4.6	**–15**	4.8
Canada	530	1.9	541	2.1	**–11**	2.1	513	2.1	523	2.1	**–10**	2.0	**–17**	3.4	**–18**	3.5
Czech Republic	509	4.4	524	4.3	**–15**	5.1	493	3.6	505	3.7	**–12**	4.6	**–16**	6.0	**–19**	6.0
Denmark	506	3.0	523	3.4	**–17**	3.2	493	2.3	507	2.9	**–14**	2.3	**–13**	4.2	**–16**	4.8
Finland	541	2.1	548	2.5	**–7**	2.7	520	2.2	517	2.6	3	2.9	**–20**	3.6	**–31**	4.1
France	507	2.9	515	3.6	**–9**	4.2	491	2.5	499	3.4	**–9**	3.4	**–16**	4.3	**–16**	5.3
Germany	499	3.9	508	4.0	**–9**	4.4	507	3.4	520	3.0	**–14**	2.8	8	5.5	**12**	5.4
Greece	436	3.8	455	4.8	**–19**	3.6	449	2.6	457	3.3	**–8**	3.2	**13**	5.0	2	6.1
Hong Kong–China	548	4.6	552	6.5	–4	6.6	553	3.9	568	4.6	**–15**	5.7	5	6.3	16	8.2
Hungary	486	3.3	494	3.3	**–8**	3.5	473	3.6	482	3.7	**–9**	3.7	**–13**	5.3	**–12**	5.4
Iceland	523	2.2	508	2.3	**15**	3.5	496	2.3	490	2.3	**6**	3.0	**–27**	3.7	**–18**	3.8
Ireland	495	3.4	510	3.0	**–15**	4.2	494	2.6	509	3.3	**–15**	3.8	–2	4.7	–1	4.8
Italy	457	3.8	475	4.6	**–18**	5.9	476	2.2	494	2.4	**–18**	2.5	**19**	4.8	**19**	5.5
Japan	530	4.0	539	5.8	–8	5.9	527	3.6	545	4.6	**–18**	4.3	–3	5.7	6	7.7
Korea	528	5.3	552	4.4	**–23**	6.8	544	5.1	562	5.8	**–18**	6.2	**16**	7.7	10	7.5
Latvia	482	3.6	485	4.8	–3	4.0	493	3.2	489	3.4	4	3.6	**10**	5.1	4	6.2
Liechtenstein	521	6.3	550	7.2	**–29**	10.9	523	5.8	546	6.0	**–23**	8.8	2	8.7	–4	9.6
Luxembourg	485	1.5	502	1.9	**–17**	2.8	477	1.4	502	1.5	**–25**	2.0	**–8**	2.8	0	3.1
Macao–China	517	3.3	538	4.8	**–21**	5.8	537	1.3	540	1.4	–3	1.9	**20**	4.0	1	5.4
Mexico	380	4.1	391	4.3	**–11**	3.9	406	1.4	420	1.6	**–14**	1.2	**26**	4.7	**30**	4.9
Netherlands	535	3.5	540	4.1	–5	4.3	518	3.9	528	3.6	**–10**	2.8	**–17**	5.6	**–12**	5.7
New Zealand	516	3.2	531	2.8	**–14**	3.9	492	2.9	507	3.2	**–15**	4.3	**–24**	4.7	**–24**	4.7
Norway	492	2.9	498	2.8	–6	3.2	488	3.4	490	2.8	–2	3.0	–4	4.9	–8	4.4
OECD average	494	0.7	505	0.7	**–11**	0.8	491	0.6	502	0.6	**–11**	0.6	**–4**	1.0	**–4**	1.0
Poland	487	2.9	493	3.0	–6	3.1	516	3.8	520	4.3	–4	3.4	**28**	5.1	**27**	5.5
Portugal	460	3.4	472	4.2	**–12**	3.3	481	3.9	493	4.1	**–11**	2.5	**21**	5.6	**20**	6.2
Russian Federation	463	4.2	473	5.3	**–10**	4.4	483	3.1	481	3.7	2	3.0	**20**	5.5	8	6.7
Slovak Republic	489	3.6	507	3.9	**–19**	3.7	477	4.1	486	4.1	**–9**	4.5	**–12**	5.7	**–21**	6.0
Spain	481	2.2	490	3.4	**–9**	3.0	476	2.0	492	2.4	**–16**	2.2	–5	3.5	3	4.6
Sweden	506	3.1	512	3.0	**–7**	3.3	480	2.4	477	3.0	3	3.0	**–26**	4.4	**–35**	4.6
Switzerland	518	3.6	535	4.7	**–17**	4.9	524	3.1	537	3.5	**–13**	2.7	7	5.2	3	6.2
Thailand	419	3.4	415	4.0	4	4.2	433	4.1	419	3.6	**14**	3.6	**14**	5.6	4	5.7
Turkey	415	6.7	430	7.9	**–15**	6.2	444	5.7	452	5.1	–8	4.7	**29**	9.0	**22**	9.6
United States	480	3.2	486	3.3	**–6**	2.9	479	3.9	484	3.8	–5	2.8	–1	5.4	–2	5.4

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 2.6 Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012 on the mathematical literacy scale for Australia by sex

PISA cycle	Females		Males		Difference (Female – Male)	
	Mean score	SE	Mean score	SE	Score dif.	SE
PISA 2003	522	2.7	527	3.0	–5	3.8
PISA 2006	513	2.4	527	3.2	**–14**	3.4
PISA 2009	509	2.8	519	3.0	**–10**	2.9
PISA 2012	498	2.0	510	2.4	**–12**	3.1

Note: Values that are statistically significant are indicated in bold.

Mathematical literacy performance changes across the Australian jurisdictions

Table 2.7 shows the mean mathematical literacy scores in PISA 2003, PISA 2006, PISA 2009 and PISA 2012, together with the differences in performance between PISA 2003 and PISA 2012 for the jurisdictions. All jurisdictions, except Victoria, showed a significant decline in their mathematical literacy performance. The largest change was in South Australia and the Northern Territory with a decrease of 46 and 45 score points on average respectively, followed by Western Australia, Tasmania and the Australian Capital Territory with decreases around 30 score points on average, and then in New South Wales and Queensland with decreases around 16 score points on average.

Table 2.7 Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by jurisdiction

Jurisdiction	PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2003 and 2012 (PISA 2012 – PISA 2003)	
	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
ACT	548	3.5	539	5.6	528	6.4	518	3.6	**–30**	5.4
NSW	526	4.3	523	5.0	512	5.2	509	3.6	**–17**	5.9
VIC	511	5.1	513	4.0	512	4.9	501	3.7	–10	6.6
QLD	520	6.9	519	4.4	518	7.5	503	2.9	**–16**	7.7
SA	535	4.9	520	4.3	509	5.3	489	3.3	**–46**	6.2
WA	548	4.1	531	6.5	529	7.2	516	3.4	**–32**	5.7
TAS	507	9.4	502	3.8	487	5.1	478	3.4	**–30**	10.2
NT	496	4.9	481	6.2	487	4.9	452	10.4	**–45**	11.6

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

The mean mathematical literacy scores from PISA 2003 to PISA 2012—as well as the mean score difference in mathematical literacy between PISA 2003 and PISA 2012—for females and males by jurisdiction is shown in Table 2.8. Females in all jurisdictions, except Victoria, showed a significant decline in their mathematical literacy performance. The largest change was found in the Northern Territory with a decrease of 56 score points on average, which equates to almost one proficiency level or around one-and-a-half years of schooling. This was followed by South Australia with 47 score points on average and Western Australia with 42 score points on average, then Tasmania and the Australian Capital Territory with around 30 score points on average, and Queensland and New South Wales with around 20 score points on average.

There was a statistically significant decline in the mathematical literacy performance of males in five jurisdictions. In South Australia, the mean mathematical literacy performance for males dropped 44 score points on average. In the Australian Capital Territory and the Northern Territory there was a decline of around 30 score points on average, and in Western Australia and Tasmania there was a decline of around 25 score points on average.

Table 2.8 Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by jurisdiction and sex

Jurisdiction	Females										Males									
	PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2003 and 2012 (PISA 2012 – PISA 2003)		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2003 and 2012 (PISA 2012 – PISA 2003)	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE
ACT	547	12.2	529	6.6	524	9.2	517	4.6	**–31**	13.1	548	10.2	548	8.8	532	10.5	518	5.5	**–30**	11.7
NSW	524	3.9	518	4.6	509	5.2	505	4.0	**–19**	5.9	529	6.9	527	7.9	516	7.1	513	5.6	–16	9.1
VIC	503	6.2	501	5.3	505	6.0	491	3.7	–12	7.4	518	6.6	524	4.9	520	5.8	509	5.1	–9	8.5
QLD	521	8.6	513	5.8	513	7.2	500	3.6	**–21**	9.6	518	7.7	526	4.6	523	8.5	507	3.9	–11	8.9
SA	530	7.1	514	5.6	502	4.4	483	3.9	**–47**	8.4	540	7.0	527	5.1	516	6.8	495	4.3	**–44**	8.4
WA	546	4.3	522	7.3	525	7.9	504	4.5	**–42**	6.6	551	5.7	541	8.2	532	8.7	528	5.3	**–23**	8.0
TAS	508	9.9	494	4.4	481	8.7	473	4.9	**–35**	11.3	507	10.7	510	5.1	492	6.9	482	4.9	**–25**	11.9
NT	501	7.7	474	10.3	485	7.4	445	15.0	**–56**	17.0	491	6.2	487	5.4	490	5.4	459	9.9	**–32**	11.9

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

In four jurisdictions (South Australia, Western Australia, Tasmania and the Northern Territory), there was a significant increase in the proportion of low-performing students and a significant decrease in the proportion of top-performing students between PISA 2003 and PISA 2012. There were 12% more students in South Australia, 8% in Western Australia, 9% in Tasmania and 14% in the Northern Territory who had not reached Level 2 in PISA 2012 compared to PISA 2003. There were 13% fewer students in South Australia, 10% in Western Australia, 5% in Tasmania and 8% in the Northern Territory who had not reached Level 5 or above in PISA 2012 compared to PISA 2003 (Table 2.9).

In the Australian Capital Territory, the proportion of top-performing students decreased significantly (by 9%) between PISA 2003 and PISA 2012, while in New South Wales, the proportion of low-performing students significantly increased (by 6%).

Table 2.9 Percentage of students performing below Level 2 and at Level 5 or above on mathematical literacy in PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012, by jurisdiction

Jurisdiction	PISA 2003				PISA 2006				PISA 2009				PISA 2012				Difference between 2003 and 2012 (PISA 2012 – PISA 2003)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	11	1.3	27	1.8	10	1.7	23	2.3	14	2.1	21	2.4	16	1.7	19	1.7	5	2.1	**–9**	2.5
NSW	14	1.2	20	1.9	13	1.2	18	2.0	17	1.3	16	1.9	20	1.1	18	1.4	**6**	1.6	–3	2.4
VIC	17	1.6	15	1.4	14	1.2	14	1.3	16	1.7	15	1.3	19	1.2	12	1.4	2	2.0	–3	2.0
QLD	16	2.1	18	2.2	13	1.1	16	1.5	15	1.5	18	2.8	20	1.2	15	1.1	3	2.4	–4	2.4
SA	11	1.3	23	1.9	12	1.7	15	1.4	16	1.8	14	1.8	23	1.4	10	1.1	**12**	1.9	**–13**	2.2
WA	8	1.0	28	1.6	11	2.1	21	1.9	13	1.9	22	2.4	16	1.2	17	1.4	**8**	1.6	**–10**	2.1
TAS	18	3.3	14	2.3	18	1.8	12	1.3	24	2.3	10	1.3	27	1.6	9	1.2	**9**	3.6	**–5**	2.6
NT	21	1.9	14	2.9	25	2.5	11	1.5	24	2.7	10	1.6	36	4.2	7	2.2	**14**	4.7	**–8**	3.7

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Mathematical literacy performance changes for Indigenous students

Mathematical literacy performance for Indigenous students remained constant from PISA 2003 to PISA 2009. In PISA 2012, Indigenous students achieved a mean score of 417 points, which was significantly lower, by 23 score points on average, than the mean mathematical literacy score in PISA 2003 (Table 2.10).

The average mathematical literacy performance for non-Indigenous students has been decreasing from PISA 2003, with a significant decline of 19 score points on average between PISA 2003 and PISA 2012.

Table 2.10 Mean mathematical literacy scores for PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2003 and PISA 2012, by Indigenous background

Indigenous background	PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2003 and 2012 (PISA 2012 – PISA 2003)	
	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
Indigenous	440	5.4	442	7.3	441	5.3	417	4.8	**–23**	7.5
Non–Indigenous	526	2.1	522	2.3	517	2.5	507	1.6	**–19**	3.3

Notes: Values that are statistically significant are indicated in bold.

The proportion of low-performing Indigenous students did not change significantly between PISA 2003 and PISA 2012, but there was a significant decrease (2%) in the proportion of top-performing Indigenous students between PISA 2003 and PISA 2012 (Table 2.11).

Between PISA 2003 and PISA 2012, there was a significant shift in the proportion of low-performing and top-performing non-Indigenous students. In PISA 2012, there were 5% more low-performing students and 5% fewer top-performing students than in PISA 2003.

Table 2.11 Percentage of students performing below Level 2 and at Level 5 or above on mathematical literacy in PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2003 and PISA 2012, by Indigenous background

Indigenous background	PISA 2003				PISA 2006				PISA 2009				PISA 2012				Difference between 2003 and 2012 (PISA 2012 – PISA 2003)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Indigenous	43	4.0	5	1.0	39	3.8	3	0.8	40	2.5	3	0.7	50	2.2	2	0.4	7	4.6	**–2**	1.1
Non–Indigenous	14	0.7	20	0.8	12	0.6	17	0.8	15	0.6	17	0.9	19	0.6	15	0.7	**5**	0.9	**–5**	1.0

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

CHAPTER 3

Australian students' performance on the mathematical literacy subscales

Key findings: Content subscales

Change and relationships subscale

- Australia achieved an average score of 509 points on the change and relationships subscale, which was significantly higher than the OECD average of 493 score points. Australia was outperformed by 13 countries: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Estonia, Switzerland, Canada, Finland and the Netherlands. Australia's performance was not statistically different from five countries: Germany, Belgium, Vietnam, Poland and Austria. All other countries performed at a level significantly lower than Australia.
- Eighteen per cent of Australian students were top performers (reaching Level 5 or above) compared to 15% of students across OECD countries.
- One-fifth of Australian students were low performers (failing to reach Level 2) compared to one-quarter of students across OECD countries.
- Males outperformed females in Australia by 12 score points, with males achieving a mean score of 515 score points while females achieved a mean score of 503 points.
- In Australia, 16% of female and 20% of males were top performers, while 21% of females and 19% of males were low performers.
- The Australian Capital Territory and Western Australia achieved at a similar level to New South Wales, and significantly higher than all the other jurisdictions. The Northern Territory was the only jurisdiction that was significantly outperformed by all other jurisdictions.
- Males from Victoria, Queensland, South Australia and Western Australia performed significantly higher than their female counterparts.

Space and shape subscale

- Australia achieved a mean score of 497 points on the space and shape subscale, which was significantly higher than the OECD average of 490 score points. Australia was outperformed by 17 countries: Shanghai–China, Chinese Taipei, Singapore, Korea, Hong Kong–China, Macao–China, Japan, Switzerland, Liechtenstein, Poland, Estonia, Canada, Belgium, the Netherlands, Germany, Finland and Slovenia. Australia's performance was not statistically different from nine countries: Vietnam, Austria, the Czech Republic, Latvia, Denmark, the Russian Federation, Portugal, New Zealand and the Slovak Republic. All other countries performed at a level significantly lower than Australia.

- Fourteen per cent of Australian students were top performers, the same proportion as the OECD average.
- Twenty-three per cent of Australian students were low performers compared to 26% of students across OECD average.
- Males outperformed females in Australia by 20 score points, with males achieving a mean score of 506 score points while females achieved a mean score of 486 points.
- In Australia, 12% of females and 16% of males were top performers, while 27% of females and 21% of males were low performers.
- The Australian Capital Territory and Western Australia performed at a similar level to New South Wales, and significantly higher than all the other jurisdictions. The performances for Tasmania and the Northern Territory were significantly lower than the other jurisdictions, but not significantly different from each other.
- Males from New South Wales, Victoria, Queensland, South Australia, Western Australia and Tasmania performed significantly higher than their female counterparts.

Quantity subscale

- Australia achieved a mean score of 500 points on the quantity subscale, which was significantly higher than the OECD average of 495 score points. Australia was outperformed by 17 countries: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Liechtenstein, Korea, the Netherlands, Switzerland, Macao–China, Finland, Estonia, Belgium, Poland, Japan, Germany, Canada and Austria. Australia's performance was not statistically different from nine countries: Vietnam, Ireland, the Czech Republic, Slovenia, Denmark, New Zealand, Iceland, France and the United Kingdom. All other countries performed at a level significantly lower than Australia.
- Sixteen per cent of Australian students were top performers compared to 14% of students across OECD countries.
- Twenty-two per cent of Australian students were low performers compared to 23% of students across OECD countries.
- Male students outperformed females in Australia by 10 score points, with males achieving a mean score of 505 score points while females achieved a mean score of 495 points.
- In Australia, 14% of females and 17% of males were top performers, while 24% of females and 21% of males were low performers.
- The Australian Capital Territory and Western Australia achieved at a similar level to New South Wales, and significantly higher than all other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.
- Males from Victoria, South Australia, Western Australia and Tasmania performed significantly higher than their female counterparts.

Uncertainty and data subscale

- Australia achieved a mean score of 508 points on the uncertainty and data subscale, which was significantly higher than the OECD average of 493 score points. Australia was outperformed by 14 countries: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, the Netherlands, Japan, Liechtenstein, Macao–China, Switzerland, Vietnam, Finland, Poland and Canada. Australia's performance was not statistically different from seven countries: Estonia, Germany, Ireland, Belgium, New Zealand, Denmark and the United Kingdom. All other countries performed at a level significantly lower than Australia.
- Sixteen per cent of Australian students were top performers compared to 12% of students across OECD countries.
- Eighteen per cent of Australian students were low performers compared to 23% of students across OECD countries.

- Males outperformed females in Australia by 7 score points, with males achieving a mean score of 511 score points while females achieved a mean score of 504 points.
- In Australia, 14% of females and 17% of males were top performers, while 19% of female and 18% of males were low performers.
- The Australian Capital Territory's performance was similar to Western Australia and significantly higher than all other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.
- Males from Victoria and Western Australia performed significantly higher than their female counterparts.

Key findings: Process subscales

Formulating situations mathematically subscale

- Australia achieved a mean score of 498 points on the formulating subscale, which was significantly higher than the OECD average of 492 points. Australia was outperformed by 16 countries: Shanghai–China, Singapore, Chinese Taipei, Hong Kong–China, Korea, Japan, Macao–China, Switzerland, Liechtenstein, the Netherlands, Finland, Estonia, Canada, Poland, Belgium and Germany. Australia's performance was not significantly different from seven countries: Denmark, Iceland, Austria, Vietnam, New Zealand, the Czech Republic and Ireland. All other countries performed at a level significantly lower than Australia.
- Sixteen per cent of Australian students were top performers, a similar proportion to the 15% of students across OECD countries.
- One-quarter of Australian students were low performers, which was similar to the 26% of students across OECD countries.
- In Australia, males performed significantly higher than females by 17 score points. Males achieved a mean score of 506 points, while females achieved a mean score of 489 points.
- In Australia, 19% of males and 14% of females were top performers, while 22% of males and 27% of females were low performers.
- The Australian Capital Territory achieved at a level not significantly different to Western Australia and significantly higher than all the other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.
- Males in Victoria, Queensland, South Australia and Western Australia performed significantly higher than their female counterparts.

Employing mathematical concepts, facts, procedures and reasoning subscale

- Australian students achieved a mean score of 500 points, which was significantly higher than the OECD average of 493 score points. Nineteen countries performed significantly higher than Australia. These countries were: Shanghai–China, Singapore, Hong Kong–China, Korea, Chinese Taipei, Liechtenstein, Macao–China, Japan, Switzerland, Estonia, Vietnam, Poland, the Netherlands, Canada, Germany, Belgium, Finland, Austria and Slovenia. Five countries were not significantly different from Australia: the Czech Republic, Ireland, France, Latvia and New Zealand. All other countries performed at a level significantly lower than Australia.
- Thirteen per cent of Australian students were top performers, which was similar to the 12% of students across OECD countries.
- Around one-fifth of Australian students were low performers compared to almost one-quarter of students across OECD countries.
- Australian males outperformed Australian females by 10 score points, with males achieving a mean score of 505 points while females achieved a mean score of 495 points.
- In Australia, 15% of males and 12% of females were top performers while 19% of males and 21% of females were low performers.
- Achievement in the Australian Capital Territory, Western Australia and New South Wales was similar, while the Northern Territory performed significantly lower than all other jurisdictions.

- Males in Victoria, South Australia and Western Australia performed significantly higher than females.

Interpreting, applying and evaluating mathematical outcomes subscale

- Australia achieved a mean score of 514 points on the interpreting subscale, which was significantly higher than the OECD average of 497 points. Australia was outperformed by 12 countries: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Liechtenstein, Korea, Japan, Macao–China, Switzerland, Finland, the Netherlands and Canada. Australia's performance was not significantly different from seven countries: Germany, Poland, Belgium, Estonia, New Zealand, France and Austria. All other countries performed at a level significantly lower than Australia.
- Eighteen per cent of Australian students were top performers compared to the OECD average of 14%.
- Eighteen per cent of Australian students were low performers compared to the OECD average of 23%.
- Australian males performed significantly higher than Australian females by 10 points, with males scoring 519 points on average compared to females who scored 509 points on average.
- In Australia, 21% of males and 16% of females were top performers while 17% of males and 19% of females were low performers.
- The Australian Capital Territory and Western Australia's performance was similar to each other and significantly higher than all other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.
- Males in Victoria, South Australia and Western Australia performed significantly higher than their female counterparts.

The previous chapter summarised the mathematical literacy performance of students in PISA 2012 on the overall mathematical literacy scale. This chapter provides further detail about students' performance on the different aspects of mathematical literacy. It examines students' performance on four mathematical content subscales and three mathematical process subscales.

Students' performance on the mathematical literacy content subscales

The PISA mathematical literacy assessment framework describes how mathematical content knowledge is organised into four content categories. These broad categories are based on the mathematical phenomena that involve different kinds of mathematical thinking and relate to mathematics curriculum in schools. The four content categories are:

1. *Change and relationships*: emphasis on relationships among objects and the mathematical processes associated with changes in those relationships. An item that involves thinking about the relationships among the variables speed, distance and time in relation to travel would be an example of an item classified in this category.
2. *Space and shape*: emphasis on spatial reasoning among objects, and measurement and other geometric aspects of the spatial world. An example of this item category is spatial reasoning and working with measurements and area calculations with a model of a real-world object.
3. *Quantity*: emphasis on comparisons and calculations based on quantitative relationships and numeric properties of objects and phenomena. An example of an item classified in this category involves reasoning about quantities of given properties of different objects and calculations with given quantities.

4. *Uncertainty and data*: emphasis on interpreting and working with data and with different data presentation forms, and problems involving probabilistic reasoning. An item that involves interpreting a bar chart is an example of an item that would be classified in this category.

PISA 2012 reports outcomes for each of these content categories on separate subscales. These results reflect the differences in curriculum priorities and topic content. Figure 3.1 shows the descriptions of the six levels of proficiency on the change and relationships and space and shape subscales, while Figure 3.2 shows the descriptions of the six levels of proficiency on the quantity and uncertainty and data subscales.

Proficiency level	Change and relationships	Space and shape
	What students can typically do at each level	
6	Students can use significant insight, abstract reasoning and argumentation skills, and technical knowledge and conventions to solve problems involving relationships among variables and to generalise mathematical solutions to complex real-world problems. They can create and use an algebraic model of a functional relationship incorporating multiple quantities. They can apply deep geometrical insight to work with complex patterns; and they can use complex proportional reasoning and complex calculations with percentages to explore quantitative relationships and change.	Students can: solve complex problems involving multiple representations or calculations; identify, extract and link relevant information, e.g., by extracting relevant dimensions from a diagram or map and using scale to calculate an area or distance; use spatial reasoning with significant insight and reflection, e.g., by interpreting text and related contextual material to formulate a useful geometric model and applying it while taking into account contextual constraints; recall and apply relevant procedural knowledge from their base of mathematical knowledge, such as in circle geometry, trigonometry, Pythagoras' rule, or area and volume formula to solve problems; and can generalise results and findings, communicate solutions and provide justifications and argumentation.
5	Students can solve problems by using algebraic and other formal mathematical models, including in scientific contexts. They can use complex and multi-step problem-solving skills, and can reflect on and communicate reasoning and arguments, e.g., in evaluating and using a formula to predict the quantitative effect of change in one variable on another. They can use complex proportional reasoning, e.g., to work with rates and they can work competently with formula and with expressions including inequalities.	Students can solve problems that require appropriate assumptions to be made or that involve reasoning from assumptions provided while taking into account explicitly stated constraints, e.g., in exploring and analysing the layout of a room and the furniture it contains. They solve problems using theorems or procedural knowledge, such as symmetry properties, or similar triangle properties or formula including those for calculating area, perimeter or volume of familiar shapes. They use well-developed spatial reasoning, argument and insight to infer relevant conclusions and to interpret and link different representations, e.g., to identify a direction or location on a map from textual information.
4	Students can understand and work with multiple representations, including algebraic models of real-world situations. They can reason about simple functional relationships between variables, going beyond individual data points to identify simple underlying patterns. They can use some flexibility in interpretation and reasoning about functional relationships (e.g., in exploring distance–time–speed relationships) and can modify a functional model or graph to fit a specified change to the situation. They can communicate the resulting explanations and arguments.	Students can solve problems by using basic mathematical knowledge, such as angle and side-length relationships in triangles, and by doing so in a way that involves multi-step, visual and spatial reasoning and argumentation in unfamiliar contexts. They can link and integrate different representations, e.g., to analyse the structure of a three-dimensional object based on two different perspectives of it. They can compare objects using geometric properties.
3	Students can solve problems that involve working with information from two related representations (text, graph, table, formula), requiring some interpretation, and use reasoning in familiar contexts. They show some ability to communicate their arguments. Students at this level can make a straightforward modification to a given functional model to fit a new situation. They use a range of calculation procedures to solve problems, including ordering data, time difference calculations, substitution of values into a formula or linear interpolation.	Students can: solve problems that involve elementary visual and spatial reasoning in familiar contexts, such as calculating a distance or a direction from a map or a GPS device; link different representations of familiar objects or appreciate properties of objects under some simple specified transformation; and devise simple strategies and apply basic properties of triangles and circles. They can use appropriate supporting calculation techniques, such as scale conversions needed to analyse distances on a map.
2	Students can locate relevant information about a relationship from data provided in a table or graph and make direct comparisons, e.g., to match given graphs to a specified change process. They can reason about the basic meaning of simple relationships expressed in text or numeric form by linking text with a single representation of a relationship (graph, table, simple formula) and can correctly substitute numbers into simple formula, sometimes expressed in words. At this level, student can use interpretation and reasoning skills in a straightforward context involving linked quantities.	Students can solve problems involving a single familiar geometric representation (e.g., a diagram or other graphic) by comprehending and drawing conclusions in relation to clearly presented basic geometric properties and associated constraints. They can also evaluate and compare spatial characteristics of familiar objects in a situation where given constraints apply, such as comparing the height or circumference of two cylinders having the same surface area, or deciding whether a given shape can be dissected to produce another specified shape.
1	Students can evaluate single given statements about a relationship expressed clearly and directly in a formula, or in a graph. Their ability to reason about relationships, and about change in those relationships, is limited to simple expressions and to those located in familiar situations. They may apply simple calculations needed to solve problems related to clearly expressed relationships.	Students can recognise and solve simple problems in a familiar context using pictures or drawings of familiar geometric objects and applying basic spatial skills, such as recognising elementary symmetry properties, comparing lengths or angle sizes, or using procedures, such as dissection of shapes.

Figure 3.1 Summary descriptions of the six proficiency levels on the change and relationships and space and shape subscales

Proficiency level	Quantity	Uncertainty and data
	What students can typically do at each level	
6	Students can: conceptualise and work with models of complex quantitative processes and relationships; devise strategies for solving problems; formulate conclusions, arguments and precise explanations; interpret and understand complex information, and link multiple complex information sources; interpret graphical information and apply reasoning to identify, model and apply a numeric pattern. They can: analyse and evaluate interpretive statements based on data provided; work with formal and symbolic expressions; plan and implement sequential calculations in complex and unfamiliar contexts, including working with large numbers, e.g., to perform a sequence of currency conversions, entering values correctly and rounding results. These students work accurately with decimal fractions. They use advanced reasoning concerning proportions, geometric representations of quantities, combinatorics and integer number relationships. They interpret and understand formal expressions of relationships among numbers, including in a scientific context.	Students can interpret, evaluate and critically reflect on a range of complex statistical or probabilistic data, information and situations to analyse problems. These students bring insight and sustained reasoning across several problem elements. They understand the connections between data and the situations they represent, and are able to make use of those connections to explore problem situations fully. They bring appropriate calculation techniques to bear to explore data or to solve probability problems. They can produce and communicate conclusions, reasoning and explanations.
5	Students can formulate comparison models and compare outcomes to determine the highest price, and interpret complex information about real-world situations (including graphs, drawings and complex tables, e.g., two graphs using different scales). They can generate data for two variables and evaluate propositions about the relationship between them. Students can: communicate reasoning and argument; recognise the significance of numbers to draw inferences; and provide a written argument evaluating a proposition based on data provided. They can: make an estimation using knowledge about daily life; calculate relative and/or absolute change; calculate an average; calculate relative and/or absolute difference, including percentage difference, given raw difference data; and can convert units (e.g., calculations involving areas in different units).	Students can interpret and analyse a range of statistical or probabilistic data, information and situations to solve problems in complex contexts that require linking of different problem components. They can use proportional reasoning effectively to link sample data to the population they represent and appropriately interpret data series over time. They are systematic in their use and exploration of data. Students can use statistical and probabilistic concepts and knowledge to reflect, draw inferences and produce and communicate results.
4	Students can: interpret complex instructions and situations; relate text-based numerical information to a graphic representation; identify and use quantitative information from multiple sources; deduce system rules from unfamiliar representations; formulate a simple numeric model; set up comparison models; and explain their results. They can: carry out accurate and more complex or repeated calculations, such as adding 13 given times in hour/minute format; carry out time calculations using given data on distance and speed of a journey; perform simple division of large multiples in context; carry out calculations involving a sequence of steps; and accurately apply a given numeric algorithm involving a number of steps. Students can perform calculations involving proportional reasoning, divisibility or percentages in simple models of complex situations.	Students can activate and employ a range of data representations and statistical or probabilistic processes to interpret data, information and situations to solve problems. They can work effectively with constraints, such as statistical conditions that might apply in a sampling experiment, and they can interpret and actively translate between two related data representations (such as a graph and a data table). Students can perform statistical and probabilistic reasoning to make contextual conclusions.
3	Students can use basic problem-solving processes, including devising a simple strategy to test scenarios, understand and work with given constraints, use trial and error, and use simple reasoning in familiar contexts. Students can: interpret a text description of a sequential calculation process and correctly implement the process; identify and extract data presented directly in textual explanations of unfamiliar data; interpret text and diagrams describing a simple pattern; and perform calculations, including working with large numbers, calculations with speed and time, and conversion of units (e.g., from an annual rate to a daily rate). They understand place value involving mixed two- and three-decimal values and including working with prices. They can: order a small series of (four) decimal values; calculate percentages of up to three-digit numbers; and apply calculation rules given in natural language.	Students can interpret and work with data and statistical information from a single representation that may include multiple data sources, such as a graph representing several variables, or from two related data representations (such as a simple data table and graph). They can work with and interpret descriptive statistical, probabilistic concepts and conventions in contexts such as coin tossing or lotteries, and draw conclusions from data (such as calculating or using simple measures of centre and spread). Students can perform basic statistical and probabilistic reasoning in simple contexts.
2	Students can interpret simple tables to identify and extract relevant quantitative information, and can interpret a simple quantitative model (such as a proportional relationship) and apply it using basic arithmetic calculations. They can: identify the links between relevant textual information and tabular data to solve word problems; interpret and apply simple models involving quantitative relationships; identify the simple calculation required to solve a straightforward problem; carry out simple calculations involving basic arithmetic operations; order two- and three-digit whole numbers and decimal numbers with one or two decimal places; and calculate percentages.	Students can identify, extract and comprehend statistical data presented in a simple and familiar form, such as a simple table, a bar graph or pie chart. They can identify, understand and use basic descriptive statistical and probabilistic concepts in familiar contexts, such as tossing coins or rolling dice. Students can interpret data in simple representations and apply suitable calculation procedures that connect given data to the problem context represented.
1	Students can solve basic problems in which relevant information is explicitly presented and the situation is straightforward and very limited in scope. Students can handle situations where the required computational activity is obvious and the mathematical task is basic, such as a one-step simple arithmetic operation, or to total the columns of a simple table and compare the results. They can: read and interpret a simple table of numbers; extract data and perform simple calculations; use a calculator to generate relevant data; and extrapolate from the data generated, using reasoning and calculation with a simple linear model.	Students can identify and read information presented in a small table or simple well-labelled graph to locate and extract specific data values while ignoring distracting information, and recognise how these relate to the context. Students can recognise and use basic concepts of randomness to identify misconceptions in familiar experimental contexts, such as lottery outcomes.

Figure 3.2 Summary descriptions of the six proficiency levels on the quantity and uncertainty and data subscales

Australia's performance on the content subscales from an international perspective

Table 3.1 provides the mean scores for the four content category subscales (change and relationships, space and shape, quantity, and uncertainty and data) together with their associated standard errors, confidence intervals around the mean and the difference between the 5th and 95th percentiles. In addition, the colour bands indicate how other countries have performed relative to Australia: significantly higher, significantly lower or not significantly different. Results have not been included for those countries that achieved a mean score lower than the lowest performing OECD country, Mexico.[1]

Students' performance across countries on the change and relationships subscale

Australia was one of 14 OECD countries and seven partner countries who performed significantly higher than the OECD average (493 score points) on the change and relationships subscale. Seven countries achieved a mean score that was not significantly different from the OECD average, while the remaining countries achieved a mean score that was significantly below the OECD average.

Australia achieved a mean score of 509 score points on the change and relationships subscale. Thirteen countries (Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, Macao–China, Japan, Liechtenstein, Estonia, Switzerland, Canada, Finland and the Netherlands) performed significantly higher than Australia. Australia's performance was not significantly different to five countries (Germany, Belgium, Vietnam, Poland and Austria), while all other countries (including New Zealand, the United Kingdom and the United States) performed at a level significantly lower than Australia.

On average across OECD countries, the change and relationships subscale was similar to the mean overall score for mathematical literacy (494 points). The mean change and relationships subscale score was 11 score points higher (the largest difference) in Shanghai–China than on the overall mathematical literacy scale. For other high-performing countries, the mean score difference between the change and relationships subscale and overall mathematical literacy scale ranged from 1 score point in Chinese Taipei to 7 score points in Singapore and Liechtenstein.

Australia scored 5 points higher on the change and relationships subscale than on the overall mathematical literacy scale, suggesting that Australian students found items related to change and relationships to be a relatively easier area of content knowledge.

Students' performance across countries on the space and shape subscale

Twenty-two countries (15 OECD countries, including Australia, and 7 partner countries) achieved significantly higher than the OECD average of 490 score points. Seven countries had mean scores that were not statistically different from the OECD average, while all other countries had mean scores that were significantly lower than the OECD average.

Australia's mean score on the space and shape subscale was 497 score points. Seventeen countries (Shanghai–China, Chinese Taipei, Singapore, Korea, Hong Kong–China, Macao–China, Japan, Switzerland, Liechtenstein, Poland, Estonia, Canada, Belgium, the Netherlands, Germany, Finland and Slovenia) performed significantly higher than Australia. Nine countries (Vietnam, Austria, the Czech Republic, Latvia, Denmark, the Russian Federation, Portugal, New Zealand and the Slovak Republic) performed not significantly different to Australia, while all other countries (including the United Kingdom and the United States) performed at a level significantly lower than Australia.

The mean score on the space and shape subscale was 4 points lower than the mean score on the overall mathematical literacy scale. The highest performing countries scored at a higher level on the space and shape subscale than on the overall mathematical literacy scale. Singapore scored 7 points higher and Hong Kong–China scored 6 points higher on the space and shape subscale; while Korea, Macao–China

1 For brevity, results for those countries that achieved a mean score lower than Mexico have not been included in this chapter. These countries are: Montenegro, Uruguay, Costa Rica, Albania, Brazil, Argentina, Tunisia, Jordan, Colombia, Qatar, Indonesia and Peru.

Table 3.1 Mean scores in students' performance on the content subscales, by country

Change and relationships subscale

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	624	3.6	616–631	367
	Singapore	580	1.5	577–583	373
	Hong Kong–China	564	3.6	557–571	343
	Chinese Taipei	561	3.5	554–567	396
	Korea	559	5.2	548–568	346
	Macao–China	542	1.2	540–544	324
	Japan	542	4.0	534–550	353
	Liechtenstein	542	4.0	534–550	340
	Estonia	530	2.3	525–534	276
	Switzerland	530	3.4	522–536	336
	Canada	525	2.0	521–528	312
	Finland	520	2.6	515–525	314
	Netherlands	518	3.9	510–525	324
Not significantly different from Australia	Germany	516	3.8	508–523	368
	Belgium	513	2.6	508–518	372
	Vietnam	509	5.1	499–519	309
	Poland	509	4.1	501–517	330
	Australia	**509**	**1.7**	**505–512**	**341**
	Austria	506	3.4	499–513	350
Significantly lower than Australia	Ireland	501	2.6	496–506	287
	New Zealand	501	2.5	495–505	367
	Czech Republic	499	3.5	492–506	357
	Slovenia	499	1.1	497–501	329
	France	497	2.7	491–502	354
	Latvia	496	3.4	489–502	295
	United Kingdom	496	3.4	489–502	326
	Denmark	494	2.7	488–499	298
	OECD average	**493**	**0.6**	**491–493**	**332**
	Russian Federation	491	3.4	484–497	306
	United States	488	3.5	481–495	310
	Luxembourg	488	1.0	485–489	335
	Iceland	487	1.9	483–490	329
	Portugal	486	4.1	478–494	323
	Spain	482	2.0	477–485	304
	Hungary	481	3.5	474–488	331
	Lithuania	479	3.2	472–485	301
	Norway	478	3.1	471–483	338
	Italy	477	2.1	472–480	328
	Slovak Republic	474	4.0	466–482	373
	Sweden	469	2.8	463–474	350
	Croatia	468	4.2	459–476	339
	Israel	462	5.3	451–472	385
	Turkey	448	5.0	438–457	301
	Greece	446	3.2	439–452	331
	Romania	446	3.9	437–453	295
	United Arab Emirates	442	2.6	437–447	313
	Serbia	442	4.1	433–450	344
	Cyprus	440	1.2	437–442	336
	Bulgaria	434	4.5	425–443	358
	Kazakhstan	433	3.2	426–439	275
	Thailand	414	3.9	405–421	307
	Chile	411	3.5	404–417	310
	Mexico	405	1.6	401–407	285
	Malaysia	401	4.0	393–409	302

Space and shape subscale

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	649	3.6	641–656	376
	Chinese Taipei	592	3.8	584–599	441
	Singapore	580	1.5	576–582	383
	Korea	573	5.2	562–583	365
	Hong Kong–China	567	4.0	558–574	352
	Macao–China	558	1.4	555–560	358
	Japan	558	3.7	550–564	330
	Switzerland	544	3.1	538–550	336
	Liechtenstein	539	4.5	530–548	322
	Poland	524	4.2	515–532	327
	Estonia	513	2.5	507–517	307
	Canada	510	2.1	506–514	314
	Belgium	509	2.4	504–513	354
	Netherlands	507	3.5	500–514	310
	Germany	507	3.2	500–513	321
	Vietnam	507	5.1	496–516	328
	Finland	507	2.1	502–510	297
	Slovenia	503	1.4	500–506	325
Not significantly different from Australia	Austria	501	3.1	494–507	322
	Czech Republic	499	3.4	492–505	335
	Latvia	497	3.3	490–503	289
	Denmark	497	2.5	491–501	276
	Australia	**497**	**1.8**	**492–500**	**335**
	Russian Federation	496	3.9	488–503	313
	Portugal	491	4.2	482–499	351
	New Zealand	491	2.4	485–495	330
	OECD average	**490**	**0.5**	**488–490**	**322**
	Slovak Republic	490	4.1	481–497	359
Significantly lower than Australia	France	489	2.7	483–494	326
	Iceland	489	1.5	485–491	295
	Italy	487	2.5	482–492	348
	Luxembourg	486	1.0	484–488	312
	Norway	480	3.3	473–486	335
	Ireland	478	2.6	472–482	308
	Spain	477	2.0	472–480	308
	United Kingdom	475	3.5	468–482	328
	Hungary	474	3.4	466–480	318
	Lithuania	472	3.1	466–478	324
	Sweden	469	2.5	463–473	310
	United States	463	4.0	455–471	317
	Croatia	460	3.9	452–467	287
	Kazakhstan	450	3.9	442–457	278
	Israel	449	4.8	439–458	344
	Romania	447	4.1	439–455	300
	Serbia	446	3.9	438–453	323
	Turkey	443	5.5	432–453	360
	Bulgaria	442	4.3	433–450	313
	Greece	436	2.6	431–441	295
	Cyprus	436	1.1	434–438	303
	Malaysia	434	3.4	427–441	284
	Thailand	432	4.1	424–440	316
	United Arab Emirates	425	2.4	419–429	316
	Chile	419	3.2	412–424	281
	Mexico	413	1.6	409–415	270

	Quality subscale				
	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	591	3.2	584–597	322
	Singapore	569	1.2	566–571	341
	Hong Kong–China	566	3.4	558–572	335
	Chinese Taipei	543	3.1	537–549	350
	Liechtenstein	538	4.1	530–546	322
	Korea	537	4.1	529–545	305
	Netherlands	532	3.6	524–538	317
	Switzerland	531	3.1	525–537	315
	Macao–China	531	1.1	528–532	300
	Finland	527	1.9	522–530	287
	Estonia	525	2.2	520–528	285
	Belgium	519	2.0	514–522	340
	Poland	519	3.5	511–525	289
	Japan	518	3.6	511–525	311
	Germany	517	3.1	511–523	325
	Canada	515	2.2	511–519	327
	Austria	510	2.9	504–515	298
Not significantly different from Australia	Vietnam	509	5.5	498–519	308
	Ireland	505	2.6	500–510	303
	Czech Republic	505	3.0	499–510	333
	Slovenia	504	1.2	501–506	310
	Denmark	502	2.4	497–507	295
	Australia	**500**	**1.9**	**496–503**	**339**
	New Zealand	499	2.4	494–503	337
	Iceland	496	1.9	492–500	339
	France	496	2.6	491–501	337
Significantly lower than Australia	**OECD average**	**495**	**0.5**	**494–496**	**320**
	Luxembourg	495	1.0	492–496	330
	United Kingdom	494	3.8	486–501	334
	Norway	492	2.9	486–497	313
	Spain	491	2.3	486–495	330
	Italy	491	2.0	486–494	331
	Latvia	487	2.9	481–492	275
	Slovak Republic	486	3.5	479–493	346
	Lithuania	483	2.8	477–488	306
	Sweden	482	2.5	476–486	320
	Portugal	481	4.0	473–489	315
	Croatia	480	3.7	472–487	305
	Israel	480	5.2	469–489	383
	Russian Federation	478	3.0	472–483	306
	United States	478	3.9	470–485	325
	Hungary	476	3.4	468–482	327
	Serbia	456	3.7	448–463	317
	Greece	455	3.0	449–461	318
	Romania	443	4.5	434–451	307
	Bulgaria	443	4.3	434–451	332
	Turkey	442	5.0	431–451	319
	Cyprus	439	1.1	436–440	329
	United Arab Emirates	431	2.7	425–436	330
	Kazakhstan	428	3.5	421–434	259
	Chile	421	3.3	414–427	296
	Thailand	419	3.7	411–425	291
	Mexico	414	1.5	410–416	288
	Malaysia	409	3.6	401–416	309

	Uncertainty and data subscale				
	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	592	3.0	585–597	314
	Singapore	559	1.5	556–562	341
	Hong Kong–China	553	3.0	547–559	302
	Chinese Taipei	549	3.2	542–554	352
	Korea	538	4.2	529–546	316
	Netherlands	532	3.8	524–539	320
	Japan	528	3.5	521–534	295
	Liechtenstein	526	3.9	518–533	321
	Macao–China	525	1.1	523–527	292
	Switzerland	522	3.2	515–527	320
	Vietnam	519	4.5	510–528	261
	Finland	519	2.4	514–523	297
	Poland	517	3.5	509–523	286
	Canada	516	1.8	512–520	294
Not significantly different from Australia	Estonia	510	2.0	506–514	267
	Germany	509	3.0	502–514	329
	Ireland	509	2.5	503–513	288
	Belgium	508	2.5	502–512	358
	Australia	**508**	**1.5**	**504–510**	**316**
	New Zealand	506	2.6	500–510	348
	Denmark	505	2.4	500–509	278
	United Kingdom	502	3.0	496–508	318
Significantly lower than Australia	Austria	499	2.7	493–503	308
	Norway	497	3.0	490–502	299
	Slovenia	496	1.2	493–498	301
	Iceland	496	1.8	492–499	323
	OECD average	**493**	**0.5**	**492–494**	**306**
	France	492	2.7	486–497	335
	Czech Republic	488	2.8	482–493	301
	United States	488	3.5	481–495	291
	Spain	487	2.3	482–491	307
	Portugal	486	3.8	478–493	298
	Luxembourg	483	1.0	480–484	326
	Sweden	483	2.5	477–487	306
	Italy	482	2.0	478–486	316
	Latvia	478	2.8	472–483	258
	Hungary	476	3.3	469–482	313
	Lithuania	474	2.7	468–478	300
	Slovak Republic	472	3.6	464–478	328
	Croatia	468	3.5	461–474	295
	Israel	465	4.7	455–474	358
	Russian Federation	463	3.3	456–469	279
	Greece	460	2.6	455–465	290
	Serbia	448	3.3	441–454	283
	Turkey	447	4.6	438–456	303
	Cyprus	442	1.1	440–444	297
	Romania	437	3.3	430–442	253
	Thailand	433	3.1	426–439	253
	United Arab Emirates	432	2.4	427–436	286
	Bulgaria	432	3.9	423–439	296
	Chile	430	2.9	424–435	252
	Malaysia	422	3.0	416–427	270
	Kazakhstan	414	2.6	408–418	193
	Mexico	413	1.2	410–415	221

and Japan scored around 20 score points higher, and Chinese Taipei and Shanghai–China scored more than 30 score points higher than on the overall mathematical literacy scale.

Australia was among one of the countries that achieved a mean score on the space and shape subscale that was lower than on the overall mathematical literacy scale, indicating students found this content area relatively more difficult. Australia scored 7 points lower on the space and shape subscale than on the overall mathematical literacy scale, while the United Kingdom, the United States and Ireland scored at least 18 points lower on the space and shape subscale than on the overall mathematical literacy scale.

Students' performance across countries on the quantity subscale

Australia was one of 16 OECD countries and seven partner countries who performed significantly higher than the OECD average (495 score points) on the quantity subscale. Seven countries achieved a mean score that was not significantly different to the OECD average. The remaining countries achieved a mean score that was significantly below the OECD average.

Australian students achieved a mean score of 500 points on the quantity subscale. Seventeen countries performed significantly higher than Australia. These were: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Liechtenstein, Korea, the Netherlands, Switzerland, Macao–China, Finland, Estonia, Belgium, Poland, Japan, Germany, Canada and Austria. The nine countries whose scores were not significantly different from Australia were: Vietnam, Ireland, the Czech Republic, Slovenia, Denmark, New Zealand, Iceland, France and the United Kingdom. All other countries (including the United States) performed at a level significantly lower than Australia.

Across OECD countries, the mean scores on the quantity subscale and the overall mathematical literacy scale were similar. Four of the top-performing countries achieved a lower score on the quantity subscale than on the overall mathematical literacy scale. Korea, Chinese Taipei and Japan scored around 17 points lower, and Shanghai–China scored 22 points lower on the quantity subscale than on the overall mathematical literacy scale. Australia scored 4 points lower on the on the quantity subscale than on the overall mathematical literacy scale.

Students' performance across countries on the uncertainty and data subscale

There were 17 OECD countries, including Australia, and six partner countries who performed significantly higher than the OECD average (493 score points) on the uncertainty and data subscale. Six countries achieved a mean score that was not significantly different from the OECD average, while the remaining countries achieved a mean score that was significantly below the OECD average.

Australia's mean score on the uncertainty and data subscale was 508 score points. Australia was outperformed by 14 countries: Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Korea, the Netherlands, Japan, Liechtenstein, Macao–China, Switzerland, Vietnam, Finland, Poland and Canada. Seven countries (Estonia, Germany, Ireland, Belgium, New Zealand, Denmark and the United Kingdom) performed at a level not significantly different from Australia. All other countries (including the United States) performed at a level significantly lower than Australia.

Across OECD countries, the mean uncertainty and data score was similar to the mean overall score for mathematical literacy. The mean uncertainty and data subscale score was lower than on the overall mathematical literacy scale in a number of high-performing countries, including Singapore (by 14 score points), Korea (by 16 score points) and Shanghai–China (by 21 score points). Australia scored 4 points higher on the uncertainty and data subscale than on the overall mathematical literacy scale.

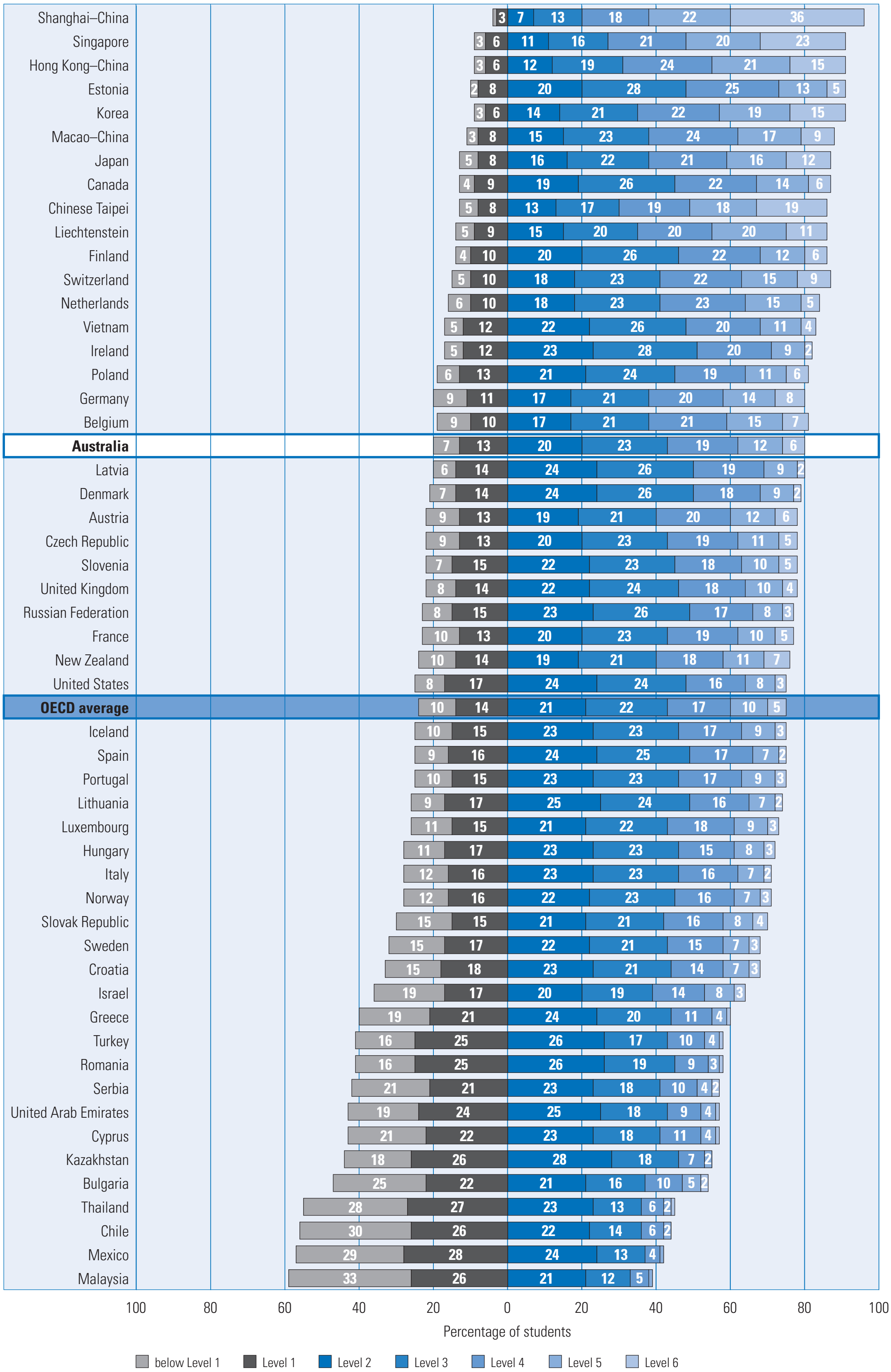
Students' proficiencies on the change and relationships subscale across countries

Figure 3.3 shows the proportion of students at each proficiency level on the change and relationships subscale for participating countries. Countries have been ordered by the percentage of students classified at below Level 2, with the lowest proportion of students below Level 2 placed at the top of the figure and the highest proportion of students below Level 2 at the bottom of the figure.

Countries with the highest proportion of students achieving Level 5 or 6, the top performers, on this subscale were found in Shanghai–China (58%), Singapore (43%), Chinese Taipei (37%), Hong Kong–China (36%), Korea (34%) and Liechtenstein (31%). Eighteen per cent of Australian students were top performers on the change and relationships subscale, while 15% of students across the OECD on average were top performers.

Almost one-quarter (24%) of students across the OECD failed to reach Level 2, the international minimum proficiency level, on the change and relationships subscale, while one-fifth of Australian students also performed below Level 2. For the highest performing countries, 4% of students in Shanghai–China, 9% in Singapore, Hong Kong–China and Korea, and 10% in Estonia failed to achieve Level 2. For the lowest performing countries (including Malaysia, Mexico, Chile and Thailand), at least half of their students were placed below Level 2 on the change and relationships subscale.

Comparing performance on the overall mathematical literacy scale with performance on the change and relationships subscale, Australia, along with the high-performing countries of Shanghai–China, Singapore, Hong Kong–China and Korea, had around 3% more students who were top performers on the change and relationships subscale than on the overall mathematical literacy scale, which was a similar proportion across the OECD. At the lower end of the proficiency scale, there was around a 4% difference in the proportion of low performers on the change and relationships subscale than on the overall mathematical literacy scale in Mexico, Malaysia and Thailand.



Note: In cases in which 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 3.3 Percentage of students across the change and relationships proficiency level subscale, by country

Students' proficiencies on the space and shape subscale across countries

The proportions of students at each proficiency level on the space and shape subscale are shown in Figure 3.4. Shanghai–China achieved the highest proportion of top performers on the space and shape subscale, with 67% of students performing at this level. This was followed by 48% of students in Chinese Taipei and around 40% of students in Korea and Singapore achieving Level 5 or 6. Fourteen per cent of Australian students were top performers, which was the same proportion of top performers across OECD countries. Mexico, Chile, Malaysia and Greece achieved the lowest proportion of high performers on the space and shape subscale.

Three per cent of students in Shanghai–China were low performers on the space and shape subscale. Other high-performing countries had fewer than 12% of students who failed to reach Level 2. This included Japan (8%), Hong Kong–China and Korea (9%), Macao–China (11%) and Chinese Taipei (12%). In Australia, 23% of students were low performers, while 26% of students across the OECD were placed below Level 2 on the space and shape subscale.

There were higher proportions of top performers on the space and shape subscale than on the overall mathematical literacy scale in some countries. The largest differences were found in Shanghai–China and Chinese Taipei (by 11%) and in Macao–China (by 9%). In Australia, the proportion on the space and shape subscale was similar to the proportion of top performers on the overall mathematical literacy scale, while across the OECD, there were 2% more students who were top performers on the space and shape subscale compared to the overall mathematical literacy scale.

Students' proficiencies on the quantity subscale across countries

Figure 3.5 shows the proportion of students at each proficiency level on the quantity subscale for participating countries. Almost half (46%) the students from Shanghai–China and almost 40% of students in Hong Kong–China and Singapore reached Level 5 or 6. Sixteen per cent of students in Australia were top performers, which was higher than the 14% of students across the OECD who also reached Level 5 or 6. Mexico and Kazakhstan had the lowest proportion of high performers, with only 1% of their students achieving Level 5 or 6.

For the low performers, between 5 and 10% of students were placed below Level 2 in Shanghai–China, Hong Kong–China, Singapore and Korea, while in Chile, Thailand, Mexico and Malaysia at least half of the students failed to reach Level 2. There were similar proportions of low performers in Australia and across the OECD (22 and 23% respectively) who failed to reach Level 2 on the quantity subscale.

Comparing performance on the quantity subscale and on the overall mathematical literacy scale, Shanghai–China, Korea, Chinese Taipei, Japan, Macao–China and Singapore had lower proportions of top performers on the quantity subscale, ranging from 2 to 10%, than on the overall mathematical literacy scale. In Australia, the proportion of top performers on the quantity subscale was similar to the proportion on the overall mathematical literacy scale, while across the OECD, there were 14% of top performers on the quantity subscale compared to 12% on the overall mathematical literacy scale.

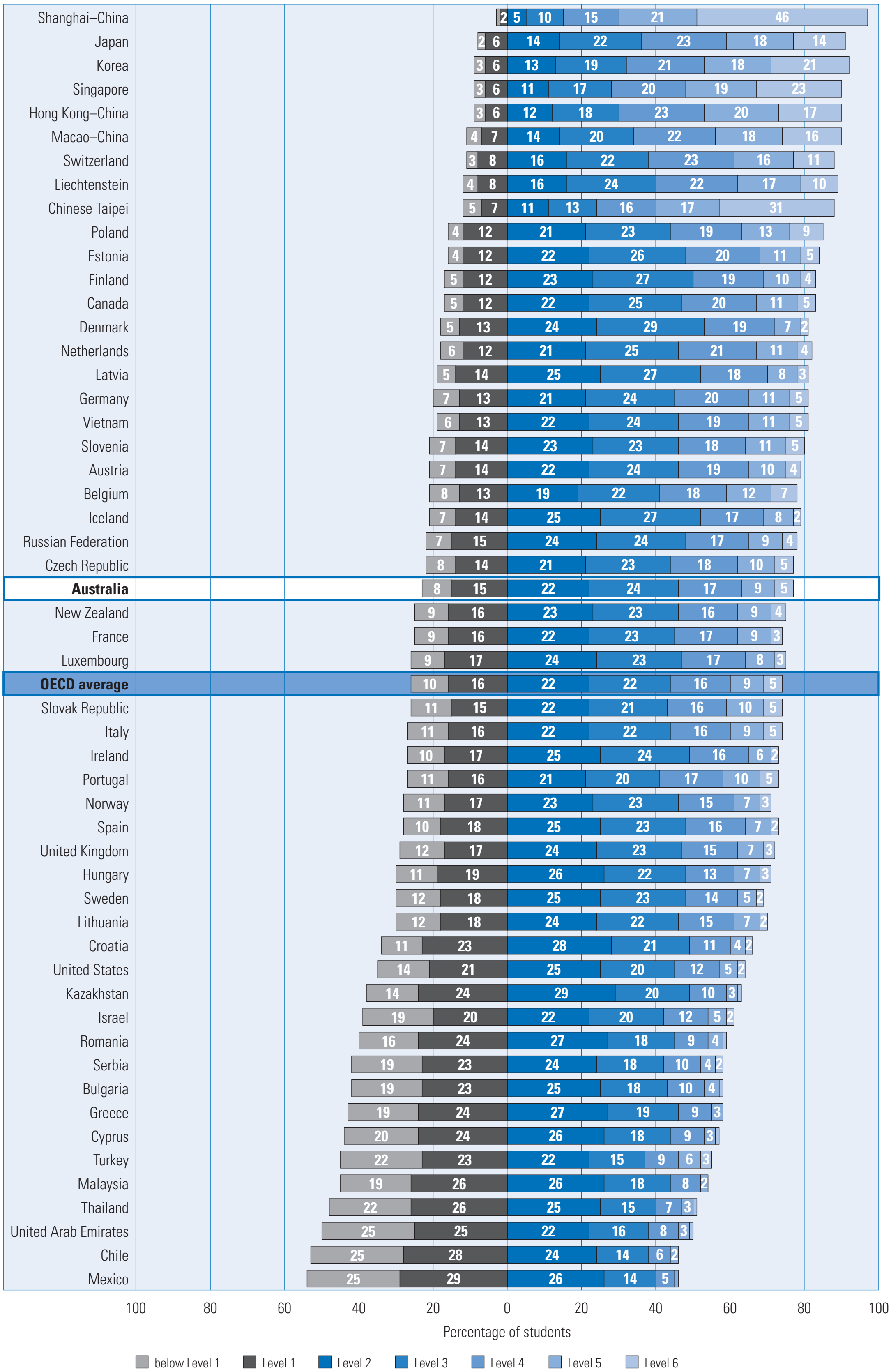


Figure 3.4 Percentage of students across the space and shape proficiency level subscale, by country

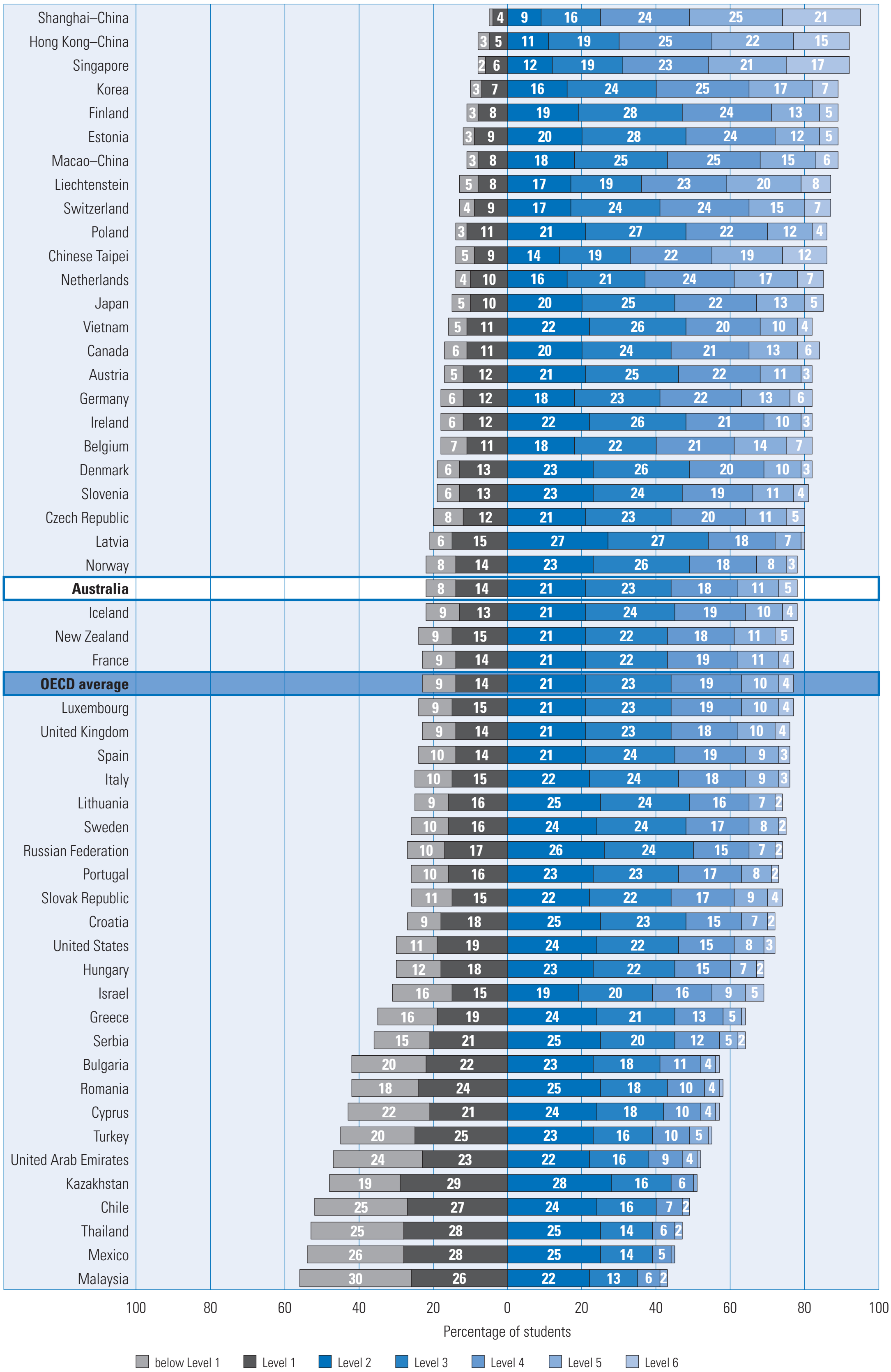


Figure 3.5 Percentage of students across the quantity proficiency level subscale, by country

Students' proficiencies on the uncertainty and data subscale across countries

The proportions of students at each proficiency level on the uncertainty and data subscale are shown in Figure 3.6. A number of high-performing countries also had the highest proportion of top performers on the uncertainty and data subscale. In Hong Kong–China, Chinese Taipei and Singapore, around 31% of students were top performers and in Shanghai–China, 46% of students reached Level 5 or 6. Sixteen per cent of Australian students were top performers, while 12% of students across the OECD were top performers. In Mexico, Kazakhstan, Malaysia, Chile and Romania, there were fewer than 2% of students who had reached the highest proficiency levels on the uncertainty and data subscale.

For the highest performing countries, 4% of students in Shanghai–China and 8% of students in Hong Kong–China performed below Level 2. In Australia, 18% of students performed at this level, while around one-quarter (23%) of students across the OECD failed to reach Level 2 on the uncertainty and data subscale. In Mexico and Kazakhstan, at least half of their students were placed below Level 2 on the uncertainty and data subscale.

The proportion of top performers across the high-performing countries on the overall mathematical literacy scale was lower than the proportion of top performers on the uncertainty and data subscale. This varied from 4% in Hong Kong–China to 10% in Shanghai–China. The proportion of top performers across the OECD on average on the uncertainty and data subscale was the same as the proportion of top performers on the overall mathematical literacy scale. In Australia, there were similar proportions of top performers in Australia between the uncertainty and data subscale and the overall mathematical literacy scale.

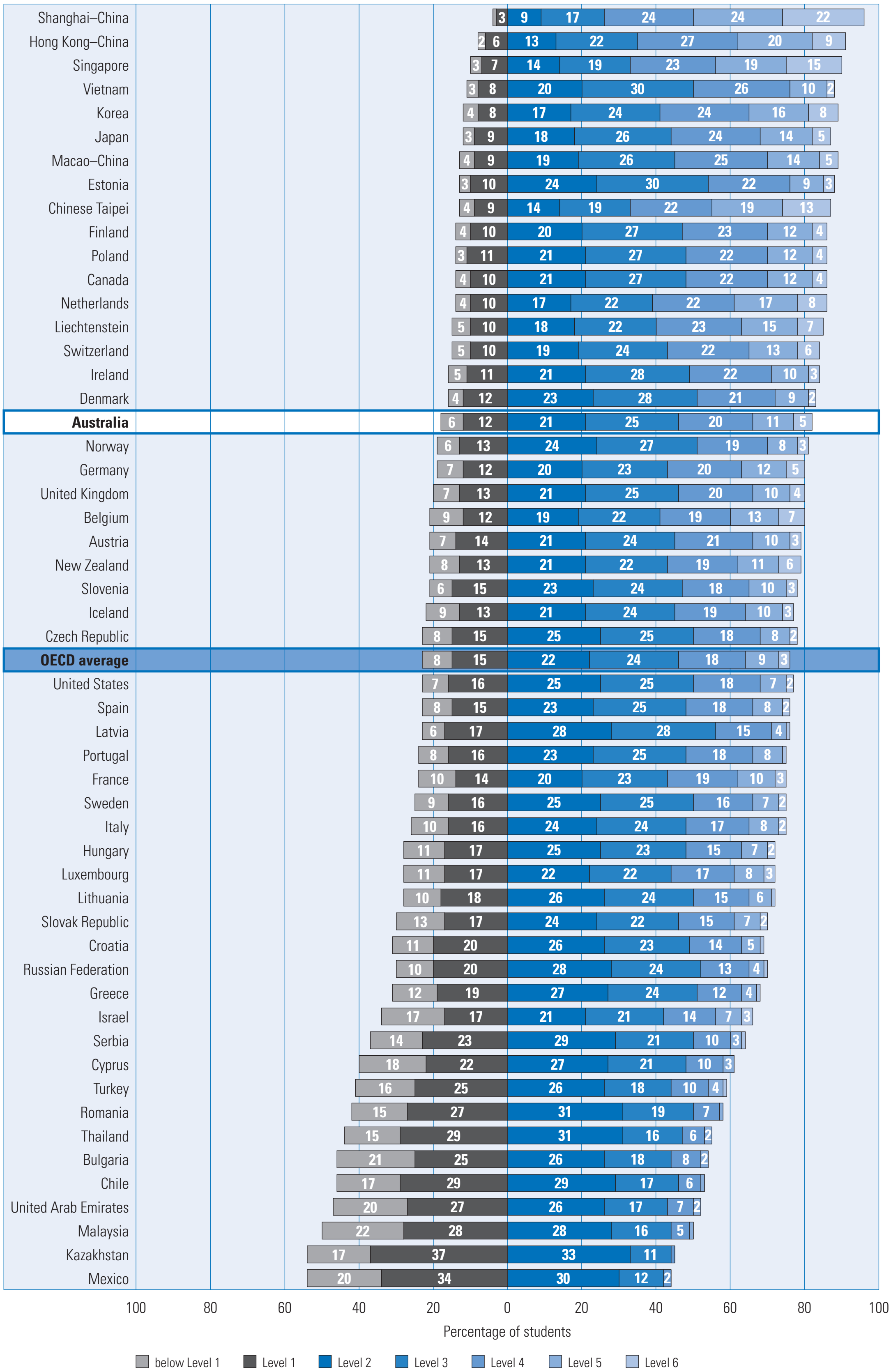


Figure 3.6 Percentage of students across the uncertainty and data proficiency level subscale, by country

Australia's performance on the content subscales from an international perspective by sex

The mean scores and standard errors for females and males, along with the difference between the mean scores for the four content subscales by sex are shown in Figure 3.7.

Students' performance on the change and relationships subscale by sex across countries

On average across OECD countries, males performed significantly higher in the change and relationships subscale than females by 11 score points. Across the OECD, the mean score for males was 498 score points and the mean score for females was 487 score points. In Australia, males outperformed females by 12 score points, with males achieving a mean score of 515 points while females achieved a mean score of 503 points.

Thirty countries showed significant differences between the sexes, the majority in favour of males. The largest differences were found in Chile, with males scoring 32 score points higher than females, and in Luxembourg, with males outperforming females by 25 score points. Among the highest performing countries, males in Shanghai–China and Hong Kong–China also performed at significantly higher levels than females, by 10 and 16 score points respectively. There were significant differences between the sexes in all English speaking countries, except the United States. In Ireland, Canada and United Kingdom, the difference was around 14 score points, while in New Zealand, the gap was 17 score points.

In only four countries—Kazakhstan, Latvia, Malaysia and Thailand—females achieved significantly higher than males (with differences ranging from 8 to 19 score points).

Students' performance on the space and shape subscale by sex across countries

On average across OECD countries, the mean gap between the sexes on the space and shape subscale (15 score points) was larger than on the other content subscales. Males scored 497 points, which was significantly higher than females, who scored 482 points. In Australia, males outperformed females by 20 score points, with males achieving a mean score of 506 points while females achieved a mean score of 486 points.

Approximately 70% of countries showed significant differences by sex, with Chile, Luxembourg and Austria showing the largest differences by sex on the space and shape subscale. Males achieved significantly higher than females by 31 score points in Chile, by 34 score points in Luxembourg and by 36 score points in Austria. The gap in Korea and Hong Kong–China (of around 20 score points) was similar to the difference between the sexes found in Australia. In English-speaking countries, there were varying differences in the performance of males and females. Ireland and New Zealand had the widest gap with around 25 score points, while the gap in the United States was narrower with 7 score points. The difference between the sexes in Canada and the United Kingdom were 10 and 13 score points respectively.

Only one country, Iceland, showed a significant difference in favour of females, scoring 8 points higher than their male counterparts.

Students' performance on the quantity subscale by sex across countries

Males across OECD countries scored 501 points, performing significantly higher than females on the quantity subscale, who scored 490 points. The 11 score point difference by sex across OECD countries was similar to the gap between the sexes for Australian students (10 score points). In Australia, males achieved a mean score of 505 points, while females achieved a mean score of 495 points.

Significant differences between the sexes were found in about two-thirds of countries. The largest differences were found in Liechtenstein, Chile and Luxembourg, with males scoring around 22 score points higher than females. Among the highest performing countries, males in Japan performed at significantly higher levels than females (by 19 score points), while the gap between sexes was narrower in Macao–China (5 score points) and in Shanghai–China (10 score points). The significantly higher performance of males than females was also found in most other English speaking countries: Canada (with a difference of 9 score points), the United Kingdom (with a difference of 13 score points), and New Zealand and Ireland (with a difference of 14 score points).

In only three countries—Singapore, Sweden and Thailand—females achieved significantly higher than males (with differences of 6, 7 and 17 score points respectively).

Students' performance on the uncertainty and data subscale by sex across countries

On average across OECD countries, males performed significantly higher than females on the uncertainty and data subscale (8 score points). Across the OECD, the mean score for males was 497 score points and for females was 489 score points. Australian males achieved a mean score of 511 points, which was significantly higher, by 7 score points, than the mean score of 504 points for females.

Internationally, approximately half the countries showed significant differences by sex on the uncertainty and data subscale. For those countries where males outperformed females, Liechtenstein and Luxembourg showed the largest differences with around 22 score points. In the high-performing countries, significant differences were found in Korea and Hong Kong–China, with males performing 18 and 12 score points more respectively than females, while in English-speaking countries, significant differences were found in Canada (a difference of 9 score points) and in Ireland and the United Kingdom (a difference of around 14 score points).

In four countries, females scored significantly higher than males on the uncertainty and data subscale. In Finland, the difference was 5 score points, in Iceland, the difference was 10 score points, while in Malaysia and Thailand the difference was around 15 score points.

Change and relationships subscale

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	422	4.6	403	4.1
Malaysia	408	4.3	394	4.9
Latvia	501	3.6	492	4.0
Kazakhstan	437	3.6	429	3.7
Sweden	472	3.1	466	3.6
Russian Federation	493	3.5	489	4.0
United Arab Emirates	445	3.0	440	4.2
Iceland	488	2.5	485	2.5
Bulgaria	436	4.9	433	5.3
Cyprus	441	1.8	439	1.9
Turkey	449	5.7	448	5.4
Macao–China	543	1.5	542	1.7
Singapore	580	1.9	581	2.2
Poland	509	4.3	510	4.7
Romania	445	4.1	446	4.7
Lithuania	479	3.3	480	3.5
Finland	520	2.8	521	3.2
Norway	476	3.8	479	3.2
Slovak Republic	472	4.5	476	4.9
Greece	444	3.1	448	4.3
Chinese Taipei	559	5.8	563	5.7
Slovenia	497	2.2	501	1.7
United States	486	3.9	490	3.9
Croatia	465	4.6	470	5.1
Serbia	439	4.6	445	4.9
Estonia	527	2.4	533	2.8
Hungary	479	4.0	485	4.0
Czech Republic	496	4.2	503	4.5
Vietnam	506	4.9	514	5.9
Belgium	509	2.9	517	3.6
Netherlands	514	4.2	522	4.3
Portugal	482	4.1	490	4.4
Shanghai–China	619	3.9	629	4.4
OECD average	**487**	**0.6**	**498**	**0.7**
Mexico	399	1.7	410	1.9
Germany	510	4.2	521	3.9
France	491	2.8	503	3.7
Switzerland	524	3.6	536	3.9
Australia	**503**	**2.2**	**515**	**2.5**
Israel	456	4.0	469	8.9
Ireland	494	3.1	508	3.6
Canada	518	2.2	532	2.2
United Kingdom	489	3.9	504	4.4
Denmark	486	2.7	502	3.3
Hong Kong–China	556	4.3	572	5.0
Spain	473	2.1	490	2.5
New Zealand	492	3.5	509	3.6
Italy	467	2.3	486	2.4
Liechtenstein	531	6.5	552	6.3
Korea	548	5.4	569	6.6
Japan	531	4.2	553	5.0
Austria	495	4.1	518	4.8
Luxembourg	475	1.3	500	1.5
Chile	396	3.4	428	4.5

Difference in mean score

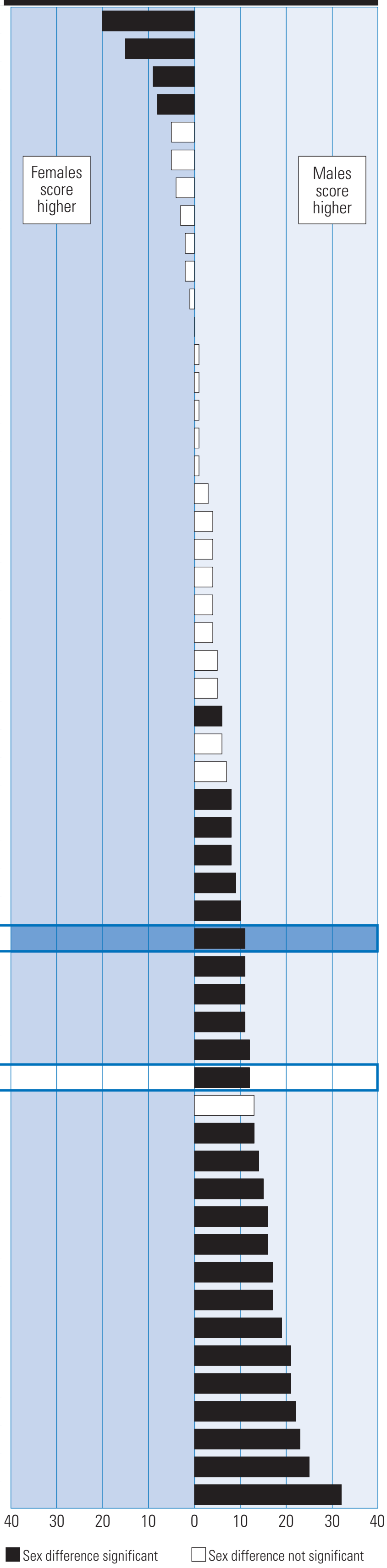
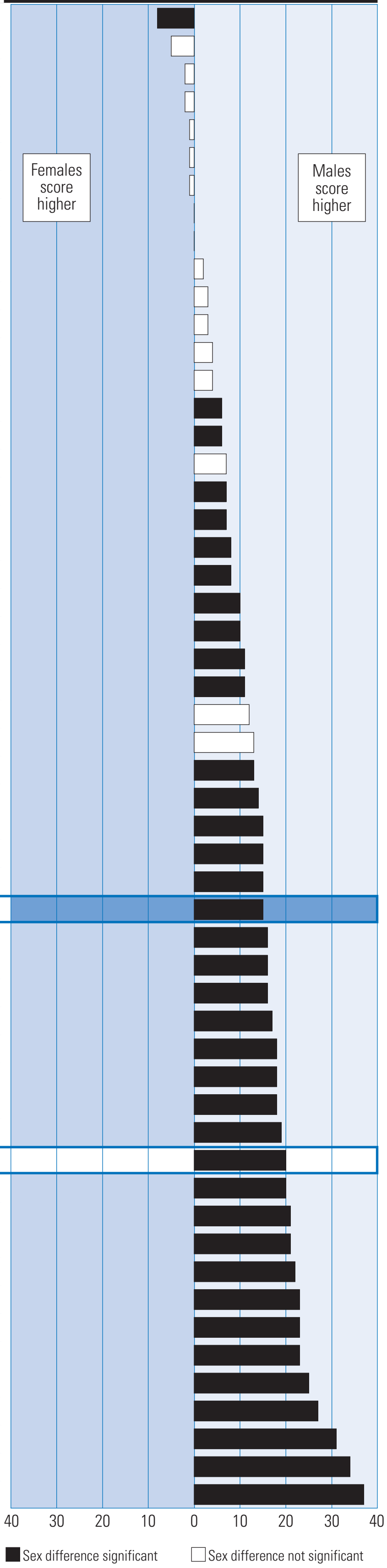


Figure 3.7 Mean scores and differences by sex in students' performance on the content subscales, by country

Space and shape subscale					
	Females		Males		
Country	Mean score	SE	Mean score	SE	Difference in mean score
Iceland	493	2.2	485	2.0	
Singapore	582	1.9	577	2.3	
Thailand	433	4.8	431	4.0	
Lithuania	473	3.5	471	3.3	
United Arab Emirates	425	3.5	424	3.5	
Finland	507	2.3	506	2.7	
Latvia	497	3.6	496	3.8	
Shanghai–China	649	3.7	649	4.4	
Bulgaria	442	4.6	442	5.0	
Malaysia	433	4.0	435	3.9	
Sweden	467	2.8	470	3.0	
Norway	478	4.1	481	3.4	
Estonia	510	3.0	515	3.0	
Russian Federation	494	3.8	498	4.6	
Cyprus	433	1.5	439	1.6	
Slovenia	500	2.2	506	2.0	
Macao–China	554	1.6	561	2.0	
Chinese Taipei	589	6.4	596	6.2	
United States	460	4.4	467	4.3	
Poland	520	4.4	528	4.9	
Kazakhstan	446	4.3	454	4.2	
Romania	443	4.4	452	4.7	
Canada	505	2.3	515	2.4	
Serbia	441	4.2	452	4.5	
Greece	431	2.8	442	3.3	
Turkey	437	6.8	449	5.8	
Israel	443	3.6	456	8.0	
United Kingdom	469	4.2	482	4.3	
Denmark	490	2.5	504	3.0	
Slovak Republic	482	4.7	496	4.7	
Portugal	483	4.4	498	4.6	
Croatia	452	4.1	468	4.7	
OECD average	**482**	**0.6**	**497**	**0.7**	
Netherlands	499	4.0	515	3.5	
Germany	499	3.7	515	3.4	
France	481	2.9	497	3.6	
Hungary	465	4.1	482	3.8	
Spain	468	2.3	486	2.5	
Belgium	500	2.8	518	3.0	
Japan	548	4.0	566	4.6	
Switzerland	535	3.4	554	3.5	
Australia	**486**	**2.3**	**506**	**2.5**	
Korea	562	5.9	583	6.6	
Hong Kong–China	555	4.5	576	5.6	
Mexico	402	1.7	423	1.9	
Czech Republic	487	3.7	509	4.2	
Italy	476	2.7	498	2.8	
Liechtenstein	527	7.5	550	6.2	
Vietnam	496	5.0	519	5.9	
Ireland	465	3.0	490	3.7	
New Zealand	477	3.1	504	3.5	
Chile	404	3.2	435	3.8	
Luxembourg	469	1.5	503	1.4	
Austria	483	3.4	519	4.5	



Quantity subscale					
	Females		Males		
Country	Mean score	SE	Mean score	SE	Difference in mean score
Thailand	426	4.4	409	3.8	
Malaysia	413	4.3	405	4.3	
Sweden	485	2.9	478	3.1	
United Arab Emirates	434	3.5	428	4.3	
Singapore	572	1.7	566	1.8	
Iceland	499	2.5	494	2.6	
Finland	528	2.1	525	2.6	
Bulgaria	443	4.7	442	5.1	
Latvia	487	3.3	487	3.5	
Russian Federation	478	3.2	478	3.5	
Cyprus	438	1.8	439	1.8	
Kazakhstan	427	4.1	429	3.7	
Romania	442	4.8	444	5.2	
Lithuania	482	3.2	484	3.1	
Norway	491	3.5	494	3.0	
Poland	516	3.7	521	4.1	
Macao–China	528	1.4	533	1.5	
United States	475	4.1	481	4.3	
Vietnam	506	5.4	512	6.2	
Slovenia	500	2.1	508	1.8	
Estonia	521	2.5	528	2.6	
Hungary	472	3.9	480	3.8	
Chinese Taipei	540	5.0	548	4.8	
Serbia	452	4.3	460	4.3	
France	492	2.7	501	3.7	
Hong Kong–China	561	4.2	570	4.4	
Canada	511	2.4	520	2.5	
Shanghai–China	586	3.5	596	3.8	
Czech Republic	500	4.0	510	3.5	
Switzerland	526	3.0	536	3.8	
Australia	**495**	**2.2**	**505**	**2.7**	
Greece	450	3.1	461	4.0	
Netherlands	527	4.0	537	3.8	
Belgium	513	2.5	524	2.8	
OECD average	**490**	**0.6**	**501**	**0.6**	
Slovak Republic	481	4.2	492	4.1	
Portugal	475	4.1	487	4.4	
Korea	531	5.0	543	5.0	
Israel	473	3.8	486	8.6	
United Kingdom	488	4.1	501	4.8	
Turkey	435	5.7	449	5.5	
Ireland	498	3.0	512	3.7	
New Zealand	492	3.1	506	3.3	
Germany	510	3.6	524	3.3	
Denmark	495	2.4	510	3.2	
Croatia	472	4.0	488	4.6	
Mexico	406	1.7	422	1.7	
Austria	502	3.8	519	3.6	
Italy	482	2.3	499	2.5	
Japan	508	3.5	527	4.5	
Spain	481	2.4	501	2.7	
Liechtenstein	527	6.4	548	6.3	
Chile	411	3.4	433	4.0	
Luxembourg	483	1.3	506	1.5	

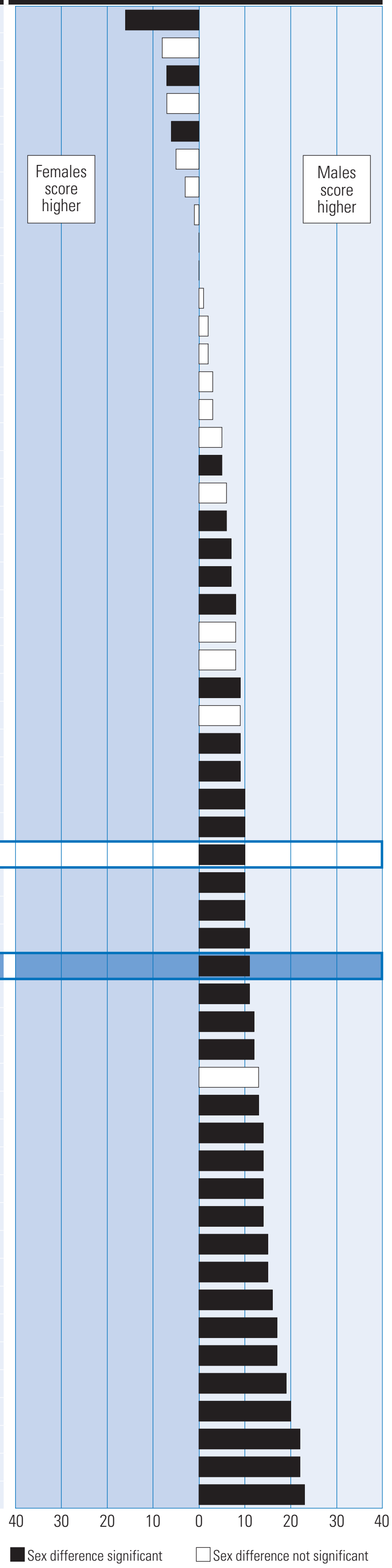
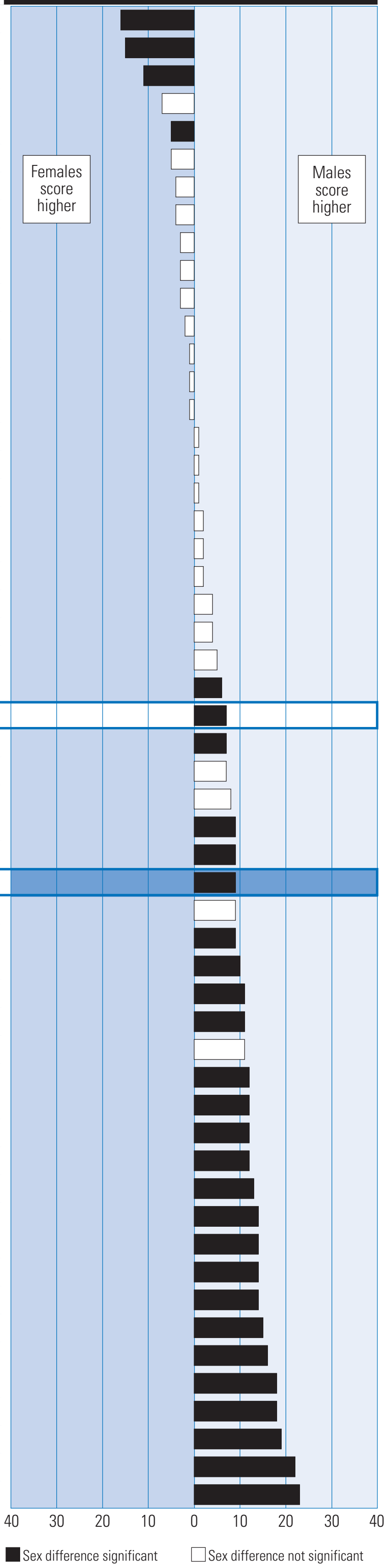


Figure 3.7 Mean scores and differences by sex in students' performance on the content subscales, by country *(continued)*

Uncertainty and data subscale

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	440	3.7	424	3.4
Malaysia	429	3.2	414	3.6
Iceland	501	2.5	491	2.4
United Arab Emirates	435	3.1	428	3.7
Finland	521	2.6	516	2.9
Russian Federation	465	3.4	461	3.8
Cyprus	444	1.8	440	1.7
Singapore	561	2.0	558	2.0
Bulgaria	433	4.2	430	4.7
Latvia	480	3.2	477	3.2
Slovenia	497	2.1	495	1.7
Lithuania	475	3.0	472	3.0
Sweden	483	2.7	482	3.2
Kazakhstan	414	2.9	413	3.0
Norway	497	3.5	496	3.2
Vietnam	519	4.1	520	5.1
France	492	2.8	492	3.7
Romania	436	3.6	437	3.9
Poland	516	3.8	518	4.0
Macao–China	524	1.5	526	1.6
United States	487	3.8	489	3.8
Chinese Taipei	547	5.6	550	5.0
Shanghai–China	590	3.1	594	3.7
Greece	458	2.7	463	3.5
Estonia	507	2.2	513	2.5
Australia	**504**	**1.9**	**511**	**2.3**
Belgium	504	2.9	511	3.2
Hungary	472	4.0	479	3.5
New Zealand	502	3.1	509	3.9
Mexico	409	1.3	417	1.4
Canada	512	2.0	521	2.2
OECD average	**489**	**0.5**	**497**	**0.6**
Turkey	443	5.3	452	5.0
Netherlands	527	4.4	536	4.0
Croatia	463	3.8	473	4.3
Czech Republic	483	3.3	493	3.4
Slovak Republic	466	4.0	477	4.2
Israel	459	3.4	471	7.9
Serbia	443	3.4	454	4.1
Portugal	480	3.8	492	4.1
Hong Kong–China	547	3.5	559	4.4
Japan	522	3.4	534	4.6
United Kingdom	496	3.5	509	4.1
Denmark	498	2.5	512	2.9
Germany	502	3.6	516	3.2
Ireland	501	2.9	516	3.7
Switzerland	514	3.3	529	3.6
Italy	475	2.2	490	2.4
Spain	478	2.3	495	2.8
Korea	528	4.8	546	5.3
Austria	489	3.6	508	3.6
Chile	421	2.8	440	3.6
Liechtenstein	514	5.7	536	6.1
Luxembourg	471	1.4	494	1.5

Difference in mean score



Students' proficiencies on the four content subscales across countries by sex

The proportions of females and males in Australia and across OECD countries who performed at each of the proficiency levels on the four content subscales are shown in Figure 3.8. Generally, at the higher end of the content proficiency subscales, there were higher proportions of males than females, whereas at the lower end of the proficiency subscales, there were higher proportions of females than males.

On the change and relationships subscale, 16% of females and 20% of male students in Australia were top performers, while 21% of females and 19% of males were low performers. Across the OECD countries, 12% of females and 17% of males were top performers, while 25% of females and 24% of males were low performers.

The change and relationships subscale saw a higher proportion of females (by 4%) and males (by 3%) at the higher end of the subscale and a similar proportion of females and males at the lower end of the proficiency subscale compared to the corresponding proportions of students across the overall mathematical literacy proficiency scale.

In Australia, 12% of females and 16% of males were top performers on the space and shape subscale, while 27% of females and 21% of males were low performers. Across OECD countries, 11% of females and 15% of males were top performers, while 32% of females and 28% of males were low performers.

While the proportions of female and male top performers on the space and shape subscale were similar to the corresponding proportions of students across the overall mathematical literacy proficiency scale, the proportions of Australian female and male low performers on the space and shape subscale were higher (6% for females and 3% for males) than compared to the corresponding proportions of students on the overall mathematical literacy proficiency scale.

On the quantity subscale, 14% of Australian females and 17% of Australian males were top performers, while 24% of Australian females and 21% of Australian males were low performers. Across OECD countries, 12% of females and 16% of males were top performers, while 24% of females and 23% of males were low performers.

The comparison of proficiency levels between the quantity subscale and the overall mathematical literacy scale showed the proportion of female top performers on the quantity subscale was higher (by 2%), while the proportion of male top performers between the quantity subscale and the overall mathematical literacy scale were similar. The proportion of female and male low performers on the quantity subscale was higher (by 3% for both females and males) than on the overall mathematical literacy scale.

On the uncertainty and data subscale, 14% of females and 17% of males in Australia were top performers, while 19% of females and 18% of males were low performers. Across OECD countries, 10% of females and 14% of males were top performers, while there was an equal proportion of females and males (23%) who were low performers.

Among Australian students, the proportion of female top performers on the uncertainty and data subscale was 2% higher than on the overall mathematical literacy scale, while the proportion of male top performers between this subscale and the overall mathematical literacy scale was similar. There were 2% more female low performers on the uncertainty and data subscale than on the overall mathematical literacy scale.

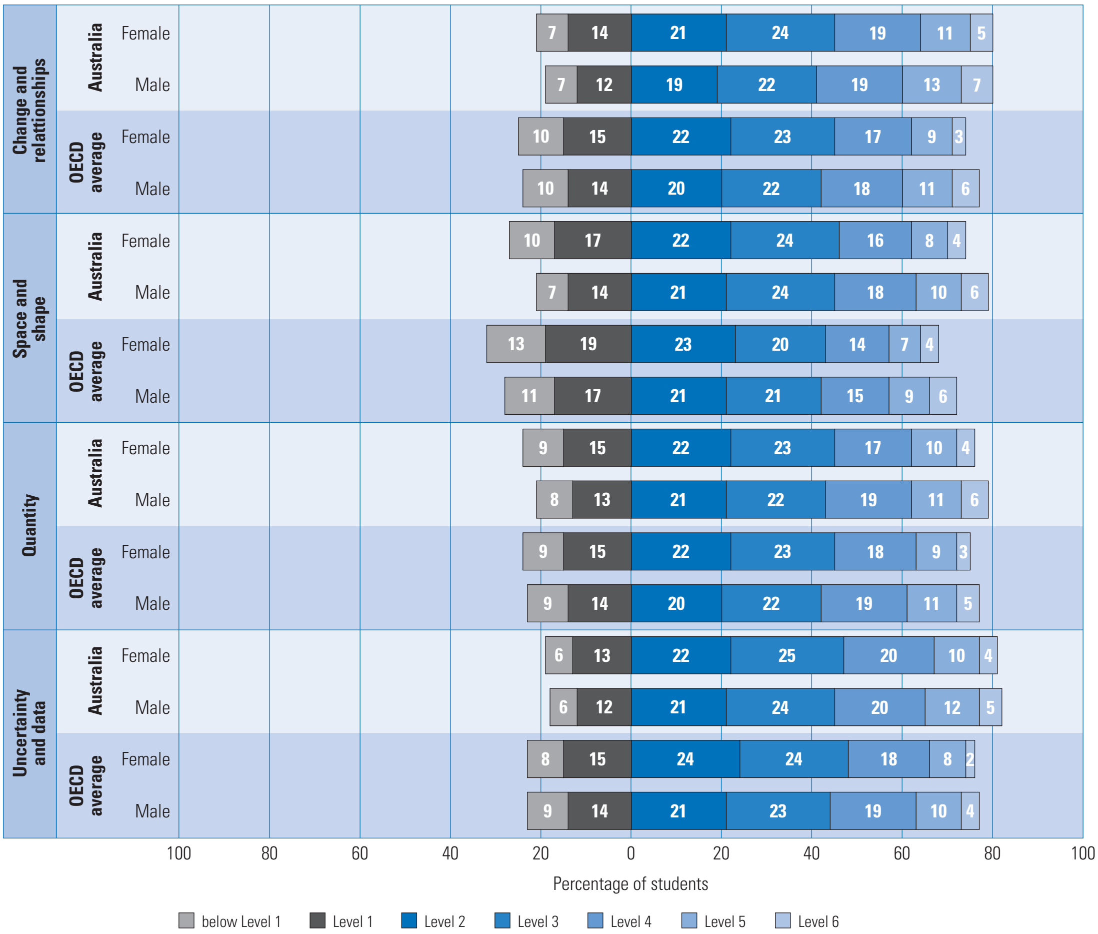


Figure 3.8 Percentage of students across the content proficiency level subscales by sex, for Australia and the OECD average

Australia's performance on the content subscales from a national perspective

The mean scores of the Australian jurisdictions on the change and relationships subscale, with comparisons between the jurisdictions are shown in Table 3.2. The Australian Capital Territory and Western Australia achieved at a similar level to New South Wales, and significantly higher than all the other jurisdictions. The Northern Territory was the only jurisdiction that was significantly outperformed by all other jurisdictions.

Western Australia, the Australian Capital Territory, New South Wales, Queensland and Victoria performed significantly higher than the OECD average. South Australia's performance was not significantly different, while Tasmania and the Northern Territory performed significantly lower than OECD average.

Table 3.2 Multiple comparisons of mean performance on the change and relationships subscale, by jurisdiction

Jurisdiction	Mean score	SE	WA	ACT	NSW	QLD	VIC	SA	TAS	NT	OECD average
WA	520	4.3		●	●	▲	▲	▲	▲	▲	▲
ACT	520	4.1	●		●	▲	▲	▲	▲	▲	▲
NSW	514	3.9	●	●		●	●	▲	▲	▲	▲
QLD	509	3.1	▼	▼	●		●	▲	▲	▲	▲
VIC	506	3.9	▼	▼	●	●		▲	▲	▲	▲
SA	493	3.4	▼	▼	▼	▼	▼		▲	▲	●
TAS	481	3.8	▼	▼	▼	▼	▼	▼		▲	▼
NT	456	10.2	▼	▼	▼	▼	▼	▼	▼		▼
OECD average	**493**	**0.6**	▼	▼	▼	▼	▼	●	▲	▲	

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

Table 3.3 shows the mean scores of the Australian jurisdictions on the space and shape subscale, with comparisons between the jurisdictions. The Australian Capital Territory and Western Australia performed at a similar level to New South Wales and significantly higher than all the other jurisdictions. The performances of Tasmania and the Northern Territory were significantly lower than the other jurisdictions, but not significantly different from each other.

The Australian Capital Territory, Western Australia and New South Wales performed significantly higher than the OECD average, and Queensland and Victoria performed at a similar level to the OECD average. South Australia, Tasmania and the Northern Territory performed significantly lower than OECD average.

Table 3.3 Multiple comparisons of mean performance on the space and shape subscale, by jurisdiction

Jurisdiction	Mean score	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	511	3.8		●	●	▲	▲	▲	▲	▲	▲
WA	508	4.0	●		●	▲	▲	▲	▲	▲	▲
NSW	503	4.1	●	●		●	●	▲	▲	▲	▲
QLD	496	3.3	▼	▼	●		●	▲	▲	▲	●
VIC	492	4.1	▼	▼	●	●		●	▲	▲	●
SA	481	3.9	▼	▼	▼	▼	●		▲	▲	▼
TAS	470	3.6	▼	▼	▼	▼	▼	▼		●	▼
NT	458	10.9	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**490**	**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

The mean scores of the Australian jurisdictions on the quantity subscale, with comparisons between the jurisdictions, are shown in Table 3.4. The Australian Capital Territory and Western Australia achieved at a similar level to New South Wales and significantly higher than all the other jurisdictions. The Northern Territory performed significantly lower than all the other jurisdictions.

The Australian Capital Territory, Western Australia and New South Wales performed significantly higher than the OECD average, and Victoria and Queensland's performance was statistically similar to the OECD average; while South Australia, Tasmania and the Northern Territory performed significantly lower than OECD average.

Table 3.4 Multiple comparisons of mean performance on the quantity subscale, by jurisdiction

Jurisdiction	Mean	SE	ACT	WA	NSW	VIC	QLD	SA	TAS	NT	OECD average
ACT	513	4.1		●	●	▲	▲	▲	▲	▲	▲
WA	512	3.9	●		●	▲	▲	▲	▲	▲	▲
NSW	505	3.8	●	●		●	●	▲	▲	▲	▲
VIC	499	4.1	▼	▼	●		●	▲	▲	▲	●
QLD	498	3.6	▼	▼	●	●		▲	▲	▲	●
SA	481	3.5	▼	▼	▼	▼	▼		▲	▲	▼
TAS	470	3.6	▼	▼	▼	▼	▼	▼		▲	▼
NT	445	9.7	▼	▼	▼	▼	▼	▼	▼		▼
OECD average	**495**	**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

Table 3.5 shows the mean scores of the Australian jurisdictions on the uncertainty and data subscale, with comparisons between the jurisdictions. The Australian Capital Territory's performance was similar to Western Australia's performance and significantly higher than all other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.

The Australian Capital Territory, Western Australia, New South Wales, Queensland and Victoria performed significantly higher than the OECD average. South Australia performed on par with the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.

Table 3.5 Multiple comparisons of mean performance on the uncertainty and data subscale, by jurisdiction

Jurisdiction	Mean	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	526	3.8		●	▲	▲	▲	▲	▲	▲	▲
WA	522	3.2	●		●	▲	▲	▲	▲	▲	▲
NSW	513	3.7	▼	●		●	●	▲	▲	▲	▲
QLD	506	3.2	▼	▼	●		●	▲	▲	▲	▲
VIC	503	3.8	▼	▼	●	●		●	▲	▲	▲
SA	495	3.8	▼	▼	▼	▼	●		▲	▲	●
TAS	484	3.5	▼	▼	▼	▼	▼	▼		▲	▼
NT	447	10.9	▼	▼	▼	▼	▼	▼	▼		▼
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

Table 3.6 shows further statistical details about the performance of the jurisdictions on the content subscales, including the confidence interval and the difference between the 5th and 95th percentiles. The difference between each of the content subscale scores and the mean overall mathematical literacy score is also shown, along with the mean and standard errors for the four content subscales and the overall mathematical literacy subscale, for convenience.

On the change and relationships and the uncertainty and data subscales, Victoria had the narrowest spread of scores between students in the 5th and 95th percentiles, whereas the Northern Territory had the widest spread of scores between the lowest and highest performing students. South Australia had the narrowest distribution between the lowest and highest performing students on the space and shape and the quantity subscales, while New South Wales had the widest scores on the space and shape subscale, and the Northern Territory had the widest spread of scores on the quantity subscale.

In terms of mean scores, the areas of change and relationships and uncertainty and data are relative strengths for most Australian students, while the areas of quantity and space and shape are apparently areas of relative weakness.

Students' proficiencies on the content subscales across the Australian jurisdictions

Figure 3.9 shows the proportion of students at each proficiency level on the change and relationships subscale by jurisdiction, along with the results for Australia, Shanghai–China and the OECD average for comparison.

Western Australia had the highest proportion of students who were top performers (22%), reaching Level 5 or 6 on the change and relationships subscale. In the other jurisdictions, the proportions of students who were top performers ranged from 9% in the Northern Territory to 20% in the Australian Capital Territory and New South Wales. Across the OECD, 15% of students achieved Level 5 or 6 on the change and relationships subscale, which was lower than the 18% of top performers in Australia.

The Australian Capital Territory and Western Australia had the lowest proportion of students placed at below Level 2, with around 17% of students in this category. In Queensland, Victoria and New South Wales, one-fifth of students were low performers, which was lower than the 24% of students across OECD countries. Around one-quarter of students from South Australia and Tasmania, and 35% of students in the Northern Territory, were low performers on the change and relationships subscale.

Table 3.6 Mean scores and distribution of students' performance on the content subscales, by jurisdiction

Change and relationships subscale					
Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
ACT	520	4.1	512–528	331	3
NSW	514	3.9	506–522	356	5
VIC	506	3.9	499–514	322	6
QLD	509	3.1	502–515	333	5
SA	493	3.4	486–499	336	4
WA	520	4.3	512–529	344	4
TAS	481	3.8	474–489	348	4
NT	456	10.2	436–476	402	5

Space and shape subscale					
Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
ACT	511	3.8	503–518	330	–7
NSW	503	4.1	495–511	360	–7
VIC	492	4.1	484–500	319	–9
QLD	496	3.3	489–502	326	–8
SA	481	3.9	474–489	308	–8
WA	508	4.0	500–516	314	–8
TAS	470	3.6	463–478	312	–7
NT	458	10.9	436–479	321	6

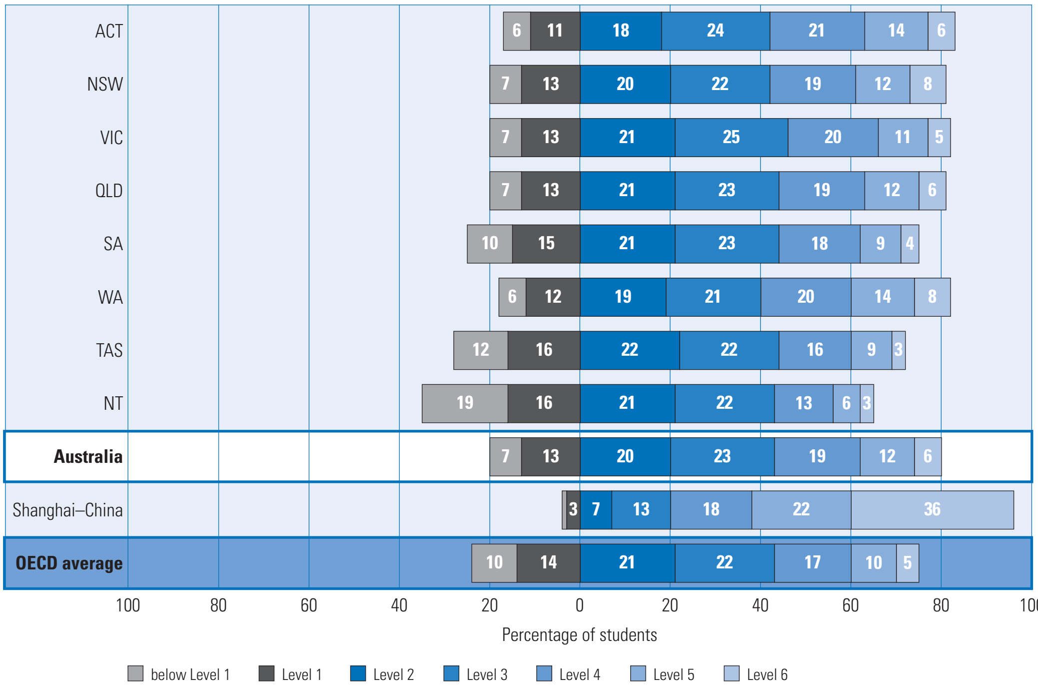


Figure 3.9 Percentage of students across the change and relationships proficiency level subscale, by jurisdiction

On the space and shape subscale, Western Australia, New South Wales and the Australian Capital Territory had between 16 and 18% of students reaching Level 5 or 6. Queensland had a similar proportion of top performers to the OECD average (14%), while Victoria, South Australia, Tasmania and the Northern Territory recorded proportions of students at these levels that were lower than the OECD average.

The lowest proportions of students who failed at achieve Level 2 were recorded in Western Australia (19%) and the Australian Capital Territory (20%). Students from these two jurisdictions (as well as New South Wales, Queensland and Victoria) had a smaller proportion of low performers than the OECD average (26%); while South Australia, Tasmania and the Northern Territory had larger proportions of students that did not achieve the international minimum proficiency standard (Figure 3.10).

Quantity subscale					
Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
ACT	513	4.1	505–521	332	–4
NSW	505	3.8	497–512	356	–4
VIC	499	4.1	490–507	320	–2
QLD	498	3.6	491–505	336	–6
SA	481	3.5	474–488	317	–8
WA	512	3.9	505–520	327	–4
TAS	470	3.6	463–477	343	–8
NT	445	9.7	426–464	379	–6

Uncertainty and data subscale					
Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
ACT	526	3.8	519–534	324	9
NSW	513	3.7	505–520	333	4
VIC	503	3.8	496–511	299	2
QLD	506	3.2	500–513	310	3
SA	495	3.8	488–502	308	6
WA	522	3.2	516–528	313	6
TAS	484	3.5	477–490	321	6
NT	447	10.9	426–469	371	–4

Overall mathematical literacy scale		
Jurisdiction	Mean score	SE
ACT	518	3.6
NSW	509	3.6
VIC	501	3.7
QLD	503	2.9
SA	489	3.3
WA	516	3.4
TAS	478	3.4
NT	452	10.4

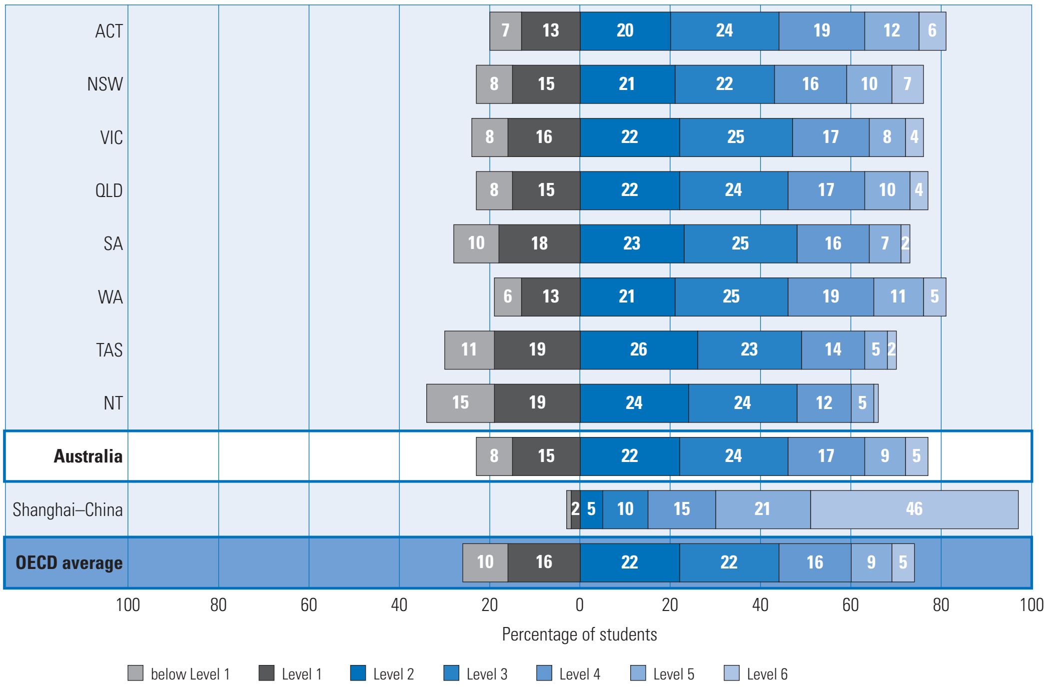


Figure 3.10 Percentage of students across the space and shape proficiency level subscale, by jurisdiction

Figure 3.11 shows the proportions of students at each of the proficiency levels in each jurisdiction on the quantity subscale. Around one-fifth of students in the Australian Capital Territory, New South Wales and Western Australia were top performers, which was higher than across the OECD average; while the proportion of students in Victoria (14%) was equal to the OECD average. Ten per cent of students in South Australia, 9% in Tasmania and 7% in the Northern Territory reached Level 5 or 6, all lower than the proportion of students across the OECD.

Almost 40% of students in the Northern Territory, 30% of students in Tasmania, 26% of students in South Australia and 24% of students in Queensland failed to reach Level 2, all higher proportions than the OECD average (23%). The proportion of students in the remaining jurisdictions ranged from 16% in the Australian Capital Territory to 22% in New South Wales and Victoria.

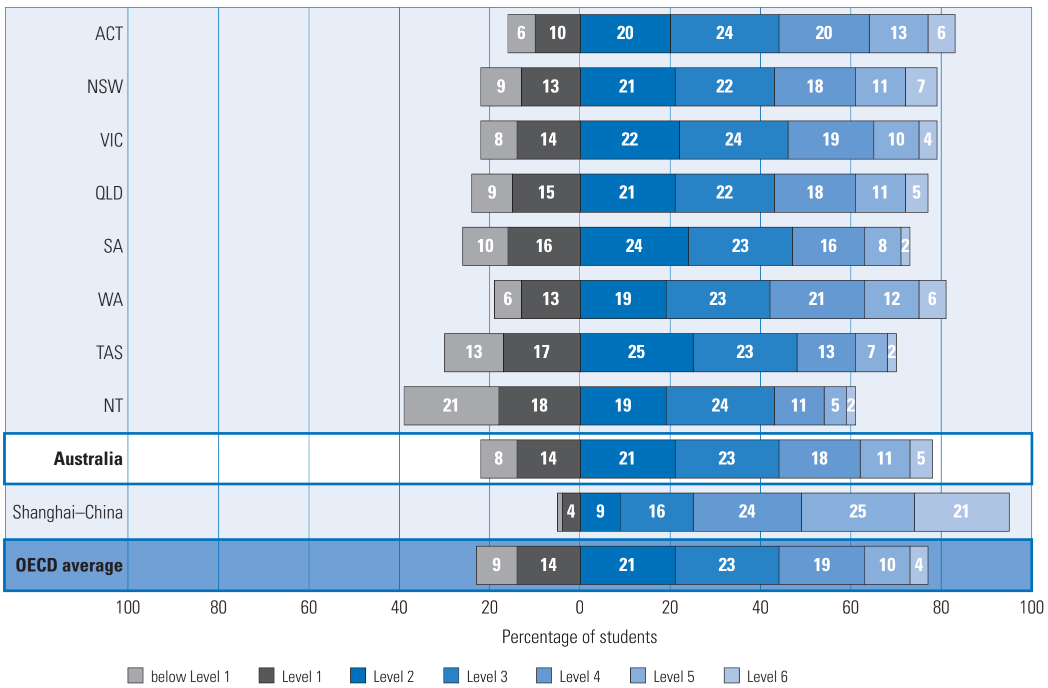


Figure 3.11 Percentage of students across the quantity proficiency level subscale, by jurisdiction

The Australian Capital Territory and Western Australia had the highest proportion of students who were top performers (22 and 20% respectively), reaching Level 5 or 6 on the uncertainty and data subscale. In the other jurisdictions, the proportions of students who were top performers ranged from 6% in the Northern Territory to 18% in New South Wales. Across the OECD, 12% of students achieved Level 5 or 6 on the uncertainty and data subscale, which was lower than the proportion for Australia overall.

The Australian Capital Territory had the lowest proportion of students placed at below Level 2, with 14% of students in this category. In Western Australia, New South Wales, Victoria, Queensland and South Australia, between 16 and 21% of students were low performers, all lower than the OECD average (23%). One-quarter of students in Tasmania and approximately one-third of students in the Northern Territory were low performers.

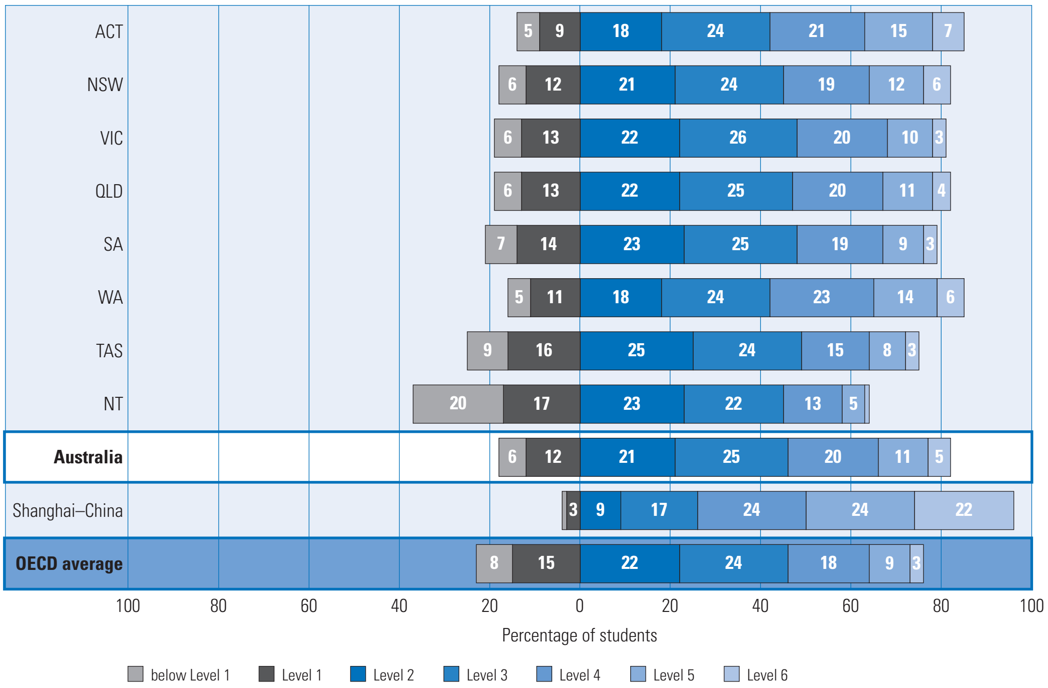


Figure 3.12 Percentage of students across the uncertainty and data proficiency level subscale, by jurisdiction

Students' performance on the content subscales by sex across Australian jurisdictions

The mean mathematical literacy content subscale scores for females and males are shown in Figure 3.13 with the associated standard errors and the difference in mean scores. Males from Western Australia and Victoria performed significantly higher on all four content subscales than females. Males from South Australia performed significantly higher on three of the four content subscales than females. Males from Queensland and Tasmania performed significantly higher than females on two of the content subscales, while males from New South Wales performed significantly higher on one of the content subscales.

On the change and relationships subscale, the largest difference between the sexes was reported in Western Australia, with males scoring 22 score points higher than females. The difference by sex in South Australia was 12 score points, and in Queensland, 11 score points.

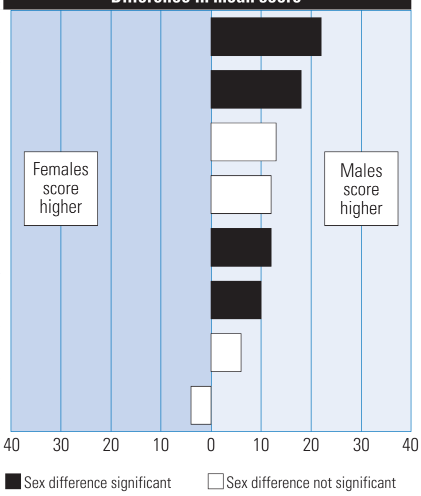
On the space and shape subscale, significant differences by sex were found in Western Australia (29 score points), Victoria (24 score points), New South Wales (19 score points), South Australia (15 score points), Tasmania (14 score points) and Queensland (13 score points).

On the quantity subscale, the largest difference by sex was reported in Western Australia, with males scoring 24 score points higher than females. This was followed by Victoria (18 score points), Tasmania (17 score points) and South Australia (16 score points).

On the uncertainty and data subscale, significant differences by sex were found in Western Australia (17 score points) and Victoria (12 score points).

Change and relationships subscale

Jurisdiction	Females Mean score	Females SE	Males Mean score	Males SE
WA	509	5.8	531	6.3
VIC	497	4.2	515	5.3
TAS	475	5.3	488	5.3
NT	451	15.9	463	9.0
SA	487	4.1	499	4.5
QLD	503	3.7	514	4.1
NSW	511	4.3	517	5.8
ACT	523	5.4	518	6.0



Space and shape subscale

Jurisdiction	Females Mean score	Females SE	Males Mean score	Males SE
WA	493	4.1	522	6.1
VIC	479	4.5	503	5.5
NSW	493	4.4	512	6.0
SA	474	4.4	489	5.1
TAS	463	4.8	477	5.0
ACT	504	4.9	517	5.7
QLD	489	4.2	502	4.1
NT	452	16.0	464	9.3

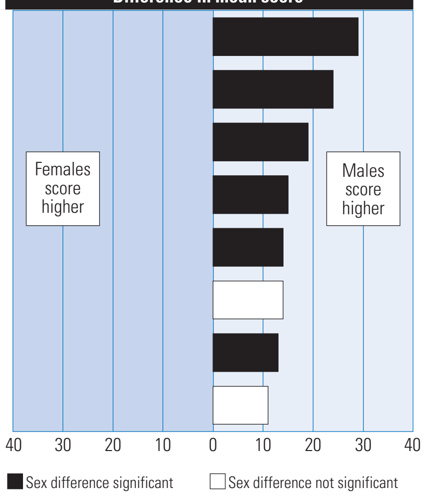


Figure 3.13 Mean scores and differences by sex in students' performance on the content subscales, by jurisdiction

Figure 3.14 shows the proportion of females and males at each of the change and relationships subscale proficiency levels by jurisdiction and sex. The highest proportion of males achieving Level 5 or 6 were in Western Australia (25%), followed by the Australian Capital Territory (21%), New South Wales (22%), Queensland (19%) and Victoria (18%). Other jurisdictions achieved below the OECD average (17%). South Australia recorded 16% of top performers, Tasmania recorded 14% and the Northern Territory recorded 10% of top performers on the change and relationships subscale.

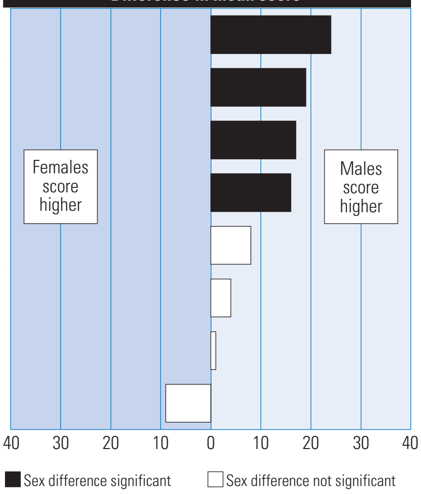
Twenty per cent of females in the Australian Capital Territory were top perfomers, while Victoria, Queensland, New South Wales and Western Australia achieved between 13 and 19% of females who reached Level 5 or 6, which was higher than the OECD average (12%). In other jurisdictions, the proportion of female top performers ranged from 8% in the Northern Territory to 16% in South Australia.

The largest proportions of males who did not reach Level 2 were from the Northern Territory (34%), Tasmania (26%) and South Australia (24%), which were equal or higher than the OECD average of 24%. In other jurisdictions, the proportion of male low performers on the change and relationships subscale ranged from 16% in Western Australia to 20% in New South Wales.

Tasmania and the Northern Territory reported the highest proportion of females who failed to reach Level 2 with 31 and 36% respectively. Twenty-six per cent of females in South Australia were low performers, which was similar to the OECD average (25%). For females in other jurisdictions, the proportions placed below Level 2 ranged from 15% in the Australian Capital Territory to 21% in Victoria and Queensland.

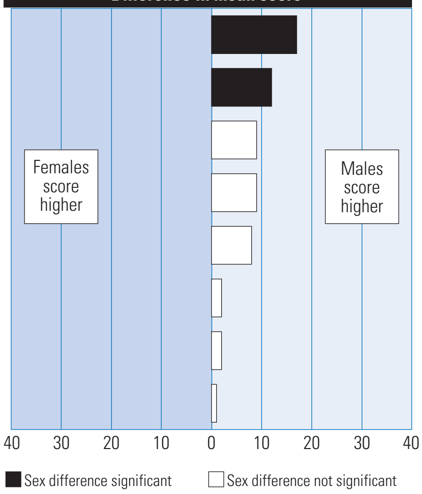
Quantity subscale

Jurisdiction	Females Mean score	Females SE	Males Mean score	Males SE
WA	500	5.0	524	5.6
VIC	489	4.2	507	5.6
TAS	461	5.0	478	5.0
SA	474	4.2	490	4.2
NT	441	14.9	449	8.8
QLD	496	4.3	500	4.7
NSW	504	4.2	505	5.8
ACT	518	5.0	509	6.0



Uncertainty and data subscale

Jurisdiction	Females Mean score	Females SE	Males Mean score	Males SE
WA	513	5.3	530	4.9
VIC	497	3.9	509	5.1
TAS	479	5.0	488	4.9
NT	443	15.1	452	9.8
SA	492	4.4	499	4.4
NSW	511	3.7	514	5.7
ACT	525	4.8	527	5.8
QLD	506	3.8	507	4.3



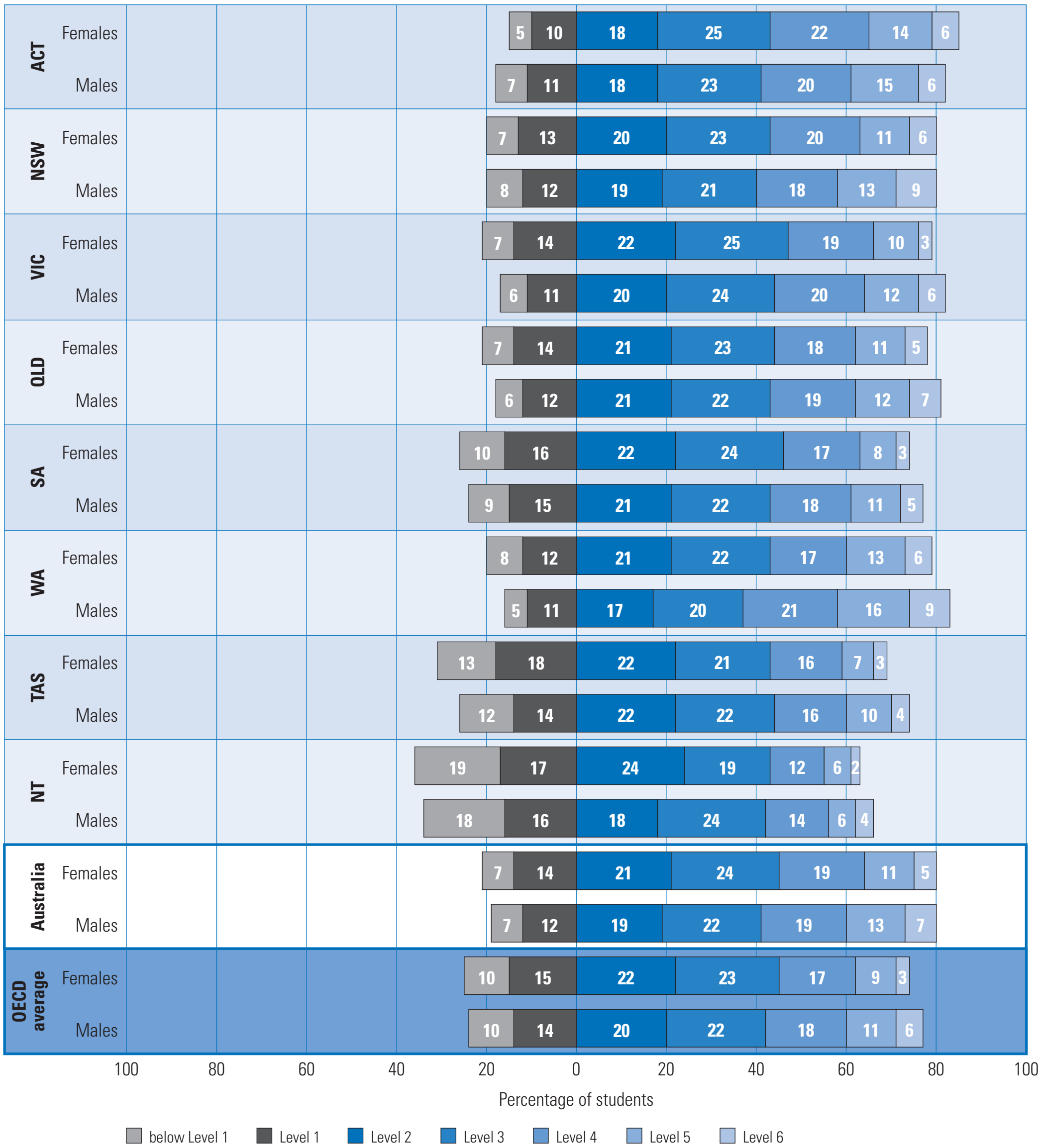


Figure 3.14 Percentage of students across the change and relationships proficiency level subscale, by jurisdiction and sex

On the space and shape subscale, males in New South Wales (21%) and Western Australia and the Australian Capital Territory (20%) achieved the highest proficiency levels. Fifteen per cent of males in Queensland were top performers, the same proportion as that across all OECD countries. In the other jurisdictions, the percentage of males reaching Level 5 or 6 ranged from 6% in the Northern Territory to 14% in Victoria.

The highest proportion of female top performers was in the Australian Capital Territory (16%), followed by New South Wales (14%) and Queensland (13%). Eleven per cent of females were top performers in Western Australia, which was also the same proportion of female top performers across the OECD. The remaining jurisdictions had proportions that were lower than the OECD, ranging from 6% in the Northern Territory to 9% in Victoria.

Thirty per cent of males in the Northern Territory were low performers, while the percentages of males in other jurisdictions were lower than the OECD average (28%), ranging from 15% in Western Australia to 27% in Tasmania (Figure 3.15).

Thirty-four per cent of females in Tasmania and 37% of females in the Northern Territory were placed at below Level 2. Across the OECD, 32% of females failed to reach Level 2, which was higher than the proportion of females in the Australian Captial Territory (22%), Western Australia (23%), New South Wales and Queensland (25%), Victoria (27%) and South Australia (31%).

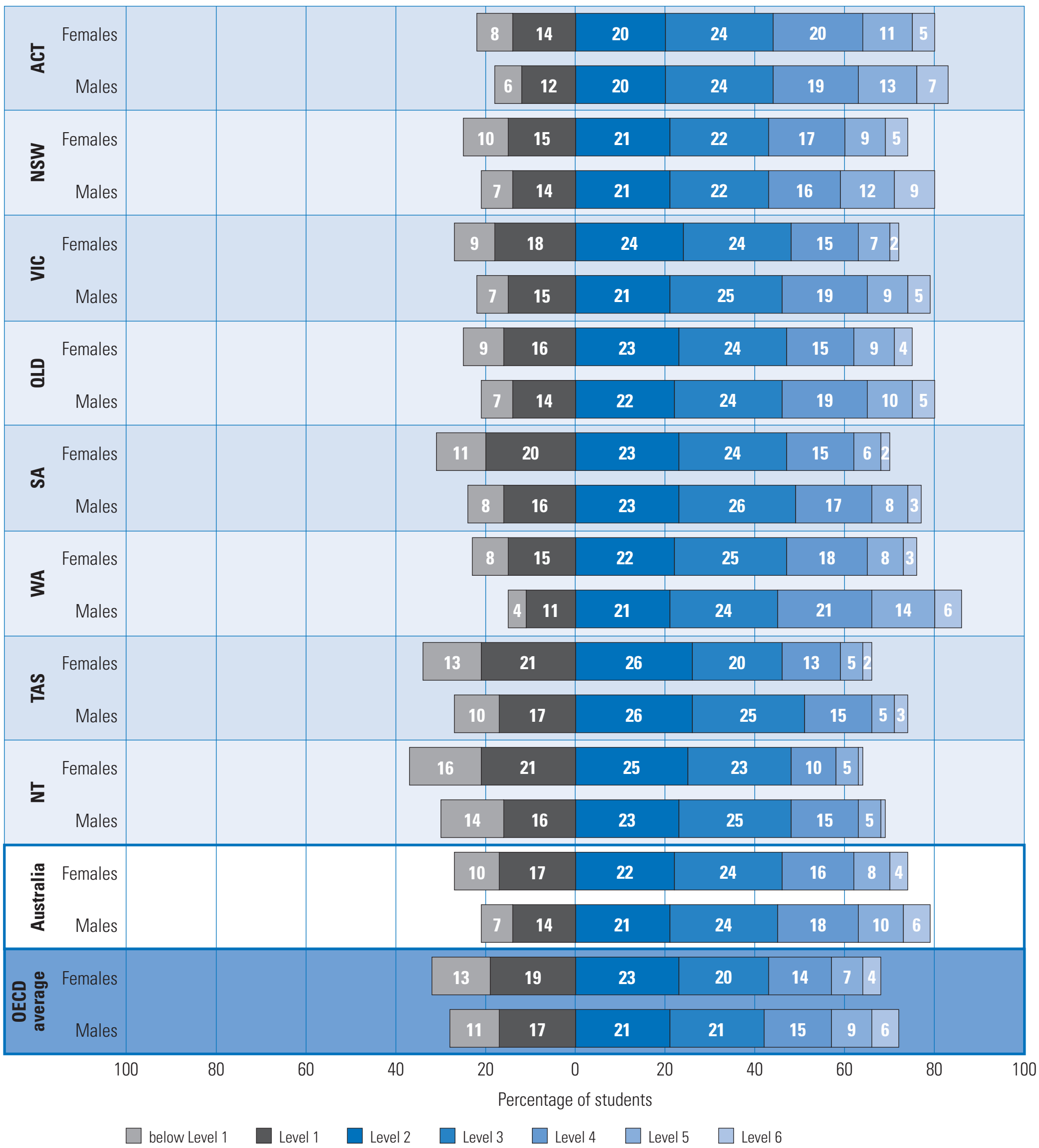


Figure 3.15 Percentage of students across the space and shape proficiency level subscale, by jurisdiction and sex

Figure 3.16 shows the proportions of females and males at each of the quantity subscale proficiency levels by jurisdiction and sex. The highest proportion of males achieving Level 5 or 6 was in Western Australia (21%). Other jurisdictions had between 8 and 19% of males who were top performers. The Northern Territory and Tasmania recorded the lowest proportions of students who achieved Level 5 or 6. Across OECD countries, 16% of males reached Level 5 or 6.

The highest proportions of females who were top performers were reported in the Australian Capital Territory (19%), followed by New South Wales (17%) and Queensland (15%). Across OECD countries, 12% of females reached Level 5 or 6. All other jurisdictions achieved lower proportions of female top performers, ranging from 5% in the Northern Territory to 14% in Western Australia.

Thirty-nine per cent of males were in the Northern Territory and 27% of males in Tasmania failed to reach Level 2. In other jurisdictions, the proportion of male low performers ranged from 16% in Western Australia to 24% in South Australia. Across OECD countries, 23% of males failed to reach Level 2.

The highest proportion of females not reaching Level 2 was in the Northern Territory (39%). Other jurisdictions had between 16 and 34% of females who were low performers. The Australian Capital Territory recorded the lowest proportion of students who were placed below Level 2. Across OECD countries, 24% of females failed to reach Level 2.

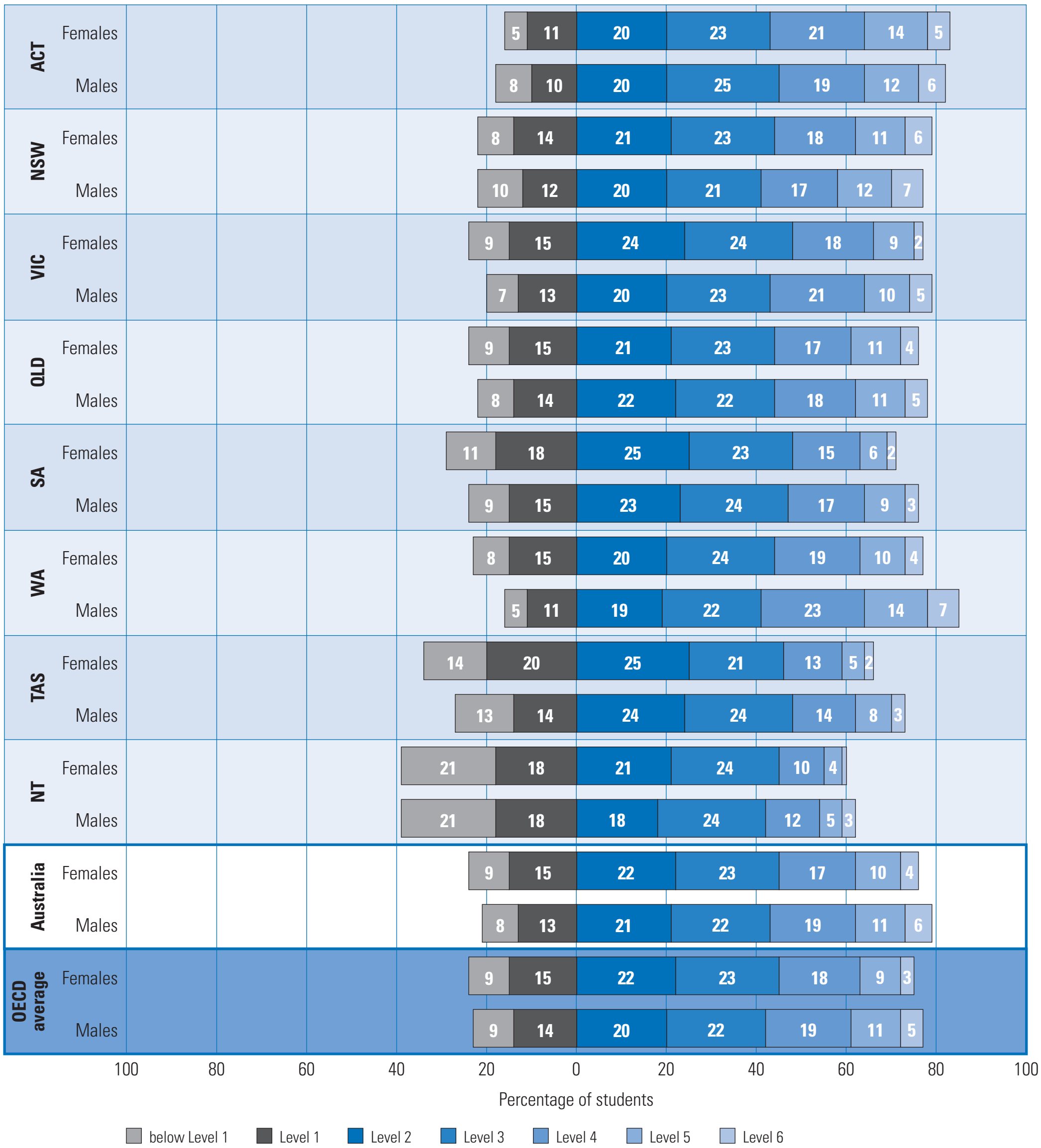


Figure 3.16 Percentage of students across the quantity proficiency level subscale, by jurisdiction and sex

On the uncertainty and data subscale, males in the Australian Capital Territory (24%), Western Australia (21%) and New South Wales (19%) achieved the highest proficiency levels. Sixteen per cent of males in Queensland and 15% of males in Victoria were also top performers. Fourteen per cent of males in South Australia achieved the same proportion as that across the OECD countries. The lowest proportions of male top performers were reported in the Northern Territory (8%) and Tasmania (12%).

One-fifth of females in the Australian Capital Territory achieved Level 5 or 6, followed by 17% in Western Australia and New South Wales, 14% in Queensland and 11% in Victoria. Ten per cent of females in South Australia were top performers, the same proportion as the OECD average; while for the Northern Territory and Tasmania, the proportion of females reaching Level 5 or 6 was lower (at 4 and 9% respectively).

The highest proportions of males who failed to reach Level 2 were from the Northern Territory (36%) and Tasmania (23%). All other jurisdictions had proportions ranging from 21% in South Australia to 14% in Western Australia. Across OECD countries, 23% of males were low performers.

A greater proportion of females in the Northern Territory (37%) and Tasmania (28%) failed to achieve Level 2 compared to the OECD average of 23%. In other jurisdictions, the proportion of low-achieving females ranged from 13% in the Australian Capital Territory to 22% in South Australia.

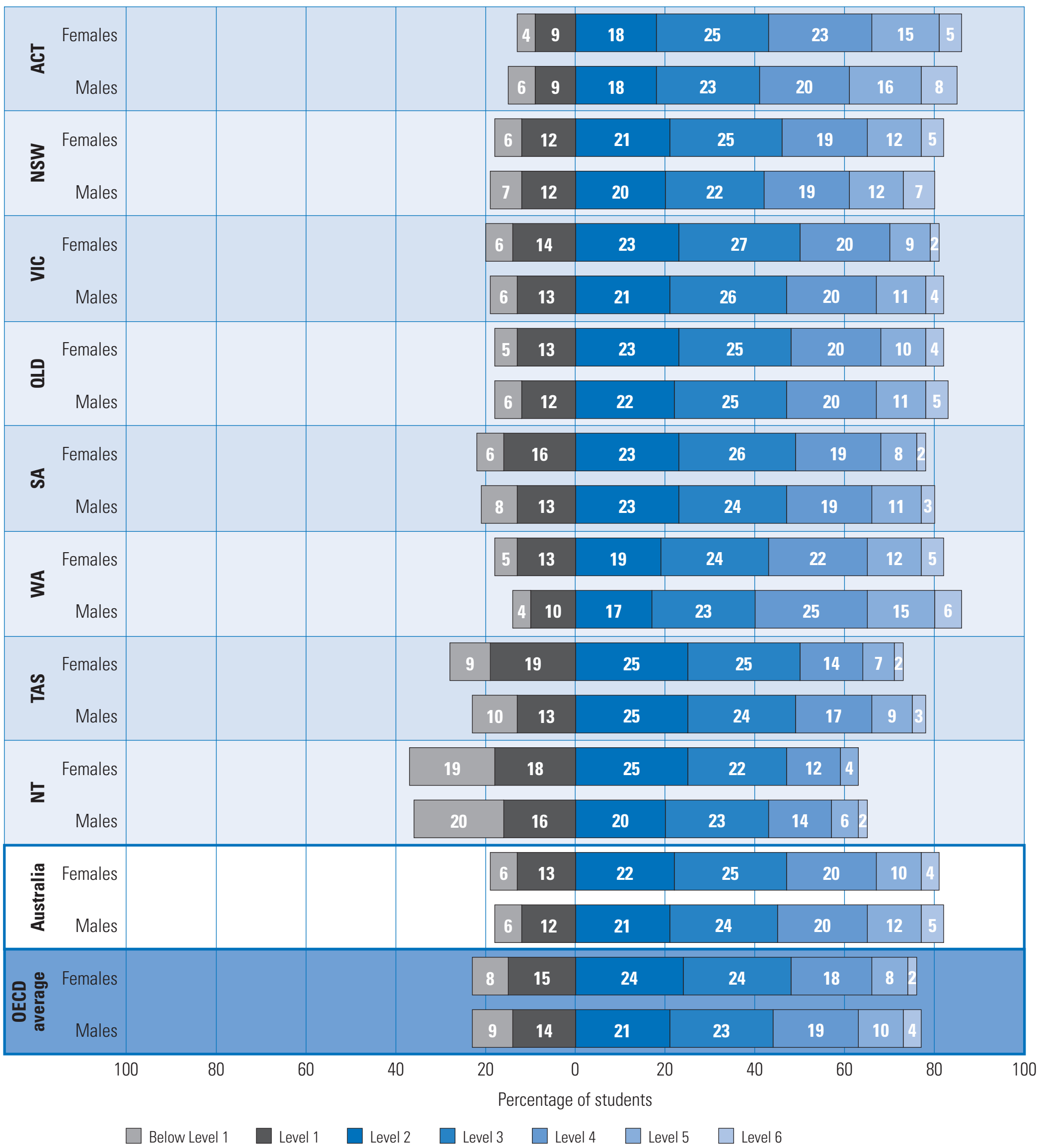


Figure 3.17 Percentage of students across the uncertainty and data proficiency level subscale, by jurisdiction and sex

Students' performance on the content subscales by geographic location of schools

The mean scores, confidence intervals and spread of scores for students by geographic location across the four content subscales are shown in Table 3.7. The differences between the mean content subscale score and the mean overall mathematical literacy score are also shown.

As with the overall mathematical literacy scale, across each of the content subscales students attending schools in metropolitan areas performed at a significantly higher level than students in schools from provincial and remote areas, and students attending schools in provincial areas performed significantly higher than students attending schools in remote areas.

The mean score difference between students in metropolitan and remote schools was larger on the change and relationships subscale (80 score points), the quantity subscale (74 score points) and the uncertainty and data subscale (71 score points) compared to the space and shape subscale (51 score points). The mean score difference between students in metropolitan and provincial schools was similar across the four content subscales: 24 score points on the change and relationships subscale; 22 score points on the space and shape subscale; 31 score points on the quantity subscale; and 26 score points in the uncertainty and data subscale. The mean score difference between students in provincial and remote schools was larger on the change and relationships subscale (56 score points) than on the uncertainty and data subscale (45 score points), the quantity subscale (43 score points) or the space and shape subscale (29 score points).

In terms of relative performance, students across the three geographic locations performed worse on the quantity subscale than on the overall mathematical literacy scale. Students attending schools in remote areas tended to score higher on the space and shape subscale than on the overall mathematical literacy score, while students attending schools in metropolitan and provincial areas tended to score worse. Students attending schools in remote areas tended to score lower on the change and relationships subscale compared to their performance on the overall mathematical literacy score; while students attending schools in metropolitan and provincial areas scored higher on the change and relationships subscale compared to their performance on the overall mathematical literacy score. On the uncertainty and data subscale, students attending schools in metropolitan and provincial areas tended to score higher compared to their performance on the overall mathematical literacy scale; while for students in remote areas, the mean score on the uncertainty and data subscale and on the overall mathematical literacy scale was the same.

Students across the three geographic locations performed worse on the quantity subscale, scoring lower than on the overall mathematical literacy scale. While students attending schools in metropolitan and provincial areas found uncertainty and data items easier, students attending schools in remote areas found this process neither easier nor harder.

The proportions of students who performed at each of the proficiency levels on the four content subscales by geographic location is shown in Figure 3.18.

On the change and relationships subscale, 20% of students from metropolitan schools performed at Level 5 or 6, compared to 12% of students from provincial schools and 7% of students from remote schools. One-fifth (19%) of students from metropolitan schools did not reach Level 2, compared to 24% of students from provincial schools and 43% of students from remote schools.

Table 3.7 Mean scores in students' performance on the content subscales, by geographic location of school

Geographic location	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Change and relationships subscale					
Metropolitan	516	2.1	512–520	343	5
Provincial	492	2.5	487–497	322	6
Remote	436	19.4	398–474	423	–8
Space and shape subscale					
Metropolitan	503	2.3	498–507	341	–9
Provincial	481	2.9	475–487	308	–5
Remote	452	15.9	421–483	328	8
Quantity subscale					
Metropolitan	509	2.3	504–513	339	–3
Provincial	478	3.2	472–484	323	–8
Remote	435	17.2	401–469	403	–9
Uncertainty and data subscale					
Metropolitan	515	1.9	512–519	319	4
Provincial	489	2.7	483–494	300	3
Remote	444	14.8	415–473	368	0

On the space and shape subscale, 16% of students from metropolitan schools were top performers, compared to 10% of students from provincial schools and 5% of students from remote schools. At the lower end of the proficiency scale, 22% of students from metropolitan schools were low performers, compared to 27% of students from provincial schools and 36% of students from remote schools.

On the quantity subscale, 18% of students from metropolitan schools performed at Level 5 or 6, compared to 9% of students from provincial schools and 5% of students from remote schools. Twenty per cent of students from metropolitan schools were placed below Level 2, compared to 27% of students from provincial schools and 44% of students from remote schools.

On the uncertainty and data subscale, 18% of students from metropolitan schools performed at Level 5 or 6, compared to 10% of students from provincial schools and 5% of students from remote schools. Seventeen per cent of students from metropolitan schools did not reach Level 2, compared to 22% of students from provincial schools and 40% of students from remote schools.

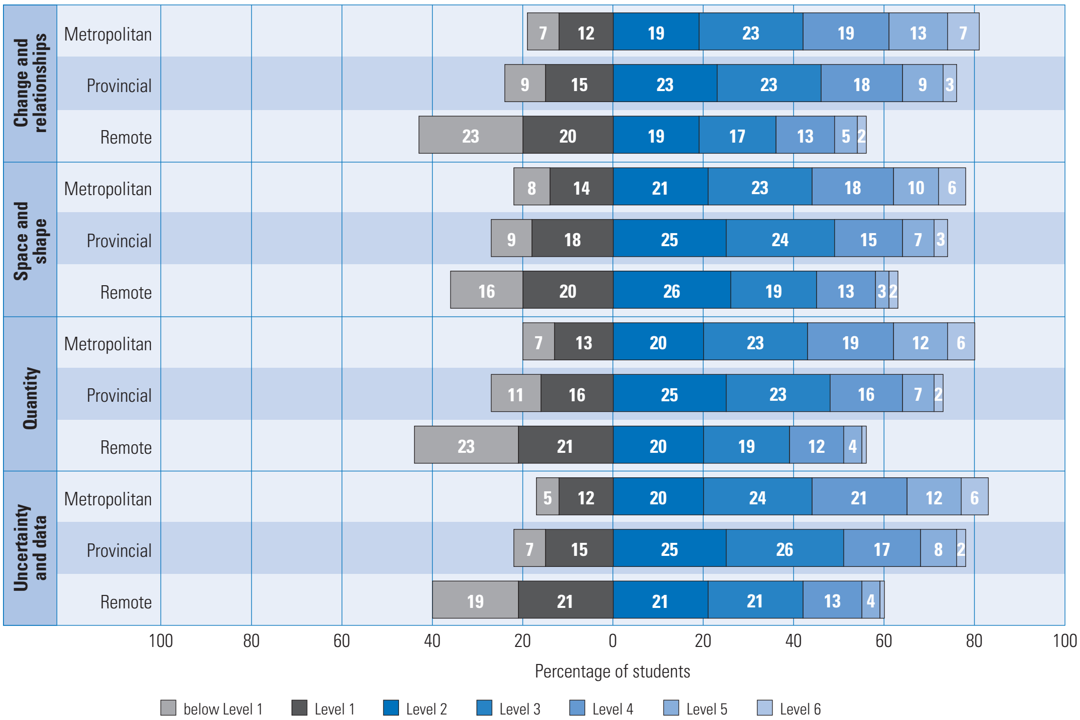


Figure 3.18 Percentage of students across the content proficiency level subscales, by geographic location of school

Students' performance on the content subscales by Indigenous background

Table 3.8 provides the mean performance of Indigenous and non-Indigenous students across the content subscales. The mean score for Indigenous students' performance ranged from 407 on the quantity subscale to 422 score points on the uncertainty and data subscale. The mean score for non-Indigenous students' performance ranged from 499 on the space and shape subscale to 512 score points on the change and relationships subscale. Indigenous students recorded a mean score that was significantly lower than the mean score for non-Indigenous students across each of the content subscales.

In terms of relative performance, Indigenous students tended to score higher on the uncertainty and data subscale (5 score points difference) and lower on the quantity subscale (10 score points difference) compared to the overall mathematical literacy scale, while the change and relationships and space and shape subscales were neither easier nor harder than on the overall mathematical literacy scale.

Table 3.8 Mean scores in students' performance on the content subscales, by Indigenous background

Indigenous background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Change and relationships subscale					
Indigenous	418	5.5	407–428	331	0
Non–Indigenous	512	1.7	509–516	337	5
Space and shape subscale					
Indigenous	418	4.5	409–427	295	0
Non–Indigenous	499	1.8	496–503	332	–8
Quantity subscale					
Indigenous	407	6.1	395–419	353	–10
Non–Indigenous	503	1.8	500–507	334	–4
Uncertainty and data subscale					
Indigenous	422	5.2	412–432	328	5
Non–Indigenous	511	1.5	508–514	312	4

Figure 3.19 shows the proportions of Indigenous and non-Indigenous students at each of the proficiency levels on the four content subscales. The proportions of Indigenous students who were top performers were similar across four content subscales (3%), while the proportion of Indigenous students who failed to reach Level 2 ranged from 48% on the uncertainty and data subscale to 54% on the quantity subscale.

The proportions of non-Indigenous students who were top performers were similar for three of the content subscales (15% on the space and shape subscale and 16% on the quantity and the uncertainty and data subscales) and slightly higher on the change and relationships subscale (18%). The proportion of non-Indigenous students who failed to reach Level 2 ranged from 17% on the uncertainty and data subscale to 22% on the space and shape subscale.

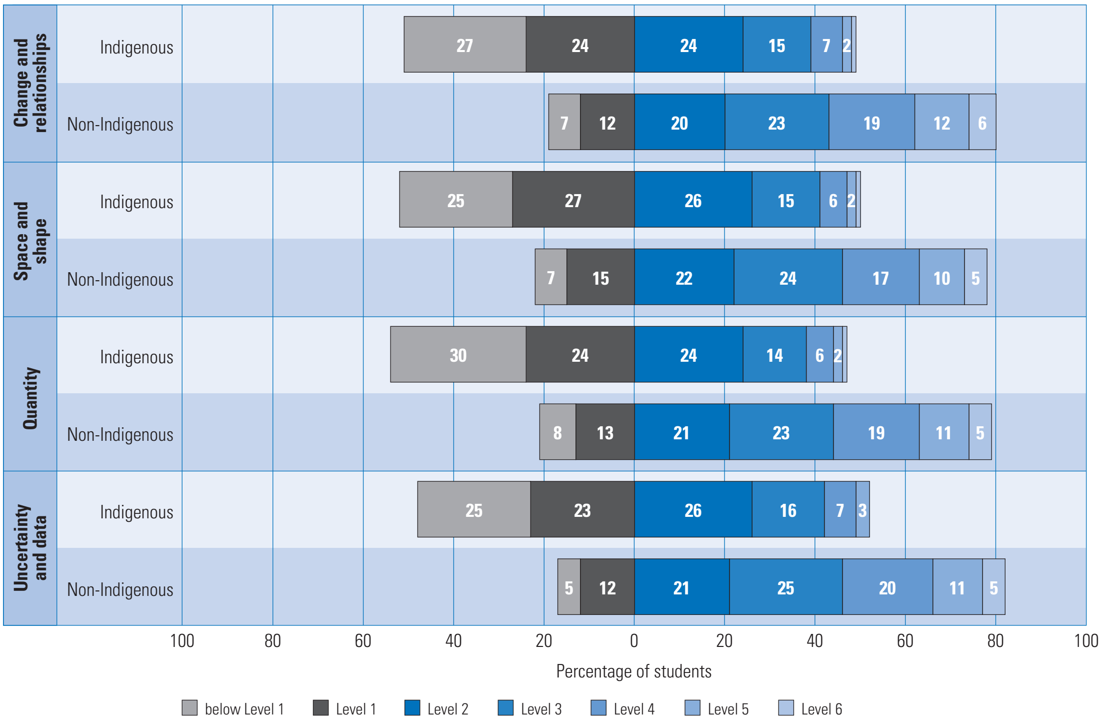


Figure 3.19 Percentage of students across the content proficiency level subscales, by Indigenous background

Students' performance on the content subscales by socioeconomic background

The mean score for each of the content subscales by socioeconomic background is shown in Table 3.9. For students in the lowest socioeconomic quartile, the mean score ranged from 455 on the space and shape subscale to 466 score points on the uncertainty and data subscale, whereas the mean score for students in the highest socioeconomic quartile ranged from 542 score points on the space and shape subscale to 557 score points on the change and relationships subscale.

Students in the highest socioeconomic quartile scored significantly higher than students from other socioeconomic quartiles. The difference between the mean scores of each socioeconomic quartile was statistically significant. The difference in performance between the highest and lowest socioeconomic quartiles was similar on the uncertainty and data, quantity, and space and shape subscales (on average around 87 score points respectively), while the difference in mean performance between the highest and lowest socioeconomic quartiles on the change and relationships subscale was slightly larger at 92 score points.

In terms of relative performance on the change and relationships subscale, the lower the socioeconomic quartile, the smaller the difference between this content subscale score and the overall mathematical literacy score. On this subscale, students in the lowest socioeconomic quartile performed 2 score points higher than their overall mathematical literacy score, while students in the highest socioeconomic quartile performed 7 score points higher than their overall mathematical literacy score. On the uncertainty and data subscale, the difference between the mean score on this subscale and on the overall mathematical literacy scale within each socioeconomic quartile was between 7 and 9 score points. For the space and shape subscale, there were around 4 score points difference between the mean score on this subscale and on the overall mathematical literacy scale within each socioeconomic quartile.

Table 3.9 Mean scores in students' performance on the content subscales, by socioeconomic background

Socioeconomic background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Change and relationships subscale					
Lowest quartile	465	2.5	460–470	320	2
Second quartile	496	2.2	491–500	317	4
Third quartile	528	2.9	522–533	315	6
Highest quartile	557	2.6	552–562	320	7
Space and shape subscale					
Lowest quartile	455	2.4	451–460	310	–7
Second quartile	483	2.3	479–488	319	–9
Third quartile	512	3.1	506–519	315	–9
Highest quartile	542	2.7	537–548	319	–7
Quantity subscale					
Lowest quartile	457	2.4	452–462	317	–6
Second quartile	488	2.1	484–493	317	–3
Third quartile	519	3.1	512–525	316	–3
Highest quartile	545	2.7	540–551	317	–4
Uncertainty and data subscale					
Lowest quartile	466	2.2	462–471	293	4
Second quartile	496	2.0	492–499	296	4
Third quartile	526	2.6	521–531	297	4
Highest quartile	553	2.4	548–557	297	3

The proportions of students across the socioeconomic quartiles at each of the proficiency levels on the four content subscales are provided in Figure 3.20.

On the change and relationships subscale, 31% of students in the highest socioeconomic quartile were top performers compared to 22% in the third quartile, 13% in the second quartile and 8% of students in the lowest socioeconomic quartile. Eight per cent of students in the highest socioeconomic quartile were low performers compared to 14% in the third quartile, 22% in the second quartile and 33% of students in the lowest socioeconomic quartile.

On the space and shape subscale, 26% of students in the highest socioeconomic quartile were top performers compared to 17% in the third quartile, 10% in the second quartile and 6% of students in the lowest socioeconomic quartile. Eleven per cent of students in the highest socioeconomic quartile were low performers compared to 18% in the third quartile, 26% in the second quartile and 36% of students in the lowest socioeconomic quartile.

On the quantity subscale, 27% of students in the highest socioeconomic quartile were top performers compared to 19% in the third quartile, 11% in the second quartile and 6% of students in the lowest socioeconomic quartile. Ten per cent of students in the highest socioeconomic quartile were low performers compared to 16% in the third quartile, 23% in the second quartile and 36% of students in the lowest socioeconomic quartile.

On the uncertainty and data subscale, 27% of students in the highest socioeconomic quartile were top performers compared to 19% in the third quartile, 11% in the second quartile and 7% of students in the lowest socioeconomic quartile. Eight per cent of students in the highest socioeconomic quartile were low performers compared to 12% in the third quartile, 20% in the second quartile and 31% of students in the lowest socioeconomic quartile.

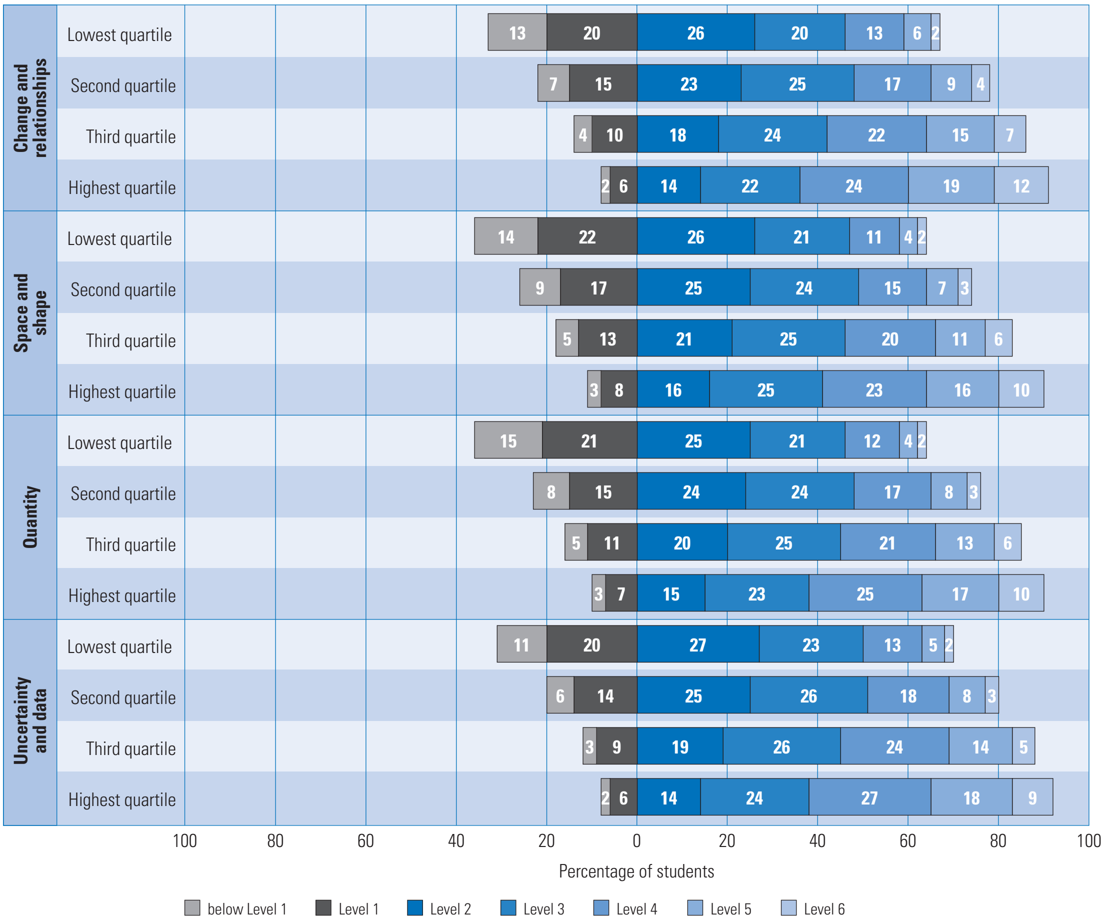


Figure 3.20 Percentage of students across the content proficiency level subscales, by socioeconomic quartiles

Students' performance on the mathematical literacy process subscales

Chapter 2 provided a description of the three broad components of the mathematical literacy assessment framework. One of the components was the mathematical processes that problem solvers use to construct a solution.[2]

Three mathematical processes have been defined in PISA:

» *Formulating situations mathematically*: emphasis on transforming the problem in context into a mathematical problem. In a problem about travelling on a bus, the process of a student recognising the elements of speed, distance and time (and the relationship between these elements as an essential step in solving the problem) is an example of formulating situations mathematically.

» *Employing mathematical concepts, facts, procedures and reasoning*: emphasis on mathematical reasoning and recognising which mathematical tools will assist with the mathematical problem. In a problem about travelling on a bus, substituting values (such as time and distance) into a formula to calculate speed is an example of this mathematical process.

» *Interpreting, applying and evaluating mathematical outcomes*: emphasis on interpreting the mathematical results of the original problem to obtain the results in context. In a problem about travelling on a bus, the process of a student evaluating the results in relation to the original problem is an example of this mathematical process.

In PISA 2012, the three mathematical processes have been described on separate subscales to illustrate students' skills and knowledge in these areas. Figure 3.21 shows the proficiency descriptions on the three mathematical literacy process subscales.

2 For further details about the mathematical literacy assessment framework, refer to Chapter 2.

Proficiency level	Formulating	Employing	Interpreting
	What students can typically do at each level		
6	Students can apply a wide variety of mathematical content knowledge to transform contextual information or data, geometric patterns or objects into a mathematical form amenable to investigation. Students can devise and follow a multi-step strategy involving significant modelling steps and extended calculation to formulate and solve complex real-world problems in a range of settings, e.g., involving material and cost calculations in a variety of contexts or to find the area of an irregular region on a map. Students can: identify what information is relevant (and what is not) from contextual information about travel times, distances and speed to formulate appropriate relationships among them; apply reasoning across several linked variables to devise an appropriate way to present data in order to facilitate pertinent comparisons; and devise algebraic formulations that represent a given contextual situation.	Students can use a strong repertoire of knowledge and procedural skills in a wide range of mathematical areas. They can: form and follow a multi-step strategy to solve a problem involving several stages; apply reasoning in a connected way across several problem elements; set up and solve an algebraic equation with more than one variable; generate relevant data and information to explore problems, e.g., using a spreadsheet to sort and analyse data; and justify their results mathematically and explain their conclusions and support them with well-formed mathematical arguments. Students' work is consistently precise and accurate.	Students can link multiple complex mathematical representations in an analytic way to identify and extract data and information that enables contextual questions to be answered, and can present their interpretations and conclusions in written form. E.g., students may: interpret two time-series graphs in relation to different contextual conditions; or link a relationship expressed both in a graph and in numeric form (such as in a price calculator), or in a spreadsheet and graph, to present an argument or conclusion about contextual conditions. Students can apply mathematical reasoning to data or information presented in order to generate a chain of linked steps to support a conclusion (e.g., analysing a map using scale information; analysing a complex algebraic formula in relation to the variables represented; translating data into a new time frame; performing a three-way currency conversion; or using a data-generation tool to find the information needed to answer a question). Students can gather analysis, data and their interpretation across several different problem elements or across different questions about a context, showing a depth of insight and a capacity for sustained reasoning.
5	Students can use their understanding in a range of mathematical areas to transform information or data from a problem context into mathematical form. They can transform information from different representations involving several variables into a form suitable for mathematical treatment. They can: formulate and modify algebraic expressions of relationships among variables; use proportional reasoning effectively to devise computations; gather information from different sources to formulate and solve problems involving geometric objects, features and properties, or analyse geometric patterns or relationships and express them in standard mathematical terms; transform a given model according to changed contextual circumstances; formulate a sequential calculation process based on text descriptions; and activate statistical concepts, such as randomness or sample and apply probability to formulate a model.	Students can use a range of knowledge and skills to solve problems. They can sensibly link information in graphical and diagrammatic form to textual information. They can apply spatial and numeric reasoning skills to express and work with simple models in reasonably well-defined situations and where the constraints are clear. They usually work systematically, e.g., to explore combinatorial outcomes and can sustain accuracy in their reasoning across a small number of steps and processes. They are generally able to work competently with expressions, can work with formula and use proportional reasoning, and are able to work with and transform data presented in a variety of forms.	Students can combine several processes in order to formulate conclusions based on an interpretation of mathematical information with respect to context, such as formulating or modifying a model, solving an equation or carrying out computations, and using several reasoning steps to make the links to the identified context elements. Students can make links between context and mathematics involving spatial or geometric concepts and complex statistical and algebraic concepts. They can easily interpret and evaluate a set of plausible mathematical representations, such as graphs, to identify which one highest reflects the contextual elements under analysis. Students have begun to develop the ability to communicate conclusions and interpretations in written form.
4	Students can link information and data from related representations (e.g., a table and a map, or a spreadsheet and a graphing tool) and apply a sequence of reasoning steps in order to formulate the mathematical expression needed to carry out a calculation or otherwise to solve a contextual problem. Students can: formulate a linear equation from a text description of a process, e.g., in a sales context, and formulate and apply cost comparisons to compare prices of sale items; identify which of given graphical representations corresponds to a given description of a physical process; specify a sequential calculation process in mathematical terms; identify geometrical features of a situation and use their geometric knowledge and reasoning to analyse a problem, e.g., to estimate areas or to link a contextual geometric situation involving similarity to the corresponding proportional reasoning; combine multiple decision rules needed to understand or implement a calculation where different constraints apply; and formulate algebraic expressions when the contextual information is reasonably straightforward, e.g., to connect distance and speed information in time calculations.	Students can identify relevant data and information from contextual material and use it to perform such tasks as calculating distances, using proportional reasoning to apply a scale factor, converting different units to a common scale or relating different graph scales to each other. They can work flexibly with distance–time–speed relationships and can carry out a sequence of arithmetic calculations. They can use algebraic formulations and follow a straightforward strategy and describe it.	Students can apply appropriate reasoning steps, possibly multiple steps, to extract information from a complex mathematical situation and interpret complicated mathematical objects, including algebraic expressions. They can: interpret complex graphical representations to identify data or information that answers a question; perform a calculation or data manipulation (e.g., in a spreadsheet) to generate additional data needed to decide whether a constraint (such as a measurement condition or a size comparison) is met; interpret simple statistical or probabilistic statements in such contexts as public transport or health and medical test interpretation to link the meaning of the statements to the underlying contextual issues; conceptualise a change needed to a calculation procedure in response to a changed constraint; and analyse two data samples (e.g., relating to a manufacturing process) to make comparisons and draw and express conclusions.

Figure 3.21 Summary descriptions of the six proficiency levels for the mathematical literacy process subscales

Proficiency level	Formulating	Employing	Interpreting
	What students can typically do at each level		
3	Students can identify and extract information and data from text, tables, graphs, maps or other representations and make use of them to express a relationship mathematically, including interpreting or adapting simple algebraic expressions related to an applied context. Students can: transform a textual description of a simple functional relationship into a mathematical form, e.g., with unit costs or payment rates; form a strategy involving two or more steps to link problem elements or to explore mathematical characteristics of the elements; apply reasoning with geometric concepts and skills to analyse patterns or identify properties of shapes or a specified map location, or to identify information needed to carry out some pertinent calculations, including calculations involving the use of simple proportional models and reasoning, where the relevant data and information is immediately accessible; and understand and link probabilistic statements to formulate probability calculations in contexts, such as in a manufacturing process or a medical test.	Students frequently have sound spatial reasoning skills enabling them, e.g., to use the symmetry properties of a figure, recognise patterns presented in graphical form or use angle facts to solve a geometric problem. Students can connect two different mathematical representations, such as data in a table and in a graph, or an algebraic expression with its graphical representation, enabling them, e.g., to understand the effect of changing data in one representation on the other. They can handle percentages, fractions and decimal numbers and work with proportional relationships.	Students begin to be able to use reasoning, including spatial reasoning, to support their interpretations of mathematical information in order to make inferences about features of the context. They combine reasoning steps systematically to make various connections between mathematical and contextual material or when required to focus on different aspects of a context, e.g., where a graph shows two data series or a table contains data on two variables that must be actively related to each other to support a conclusion. They can test and explore alternative scenarios, using reasoning to interpret the possible effects of changing some of the variables under observation. They can use appropriate calculation steps to assist their analysis of data and support the formation of conclusions and interpretations, including calculations involving proportions and proportional reasoning, and in situations where systematic analysis across several related cases is needed. Students can interpret and analyse relatively unfamiliar data presentations to support their conclusions.
2	Students can understand written instructions and information about simple processes and tasks in order to express them in a mathematical form. They can: use data presented in text or in a table (e.g., giving information about the cost of some product or service) to formulate a computation required, such as to identify the length of a time period, or to present a cost comparison, or calculate an average; analyse a simple pattern, e.g., by formulating a counting rule or identifying and extending a numeric sequence; work effectively with different two- and three-dimensional standard representations of objects or situations, e.g., devising a strategy to match one representation with another to compare different scenarios, or identify random experiment outcomes mathematically using standard conventions.	Students can apply small reasoning steps to make direct use of given information to solve a problem, e.g., to implement a simple calculation model, identify a calculation error, analyse a distance–time relationship or analyse a simple spatial pattern. Students can: show an understanding of place value in decimal numbers and can use that understanding to compare numbers presented in a familiar context; correctly substitute values into a simple formula; recognise which of a set of given graphs correctly represents a set of percentages and apply reasoning skills to understand and explore different kinds of graphical representations of data; and can understand simple probability concepts.	Students can link contextual elements of the problem to mathematics, e.g., by performing appropriate calculations or reading tables. Students can make comparisons repeatedly across several similar cases, e.g., they can interpret a bar graph to identify and extract data to apply in a comparative condition where some insight is required. They can: apply basic spatial skills to make connections between a situation presented visually and its mathematical elements; identify and carry out necessary calculations to support such comparisons as costs across several contexts; and can interpret a simple algebraic expression as it relates to a given context.
1	Students can recognise or modify and use an explicit simple model of a contextual situation. Students can choose between several such models to match the situation. E.g., they can: choose between an additive and a multiplicative model in a shopping context; choose among given two-dimensional objects to represent a familiar three-dimensional object; and select one of several given graphs to represent growth of a population.	Students can: identify simple data relating to a real-world context, such as that presented in a structured table or in an advertisement where the text and data labels match directly; perform practical tasks, such as decomposing money amounts into lower denominations; use direct reasoning from textual information that points to an obvious strategy to solve a given problem, particularly where the mathematical procedural knowledge required would be limited to (e.g., arithmetic operations with whole numbers, or ordering and comparing whole numbers); understand graphing techniques and conventions; and use symmetry properties to explore characteristics of a figure, such as comparing side lengths and angles.	Students can interpret data or information expressed in a direct way in order to answer questions about the context described. They can interpret given data to answer questions about simple quantitative relational ideas (such as larger, shorter time and in between) in a familiar context, e.g., by evaluating measurements of an object against given criterion values, by comparing average journey times for two methods of transport or by comparing specified characteristics of a small number of similar objects. Similarly, they can make simple interpretations of data in a timetable or schedule to identify times or events. Students may show rudimentary understanding of concepts such as randomness and data interpretation, e.g., by identifying the plausibility of a statement about chance outcomes of a lottery, by understanding numeric and relational information in a well-labelled graph and by understanding basic contextual implications of links between related graphs.

Australia's performance on the process subscales from an international perspective

Table 3.10 provides the mean scores for the three process subscales (formulating situations mathematically; employing mathematical concepts, facts, procedures and reasoning; and interpreting, applying and evaluating mathematical outcomes), together with their associated standard errors, confidence intervals around the mean and the difference between the 5th and 95th percentiles. In addition, the colour bands indicate how other countries have performed relative to Australia: significantly higher, significantly lower or not significantly different. As in Chapter 2, results have not been included for those countries that achieved a mean score lower than the lowest performing OECD country, Mexico.[3]

Students' performance across countries on the formulating situations mathematically subscale

There were 14 OECD countries, including Australia, and six partner countries who performed significantly higher than the OECD average (492 score points) on the formulating subscale. Eight countries achieved a mean score that was not significantly different from the OECD average. The remaining countries achieved a mean score that was significantly below the OECD average.

Australia's mean score on the formulating subscale was 498 score points. Australia was outperformed by 16 countries: Shanghai–China, Singapore, Chinese Taipei, Hong Kong–China, Korea, Japan, Macao–China, Switzerland, Liechtenstein, the Netherlands, Finland, Estonia, Canada, Poland, Belgium and Germany. Seven countries (Denmark, Iceland, Austria, Vietnam, New Zealand, the Czech Republic and Ireland) performed at a level that was not significantly different from Australia. All other countries, including the United Kingdom and the United States, performed at a level significantly lower than Australia.

Across OECD countries, the mean formulating subscale score was significantly lower than the mean overall score for mathematical literacy (494 points). The mean formulating subscale score was 10 score points or higher than the overall mathematical literacy scale in Chinese Taipei and Japan (18 score points higher) and Shanghai–China (11 score points higher). In other high-performing countries (Switzerland, Hong Kong–China, Macao–China, Korea and Singapore), the mean formulating subscale score was between 7 and 9 points higher than the overall mathematical literacy scale.

Australia scored 6 points lower on the formulating subscale than the overall mathematical literacy scale, suggesting that Australian students found formulating to be a more difficult mathematical process.

Students' performance across countries on the employing mathematical concepts, facts, procedures and reasoning subscale

Twenty-two countries—15 OECD (including Australia) and seven partner countries—recorded a mean score that was significantly higher than the OECD average of 493 score points on the employing subscale. Seven countries had mean scores that were not significantly different from the OECD average, while all other countries had mean scores that were significantly lower than the OECD average.

Australian students achieved a mean score of 500 points on the employing subscale. Nineteen countries performed significantly higher than Australia. These countries were: Shanghai–China, Singapore, Hong Kong–China, Korea, Chinese Taipei, Liechtenstein, Macao–China, Japan, Switzerland, Estonia, Vietnam, Poland, the Netherlands, Canada, Germany, Belgium, Finland, Austria and Slovenia. The countries whose scores were not significantly different from Australia were: the Czech Republic, Ireland, France, Latvia and New Zealand. All other countries, including the United Kingdom and the United States, performed at a level significantly lower than Australia.

Across OECD countries, the mean employing subscale score was similar to the mean overall score for mathematical literacy. Australia scored 4 points on average lower on the employing subscale than the overall mathematical literacy score, suggesting that Australian students found this process relatively difficult. Chinese Taipei was the only high-performing country with a mean employing subscale score that was substantially

3 For brevity, results for those countries that achieved a mean score lower than Mexico have not been included in this chapter. These countries are: Montenegro, Uruguay, Costa Rica, Albania, Brazil, Argentina, Tunisia, Jordan, Colombia, Qatar, Indonesia and Peru.

lower than their overall mathematical literacy score (by 11 points), indicating that students had more difficulty using the employing process. On the other hand, students in Vietnam found these items relatively easy, scoring 12 points on average higher on this process than on the overall mathematical literacy scale.

Students' performance across countries on the interpreting, applying and evaluating mathematical outcomes subscale

There were 16 OECD countries (including Australia) and six partner countries who performed significantly higher than the OECD average (497 score points) on the interpreting subscale. Nine countries achieved a mean score that was not significantly different from the OECD average. The remaining countries achieved a mean score that was significantly below the OECD average.

Australia's mean score on the interpreting subscale was 514 score points. Twelve countries (Shanghai–China, Singapore, Hong Kong–China, Chinese Taipei, Liechtenstein, Korea, Japan, Macao–China, Switzerland, Finland, the Netherlands and Canada) achieved significantly higher than Australia; while seven countries (Germany, Poland, Belgium, Estonia, New Zealand, France and Austria) performed at a level not significantly different from Australia. All other countries, including the United Kingdom and the United States, performed at a level significantly lower than Australia.

Across OECD countries, the mean score on the interpreting subscale was slightly higher than the mean overall score for mathematical literacy (494 points). In six of the high-performing countries, the interpreting subscale score was lower than the average score on the overall mathematical literacy scale, suggesting students from these countries find interpreting mathematical information a relatively more difficult aspect of solving a mathematical problem. The largest difference was found in Shanghai–China (34 score points), followed by Singapore (18 score points), Korea (14 score points), Chinese Taipei (11 score points), Hong Kong–China (10 score points) and Macao–China (8 score points).

In a number of countries, the interpreting subscale score was higher than the mean overall mathematical literacy score, suggesting that students from these countries found this mathematical process relatively easy. In Australia, the interpreting subscale score was 10 score points on average higher than the overall mathematical literacy score; while in New Zealand, Spain, Italy, Greece and France, the mean score on the interpreting subscale was at least 11 score points on average higher.

Students' proficiencies on the formulating situations mathematically process subscale across countries

Figure 3.22 shows the proportion of students at each proficiency level on the formulating subscale for participating countries. Countries have been ordered by the percentage of students classified at below Level 2, with the lowest proportion of students below Level 2 placed at the top of the figure and the highest proportion of students below Level 2 placed at the bottom of the figure.

Countries with the highest proportion of students achieving Level 5 or 6, the top performers, on this subscale were Shanghai–China (59%), Chinese Taipei and Singapore (44%), Hong Kong–China (39%), Korea (35%), Japan (32%) and Macao–China (30%). Sixteen per cent of Australian students were top performers on the formulating subscale, which was similar to the OECD average of 15%.

One-quarter (26%) of students across the OECD failed to reach Level 2 (the international minimum proficiency level) on the formulating subscale, a similar proportion to Australian students (25%). For the highest performing countries, 6% of students in Shanghai–China, 10% in Singapore and Korea, and 11% in Hong Kong–China failed to achieve Level 2; while for the lowest performing countries (including Malaysia, Mexico, Thailand, Chile and the United Arab Emirates), at least half of their students were placed below Level 2 on the formulating subscale.

Table 3.10 Mean scores in students' performance on the process subscales, by country

Formulating process subscale

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	624	4.1	616–632	394
	Singapore	582	1.6	578–584	398
	Chinese Taipei	578	4.0	570–586	446
	Hong Kong–China	568	3.7	561–575	375
	Korea	562	5.1	552–572	361
	Japan	554	4.2	546–562	359
	Macao–China	545	1.4	542–547	361
	Switzerland	538	3.1	532–544	345
	Liechtenstein	535	4.4	526–543	337
	Netherlands	527	3.8	519–534	330
	Finland	519	2.4	514–523	319
	Estonia	517	2.3	512–521	302
	Canada	516	2.2	511–520	334
	Poland	516	4.2	507–523	334
	Belgium	512	2.4	507–516	365
	Germany	511	3.4	503–517	344
Not significantly different from Australia	Denmark	502	2.4	497–507	293
	Iceland	500	1.7	496–503	309
	Austria	499	3.2	493–505	341
	Australia	**498**	**1.9**	**494–501**	**360**
	Vietnam	497	5.1	487–507	325
	New Zealand	496	2.5	491–500	357
	Czech Republic	495	3.4	488–501	333
	Ireland	492	2.4	487–497	314
Significantly lower than Australia	Slovenia	492	1.5	488–494	340
	OECD average	**492**	**0.5**	**490–492**	**332**
	Norway	489	3.1	483–495	327
	United Kingdom	489	3.7	481–495	344
	Latvia	488	3.0	481–493	296
	France	483	2.8	477–488	348
	Luxembourg	482	1.0	479–484	333
	Russian Federation	481	3.6	474–488	311
	Slovak Republic	480	4.1	472–488	361
	Sweden	479	2.7	473–484	334
	Portugal	479	4.3	470–487	351
	Lithuania	477	3.1	471–483	338
	Spain	477	2.2	472–480	335
	United States	475	4.1	467–483	322
	Italy	475	2.2	470–479	336
	Hungary	469	3.6	462–476	332
	Israel	465	4.7	455–473	359
	Croatia	453	4.0	444–460	318
	Turkey	449	5.2	439–459	315
	Greece	448	2.3	443–452	292
	Serbia	447	3.8	439–454	323
	Romania	445	4.1	437–452	303
	Kazakhstan	442	3.8	434–449	269
	Bulgaria	437	4.2	428–444	325
	Cyprus	437	1.2	434–438	307
	United Arab Emirates	426	2.7	420–431	327
	Chile	420	3.2	413–425	289
	Thailand	416	4.0	407–423	327
	Mexico	409	1.7	406–412	285
	Malaysia	406	3.6	398–412	315

Employing process subscale

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	613	3.0	606–618	304
	Singapore	574	1.2	571–576	320
	Hong Kong–China	558	3.1	552–564	294
	Korea	553	4.3	544–561	306
	Chinese Taipei	549	3.1	542–554	355
	Liechtenstein	536	3.7	529–543	311
	Macao–China	536	1.1	533–537	286
	Japan	530	3.5	523–537	296
	Switzerland	529	2.9	523–535	298
	Estonia	524	2.1	520–528	262
	Vietnam	523	5.1	513–533	291
	Poland	519	3.5	511–525	289
	Netherlands	518	3.4	511–525	284
	Canada	517	1.9	512–520	287
	Germany	516	2.8	510–521	309
	Belgium	516	2.1	511–519	331
	Finland	516	1.8	511–519	266
	Austria	510	2.5	504–514	283
	Slovenia	505	1.2	502–507	295
Not significantly different from Australia	Czech Republic	504	2.9	497–509	307
	Ireland	502	2.4	497–506	276
	Australia	**500**	**1.7**	**497–503**	**311**
	France	496	2.3	491–500	319
	Latvia	495	2.8	489–500	262
	New Zealand	495	2.2	490–499	325
Significantly lower than Australia	Denmark	495	2.4	489–499	266
	OECD average	**493**	**0.5**	**492–494**	**298**
	Luxembourg	493	0.9	491–494	302
	United Kingdom	492	3.1	485–497	310
	Iceland	490	1.6	486–493	295
	Portugal	489	3.7	481–495	310
	Russian Federation	487	3.1	480–492	286
	Norway	486	2.7	481–491	291
	Italy	485	2.1	481–489	305
	Slovak Republic	485	3.4	478–492	330
	Lithuania	482	2.7	476–487	282
	Spain	481	2.0	477–485	283
	Hungary	481	3.2	474–487	312
	United States	480	3.5	473–486	294
	Croatia	478	3.7	470–484	299
	Sweden	474	2.5	468–478	296
	Israel	469	4.6	459–477	344
	Serbia	451	3.4	444–457	303
	Greece	449	2.7	443–453	297
	Turkey	448	5.0	438–458	308
	Romania	446	4.1	437–453	285
	Cyprus	443	1.1	440–445	299
	United Arab Emirates	440	2.4	435–444	300
	Bulgaria	439	4.1	430–447	315
	Kazakhstan	433	3.2	426–438	259
	Thailand	426	3.5	418–432	277
	Malaysia	423	3.3	416–429	285
	Chile	416	3.3	409–422	281
	Mexico	413	1.4	410–415	257

	Interpreting process subscale				
	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	579	2.9	572–584	320
	Singapore	555	1.4	552–557	344
	Hong Kong–China	551	3.4	544–558	311
	Chinese Taipei	549	3.0	543–554	345
	Liechtenstein	540	4.1	532–548	351
	Korea	540	4.2	531–548	320
	Japan	531	3.5	524–537	303
	Macao–China	530	1.0	527–531	300
	Switzerland	529	3.4	522–535	330
	Finland	528	2.2	523–532	290
	Netherlands	526	3.6	518–532	325
	Canada	521	2.0	517–525	306
Not significantly different from Australia	Germany	517	3.2	510–522	342
	Poland	515	3.5	507–521	293
	Australia	**514**	**1.7**	**510–517**	**332**
	Belgium	513	2.4	508–517	346
	Estonia	513	2.1	508–516	284
	New Zealand	511	2.5	505–515	351
	France	511	2.5	505–515	350
	Austria	509	3.3	502–515	346
Significantly lower than Australia	Denmark	508	2.5	502–512	294
	Ireland	507	2.5	501–511	301
	United Kingdom	501	3.5	494–507	333
	Norway	499	3.1	492–504	321
	Italy	498	2.1	494–502	350
	Slovenia	498	1.4	495–500	307
	OECD average	**497**	**0.5**	**496–498**	**320**
	Vietnam	497	4.5	487–505	270
	Spain	495	2.2	490–499	321
	Luxembourg	495	1.1	492–497	343
	Czech Republic	494	3.0	488–499	329
	Iceland	492	1.9	488–496	331
	Portugal	490	4.0	482–498	308
	United States	489	3.9	481–496	313
	Latvia	486	3.0	480–492	292
	Sweden	485	2.4	480–489	325
	Croatia	477	3.5	470–483	308
	Hungary	477	3.1	470–482	331
	Slovak Republic	473	3.3	466–479	335
	Russian Federation	471	2.9	465–476	294
	Lithuania	471	2.8	465–476	301
	Greece	467	3.1	461–473	322
	Israel	462	5.2	451–471	376
	Turkey	446	4.6	437–455	312
	Serbia	445	3.4	438–452	302
	Bulgaria	441	4.2	432–449	322
	Romania	438	3.1	431–444	242
	Cyprus	436	1.3	433–438	332
	Chile	433	3.1	426–438	267
	Thailand	432	3.4	425–438	266
	United Arab Emirates	428	2.4	422–432	297
	Kazakhstan	420	2.6	415–425	210
	Malaysia	418	3.1	411–423	248
	Mexico	413	1.3	410–415	239

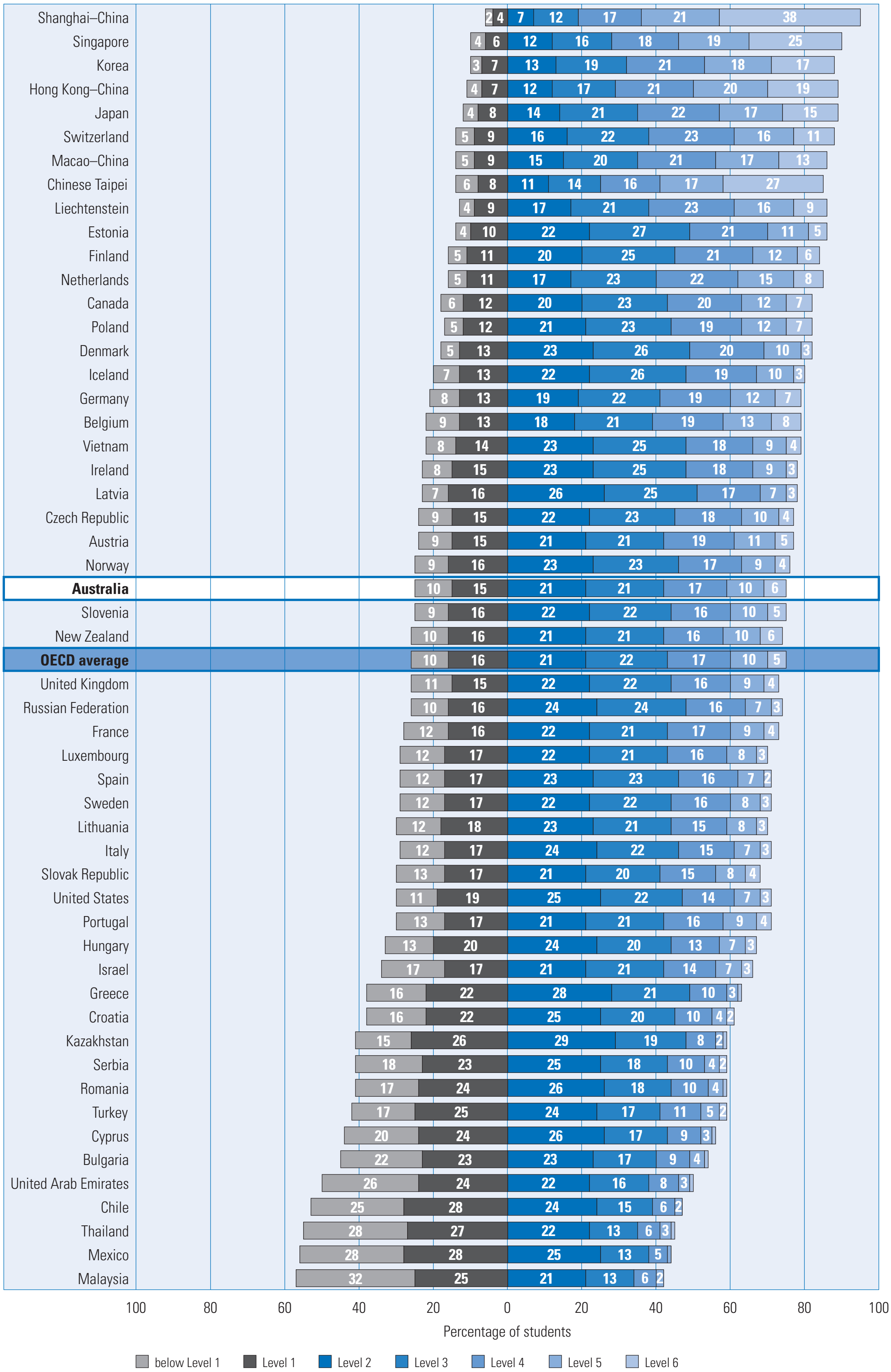


Figure 3.22 Percentage of students across the formulating proficiency level subscale, by country

Comparing performance on the formulating subscale to the overall mathematical literacy scale, Japan, Chinese Taipei, Macao–China, Hong Kong–China and Korea had larger percentages of top performers (ranging from 4% to 8%) on the formulating subscale. Across the OECD, there were 3% more top performers on the formulating subscale than on the overall mathematical literacy scale; while 1% more Australian students achieved at these levels on this subscale than on the overall mathematical literacy scale. At the lower end of the proficiency scale, there were larger percentages of low performers (between 3 and 9% of students) on the formulating subscale than on the overall mathematical literacy scale in Croatia, France and Greece.

Students' proficiencies on the employing mathematical concepts, facts, procedures and reasoning process subscale across countries

The proportions of students at each proficiency level on the employing subscale are shown in Figure 3.23. Shanghai–China achieved the highest proportion of top performers on the employing subscale, with 56% of students performing at this level. This was followed by Singapore (39% of students), and Chinese Taipei, Hong Kong–China and Korea (around one-third of students). The proportion of Australian students who achieved Level 5 or 6 on this process subscale was 13%, which was similar to the average across the OECD (12%).

For the low performers, between 3 and 10% of students were placed below Level 2 in Shanghai–China, Singapore, Hong Kong–China, Korea and Estonia; while in Mexico, Chile and Malaysia at least 50% of students failed to reach Level 2. One-fifth (21%) of Australian students and almost one-quarter (23%) of students across OECD countries failed to reach Level 2 on the employing subscale.

For the majority of countries, the proportion of students achieving Level 5 or 6 on the employing subscale was similar to the proportion of students at the same levels on the overall mathematical literacy scale. In Chinese Taipei, a lower proportion of students achieved Level 5 or Level 6 on the employing subscale than on the overall mathematical literacy scale, and in Vietnam, a higher proportion of students (4%) achieved higher levels on the subscale than on the overall mathematical literacy scale.

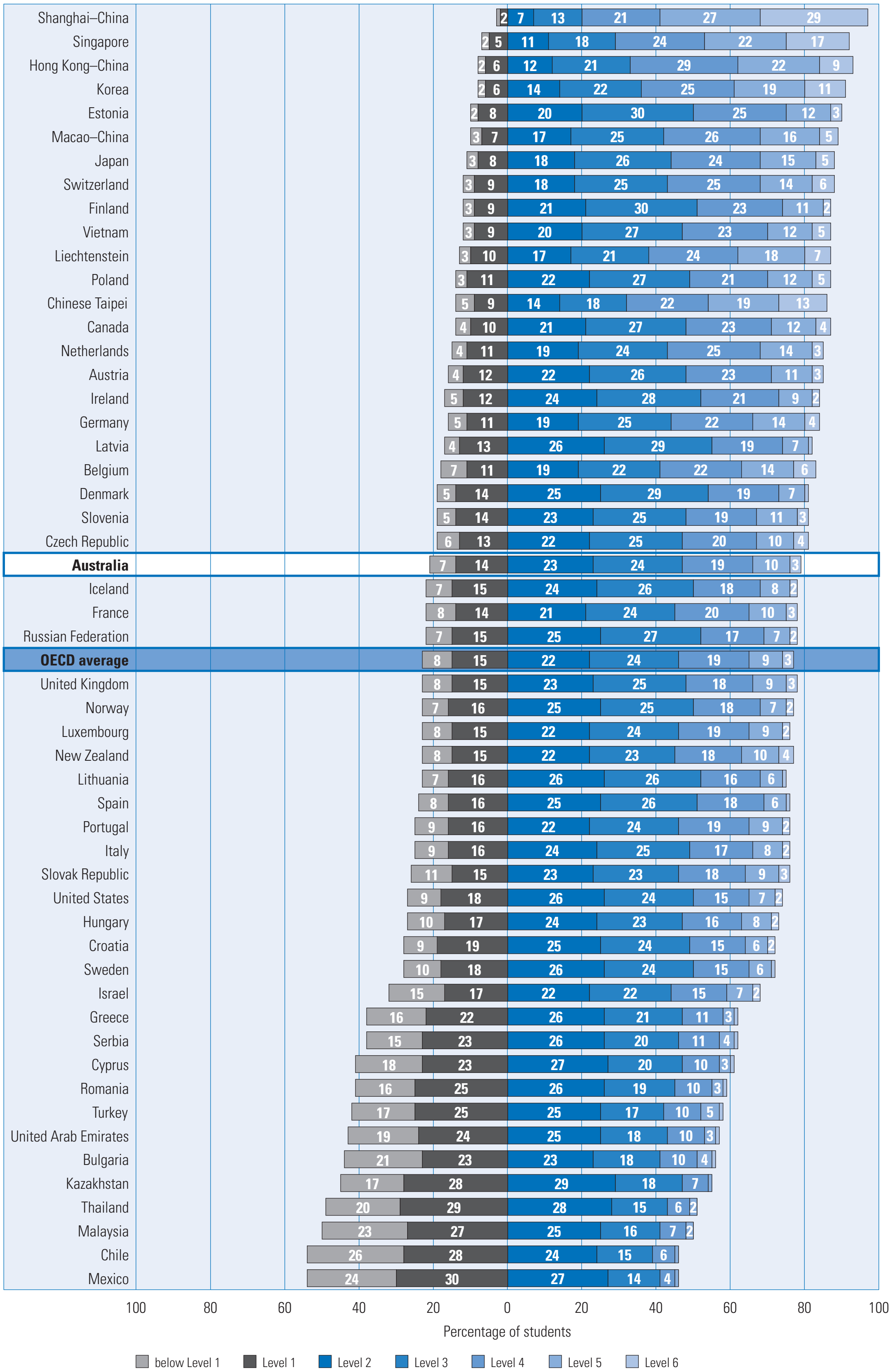


Figure 3.23 Percentage of students across the employing proficiency level subscale, by country

Students' proficiencies on the interpreting, applying and evaluating mathematical outcomes process subscale across countries

Figure 3.24 shows the proportion of students at each proficiency level on the interpreting subscale for participating countries. In Shanghai–China, 41% of students achieved Level 5 or 6, while 33% of students in Singapore, and around 30% of students in Chinese Taipei and Liechtenstein were top performers. Eighteen per cent of Australian students were top performers on the interpreting subscale, which was higher than the OECD average of 14%.

Almost one-fifth (18%) of Australian students failed to reach Level 2 on the interpreting subscale, which was lower than the proportion of students across OECD countries (23%). Fewer than 10% of students in Shanghai–China and Hong Kong–China were placed at below Level 2, while more than half the students from Kazakhstan, Malaysia and Mexico were low performers.

Across OECD countries, the proportion of students who achieved Level 5 or 6 on the interpreting subscale was 2% higher than on the overall mathematical literacy scale. The differences between the proportion of students reaching Level 5 or 6 on the interpreting subscale and the proportion of students reaching the same levels on the overall mathematical literacy scale was no larger than 6%; except in Shanghai–China, where there were 15% fewer students who achieved Level 5 or 6 on the interpreting subscale compared to the overall mathematical literacy scale.

Australia's performance on the process subscales from an international perspective by sex

Figure 3.25 shows the mean scores and standard errors for females and males, and the difference between the mean scores for the three process subscales.

Students' performance on the formulating situations mathematically process subscale by sex across countries

On average across OECD countries, males performed significantly higher (15 score points) than females on the formulating subscale. Across the OECD, the mean score for females on the formulating subscale was 484 score points and the mean score for males was 499 score points. In Australia, females achieved a mean score of 489 points, which was significantly lower than the mean score of 506 points for males. This difference (17 score points on average) was about one-third of a proficiency level or the equivalent of about half a school year.

Internationally, significant differences between the sexes on the formulating subscale were found in about 70% of countries, all in favour of males. The largest differences were found in Luxembourg, Austria, Chile and Liechtenstein, with males scoring around 30 score points on average higher than females. Among the highest performing countries, Korea and Hong Kong–China showed the largest differences between the sexes with 22 score points on average, followed by Japan with 19 score points on average. The differences between the sexes were narrower for Macao–China and Shanghai–China with a difference of around 9 score points on average; while for Singapore and Chinese Taipei the difference was not significant. There were significant differences between the sexes in all English-speaking countries. In New Zealand and Ireland, the difference was around 20 score points on average, in Canada and the United Kingdom, the difference was 12 score points, while in the United States the gap was narrower with 8 score points.

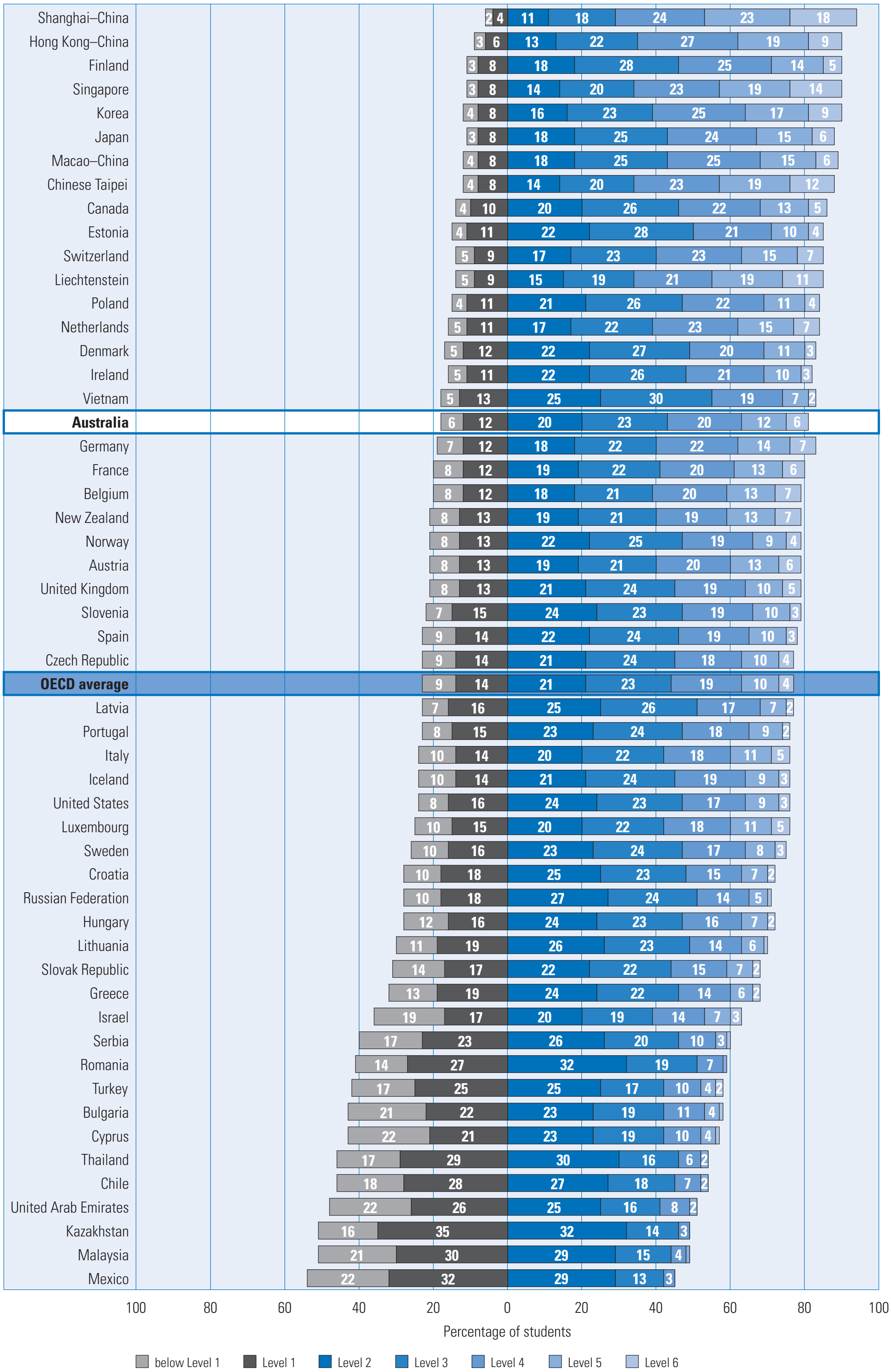


Figure 3.24 Percentage of students across the interpreting proficiency level subscale, by country

Students' performance on the employing mathematical concepts, facts, procedures and reasoning process by sex across countries

Across OECD countries, the mean difference by sex on the employing subscale (9 score points) was narrower than on the formulating subscale (15 score points). The OECD average for females was 489 score points and for males was 498 score points.

In five countries, females scored significantly higher than males on the employing subscale. The difference between the sexes was 17 score points in Thailand, 6 score points in Singapore, Latvia and Iceland, and 9 score points in Malaysia.

The largest differences by sex, in favour of males, were found in Chile and Luxembourg with around 25 score points, and in Liechtenstein and Austria, with a difference of around 20 score points. Males from three high-performing countries performed significantly higher than females, with males in Korea and Japan scoring 17 and 18 points respectively higher than females, and in Hong Kong–China scoring 11 points higher.

Australian males achieved a mean score of 505 points on the employing subscale, while females scored 495 points. The average difference of 10 score points was similar to that of other English-speaking countries.

Students' performance on the interpreting, applying and evaluating mathematical outcomes process by sex across countries

On average across OECD countries, males scored 10 points higher than females on the interpreting subscale. Across the OECD, the mean score for females on the interpreting subscale was 492 score points and for males the mean score was 502 points. In Australia, females achieved a mean score of 509 points, which was significantly lower than the mean score of 519 points for males.

The largest differences in favour of males were found in Liechtenstein (27 score points), Chile (22 score points), and Spain and Luxembourg (20 score points). Four high-performing countries showed significant differences by sex: Japan (17 score points), Hong Kong–China (12 score points) and Shanghai–China (6 score points). There was some variation in the differences between the sexes for English-speaking countries, from 7 score points in the United States to 17 score points in Ireland.

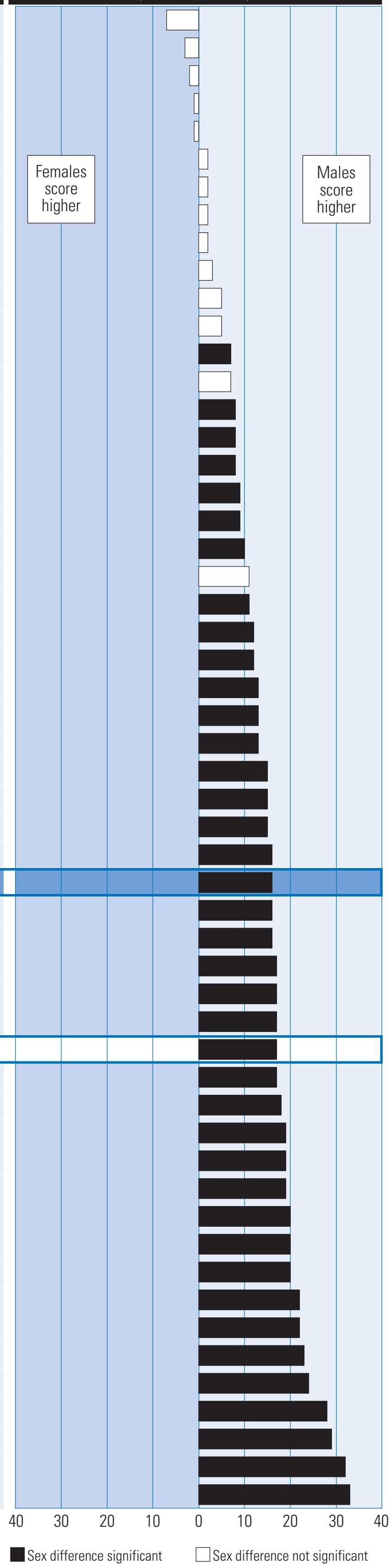
Although the difference was generally in favour of males, there were a small number of countries where females significantly outperformed males: Thailand (14 score points on average) and Malaysia, Iceland and Finland (11 score points on average).

Across the three subscales, the gap between Australian females and males was wider on the formulating subscale (17 score points) than on the employing subscale (10 score points) and interpreting subscale (10 score points).

Australian males' performances on the formulating and employing subscales were not significantly different, while their mean score on the interpreting subscale was higher (519 score points). This means that, in relative terms in Australia, males found it easier to deal with interpreting processes than either formulating or employing processes. Females also found it easier to deal with interpreting processes than the other two processes; however, females found employing processes easier than formulating processes (achieving a mean score of 495 and 489 points respectively).

Formulating subscale

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	419	4.7	412	4.4
Malaysia	407	4.1	404	4.2
Latvia	489	3.4	487	4.0
Iceland	501	2.4	499	2.4
Singapore	582	2.1	581	2.2
United Arab Emirates	425	3.6	427	3.7
Sweden	478	2.9	480	3.4
Finland	518	2.6	520	3.0
Norway	488	3.7	490	3.1
Lithuania	476	3.6	479	3.3
Bulgaria	434	4.9	439	4.8
Russian Federation	479	3.5	484	4.4
Kazakhstan	438	4.2	446	4.1
Romania	441	4.2	449	4.7
United States	471	4.6	479	4.2
Slovenia	488	2.2	496	2.4
Shanghai–China	620	4.2	629	4.9
Macao–China	540	2.2	549	1.7
Cyprus	432	1.8	441	1.6
Turkey	444	6.0	454	5.4
Chinese Taipei	573	6.9	584	6.3
Estonia	512	2.4	523	2.9
United Kingdom	483	4.4	495	4.6
Serbia	441	4.3	453	4.4
Greece	442	2.6	454	3.2
Canada	510	2.4	522	2.6
Poland	509	4.4	522	4.8
Belgium	505	2.6	520	3.2
Israel	457	3.6	472	7.7
France	476	3.0	491	3.8
Netherlands	519	4.2	535	3.8
OECD average	**484**	**0.6**	**499**	**0.7**
Slovak Republic	472	4.7	488	4.8
Croatia	444	4.2	461	5.1
Portugal	471	4.3	487	4.6
Hungary	461	4.2	478	4.0
Denmark	494	2.6	511	2.8
Australia	**489**	**2.3**	**506**	**2.8**
Czech Republic	486	3.8	503	4.3
Vietnam	489	5.0	507	5.9
Germany	501	3.9	520	3.6
Spain	467	2.3	486	2.8
Japan	544	4.4	563	5.2
Mexico	400	1.8	419	1.9
Switzerland	528	3.4	548	3.5
Ireland	482	2.8	502	3.7
Hong Kong–China	557	4.8	579	5.3
Korea	550	5.8	573	6.5
New Zealand	484	3.3	507	3.6
Italy	463	2.4	487	2.6
Liechtenstein	520	6.5	548	6.4
Chile	406	3.3	434	3.8
Austria	484	3.6	515	4.6
Luxembourg	465	1.5	498	1.4



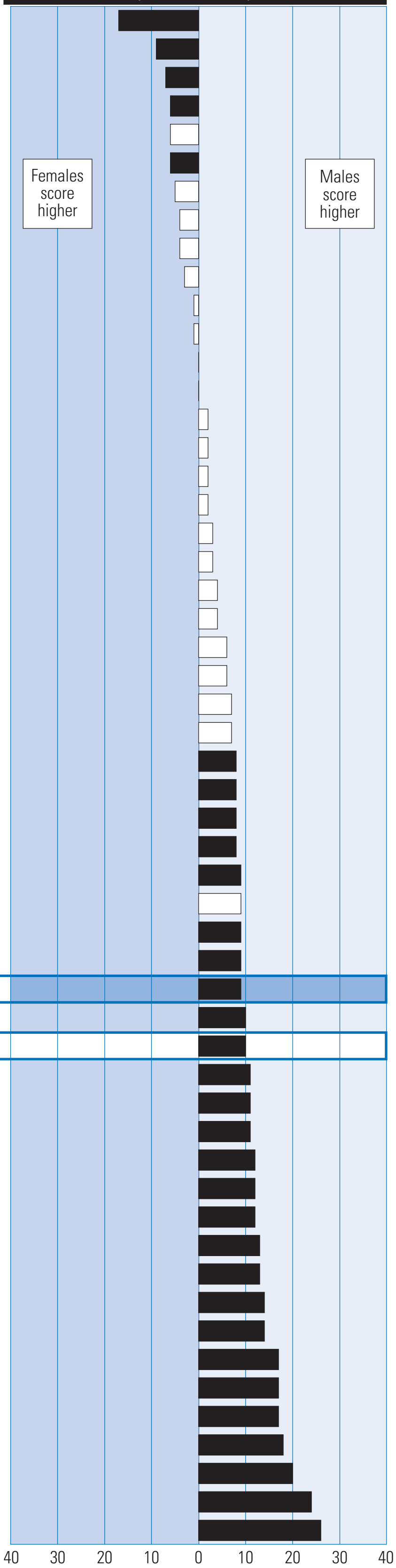
Employing subscale

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	433	4.1	416	3.7
Malaysia	427	3.8	418	3.9
Iceland	493	2.2	487	2.2
Latvia	498	3.2	492	3.3
United Arab Emirates	443	3.1	437	3.7
Singapore	577	1.7	571	1.8
Sweden	476	2.6	471	3.1
Russian Federation	489	3.3	485	3.5
Bulgaria	441	4.3	437	5.0
Finland	517	1.9	514	2.5
Poland	519	3.7	518	4.1
Lithuania	483	3.0	481	2.9
Cyprus	443	1.6	443	1.5
Kazakhstan	432	3.6	433	3.5
Macao–China	535	1.7	537	1.3
Norway	486	3.4	487	2.7
Romania	444	4.4	447	4.6
United States	479	3.7	481	3.8
Slovenia	503	2.0	506	2.0
Shanghai–China	611	3.2	614	3.6
Chinese Taipei	547	5.2	551	5.1
Estonia	522	2.4	527	2.4
Greece	446	2.9	452	3.6
Turkey	445	5.8	451	5.4
Croatia	474	3.9	481	4.6
Slovak Republic	481	4.2	489	3.9
Netherlands	515	3.8	522	3.7
Vietnam	519	4.9	527	5.9
France	492	2.5	501	3.3
Hungary	477	3.7	486	3.7
Switzerland	525	3.0	534	3.3
Israel	464	3.5	473	7.7
Portugal	484	3.8	493	4.0
Serbia	446	3.8	456	4.1
OECD average	**489**	**0.5**	**498**	**0.6**
Canada	512	2.2	521	2.1
Australia	**495**	**2.0**	**505**	**2.3**
Hong Kong–China	552	3.7	563	4.3
Germany	510	3.3	521	3.0
Belgium	510	2.7	521	2.7
Czech Republic	498	3.6	509	3.6
Denmark	489	2.4	500	3.0
United Kingdom	486	3.6	498	4.0
Ireland	496	2.7	509	3.4
Mexico	407	1.6	420	1.5
Spain	474	2.1	488	2.5
New Zealand	488	2.9	502	3.2
Japan	521	3.5	539	4.4
Korea	544	4.9	561	5.5
Italy	476	2.3	494	2.4
Liechtenstein	527	5.9	545	5.7
Austria	499	3.2	520	3.5
Luxembourg	481	1.3	505	1.2
Chile	404	3.3	430	4.1

Figure 3.25 Mean scores and differences by sex in students' performance on the process subscales, by country

Employing subscale

Difference in mean score (Female – Male)

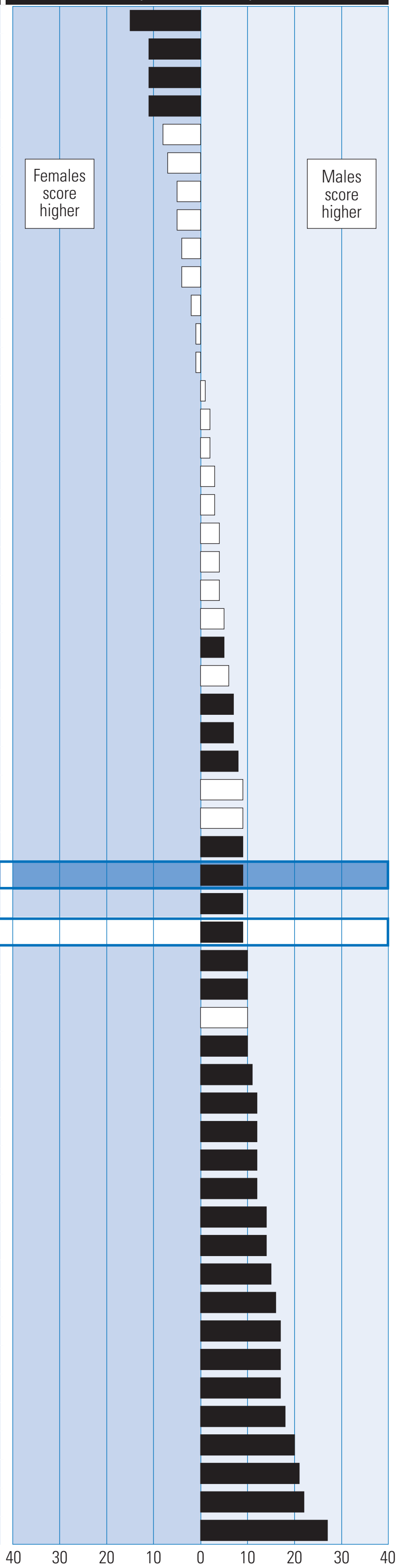


■ Sex difference significant □ Sex difference not significant

Interpreting subscale

Country	Females Mean score	Females SE	Males Mean score	Males SE
Thailand	438	3.9	424	3.7
Malaysia	423	3.3	412	3.6
Iceland	498	2.5	487	2.6
Finland	534	2.1	523	3.0
Bulgaria	445	4.4	437	5.1
United Arab Emirates	431	3.0	424	4.1
Kazakhstan	423	2.8	418	3.1
Singapore	557	2.0	553	1.9
Cyprus	438	1.8	434	1.8
Russian Federation	473	3.0	469	3.8
Sweden	486	2.5	484	3.3
Latvia	487	3.6	486	3.6
Lithuania	471	3.2	470	3.0
Slovenia	497	2.1	498	2.1
Macao–China	529	1.5	530	1.4
Norway	498	3.7	500	3.2
Chinese Taipei	548	4.9	550	4.7
Poland	513	3.7	517	4.2
France	509	2.8	513	3.7
Hungary	475	3.6	479	3.7
Estonia	511	2.3	515	2.8
Romania	435	3.4	441	3.8
Vietnam	494	4.3	500	5.2
Serbia	443	3.5	448	4.3
Shanghai–China	576	3.2	582	3.5
United States	486	3.9	493	4.4
Greece	463	3.1	471	4.0
Czech Republic	490	3.7	498	3.9
Turkey	442	5.5	451	5.1
Canada	517	2.3	526	2.3
OECD average	**492**	**0.6**	**502**	**0.7**
Slovak Republic	468	3.7	478	4.1
Australia	**509**	**2.0**	**519**	**2.4**
Netherlands	521	4.0	530	3.8
Belgium	508	2.6	518	3.2
Korea	535	4.9	545	5.4
Mexico	408	1.4	418	1.5
New Zealand	505	3.1	516	3.7
Hong Kong–China	545	3.8	557	4.8
Germany	511	3.6	522	3.4
Portugal	484	4.0	496	4.5
Switzerland	523	3.5	535	3.9
United Kingdom	494	3.8	508	4.6
Denmark	501	2.7	515	3.0
Croatia	470	3.8	484	4.2
Austria	501	4.1	517	4.5
Japan	522	3.4	539	4.5
Ireland	498	3.3	515	3.5
Israel	453	3.4	470	9.1
Italy	489	2.5	507	2.7
Luxembourg	485	1.5	505	1.6
Spain	485	2.5	505	2.5
Chile	422	3.0	444	3.9
Liechtenstein	526	6.4	553	6.4

Difference in mean score (Female – Male)



■ Sex difference significant □ Sex difference not significant

Students' proficiencies on the three process subscales across countries by sex

The proportions of females and males in Australia and across OECD countries who performed at each of the proficiency levels on the three process subscales are shown in Figure 3.26. Generally, there were higher proportions of males than females at the higher end of the proficiency scale, and higher proportions of females than males at the lower end of the proficiency scale.

On the formulating subscale, 14% of Australian females and 19% of Australian males were top performers (reaching Level 5 or 6), while 27% of Australian females and 22% of Australian males were low performers (not reaching Level 2). Across OECD countries, 12% of females and 17% of males were top performers, while 28% of females and 25% of males were low performers.

There were fewer male top performers on the formulating subscale than on the overall mathematical literacy scale, while there were a higher proportion of female top performers on this subscale than on the overall mathematical literacy scale. At the lower end of the subscale, there was a higher proportion of males and a similar proportion of females compared to the overall mathematical literacy proficiency scale.

On the employing subscale, 12% of Australian females and 15% of Australian males were top performers, while 21% of Australian females and 19% of Australian males were low performers. Across OECD countries, 9% of females and 14% of males were top performers, while 27% of females and 25% of males were low performers.

The proportion of Australian females and males across the proficiency levels on the employing subscale were similar to the distributions across proficiency levels on the overall mathematical literacy proficiency scale.

On the interpreting subscale, 16% of Australian females and 21% of Australian males were top performers, while 19% of Australian females and 17% of Australian males were low performers. Across OECD countries, 12% of females and 16% of males were top performers, while 24% of females and 23% of males were low performers.

The interpreting subscale was somewhat easier for Australian students, with the proportion of females and males at the higher end of the subscale greater than the proportion of Australian females and males on the overall mathematical literacy scale. The proportion of Australian females and males at the lower end of the interpreting subscale was similar to the proportion of Australian females and males on the overall mathematical literacy scale.

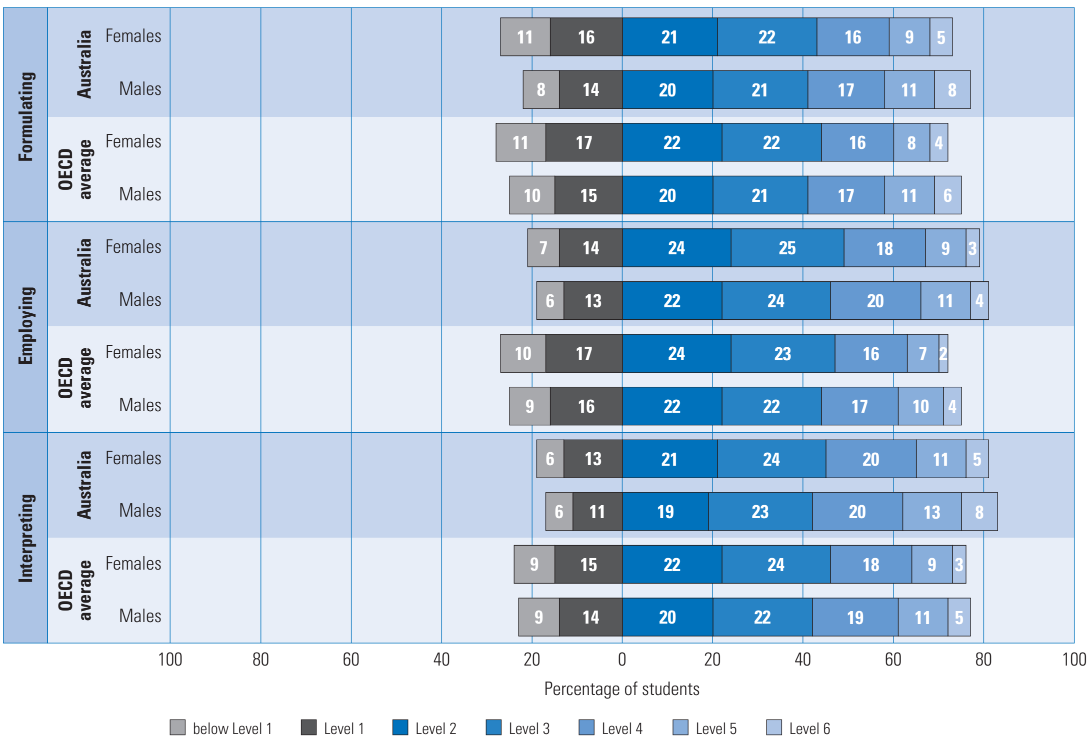


Figure 3.26 Percentage of students across the three process proficiency level subscales by sex, for Australia and the OECD average

Australia's performance on the process subscales from a national perspective

Students' performance on the process subscales across the Australian jurisdictions

Table 3.11 shows the mean scores of the Australian jurisdictions on the formulating subscale, with comparisons between jurisdictions. The Australian Capital Territory achieved at a similar level to Western Australia and achieved significantly higher than all the other jurisdictions. The Australian Capital Territory, Western Australia, New South Wales and Queensland performed significantly higher than the OECD average. Victoria's performance was not significantly different to the OECD average, while South Australia, Tasmania and the Northern Territory performed significantly lower than OECD average.

Table 3.11 Multiple comparisons of mean performance on the formulating subscale, by jurisdiction

Jurisdiction	Mean score	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	515	4.2		●	▲	▲	▲	▲	▲	▲	▲
WA	510	4.2	●		●	▲	▲	▲	▲	▲	▲
NSW	502	4.4	▼	●		●	●	▲	▲	▲	▲
QLD	499	3.1	▼	▼	●		●	▲	▲	▲	▲
VIC	495	4.2	▼	▼	●	●		▲	▲	▲	●
SA	479	3.6	▼	▼	▼	▼	▼		●	▲	▼
TAS	470	3.7	▼	▼	▼	▼	▼	●		▲	▼
NT	447	10.3	▼	▼	▼	▼	▼	▼	▼		▼
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

The mean scores of the Australian jurisdictions on the employing subscale, with comparisons between jurisdictions are shown in Table 3.12. Achievement in the Australian Capital Territory, Western Australia and New South Wales was similar and higher than most other jurisdictions, while the Northern Territory performed significantly lower than all other jurisdictions.

The Australian Capital Territory, Western Australia and New South Wales performed significantly higher than the OECD average. Queensland and Victoria's performance was similar to each other and to the OECD average, while South Australia, Tasmania and the Northern Territory performed significantly lower than the OECD average.

Table 3.12 Multiple comparisons of mean performance on the employing subscale, by jurisdiction

Jurisdiction	Mean score	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	513	3.6		●	●	▲	▲	▲	▲	▲	▲
WA	512	3.7	●		●	▲	▲	▲	▲	▲	▲
NSW	507	3.5	●	●		●	●	▲	▲	▲	▲
QLD	499	3.2	▼	▼	●		●	▲	▲	▲	●
VIC	497	4.0	▼	▼	●	●		▲	▲	▲	●
SA	484	3.4	▼	▼	▼	▼	▼		▲	▲	▼
TAS	471	3.3	▼	▼	▼	▼	▼	▼		▲	▼
NT	448	10.1	▼	▼	▼	▼	▼	▼	▼		▼
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

Table 3.13 Multiple comparisons of mean performance on the interpreting subscale, by jurisdiction

Jurisdiction	Mean score	SE	ACT	WA	NSW	QLD	VIC	SA	TAS	NT	OECD average
ACT	533	3.9		●	▲	▲	▲	▲	▲	▲	▲
WA	528	3.3	●		▲	▲	▲	▲	▲	▲	▲
NSW	516	3.7	▼	▼		●	●	▲	▲	▲	▲
QLD	513	3.3	▼	▼	●		●	▲	▲	▲	▲
VIC	512	3.6	▼	▼	●	●		▲	▲	▲	▲
SA	502	3.4	▼	▼	▼	▼	▼		●	▲	●
TAS	493	3.5	▼	▼	▼	▼	▼	●		▲	●
NT	453	9.5	▼	▼	▼	▼	▼	▼	▼		▼
OECD average	**497**	**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

Table 3.13 shows the mean scores of the Australian jurisdictions on the interpreting subscale, with comparisons between jurisdictions. The Australian Capital Territory and Western Australia's performance was similar to each other and significantly higher than all other jurisdictions. The Northern Territory performed significantly lower than all other jurisdictions.

The Australian Capital Territory, Western Australia, New South Wales, Queensland and Victoria performed significantly higher than the OECD average. South Australia and Tasmania performed at the same level as the OECD average, while the Northern Territory performed significantly lower than the OECD average.

Further statistical details about the performance of jurisdictions on the process subscales, including the confidence intervals and the difference between the 5th and 95th percentiles are shown in Table 3.14. The difference between each of the mean process subscales scores and the mean overall mathematical literacy score are also shown, along with the mean and standard errors for the three process subscales and the overall mathematical literacy scale.

Table 3.14 Mean scores and distribution of students' performance on the three process subscales, by jurisdiction

Formulating process subscale					
Jurisdiction	**Mean score**	**SE**	**Confidence interval**	**Difference between 5th and 95th percentiles**	**Difference between the subscale and the overall mathematical literacy scale**
ACT	515	4.2	507–523	362	–3
NSW	502	4.4	494–511	388	–7
VIC	495	4.2	486–503	340	–6
QLD	499	3.1	493–505	350	–4
SA	479	3.6	472–487	337	–10
WA	510	4.2	502–518	347	–7
TAS	470	3.7	463–478	345	–7
NT	447	10.3	427–467	406	–5

Employing process subscale					
Jurisdiction	**Mean score**	**SE**	**Confidence interval**	**Difference between 5th and 95th percentiles**	**Difference between the subscale and the overall mathematical literacy scale**
ACT	513	3.6	505–520	307	–5
NSW	507	3.5	500–513	325	–2
VIC	497	4.0	489–504	293	–4
QLD	499	3.2	493–505	308	–4
SA	484	3.4	478–491	298	–5
WA	512	3.7	505–519	301	–4
TAS	471	3.3	465–478	307	–6
NT	448	10.1	428–467	360	–4

On the formulating subscale, South Australia had the narrowest spread of scores between the students at the 5th and 95th percentiles, whereas the Northern Territory had the widest spread of scores.

On the employing and interpreting subscales, Victoria had the narrowest spread of scores between the students at the 5th and 95th percentiles (with 293 and 306 score points respectively); while the Northern Territory had the widest spread of scores with a range of 360 and 364 score points respectively.

In terms of relative performance, students from all jurisdictions performed worse on the formulating and employing subscales, scoring lower than on the overall mathematical literacy scale. However, students from all jurisdictions performed better on the interpreting subscale, scoring higher than on the overall mathematical literacy scale.

Students' proficiencies on the process subscales across the Australian jurisdictions

Figure 3.27 shows the proportion of students at each proficiency level on the formulating subscale by jurisdiction, along with the results for Australia overall, Shanghai–China and the OECD average for comparison.

The Australian Capital Territory had the highest proportion of students who were top performers (21%), reaching Level 5 or 6 on the formulating subscale. In the other jurisdictions, the proportions of students who were top performers ranged from 7% in the Northern Territory to 19% in New South Wales and Western Australia. Across the OECD, 15% of students achieved Level 5 or 6 on the formulating subscale, which was similar to Australia overall.

Western Australia and the Australian Capital Territory had the lowest proportions of students placed at below Level 2, with one-fifth of students in this category. In Victoria, Queensland and New South Wales, one-quarter of students were low performers, the same proportion as the average across OECD countries. Around one-third of students from South Australia, Tasmania and the Northern Territory were low performers.

Interpreting process subscale						Overall mathematical literacy scale	
Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale	Mean score	SE
ACT	533	3.9	525–540	330	15	518	3.6
NSW	516	3.7	509–524	348	7	509	3.6
VIC	512	3.6	505–519	306	11	501	3.7
QLD	513	3.3	507–520	331	10	503	2.9
SA	502	3.4	495–509	327	13	489	3.3
WA	528	3.3	521–534	333	12	516	3.4
TAS	493	3.5	486–500	346	15	478	3.4
NT	453	9.5	434–473	364	1	452	10.4

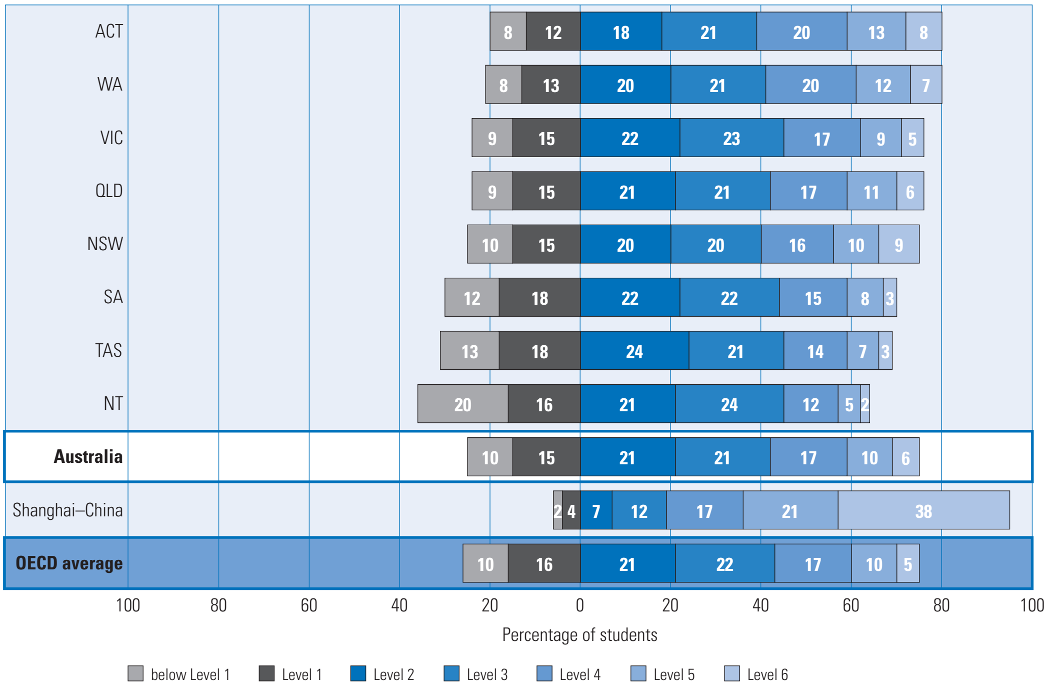


Figure 3.27 Percentage of students across the formulating proficiency level subscale, by jurisdiction

On the employing subscale, Queensland, the Australian Capital Territory, Western Australia and New South Wales had between 14 and 17% of students reaching Level 5 or 6. Victoria, South Australia, Tasmania and the Northern Territory recorded proportions of students at these levels that were lower than the OECD average of 12%.

The lowest proportion of students who failed to achieve Level 2 were recorded in the Australian Capital Territory and Western Australia (both 17%). Students from these two jurisdictions, as well as New South Wales, Victoria and Queensland had a smaller proportion of low performers than the OECD average (23%). In the Northern Territory, 37% of students did not achieve this basic level (Figure 3.28).

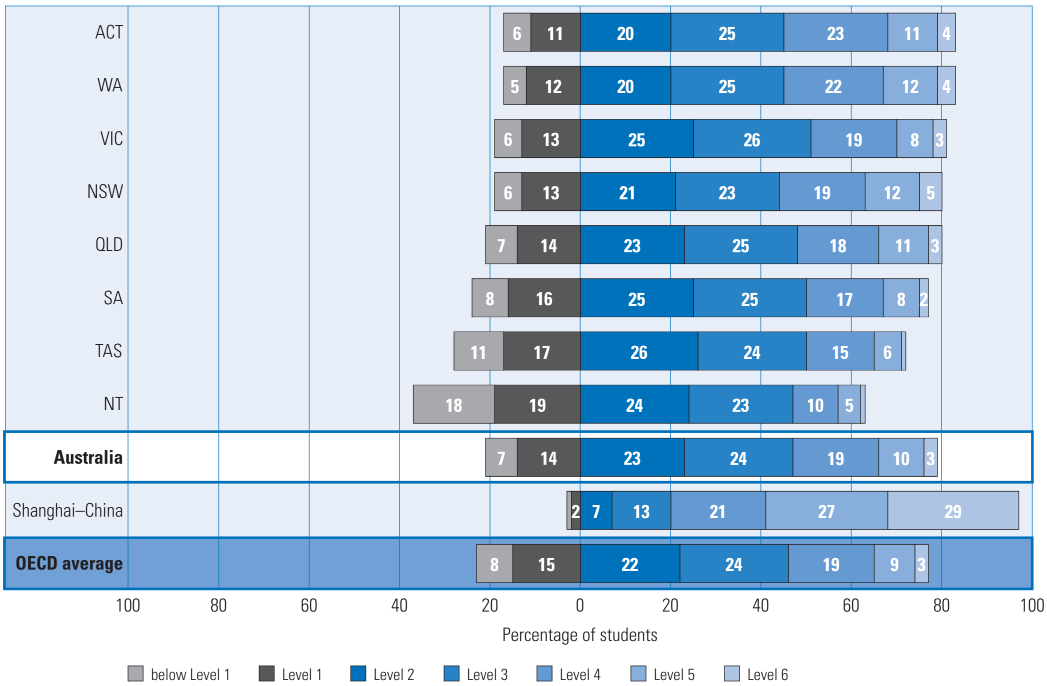


Figure 3.28 Percentage of students across the employing proficiency level subscale, by jurisdiction

Figure 3.29 shows the proportion of students at each of the proficiency levels in each jurisdiction on the interpreting subscale. Twenty-five per cent of students in the Australian Capital Territory, 22% of students in Western Australia and 20% of students in New South Wales achieved Level 5 or 6. The proportion of students from Tasmania, South Australia, Victoria and Queensland was equal to or higher than the OECD average of 14%, while just 7% of students in the Northern Territory were top performers.

More than one-third (37%) of students in the Northern Territory failed to reach Level 2. The proportion of students in Tasmania who failed to reach this level was the same as the average across the OECD (23%), while the proportion for the remaining jurisdictions ranged from 20% in South Australia to 14% in the Australian Capital Territory.

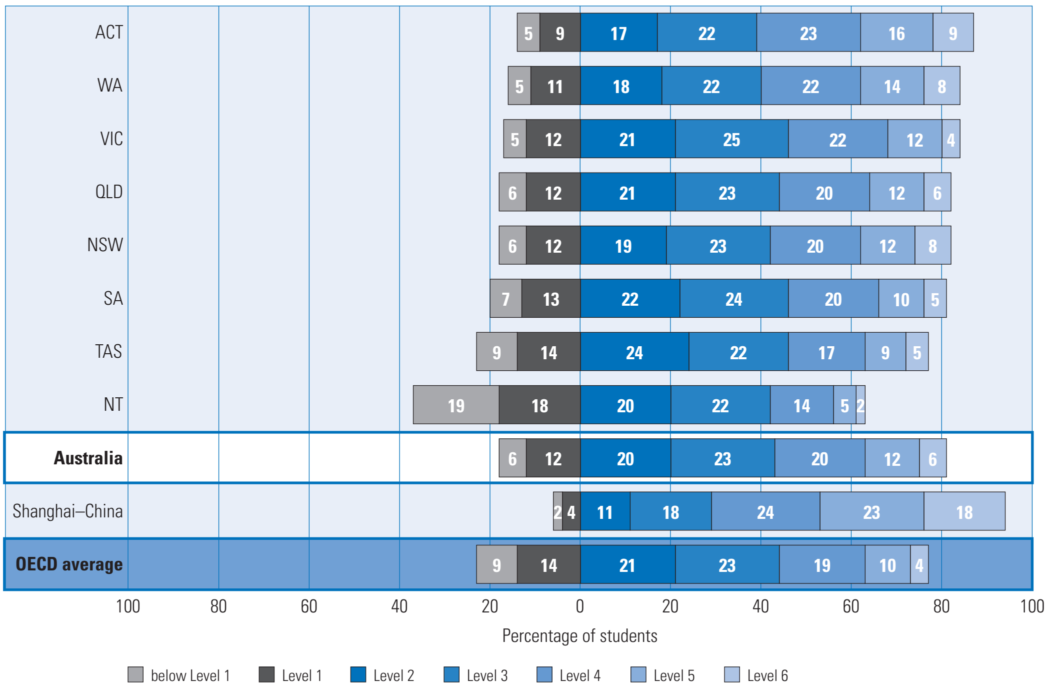


Figure 3.29 Percentage of students across the interpreting proficiency level subscale, by jurisdiction

Students' performance on the process subscales by sex across Australian jurisdictions

The mean mathematical literacy process subscale scores for females and males are shown in Figure 3.30 with the associated standard errors and the difference in mean scores. Males from Victoria, South Australia and Western Australia performed significantly higher on the three process subscales than females, while males from Queensland performed significantly higher than females on the formulating subscale.

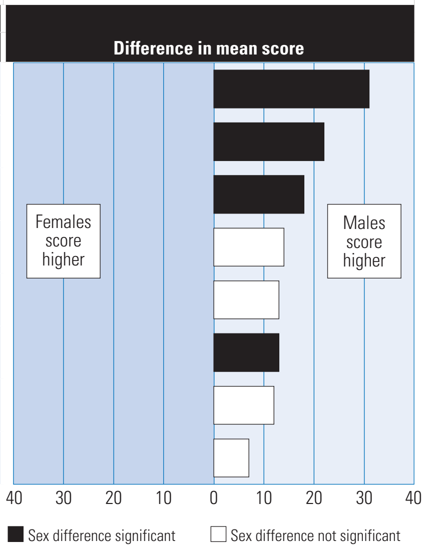
On the formulating subscale, the largest difference between the sexes was reported in Western Australia, with male students scoring 30 score points higher than female students. The difference in Victoria was 22 score points, in South Australia 19 score points and in Queensland 13 score points.

On the employing subscale, the significant differences between the sexes were in Western Australia (21 score points), Victoria (18 score points) and in South Australia (10 score points).

On the interpreting subscale, significant differences in favour of males were found in Western Australia (22 score points), Victoria (13 score points) and South Australia (12 score points).

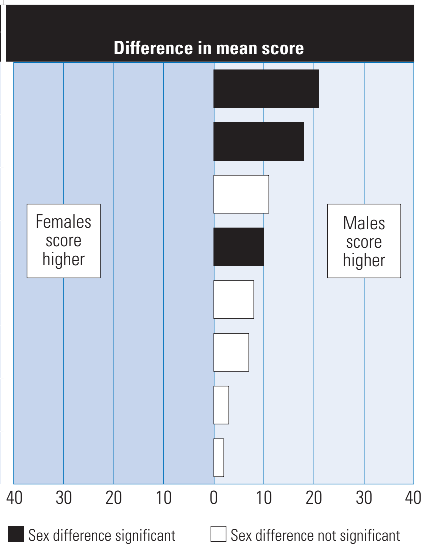
Formulating subscale

State	Females		Males	
	Mean score	SE	Mean score	SE
WA	494	5.0	524	6.6
VIC	483	4.6	505	5.7
SA	470	4.4	489	4.5
NT	440	15.6	454	9.3
TAS	464	5.1	477	5.4
QLD	492	4.1	505	4.1
NSW	496	4.7	508	6.8
ACT	511	5.6	519	6.5



Employing subscale

State	Females		Males	
	Mean score	SE	Mean score	SE
WA	501	4.6	522	5.2
VIC	487	4.2	505	5.2
TAS	466	4.7	477	4.6
SA	480	4.1	489	3.9
NT	444	14.5	452	9.0
QLD	496	4.1	503	4.1
NSW	505	3.9	508	5.2
ACT	512	4.7	513	5.6



Interpreting subscale

State	Females		Males	
	Mean score	SE	Mean score	SE
WA	516	5.5	538	4.8
VIC	505	3.6	518	4.8
SA	496	4.3	508	4.5
TAS	487	5.2	498	4.9
NT	449	14.5	458	8.5
NSW	513	4.1	519	5.6
QLD	511	3.6	515	4.3
ACT	532	5.0	533	5.9

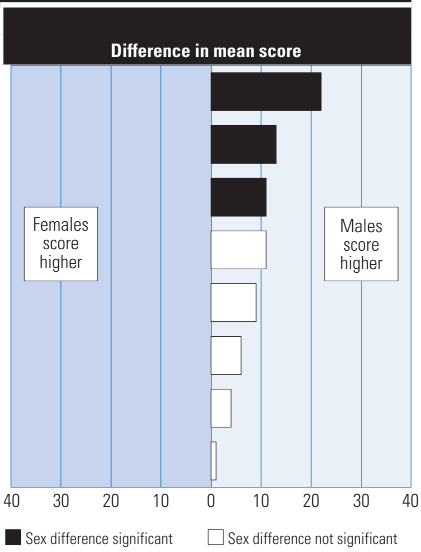


Figure 3.30 Mean scores and differences by sex in students' performance on the process subscales, by jurisdiction

The proportions of females and males at each of the formulating subscale proficiency levels by jurisdiction and sex are shown in Figure 3.31. The highest proportions of males achieving Level 5 or 6 were in Western Australia (23%), New South Wales (22%) and the Australian Capital Territory (22%). Other jurisdictions had between 9 and 18% of males who were top performers. The Northern Territory and Tasmania recorded the lowest proportions of students who were top performers. Across OECD countries, 17% of males reached Level 5 or 6.

Twenty per cent of females in the Australian Capital Territory reached Level 5 or 6; while in other jurisdictions, the proportions of top performers ranged from 6% in the Northern Territory to 17% in New South Wales. Twelve per cent of females across OECD countries achieved Level 5 or 6.

There were higher proportions of males than females achieving Level 5 or 6 in every jurisdiction. The largest difference between the sexes was found in Western Australia, while the smallest differences were found in the Australian Capital Territory and Tasmania.

The largest proportions of males who did not reach Level 2 were from the Northern Territory (34%), Tasmania (29%) and South Australia (26%), which were higher than the OECD average of 25%. Males in New South Wales achieved the same proportion as the OECD average. The proportions of males from other jurisdictions who performed below Level 2 were below the OECD average, ranging from 18% in Western Australia to 23% in Queensland.

South Australia, Tasmania and the Northern Territory reported the highest proportions of females who failed to reach Level 2, with 33, 34 and 38% respectively. For females in other jurisdictions, the proportions placed below Level 2 were lower than that for the OECD average (28%).

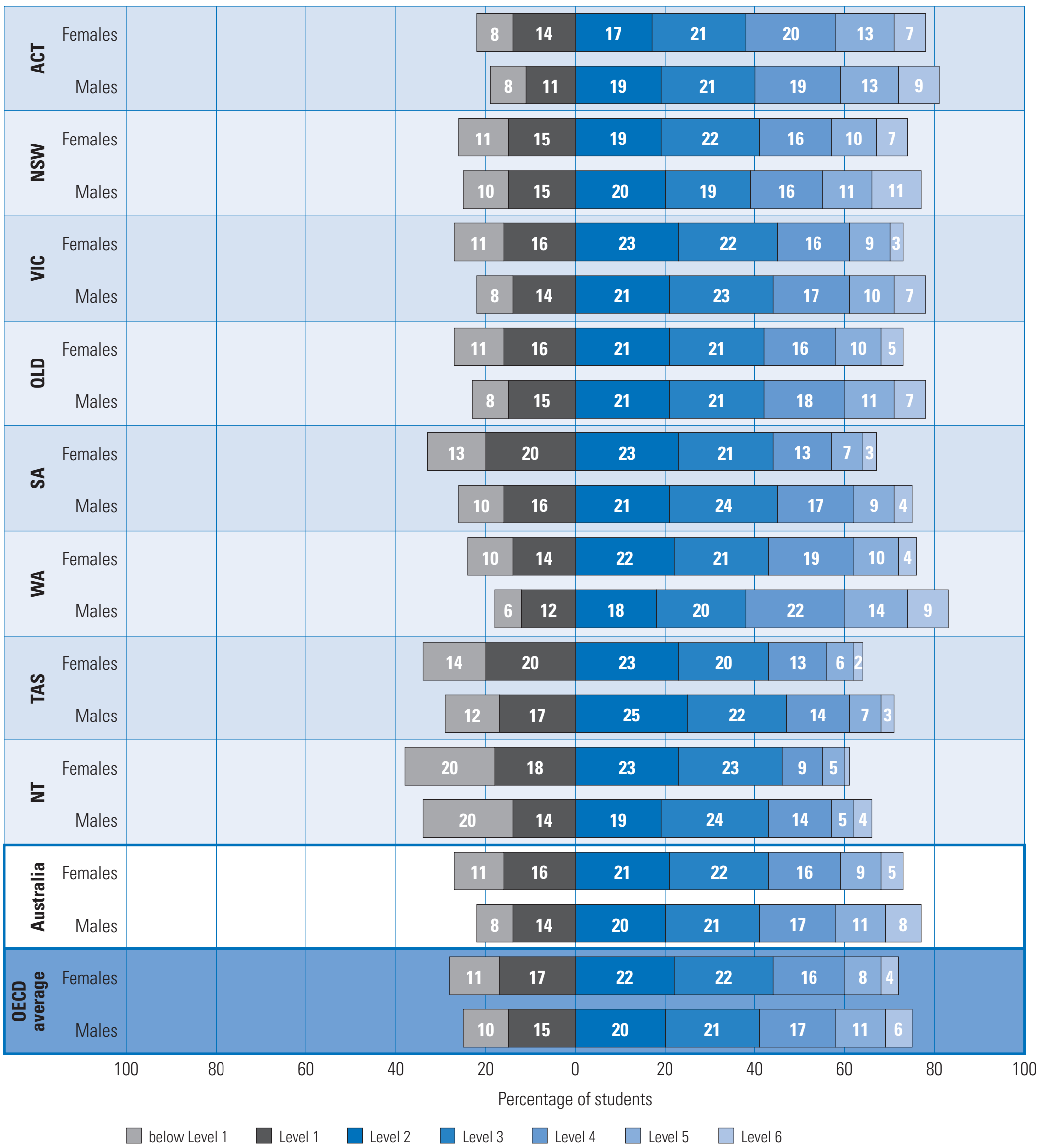


Figure 3.31 Percentage of students across the formulating proficiency level subscale, by jurisdiction and sex

On the employing subscale, males in Western Australia (19%), New South Wales (18%) and the Australian Capital Territory (17%) achieved the highest proficiency levels. Fourteen per cent of males in Queensland were top performers, the same proportion as the OECD average. In the other jurisdictions, the proportions of males reaching Level 5 or 6 ranged from 7% in Tasmania to 13% in Victoria.

Fifteen per cent of females in New South Wales achieved Level 5 or 6, followed by 14% in the Australian Capital Territory and 13% in Queensland, Western Australia and the Northern Territory. Nine per cent of females in Victoria were top performers, the same proportion as the OECD average; while for other jurisdictions, the proportion of females reaching Level 5 or 6 was lower.

The highest proportions of males who failed to reach Level 2 were from the Northern Territory (36%) and Tasmania (25%). All other jurisdictions had proportions that were lower than the OECD average (25%), ranging from 22% in South Australia to 14% in Western Australia.

A greater proportion of females in the Northern Territory (37%) and Tasmania (31%) failed to achieve Level 2, compared to the OECD average of 27%. In other jurisdictions, the proportion of low performers ranged from 15% in the Australian Capital Territory to 26% in South Australia (Figure 3.32).

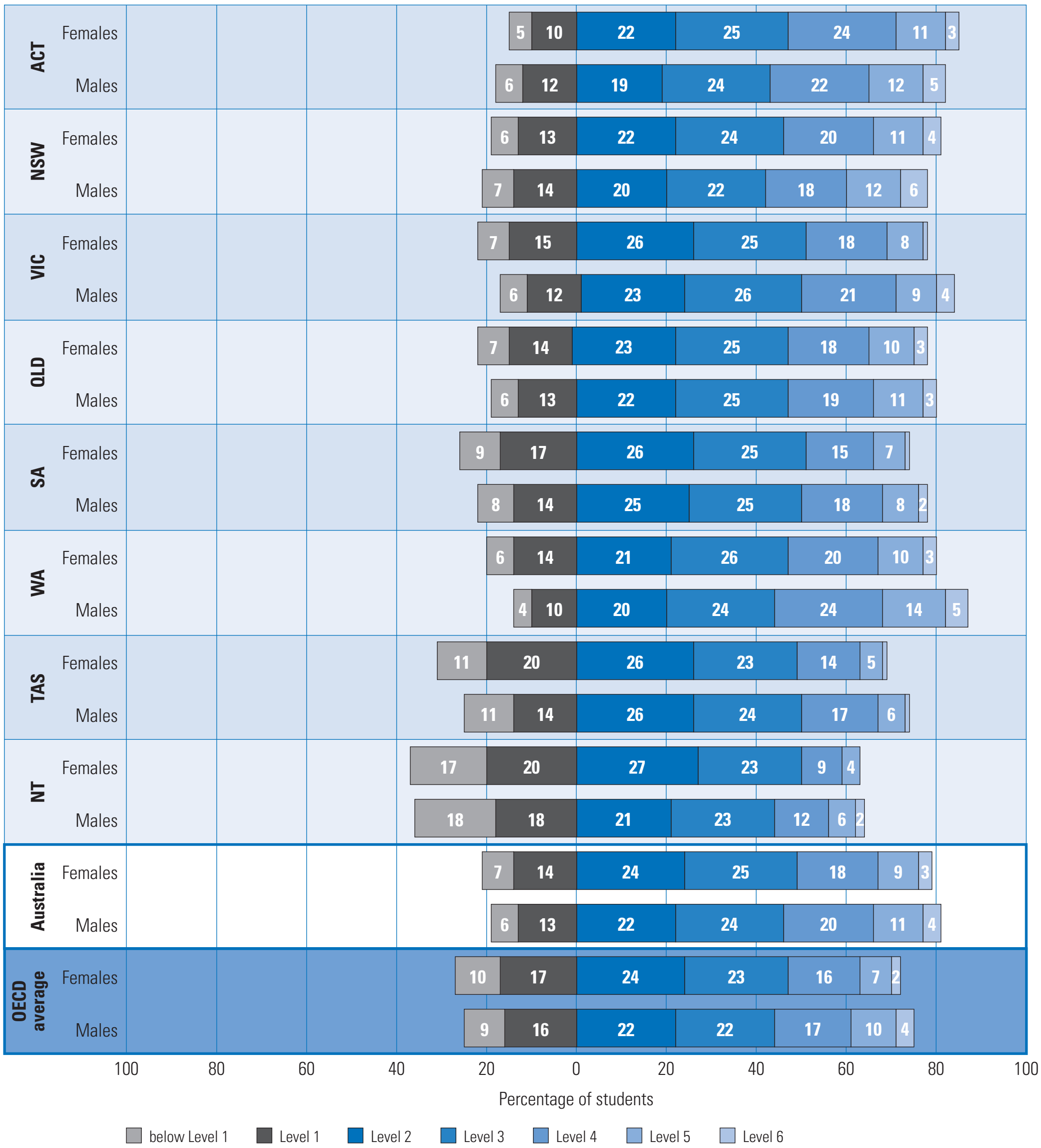


Figure 3.32 Percentage of students across the employing proficiency level subscale, by jurisdiction and sex

Figure 3.33 shows the proportions of females and males at each of the interpreting subscale proficiency levels by jurisdiction and sex. Around one-quarter of males in Western Australia and the Australian Capital Territory achieved Level 5 or 6. Just 9% of males in the Northern Territory achieved Level 5 or 6, substantially lower than the OECD average (16%).

Around one-quarter of females in the Australian Capital Territory reached Level 5 or 6. The proportion of females in the Northern Territory achieving these highest proficiency levels (5%) was (as for males) substantially lower than the OECD average (12%).

Western Australian males did better on this subscale than their counterparts in other jurisdictions. Just 12% of Western Australian males failed to achieve Level 2, compared to 37% in the Northern Territory and the OECD average of 23%.

Just 14% of female students in the Australian Capital Territory did not achieve Level 2, substantially lower than the percentage of females in the Northern Territory (36%) and the OECD average (24%).

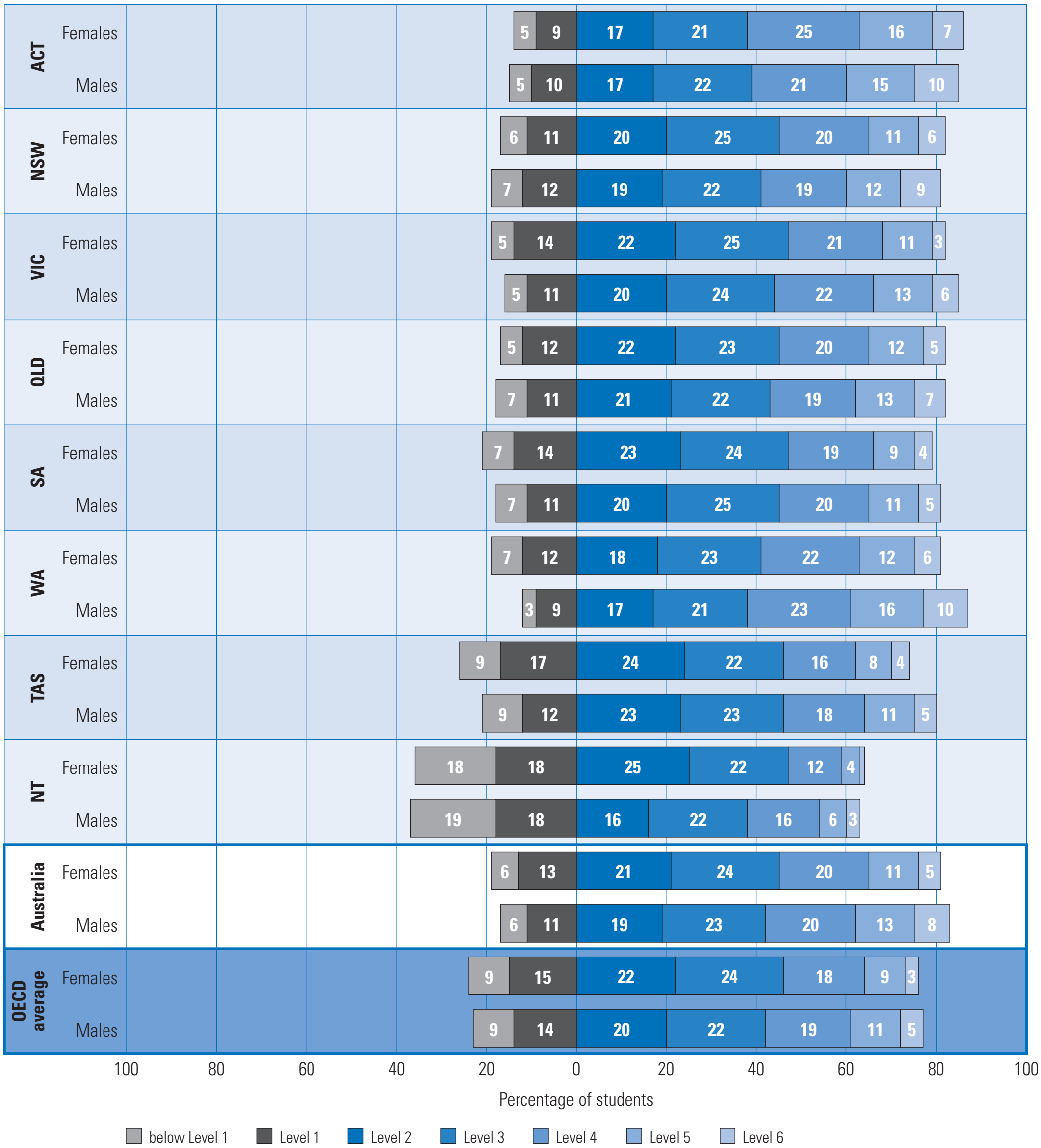


Figure 3.33 Percentage of students across the interpreting proficiency level subscale, by jurisdiction and sex

Students' performance on the process subscales by geographic location of schools

Table 3.15 shows the mean scores, confidence intervals and spread of scores for students by geographic location across the three process subscales. The difference between the mean process subscale score and the mean overall mathematical literacy score is also shown.

As with the overall mathematical literacy scale, across each of the process subscales students attending schools in metropolitan areas performed at a significantly higher level than students in schools from provincial and remote areas; and students in schools from provincial areas performed significantly higher than students in schools from remote areas. The mean score difference between students in metropolitan and remote schools was 80 score points on the formulating subscale, 65 score points on the employing subscale and 78 score points on the interpreting subscale. The mean score difference between students in metropolitan and provincial schools was similar across the three process subscales (around 26 score points), while the mean score difference between students in provincial and remote schools was larger on the formulating subscale (55 score points) and the interpreting subscale (52 score points) than on the employing subscale (38 score points).

In terms of relative performance, students across the three geographic locations performed worse on the formulating and employing subscales than on the overall mathematical literacy scale. Students attending schools in remote areas tended to score lower on the formulating subscale and similar to their overall mathematical literacy score on the other two process subscales.

Students attending schools in metropolitan and provincial areas performed better on the interpreting subscale, scoring higher than on the overall mathematical literacy scale; while students attending schools in remote areas found this process neither easier nor harder compared to the overall mathematical literacy scale.

Table 3.15 Mean scores in students' performance on the process subscales, by geographic location of school

Geographic location	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Formulating process subscale					
Metropolitan	505	2.3	501–510	366	–6
Provincial	480	2.9	474–486	335	–6
Remote	425	19.9	386–464	454	–19
Employing process subscale					
Metropolitan	508	2.0	504–512	313	–3
Provincial	481	2.7	476–486	294	–5
Remote	443	14.7	414–471	364	–1
Interpreting process subscale					
Metropolitan	522	2.1	518–526	333	10
Provincial	496	2.8	491–501	312	10
Remote	444	19.1	407–482	396	0

The proportion of students who performed at each of the proficiency levels on the three process subscales by geographic location is shown in Figure 3.34.

Patterns of achievement on the subscales mirror those on the overall mathematical literacy scale. On the formulating subscale, 19% of students from metropolitan schools (compared to 11% of students from provincial schools and 6% of students from remote schools) performed at Level 5 or 6. At the lower end of the scale, almost one-quarter (23%) of students from metropolitan schools (compared to 29% of students from provincial schools and 44% of students from remote schools) did not reach Level 2.

On the employing subscale, 15% of students from metropolitan schools (compared to 8% of students from provincial schools and 5% of students from remote schools) were top performers. At the lower end of the proficiency scale, 18% of students from metropolitan schools (compared to 24% of students from provincial schools and 39% of students from remote schools) were low performers.

On the interpreting subscale, 20% of students from metropolitan schools (compared to 12% of students from provincial schools and 7% of students from remote schools) performed at Level 5 or 6. Sixteen per cent of students from metropolitan schools (compared to 21% of students from provincial schools and 41% of students from remote schools) were placed below Level 2.

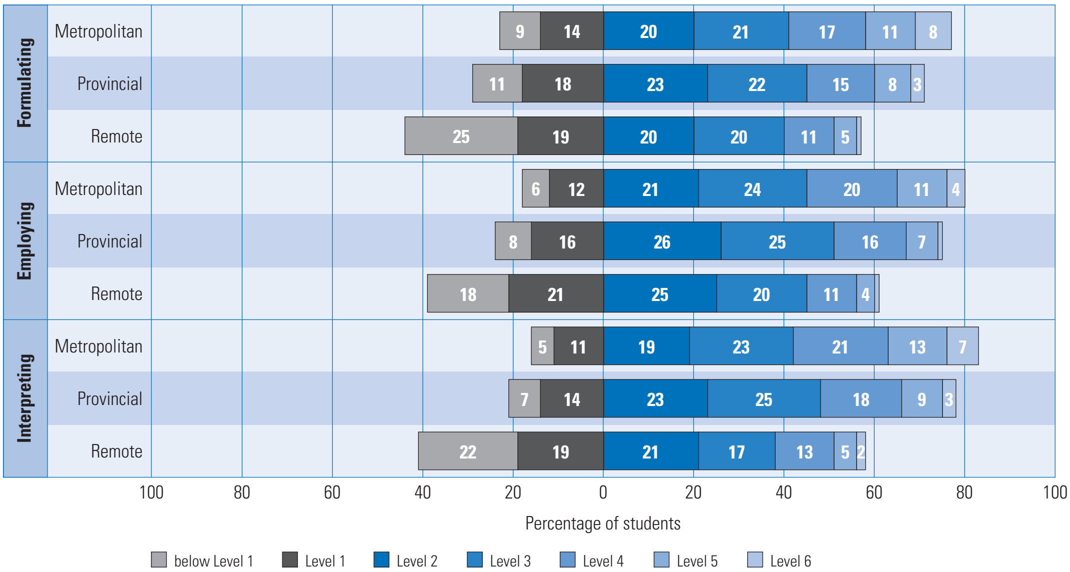


Figure 3.34 Percentage of students across the process proficiency level subscales, by geographic location of school

Students' performance on the process subscales by Indigenous background

The mean performance of Indigenous and non-Indigenous students across the process subscales is shown in Table 3.16. The mean score for Indigenous students' performance ranged from 406 on the formulating subscale to 426 score points in the interpreting subscale. Indigenous students recorded a mean score that was significantly lower than the mean score for non-Indigenous students across each of the process subscales. These differences in mean scores are equivalent to almost one proficiency level or about two-and-a-half school years on each of the process subscales.

In terms of relative performance, Indigenous students tended to score higher on the interpreting subscale (9 score points difference) and lower on the formulating subscale (11 score points difference) and the employing subscale (2 score points difference) than on the overall mathematical literacy scale.

Table 3.16 Mean scores in students' performance on the process subscales, by Indigenous background

Indigenous background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Formulating process subscale					
Indigenous	406	5.6	395–417	346	–11
Non-Indigenous	501	1.8	498–505	356	–6
Employing process subscale					
Indigenous	415	4.8	406–424	303	–2
Non-Indigenous	504	1.6	500–507	307	–4
Interpreting process subscale					
Indigenous	426	5.4	415–436	339	9
Non-Indigenous	517	1.7	514–521	327	10

The proportion of Indigenous and non-Indigenous students at each of the proficiency levels on the three process subscales are shown in Figure 3.35.

The proportion of Indigenous students who reached Level 5 or 6 was similar across the three process subscales; while the proportion of Indigenous students who failed to reach Level 2 was slightly lower on the interpreting subscale (46%) than on the employing subscale (51%) or formulating subscale (55%).

The proportion of non-Indigenous students who reached Level 5 or 6 was similar on the formulating and interpreting subscale (17 and 19% respectively) and slightly lower on the employing subscale (14%); while the proportion of non-Indigenous students who did not reach Level 2 was slightly lower on the interpreting subscale (16%) than on the employing subscale (19%) and formulating subscale (24%).

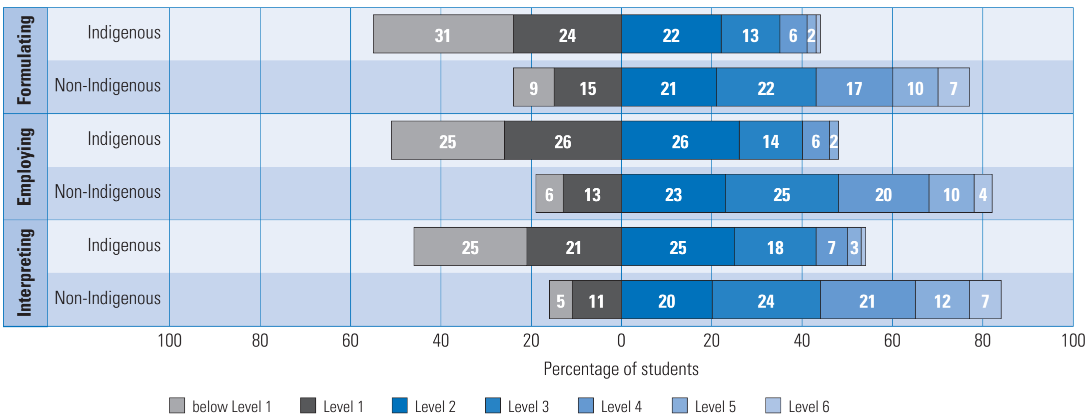


Figure 3.35 Percentage of students across the process proficiency level subscales, by Indigenous background

Students' performance on the process subscales by socioeconomic background

The mean scores for each of the three process subscales by socioeconomic background are shown in Table 3.17. The mean score for students in the lowest quartile ranged from 451 on the formulating subscale to 472 score points on the interpreting subscale, whereas the mean score for students in the highest quartile ranged from 545 score points on the employing subscale to 559 score points on the interpreting subscale.

Students in the highest quartile scored significantly higher than students from other socioeconomic quartiles. The difference between the mean scores of each socioeconomic quartile was statistically significant. The difference in performance between the highest and lowest quartiles was similar on the employing and interpreting subscales (on average 85 and 87 score points respectively) and equivalent to more than one proficiency level or almost two-and-a-half years of schooling. The difference in mean performance between the highest and lowest quartiles on the formulating subscale was larger at 98 score points.

In terms of relative performance on the formulating subscale, the lower the socioeconomic quartile, the larger the difference between this process subscale score and the overall mathematical literacy score. Students in the lowest quartile performed 11 score points on average lower than their overall mathematical literacy score, while students in the highest quartile performed at almost the same level as their overall mathematical literacy score. For each of the socioeconomic quartiles, there was less variation in the difference between the employing subscale score and overall mathematical literacy (which ranged from 3 to 5 score points); while on the interpreting subscale, students in each socioeconomic quartile performed 10 points higher than on the overall mathematical literacy scale.

Table 3.17 Mean scores in students' performance on the process subscales, by socioeconomic background

Socioeconomic background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Difference between the subscale and the overall mathematical literacy scale
Formulating process subscale					
Lowest quartile	451	2.6	446–456	333	–11
Second quartile	483	2.2	479–488	332	–8
Third quartile	517	3.0	511–523	340	–5
Highest quartile	549	2.8	543–554	343	–1
Employing process subscale					
Lowest quartile	460	2.3	455–464	293	–3
Second quartile	488	2.0	484–492	290	–4
Third quartile	518	2.7	513–523	291	–3
Highest quartile	545	2.3	540–549	282	–5
Interpreting process subscale					
Lowest quartile	472	2.4	468–477	307	10
Second quartile	502	2.1	497–506	309	10
Third quartile	532	2.7	527–538	310	11
Highest quartile	559	2.4	555–564	308	10

Figure 3.36 shows the proportion of students at each of the proficiency levels on the three process subscales by socioeconomic quartiles.

On the formulating subscale, 29% of students in the highest quartile were top performers compared to 19% in the third quartile, 12% in the second quartile and 6% of students in the lowest quartile. Eleven per cent of students in the highest quartile were low performers compared to 18% in the third quartile, 28% in the second quartile and 39% of students in the lowest quartile.

On the employing subscale, 24% of students in the highest quartile were top performers compared to 17% in the third quartile, 9% in the second quartile and 5% of students in the lowest quartile. Eight per cent of students in the highest quartile were low performers compared to 14% in the third quartile, 22% in the second quartile and 34% of students in the lowest quartile.

On the interpreting subscale, 31% of students in the highest quartile were top performers compared to 22% in the third quartile, 13% in the second quartile and 8% of students in the lowest quartile. Eight per cent of students in the highest quartile were low performers compared to 12% in the third quartile, 19% in the second quartile and 30% of students in the lowest quartile.

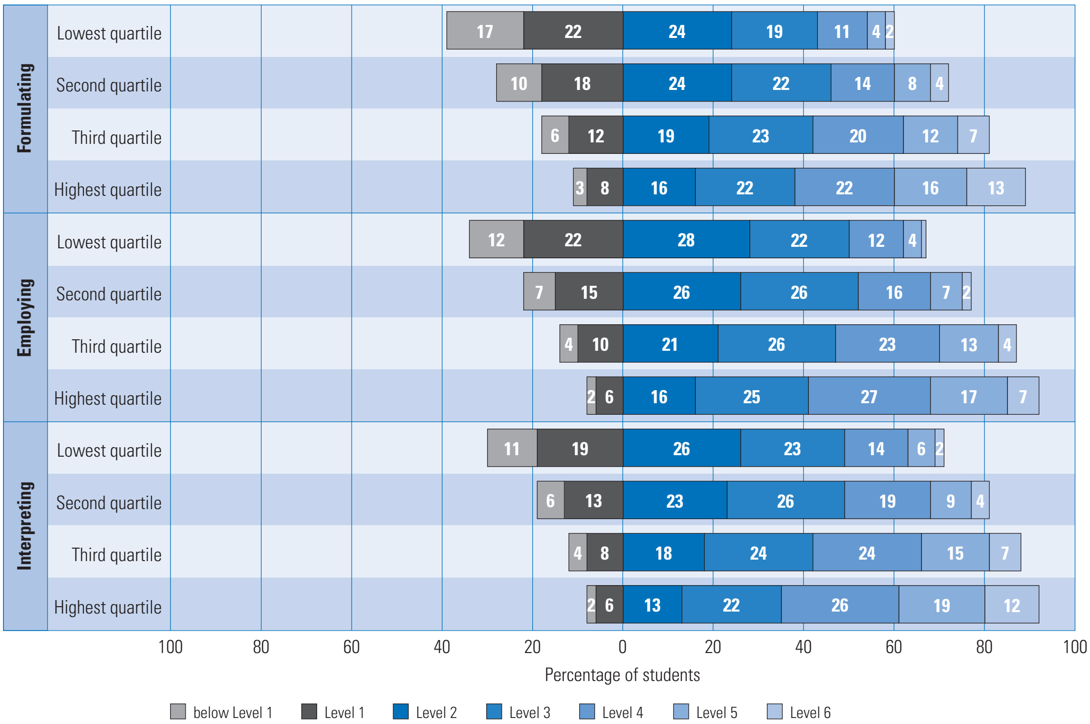


Figure 3.36 Percentage of students across the process proficiency level subscales, by socioeconomic background

CHAPTER 4

Australian students' performance in scientific literacy

Key findings

- Australia achieved an average score of 521 points in the PISA 2012 scientific literacy assessment, which was significantly higher than the OECD average of 501 score points.
- Australia was significantly outperformed by seven countries in scientific literacy: Shanghai–China, Hong Kong–China, Singapore, Japan, Finland, Estonia and Korea. Australia's performance was not significantly different from that of 11 countries: Vietnam, Poland, Canada, Liechtenstein, Germany, Chinese Taipei, the Netherlands, Ireland, Macao–China, Switzerland and the United Kingdom. Australia performed significantly higher than all other participating countries.
- Fourteen per cent of Australian students were top performers in scientific literacy, reaching proficiency Level 5 or 6, compared to 8% of students across OECD countries.
- Thirteen per cent of Australian students were low performers in scientific literacy, failing to reach Level 2, the international baseline proficiency level, compared to 18% of students across OECD countries.
- Australian males and females performed at a level that was not significantly different from one another in scientific literacy, while across OECD countries males outperformed females (by 2 score points on average).
- In Australia, 15% of males and 12% of females were top performers compared to 9% of males and 8% of females across OECD countries.
- In Australia, 14% of males and 13% of females were low performers compared to 18% of males and 17% of females across OECD countries.
- Western Australia, the Australian Capital Territory and New South Wales performed at a statistically similar level, with Western Australia and the Australian Capital Territory outperforming all other jurisdictions, while New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and Victoria achieved statistically similar scores, while the performance for Tasmania and the Northern Territory was significantly lower than the other jurisdictions, but not significantly different from each other.
- The performance of Tasmania and the Northern Territory was not significantly different to the OECD average, while all other jurisdictions performed at a significantly higher level.

- Within each jurisdiction, no significant difference between the sexes was found in scientific literacy.
- No significant differences were found between school sectors (i.e., government, Catholic and independent) in scientific literacy, once a student's individual socioeconomic background and the socioeconomic background of peers at school were taken into account.
- The scientific literacy performance of students attending schools in metropolitan areas was significantly higher than students attending schools in provincial areas (the difference representing around half a school year) and students attending schools in remote areas (the difference representing more than one-and-a-half school years). Students attending schools in provincial areas performed at a significantly higher level than students in remote schools (the difference representing about one school year).
- In metropolitan schools, 15% of students were top performers compared to 10% of students in provincial schools and 6% of students in remote schools.
- In metropolitan schools, 13% of students were low performers compared to 15% of students in provincial schools and 27% of students in remote schools.
- Indigenous students performed significantly lower in scientific literacy than non-Indigenous students, with an average difference of 84 score points, which equates to about two-and-a-half years of schooling.
- Two per cent of Indigenous students were top performers in scientific literacy compared to 14% of non-Indigenous students.
- Thirty-seven per cent of Indigenous students were low performers in scientific literacy compared to 13% of non-Indigenous students.
- Students in the highest socioeconomic quartile performed 88 score points on average higher than students in the lowest socioeconomic quartile. This difference equates to around two-and-a-half years of schooling.
- Twenty-four per cent of students in the highest socioeconomic quartile were top performers compared to 5% of students in the lowest socioeconomic quartile.
- Five per cent of students in the highest socioeconomic quartile were low performers compared to 23% of students in the lowest socioeconomic quartile.
- Australian-born students' performance was significantly lower than that of first-generation students and was not significantly different from that of foreign-born students in scientific literacy.
- Students who spoke English at home performed significantly higher in scientific literacy than students who spoke a language other than English at home.
- Australia's mean score in scientific literacy has not changed significantly between PISA 2006 and PISA 2012.
- Between PISA 2006 and PISA 2012, the proportions of top performers and low performers remained stable with no significant change between the cycles.
- Between PISA 2006 and PISA 2012, there was a significant decline in the mean scientific literacy performance for students in the Australian Capital Territory (by 15 score points on average) and in South Australia (by 19 score points on average).
- In South Australia, average scientific literacy performance declined significantly for females (a difference of 20 score points on average) and for males (a difference of 18 score points on average) between PISA 2006 and PISA 2012.
- Between PISA 2006 and PISA 2012, there was a significant increase in the proportion of low performers in New South Wales (by 3%) and in South Australia (by 4%).
- There were no significant changes in the mean scientific literacy score of Indigenous students between PISA 2006 and PISA 2012.

Scientific literacy was the major domain of PISA 2006, which allowed for an in-depth analysis of knowledge and skills to be reported. The scientific literacy framework assessment from PISA 2006 has remained essentially unchanged for PISA 2012, although as scientific literacy was a minor domain in this cycle less assessment time was devoted to this domain.

This chapter is divided into three sections. The first section provides a brief summary of the scientific literacy domain, the assessment framework and a description of how PISA measures scientific literacy.[1] The second section presents results of the PISA 2012 assessment, comparing Australia's performance with other countries and comparing students across the Australian jurisdictions and for different social groups within Australia. The last section describes changes in scientific literacy performance over time.

How is scientific literacy defined in PISA?

The PISA scientific literacy domain refers to students':

> *… scientific knowledge and use of that knowledge to identify questions, acquire new knowledge, explain scientific phenomena and draw evidence-based conclusions about science-related issues; their understanding of the characteristic features of science as a form of human knowledge and enquiry; their awareness of how science and technology shape our material, intellectual and cultural environments; and their willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen.* (OECD, 2013, p. 100)

How is scientific literacy assessed in PISA?

The scientific literacy framework consists of four interrelated aspects: the contexts in which tasks are embedded; the competencies that students need to apply; the knowledge domains involved; and students' attitudes towards science (Figure 4.1).

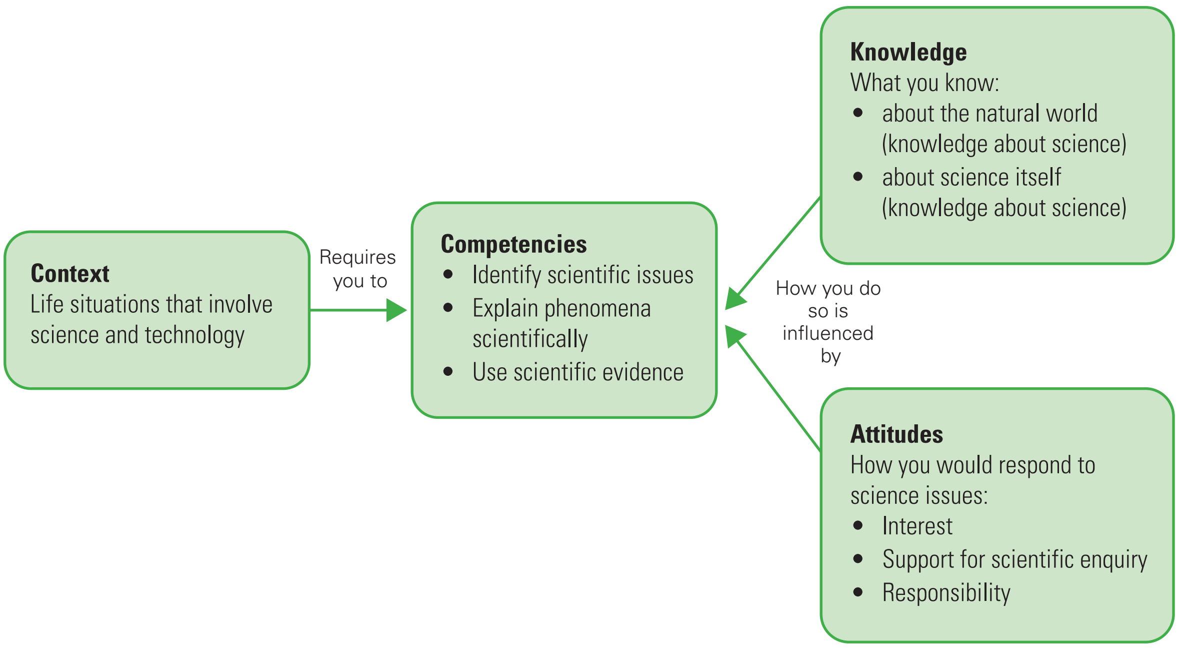


Figure 4.1 Aspects of the PISA scientific literacy framework

1 Details about the scientific literacy framework, structure of the assessment and proficiency scale have been assembled from the *PISA 2012 Assessment and Analytical Framework* (OECD, 2013).

Situations and context

The PISA scientific literacy assessment items are set in real-life situations and are not limited to life in the classroom and school. The assessment items focus on a variety of situations related to: the self, family and peer groups (personal); the community (social); and life across the globe (global). Some of the items are also framed in a historical situation, to assess an understanding of the advances in scientific knowledge.

The context of an assessment item is its specific setting within a situation. It includes all of the detailed elements to formulate the item.

The applications of scientific literacy that are involved within the personal, social and global settings as the contexts for the PISA assessment are shown in Table 4.1, along with the areas of application (health, natural resources, the environment, hazards and frontiers of science and technology).

Table 4.1 Contexts for the PISA scientific literacy assessment

Area of application	**Personal** (self, family and peer groups)	**Social** (the community)	**Global** (life across the world)
Health	Maintenance of health, accidents and nutrition	Control of disease, social transmission, food choices and community health	Epidemics and 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, and energy supply	Renewable and non-renewable energy sources, natural systems, population growth and sustainable use of species
Environment	Environmentally friendly behaviour, use and disposal of materials	Population distribution, disposal of waste, environmental impact and local weather	Biodiversity, ecological sustainability, control of pollution, and production and loss of soil
Hazards	Natural and human-induced hazards, decisions about housing	Rapid changes (earthquakes, severe weather), slow and progressive changes (coastal erosion, sedimentation), and risk assessment	Climate change and impact of modern warfare
Frontiers of science and technology	Interest in science's explanations of natural phenomena and in science-based hobbies, sport and leisure, music and personal technology	New materials, devices and processes, genetic modification, weapons technology and transport	Extinction of species, exploration of space, and origin and structure of the universe

Scientific competencies

The PISA scientific literacy framework comprises three competencies that are grounded in logic, reasoning and critical analysis. These competencies require students to identify scientific issues, explain phenomena scientifically and use scientific evidence. The essential features of each of the three competencies are described in Figure 4.2.

Identifying scientific issues
- Recognising issues that are possible to investigate scientifically
- Identifying keywords to search for scientific information
- Recognising the key features of a scientific investigation

Explaining phenomena scientifically
- Applying knowledge of science in a given situation
- Describing or interpreting phenomena scientifically and predicting changes
- Identifying appropriate descriptions, explanations and predictions

Using scientific evidence
- Interpreting scientific evidence, and making and communicating conclusions
- Identifying the assumptions, evidence and reasoning behind conclusions
- Reflecting on the societal implications of science and technological developments

Figure 4.2 PISA scientific literacy competencies

Scientific knowledge

Scientific knowledge refers to knowledge of science (knowledge about the natural world) and knowledge about science (knowledge about science itself).

Knowledge of science

An objective of the PISA assessment is to describe the extent to which students can apply their knowledge in contexts of relevance to their own lives. The assessed knowledge was selected from the major fields of physics, chemistry, biology, Earth and space science, and technology. Assessment items were: relevant to real-life situations (personal, social and global); representative of important scientific concepts; and appropriate to the developmental level of 15-year-old students. Figure 4.3 shows the four categories of knowledge of science as defined in PISA.

Physical systems
- Structure of matter (e.g., particle model, bonds)
- Properties of matter (e.g., changes of state, thermal and electrical conductivity)
- Chemical changes of matter (e.g., reactions, energy transfer, acids/bases)
- Motions and forces (e.g., velocity, friction)
- Energy and its transformation (e.g., conservation, dissipation, chemical reactions)
- Interactions of energy and matter (e.g., light and radio waves, sound and seismic waves)

Living systems
- Cells (e.g., structures and function, DNA, plant and animal)
- Humans (e.g., health, nutrition, subsystems [i.e., digestion, respiration, circulation, excretion and their relationship], disease, reproduction)
- Populations (e.g., species, evolution, biodiversity, genetic variation)
- Ecosystems (e.g., food chains, matter, energy flow)
- Biosphere (e.g., ecosystem services, sustainability)

Earth and space systems
- Structures of Earth systems (e.g., lithosphere, atmosphere, hydrosphere)
- Energy in 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)

Technology systems
- Role of science-based technology (e.g., solve problems, help humans meet needs and wants, design and conduct investigations)
- Relationships between science and technology (e.g., technologies contribute to scientific advancement)
- Concepts (e.g., optimisation, trade-offs, cost, risk, benefit)
- Important principles (e.g., criteria, constraints, innovation, invention, problem solving)

Figure 4.3 PISA categories of knowledge of science

Knowledge about science

As well as knowledge of science, PISA assesses knowledge about science, for which the framework for scientific literacy defines two categories: scientific enquiry and scientific explanations. Scientific enquiry refers to the means of science or how scientists get data; while scientific explanations refers to the goals of science or how scientists use data. The general meanings of the knowledge about science categories are shown in Figure 4.4.

Scientific enquiry
- Origin (e.g., curiosity, scientific questions)
- Purpose (e.g., to produce evidence that helps answer scientific questions, current ideas/models/theories guide enquiries)
- Experiments (e.g., different questions suggest different scientific investigations, design)
- Data type (e.g., quantitative [measurements], qualitative [observations])
- Measurement (e.g., inherent uncertainty, replicability, variation, accuracy/precision in equipment and procedures)
- Characteristics of results (e.g., empirical, tentative, testable, falsifiable, self-correcting)

Scientific explanations
- Types (e.g., hypothesis, theory, model, law)
- Formation (e.g., data representation, role of extant knowledge and new evidence, creativity and imagination, logic)
- Rules (e.g., must be logically consistent, based on evidence and historical and current knowledge)
- Outcomes (e.g., produce new knowledge, methods and technologies, lead to new questions and investigations)

Figure 4.4 PISA categories of knowledge about science

Attitudes towards science

The PISA scientific literacy framework recognises the importance individuals' attitudes play in the interest and response to science and technology in general and to issues that may affect them. When scientific literacy was the major domain in PISA 2006, an assessment of students' attitudes was undertaken using embedded attitudinal items that were placed after many of the assessment units in the cognitive assessment. As scientific literacy is a minor domain in PISA 2012, the current assessment cycle does not include any embedded attitudinal items.

The PISA 2012 scientific literacy assessment structure

Each PISA assessment includes an appropriate balance of items assessing scientific knowledge and competencies. The assessment items for scientific knowledge were evenly split between knowledge of science and knowledge about science. For the scientific competencies, 23% of items assessed identifying scientific issues, 40% assessed explaining phenomena scientifically and 37% assessed using scientific evidence.

Four types of items (simple multiple-choice, complex multiple-choice, closed constructed-response and open constructed-response) were used to assess scientific literacy in PISA 2012. Two-thirds of the assessment items were either a simple multiple-choice or complex multiple-choice. Another third (32%) of the items were open constructed-response and 2% of items were closed constructed-response.

In PISA 2012, there were 53 scientific literacy assessment items included in the assessment. This was half (49%) of the assessment items included in PISA 2006, when scientific literacy was the major domain.

Appendix E provides examples of scientific literacy items and responses from PISA 2006.

How is scientific literacy reported in PISA?

Mean scores and proficiency levels provide a summary about student performance and allow comparisons of the relative standing between different student subgroups.

Mean scores and distribution of scores

In PISA 2006, when scientific literacy was the major domain, the mean score across the 30 participating OECD countries was set at 500 score points, with a standard deviation of 95. However, with the addition of four new OECD countries in PISA 2009, the mean OECD average score for PISA 2006 was adjusted to a mean of 498 score points. In PISA 2009, the mean score across the OECD countries in scientific literacy was 501 points and in PISA 2012 the mean score remains the same at a mean score of 501 points, with a standard deviation of 93 points.

Proficiency levels

The procedure used to produce proficiency levels in scientific literacy was similar to the procedures described in Chapter 2 to provide the proficiency levels in mathematical literacy.

PISA 2012 used the six proficiency levels for scientific literacy that were developed for PISA 2006, with Level 6 as the highest and Level 1 as the lowest. Each level provides a description of the scientific knowledge and competencies that students can typically display at that level (Figure 4.5).

Proficiency level	What students can typically do at each level
6	Students can consistently identify, explain and apply scientific knowledge and knowledge about science in a variety of complex life situations. They can link different information sources and explanations, and use evidence from those sources to justify decisions. They clearly and consistently demonstrate advanced scientific thinking and reasoning, and they use their scientific understanding in support of solutions to unfamiliar scientific and technological situations. Students at this level can use scientific knowledge and develop arguments in support of recommendations and decisions that centre on personal, social or global situations.
707.9 score points	
5	Students can identify the scientific components of many complex life situations, apply both scientific concepts and knowledge about science to these situations, and can compare, select and evaluate appropriate scientific evidence for responding to life situations. Students at this level can use well-developed inquiry abilities, link knowledge appropriately and bring critical insights to situations. They can construct explanations based on evidence and arguments based on their critical analysis.
633.3 score points	
4	Students can work effectively with situations and issues that may involve explicit phenomena requiring them to make inferences about the role of science or technology. They can select and integrate explanations from different disciplines of science or technology and link those explanations directly to aspects of life situations. Students at this level can reflect on their actions and they can communicate decisions using scientific knowledge and evidence.
558.7 score points	
3	Students can identify clearly described scientific issues in a range of contexts. They can select facts and knowledge to explain phenomena and apply simple models or inquiry strategies. Students at this level can interpret and use scientific concepts from different disciplines and can apply them directly. They can develop short statements using facts and make decisions based on scientific knowledge.
484.1 score points	
2	Students have adequate scientific knowledge to provide possible explanations in familiar contexts or draw conclusions based on simple investigations. They are capable of direct reasoning and making literal interpretations of the results of scientific inquiry or technological problem solving.
409.5 score points	
1	Students have such a limited scientific knowledge that it can only be applied to a few, familiar situations. They can present scientific explanations that are obvious and follow explicitly from given evidence.
334.9 score points	

Figure 4.5 Summary descriptions of the six proficiency levels on the scientific literacy scale

Students who are placed at Level 5 or 6 (scoring 633 points or higher) are considered top performers who have higher proficiency in scientific literacy.

Students who score less than 410 score points, placing them at Level 1 or below, are considered low performers. Level 2 was established as the international baseline level of scientific literacy, defining the level of achievement on the PISA scientific literacy scale at which students begin to demonstrate the scientific knowledge and skills that will enable the students to participate actively in life situations related to science and technology.

Students who performed below the lower boundary of Level 1 (335 score points) could not be reliably described because there were not enough scientific literacy assessment items in this lower region of the scale. However, students placed at this lower level of the scientific literacy proficiency scale are considered to be lacking the necessary skills to participate fully in society beyond school.

In Australia, the nationally agreed baseline (as agreed in the *Measurement Framework for Schooling in Australia*) is Level 3. This level has been identified as the baseline 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, 2013, p. 5).

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 score 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 an adequate scientific knowledge to provide possible explanations in familiar contexts or 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 the 34 OECD countries in which there are a sizeable number of 15-year-olds who were enrolled in at least two different year levels in the PISA 2012 sample. Analyses of these data indicate that the difference between two year levels is, on average, 35 score points on the PISA scientific literacy scale. This implies that one school year corresponds to an average of 35 score points across all OECD countries on the PISA scientific literacy scale. For Australia, more precisely, one year of schooling corresponds to an average of 34 score points.

Australia's scientific literacy performance from an international perspective

Scientific literacy performance across countries

In the PISA 2012 scientific literacy assessment, Australia achieved an average score of 521 points, which was significantly higher than the OECD average of 501 score points. A total of 23 countries performed significantly higher than the OECD average. These countries included 16 OECD countries (Japan, Finland, Estonia, Korea, Poland, Canada, Germany, the Netherlands, Ireland, Australia, New Zealand, Switzerland, Slovenia, the United Kingdom, the Czech Republic and Belgium) and seven partner countries (Shanghai–China, Hong Kong–China, Singapore, Vietnam, Liechtenstein, Chinese Taipei and Macao–China). Five countries (Austria, Latvia, France, Denmark and the United States) performed at a level not significantly different from the OECD average. All other countries performed significantly lower than the OECD average.

Figure 4.6 provides the mean scientific literacy scores, along with the standard error, confidence intervals around the mean, and the difference between the 5th and 95th percentiles. In addition, this figure also shows the graphical distribution of student performance. Countries are shown in order from the highest to the lowest scientific literacy mean and the three colour bands indicate whether a particular country has performed at a significantly higher or lower level than Australia, or whether they performed at a level not significantly different to Australia. Those countries that achieved a mean score lower than Mexico, the lowest performing OECD country, have not been included.[2]

Australia was significantly outperformed by three partner countries (Shanghai–China, Hong Kong–China and Singapore) and four OECD countries (Japan, Finland, Estonia and Korea). Shanghai–China is the top-performing country in scientific literacy, with a mean score of 580 points, which is significantly higher than any other country. Shanghai–China's score in scientific literacy is in the range of proficiency Level 4, or around one proficiency level higher than the OECD average and the equivalent of around two years of schooling higher than the OECD average. Hong Kong–China achieved the next highest mean score, followed by Singapore.

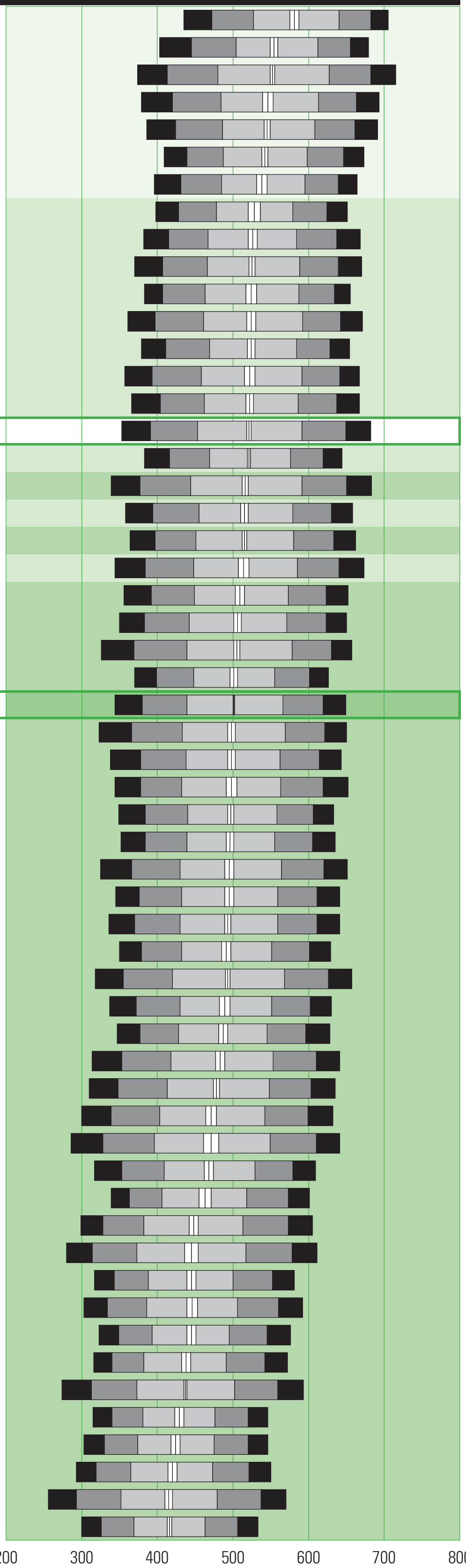
Eleven countries, including seven OECD countries, had mean scores that were not significantly different from that of Australia: Vietnam, Poland, Canada, Liechtenstein, Germany, Chinese Taipei, the Netherlands, Ireland, Macao–China, Switzerland and the United Kingdom. All other countries (including New Zealand, Slovenia and the United States) performed at a level significantly lower than Australia.

The difference in mean scores between students in the 5th and 95th percentiles varied considerably within countries. The average across all OECD countries between the low performers and the top performers was 304 score points. Among the OECD countries, the narrowest spread of scores was seen in Mexico (232 score points) and the widest spread of scores was seen in Israel (354 score points). For the three top-performing countries, the distribution of the low performers and the high performers was wider in Singapore (340 score points) than in Shanghai–China (269 score points) and Hong Kong–China (276 score points). There were 329 score points between the 5th and 95th percentiles in Australia.

2 For brevity, results for those countries that achieved a mean score lower than Mexico (415 score points) have not been included in this chapter. These countries are: Montenegro, Jordan, Argentina, Brazil, Colombia, Tunisia, Albania, Qatar, Indonesia and Peru.

Group	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Shanghai–China	580	3.0	574–586	269
	Hong Kong–China	555	2.6	549–560	276
	Singapore	551	1.5	548–554	340
	Japan	547	3.6	539–553	314
	Finland	545	2.2	541–549	306
	Estonia	541	1.9	537–545	263
	Korea	538	3.7	530–544	268
Not significantly different from Australia	Vietnam	528	4.3	519–536	254
	Poland	526	3.1	519–531	286
	Canada	525	1.9	521–529	300
	Liechtenstein	525	3.5	517–531	273
	Germany	524	3.0	518–529	310
	Chinese Taipei	523	2.3	518–527	273
	Netherlands	522	3.5	515–528	310
	Ireland	522	2.5	517–526	300
	Australia	**521**	**1.8**	**518–524**	**329**
	Macao–China	521	0.8	518–522	260
	New Zealand	516	2.1	511–519	343
	Switzerland	515	2.7	509–520	300
	Slovenia	514	1.3	511–516	297
	United Kingdom	514	3.4	507–520	327
Significantly lower than Australia	Czech Republic	508	3.0	502–514	294
	Austria	506	2.7	500–511	300
	Belgium	505	2.1	501–509	332
	Latvia	502	2.8	496–507	258
	OECD average	**501**	**0.5**	**500–502**	**304**
	France	499	2.6	493–504	328
	Denmark	498	2.7	493–503	306
	United States	497	3.8	490–504	308
	Spain	496	1.8	492–500	283
	Lithuania	496	2.6	490–500	283
	Norway	495	3.1	488–500	326
	Hungary	494	2.9	488–500	294
	Italy	494	1.9	489–497	305
	Croatia	491	3.1	485–497	280
	Luxembourg	491	1.3	488–493	337
	Portugal	489	3.7	481–496	293
	Russian Federation	486	2.9	480–491	280
	Sweden	485	3.0	478–490	328
	Iceland	478	2.1	474–482	325
	Slovak Republic	471	3.6	464–478	332
	Israel	470	5.0	460–479	354
	Greece	467	3.1	460–472	292
	Turkey	463	3.9	455–471	263
	United Arab Emirates	448	2.8	442–453	306
	Bulgaria	446	4.8	437–455	332
	Chile	445	2.9	439–450	264
	Serbia	445	3.4	438–451	287
	Thailand	444	2.9	438–449	252
	Romania	439	3.3	432–445	257
	Cyprus	438	1.2	435–439	320
	Costa Rica	429	2.9	423–435	231
	Kazakhstan	425	3.0	418–430	243
	Malaysia	420	3.0	413–425	258
	Uruguay	416	2.8	410–421	316
	Mexico	415	1.3	412–417	232

Distribution of scores



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

Figure 4.6 Mean scores and distribution of students' performance on the scientific literacy scale, by country

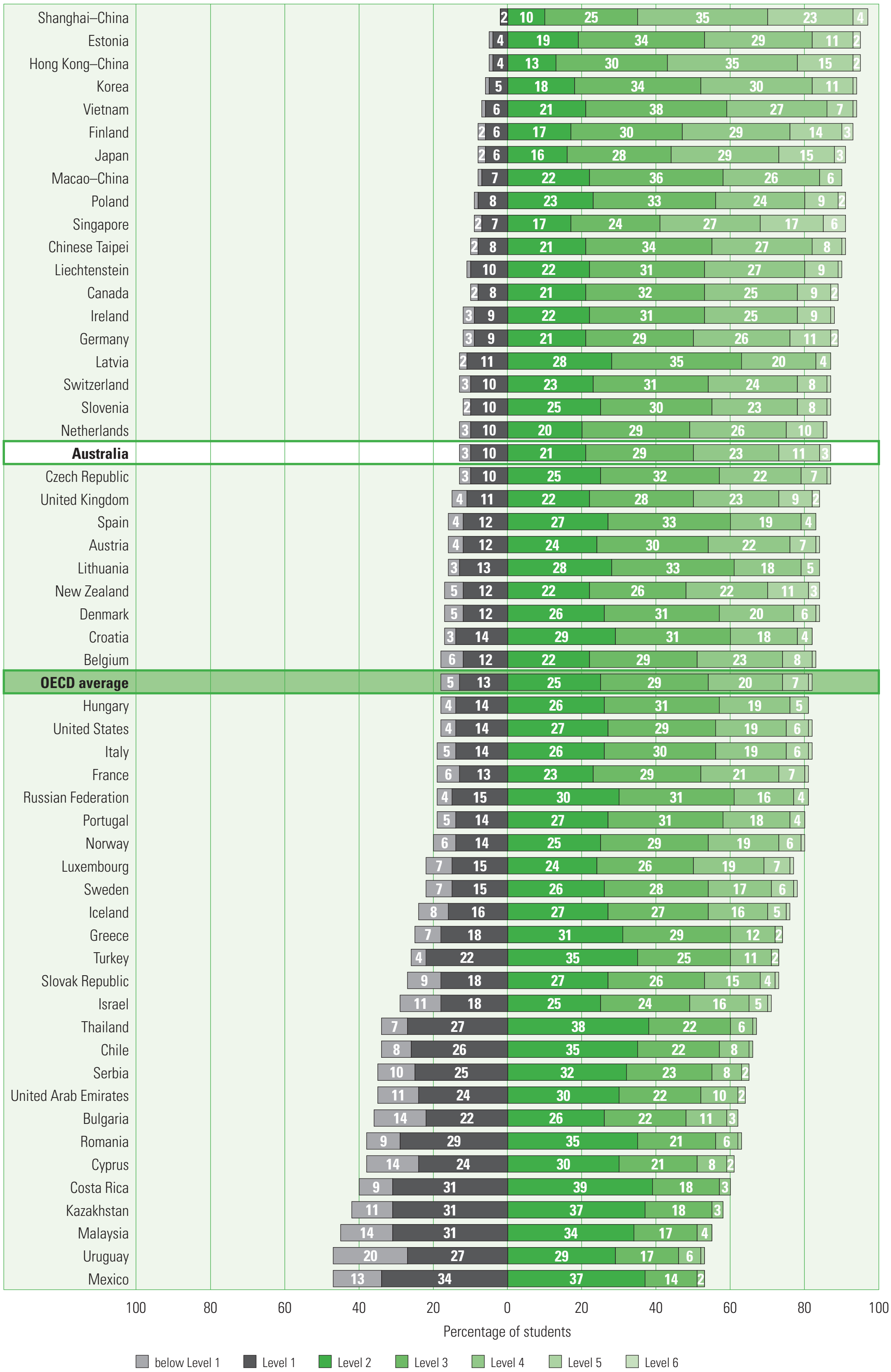
The performance of students is also described using a proficiency scale. As in mathematical literacy, there are six proficiency levels in the PISA scientific literacy assessment. The proportion of students at each scientific literacy level from below Level 1 to Level 6 by country is shown in Figure 4.7.

Students at Level 6 are highly proficient in scientific literacy and are capable of performing tasks such as identifying, explaining and applying scientific knowledge and knowledge about science in a variety of complex life situations. On average, only 1% of students across the OECD performed at this level. Singapore had 6% of students performing at this level, the highest proportion of any country, and in Shanghai–China there were 4% of students who attained Level 6. Three per cent of students were placed at Level 6 in Australia, Japan, Finland and New Zealand, while all other countries had fewer than 3% of students achieving this level of proficiency.

Students achieving at Level 5 or 6 are considered top performers. On average, 8% of students across OECD countries were top performers. More than 15% of students were top performers in Shanghai–China (27%), Singapore (23%), Japan (18%), Finland (17%) and Hong Kong–China (17%). The next country with the highest proportion of students at Level 5 or 6 was Australia with 14% of top performers.

Students achieving below Level 2 are considered low performers. These students have limited scientific knowledge that can only be applied to a few, familiar situations and they can only present scientific explanations that are obvious and follow explicitly from given evidence. On average, almost one-fifth (18%) of students across OECD countries were low performers. In some countries, the proportion of students who did not reach Level 2 was more than twice the OECD average. This was the case for Mexico (47%), Uruguay (47%), Malaysia (45%), Kazakhstan (42%) and Costa Rica (40%). Shanghai–China had the lowest proportion of low performers, with 2% of students failing to achieve Level 2, while for other top-performing countries (Hong Kong–China, Singapore, Japan, Finland, Estonia and Korea), this proportion was between 5 and 9%. Thirteen per cent of Australian students failed to reach Level 2, the same proportion as in the Czech Republic, the Netherlands, Switzerland and Latvia.

In Australia, Level 3 is the nationally agreed baseline level. Thirty-four per cent of Australian students were placed below Level 3, which was lower than the 43% of students across OECD countries. Twelve per cent of students in Shanghai–China had not reached Level 3, while there were 18% of students in Hong Kong–China and approximately 25% of students in Japan, Estonia, Korea and Singapore who had not reached Level 3.



Note: In cases in which 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 4.7 Percentage of students across the scientific literacy proficiency scale, by country[3]

3 Countries have been ordered by the percentage of students classified as below Level 2, the internationally assigned benchmark, with countries with the lowest proportion of students below Level 2 placed at the top of the figure and countries with the highest proportion of students below Level 2 at the bottom.

Country	Females: Mean score	Females: SE	Males: Mean score	Males: SE
United Arab Emirates	434	4.1	462	3.7
Bulgaria	437	5.6	457	4.6
Thailand	433	3.3	452	3.4
Finland	537	3.0	554	2.3
Latvia	495	3.6	510	2.8
Lithuania	488	3.0	503	2.6
Greece	460	3.8	473	3.0
Cyprus	431	1.8	444	1.7
Malaysia	414	3.8	425	3.1
Turkey	458	4.5	469	4.3
Slovenia	510	1.9	519	1.9
Kazakhstan	420	3.4	429	3.2
Sweden	481	3.9	489	2.8
Russian Federation	484	3.5	489	2.9
Romania	436	3.7	441	3.5
Serbia	443	4.0	447	3.8
Norway	493	3.2	496	3.7
Iceland	477	2.7	480	2.9
Poland	524	3.7	527	3.2
France	498	3.8	500	2.4
Estonia	540	2.5	543	2.3
Croatia	490	3.9	493	3.3
Portugal	488	4.1	490	3.8
United States	497	4.1	498	4.0
Macao–China	520	1.3	521	1.2
Uruguay	415	3.4	416	3.1
Israel	470	7.9	470	4.0
Singapore	551	2.1	552	1.9
Germany	524	3.1	524	3.5
Belgium	505	2.9	506	2.6
Czech Republic	509	3.7	508	3.5
Chinese Taipei	524	3.9	523	4.0
Vietnam	529	5.0	528	4.1
OECD average	**502**	**0.6**	**500**	**0.5**
Italy	495	2.2	492	2.4
Canada	527	2.4	524	2.0
Hungary	496	3.4	493	3.3
Netherlands	524	3.7	520	3.9
Korea	539	4.7	536	4.2
Ireland	524	3.4	520	3.1
New Zealand	518	3.2	513	3.3
Australia	**524**	**2.5**	**519**	**2.1**
Shanghai–China	583	3.5	578	3.1
Switzerland	518	3.3	512	2.7
Mexico	418	1.5	412	1.3
Hong Kong–China	558	3.6	551	3.1
Chile	448	3.7	442	2.9
Slovak Republic	475	4.3	467	4.2
Spain	500	2.3	493	1.9
Austria	510	3.9	501	3.4
Denmark	504	3.5	493	2.5
Japan	552	4.7	541	3.5
Costa Rica	436	3.5	424	3.2
United Kingdom	521	4.5	508	3.7
Luxembourg	499	1.7	483	1.7
Liechtenstein	533	5.8	516	5.7

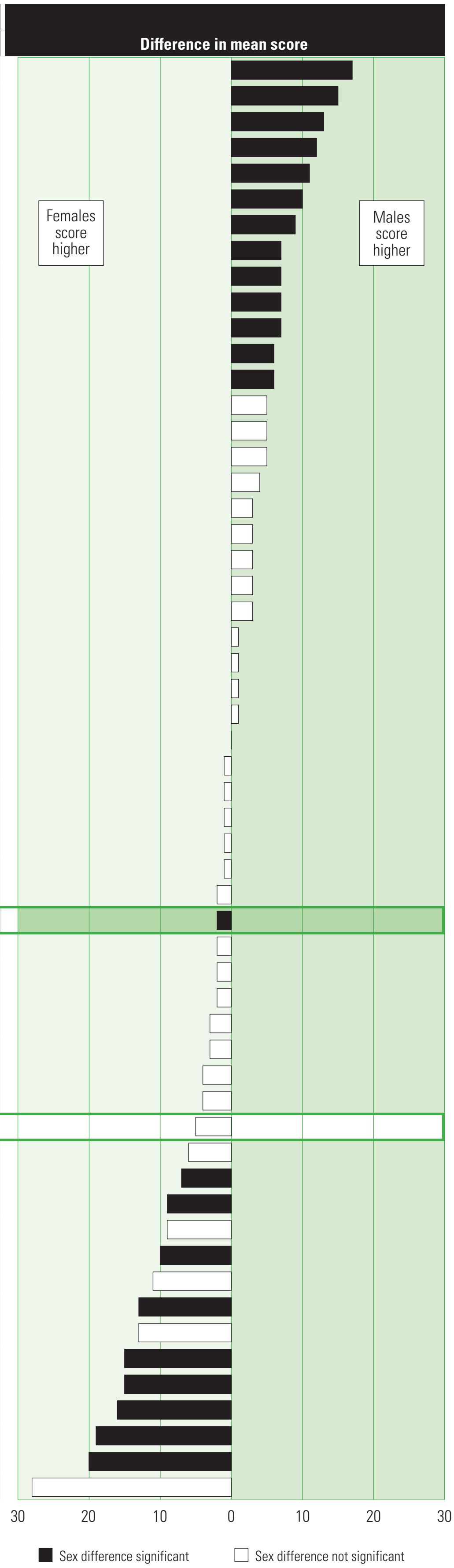


Figure 4.8 Mean scores and sex differences in students' performance on the scientific literacy scale, by country

Scientific literacy performance by sex across countries

Fewer countries showed significant differences between sexes in scientific literacy than had showed significant differences between sexes in mathematical literacy. On average across OECD countries, males outperformed females in scientific literacy by 2 score points.

Figure 4.8 shows the mean scores and corresponding standard errors for females and males, and the difference between the average female and male performance graphically. In nine countries (Chile, Costa Rica, Demark, Japan, Luxembourg, Mexico, Spain, Switzerland and the United Kingdom) there were significant differences in scientific literacy performance in favour of males, with the largest difference of 16 score points found in Luxembourg. Females significantly outperformed males in 13 countries: Bulgaria, Cyprus, Finland, Greece, Kazakhstan, Latvia, Lithuania, Malaysia, Slovenia, Sweden, Thailand, Turkey and the United Arab Emirates. The largest difference, in favour of females, was found in the United Arab Emirates; where there was a 28 score point difference between males and females. No significant differences between the sexes were found in Australia.

Figure 4.9 shows the proportion of male and female students for Australia and the OECD average at each level of the scientific literacy proficiency scale. On average across OECD countries, there were similar proportions of females and males who reached Level 5 or 6 (8 and 9% respectively) and who did not reach Level 2 (17 and 18% respectively). In Australia, there was on average a higher proportion of males (15%) than females (12%) at the higher end of the proficiency scale (Level 5 or 6), whereas the difference in the proportion of males and females at the lower end of the proficiency scale (below Level 2) was small (a difference of 1%).

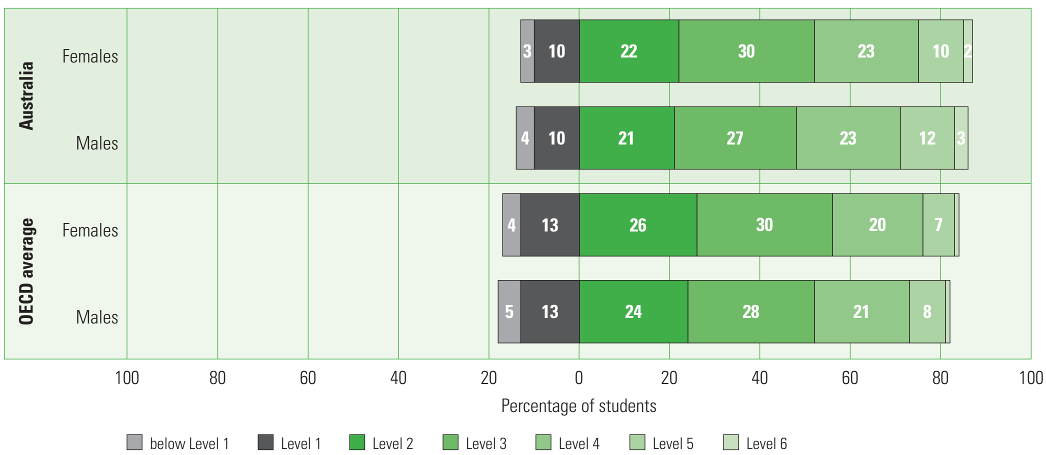


Figure 4.9 Percentage of students across the scientific literacy proficiency scale by sex, for Australia and the OECD average

Australia's scientific literacy performance in a national context

Scientific literacy performance across the Australian jurisdictions

The scientific literacy performance for students in each of the Australian jurisdictions is shown in Figure 4.10 and Table 4.2. Figure 4.10 shows the mean scores and distribution of scientific literacy scores for each jurisdiction. The mean score and distribution for Australia, the highest performing country (Shanghai–China) and the average score across all OECD countries have also been included for comparison. Table 4.2 is a multiple comparison table that provides further detail about the performance of each jurisdiction compared to the other jurisdictions.

On average in PISA 2012, Western Australia, the Australian Capital Territory and New South Wales performed at a statistically similar level, with Western Australia and the Australian Capital Territory outperforming all other jurisdictions, while New South Wales performed significantly higher than

Tasmania, South Australia and the Northern Territory. Queensland and Victoria performed on a par with South Australia. Scores for Tasmania and the Northern Territory were statistically similar to each other, but were significantly lower than the other jurisdictions. Tasmania and the Northern Territory performed at a level not significantly different from the OECD average, while the other jurisdictions all achieved significantly higher than the OECD average.

The mean scores ranged from 483 score points in the Northern Territory to 535 score points in Western Australia. This difference of 52 score points is more than half a proficiency level and the equivalent of one-and-a-half years of schooling.

The Northern Territory had the widest spread of scores, with 412 score points between the 5th and 95th percentiles. Victoria had the narrowest range, with 313 score points separating the 5th and 95th percentiles.

Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
ACT	534	3.9	526–542	348
NSW	526	3.6	518–533	348
VIC	518	3.8	510–525	313
QLD	519	3.1	513–525	318
SA	513	3.7	505–520	320
WA	535	3.7	527–542	317
TAS	500	3.8	493–507	345
NT	483	10.2	463–503	412
Australia	521	1.8	518–524	329
Shanghai–China	580	3.0	574–586	269
OECD average	501	0.5	500–502	304

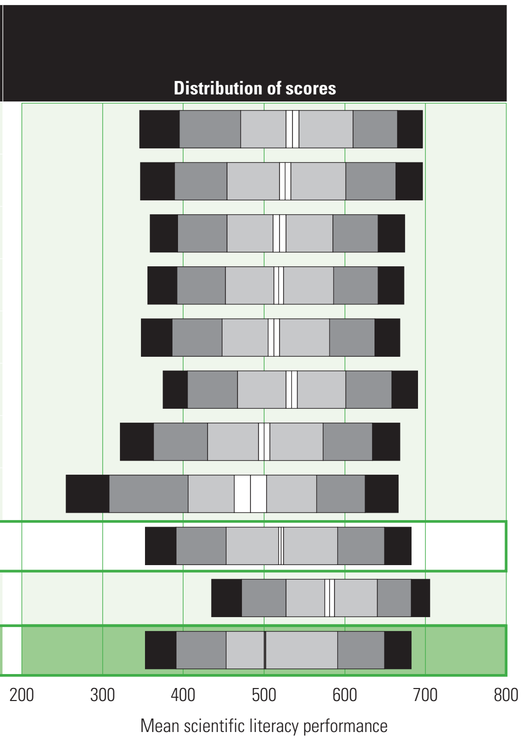


Figure 4.10 Mean scores and distribution of students' performance on the scientific literacy scale, by jurisdiction

Table 4.2 Multiple comparisons of mean scientific literacy performance, by jurisdiction[4]

Jurisdiction	Mean score	SE	WA	ACT	NSW	QLD	VIC	SA	TAS	NT	OECD average
WA	535	3.7		●	●	▲	▲	▲	▲	▲	▲
ACT	534	3.9	●		●	▲	▲	▲	▲	▲	▲
NSW	526	3.6	●	●		●	●	▲	▲	▲	▲
QLD	519	3.1	▼	▼	●		●	●	▲	▲	▲
VIC	518	3.8	▼	▼	●	●		●	▲	▲	▲
SA	513	3.7	▼	▼	▼	●	●		▲	▲	▲
TAS	500	3.8	▼	▼	▼	▼	▼	▼		●	●
NT	483	10.2	▼	▼	▼	▼	▼	▼	●		●
OECD average	**501**	**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

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

The proportions of students at each of the scientific literacy proficiency levels in each jurisdiction, along with the percentages for Australia overall, the OECD average and the highest scoring country (Shanghai–China), for comparison, are shown in Figure 4.11.

Students achieving at Level 6 demonstrated highly proficient skills and knowledge in scientific literacy. In New South Wales, 4% of students achieved Level 6, a similar proportion to that in Shanghai–China. In the Australian Capital Territory, Western Australia and the Northern Territory, 3% of students achieved Level 6, while 2% of students in Victoria, Queensland, South Australia and Tasmania were placed at Level 6, higher than the proportion of students across OECD countries.

The highest proportions of top performers—those students reaching the two top proficiency levels (Level 5 or 6)—were found in the Australian Capital Territory (17%), New South Wales (17%) and Western Australia (16%). The proportion of top performers in the other jurisdictions was above the OECD average of 8%, ranging from 9% in the Northern Territory to 12% in Queensland.

Students who do not reach Level 2, the baseline proficiency level, are considered low performers. The highest proportions of low performers were found in the Northern Territory (26%) and Tasmania (20%), which were both higher than the average of 18% of low performers across OECD countries. Fifteen per cent of students in South Australia, 14% in New South Wales and Victoria, and 13% of students from Queensland did not reach Level 2. The smallest proportions of students placed at below Level 2 were found in Western Australia (11%) and the Australian Capital Territory (12%). These proportions were about six times as large as the proportion of students from Shanghai–China who failed to reach Level 2 (2%).

Thirteen per cent of students from the Northern Territory were placed at a proficiency below Level 1 compared to 6% of students in Tasmania and fewer than 5% of students in the other jurisdictions. These results are of concern given the difficulties these students may experience in the future because they lack the required skills and knowledge in scientific literacy.

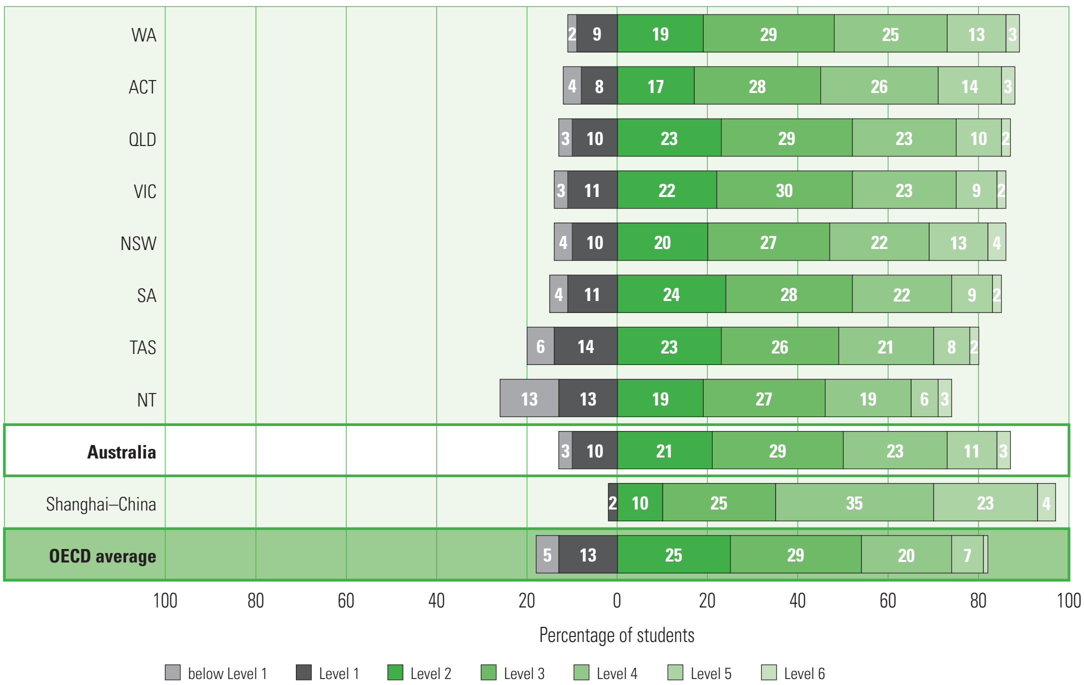


Figure 4.11 Percentage of students across the scientific literacy proficiency scale, by jurisdiction

Scientific literacy performance by sex across the Australian jurisdictions

Figure 4.12 shows that there were no statistically significant differences by sex in scientific literacy across any of the jurisdictions.

Jurisdiction	Females		Males	
	Mean score	SE	Mean score	SE
NSW	527	4.1	525	5.6
ACT	533	5.2	534	5.5
TAS	499	5.8	501	5.2
QLD	517	3.7	521	4.0
SA	510	4.6	515	4.4
NT	480	14.3	486	10.7
VIC	512	3.7	523	5.3
WA	528	5.2	541	5.7

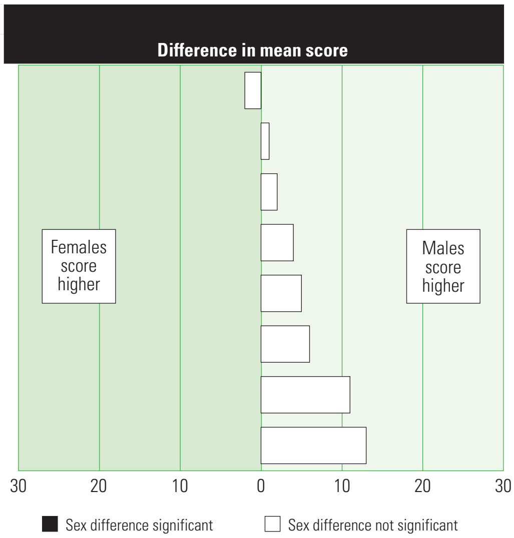


Figure 4.12 Mean scores and differences in students' performance on the scientific literacy scale, by jurisdiction and sex

Figure 4.13 shows the proportion of females and males at each of the scientific literacy proficiency levels by jurisdiction.

Eighteen per cent of males in the Australian Capital Territory and Western Australia, followed by 17% of males in New South Wales, were top performers in scientific literacy. Other jurisdictions had between 9 and 13% of males who performed at Level 5 or 6. The highest proportions of females who were top performers were also found in the Australian Capital Territory, New South Wales and Western Australia, with 15% performing at this level. In the other jurisdictions, the proportion of females reaching Level 5 or 6 ranged from 8 to 11%.

At the lower end of the proficiency scale, the highest proportions of males not reaching Level 2 were found in the Northern Territory (27%) and Tasmania (19%). There were 16% of males from New South Wales and 14% of males from Victoria and South Australia who failed to reach Level 2. Western Australia had the lowest proportion of males (10%) who were placed below Level 2. One-quarter (24%) of females from the Northern Territory failed to reach Level 2, followed closely behind by Tasmania with one-fifth (21%) of females. The proportions of females from other jurisdictions who did not reach the Level 2 ranged from 16% in South Australia to 11% in the Australian Capital Territory.

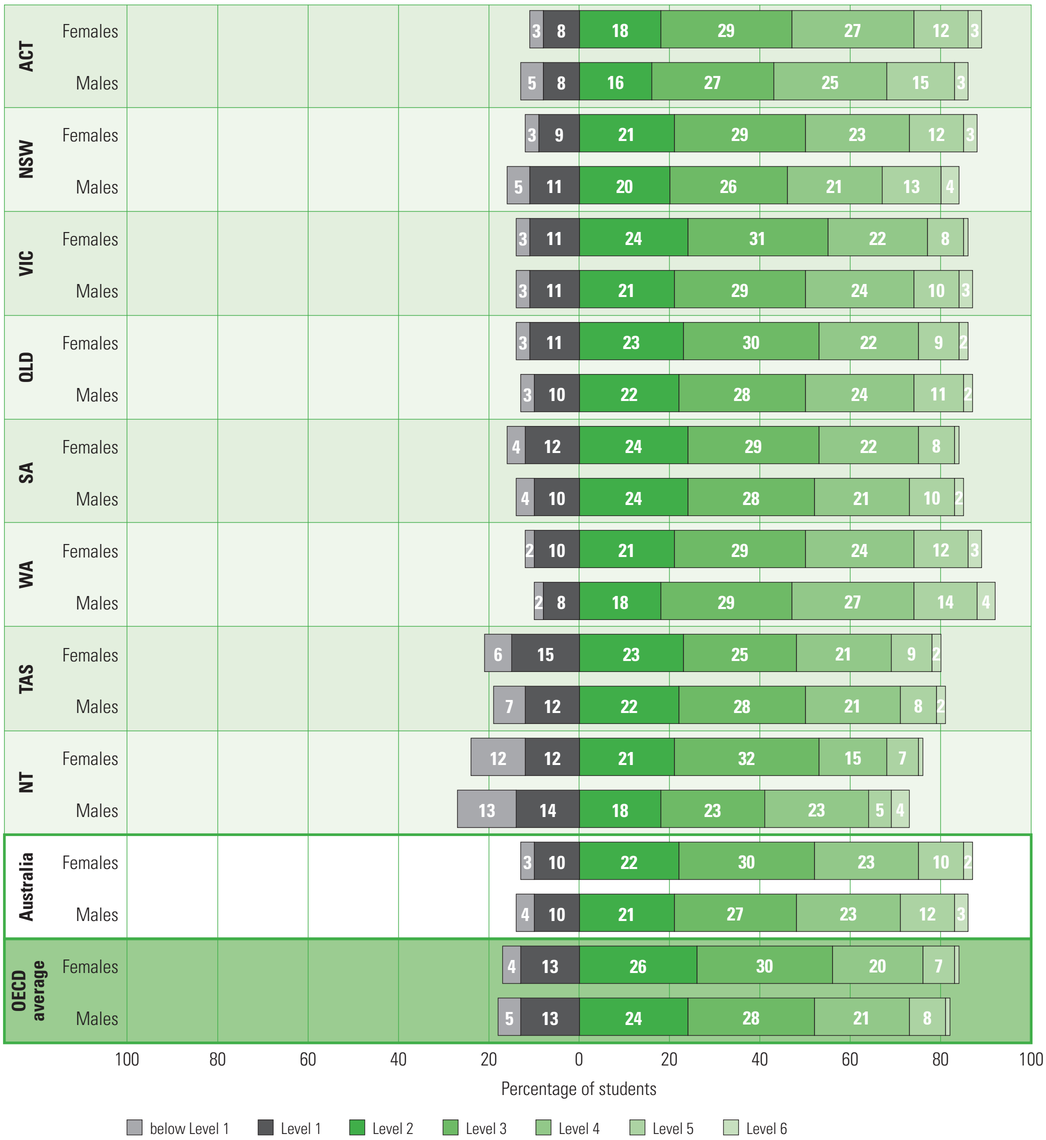


Figure 4.13 Percentage of students across the scientific literacy proficiency scale, by jurisdiction and sex

Scientific literacy performance by Australian school sectors

The unadjusted means for scientific literacy by school sector shows that, on average, students in the independent school sector achieved significantly higher than those in the Catholic or government school sectors, and that students in the Catholic sector significantly outperformed those in the government sector. Mean scores in the Catholic and independent sectors were significantly higher than the OECD average and the mean score for the government sector was not significantly different from the OECD average (Figure 4.14).

Government schools catered for the broadest range of students with a range of 335 score points, whereas the difference in scores between the 5th and 95th percentiles for independent schools was slightly narrower at 305 score points. Catholic schools had the narrowest spread of scores, with 298 score points between the students at the 5th and 95th percentiles.

School sector	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Government	506	2.5	501–511	335
Catholic	532	3.4	525–538	298
Independent	559	3.6	552–566	305

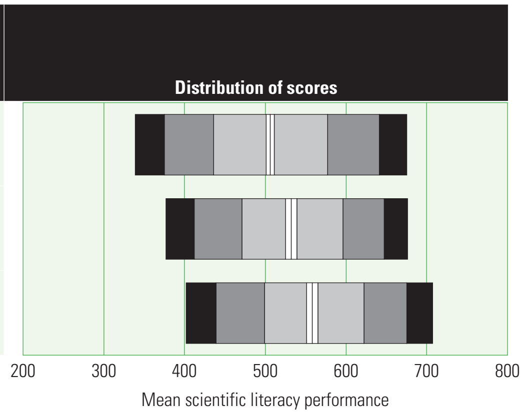


Figure 4.14 Mean scores and distribution of students' performance on the scientific literacy scale, unadjusted for student and school background, by school sector

Table 4.3 Differences in mean scientific literacy scores after adjustment for student and school socioeconomic background

	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
Government – Catholic	**26**	**16**	5
Government – Independent	**53**	**30**	8
Catholic – Independent	**27**	**14**	3

Note: Values that are statistically significant are indicated in bold.

Once student-level socioeconomic background is taken into account, the significant differences in mean performance between each of the school sectors remain, although the differences are reduced. When school-level socioeconomic background is also accounted for, the mean performance of students in government, Catholic and independent schools are statistically similar (Table 4.3).

Figure 4.15 shows the proportion of students at each of the proficiency levels in each school sector.[5] One-fifth (21%) of students from independent schools were placed at Level 5 or 6. The proportion of students who performed at this level in Catholic and government schools was 13 and 11% respectively, which was higher than the OECD average (8%). Eighteen per cent of students attending government schools failed to reach Level 2, a similar proportion to the OECD average. Nine per cent of students in Catholic schools and 5% of students in independent schools were low performers.

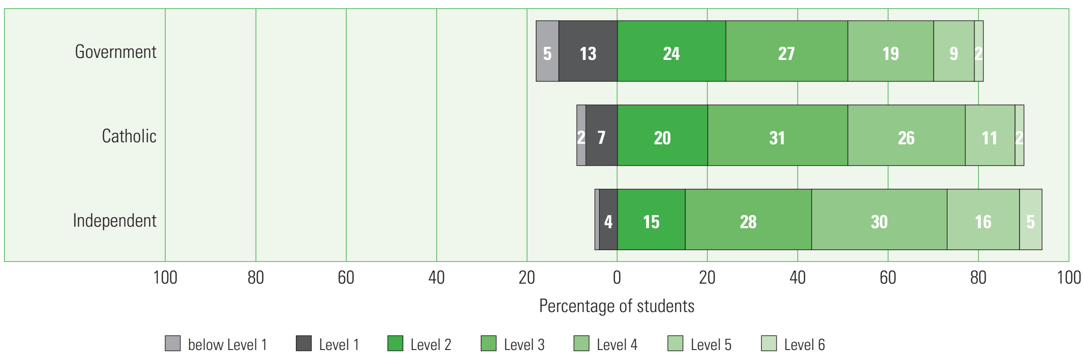


Figure 4.15 Percentage of students across the scientific literacy proficiency scale, by school sector

5 The percentages reported in this figure are unadjusted. To adjust for student and school socioeconomic background requires complicated analysis that would need to take into account ESCS within each proficiency level and this is deemed impracticable. Furthermore, adjusting for ESCS at either end of the proficiency scale adds additional uncertainty to these levels.

Scientific literacy performance by geographic location of school

Using the MCEECDYA *Schools Geographic Location Classification,*[6] schools were categorised by their geographic location using three broad categories (metropolitan, provincial and remote). The means and standard errors of students attending schools in the three school regions are shown in Figure 4.16. The differences between the mean scores of geographic locations of schools were significant. The difference in mean scores between schools in metropolitan areas and schools in remote areas was 57 score points on average, the equivalent of about three-quarters of a proficiency level or more than one-and-a-half school years. The difference in mean scores between schools in provincial areas and schools in remote areas was 39 score points on average, the equivalent of half a proficiency level or about one year of school. The difference in mean scores between students attending schools in metropolitan areas and provincial areas was 18 score points on average. The mean performance for students attending schools in metropolitan and provincial areas was significantly higher than the OECD average, while the mean performance for students attending schools in remote areas was not significantly different from the OECD average.

The spread of scores between students in the 5th and 95th percentiles for metropolitan and provincial schools was similar (330 and 321 score points respectively), but for remote schools the spread was larger at 394 score points.

Geographic location	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Metropolitan	527	2.1	523–531	330
Provincial	509	3.1	503–515	321
Remote	470	17.2	437–504	394

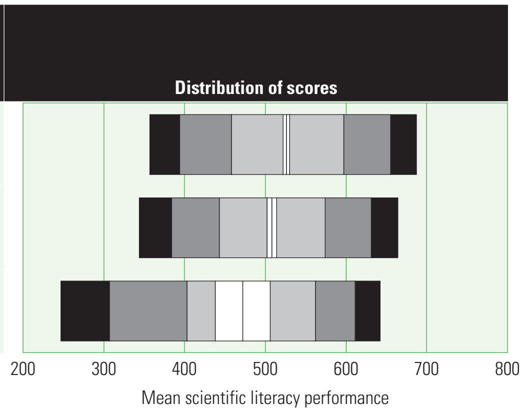


Figure 4.16 Mean scores and distribution of students' performance on the scientific literacy scale, by geographic location

The scientific literacy proficiency levels for the three geographic locations of schools are shown in Figure 4.17. Fifteen per cent of top performers in metropolitan schools reached Level 5 or 6 compared to 10% of students in provincial schools and only 6% of students in remote schools. The proportion of top performers in metropolitan and provincial schools was higher than the OECD average (8%), while the proportion of top performers in remote schools was lower than the OECD average.

The proportion of low performers in metropolitan and provincial schools was similar (13 and 15% respectively), whereas the proportion of students in remote schools not achieving Level 2 was larger at 27%. The proportion of low performers in metropolitan and provincial schools was lower than the OECD average (18%), while the proportion of low performers in remote schools was higher than the OECD average.

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

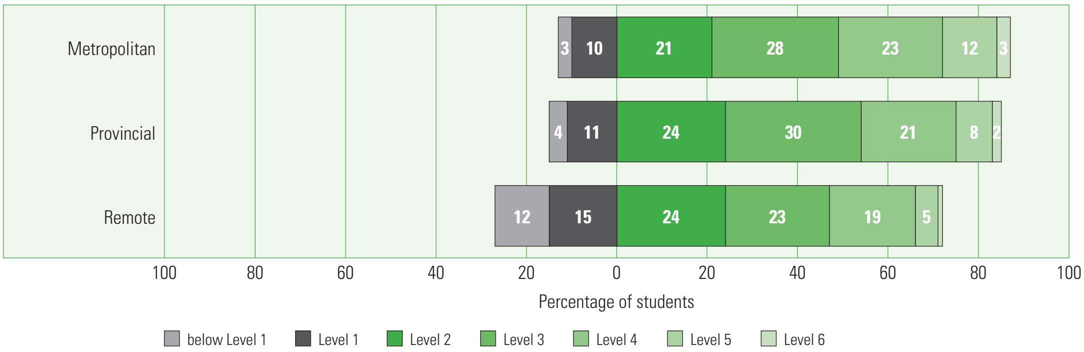


Figure 4.17 Percentage of students across the scientific literacy proficiency scale, by geographical location

Scientific literacy performance by Indigenous background

The difference in performance between Indigenous and non-Indigenous students is significant. Indigenous students achieved a mean score of 440 points, compared to a mean score of 524 points for non-Indigenous students. The difference of 84 score points in scientific literacy performance equates to more than one proficiency level or about two-and-a-half years of schooling. Indigenous students on average performed significantly lower than the OECD average, by 61 score points (Figure 4.18).

The spread of achievement between Indigenous low performers and high performers was 326 score points, which was similar to the spread of scores for non-Indigenous students (325 score points).

Indigenous background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Indigenous	440	4.3	431–448	326	
Non-Indigenous	524	1.7	521–528	325	

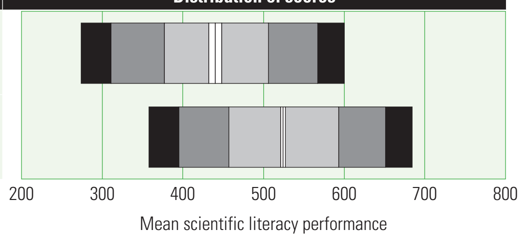


Figure 4.18 Mean scores and distribution of students' performance on the scientific literacy scale, by Indigenous background

Figure 4.19 provides further detail by showing the proportion of Indigenous and non-Indigenous students in each of the scientific literacy proficiency levels. As was the case for mathematical literacy, there is an under-representation of Indigenous students at the higher levels and an over-representation of Indigenous students at the lower levels of the scientific literacy proficiency scale. Only 2% of Indigenous students were top performers in scientific literacy compared to 14% of non-Indigenous students and an average of 8% of students across the OECD. At the lower end of the proficiency scale, 37% of Indigenous students failed to reach Level 2 compared to 13% of non-Indigenous students and 18% on average across the OECD.

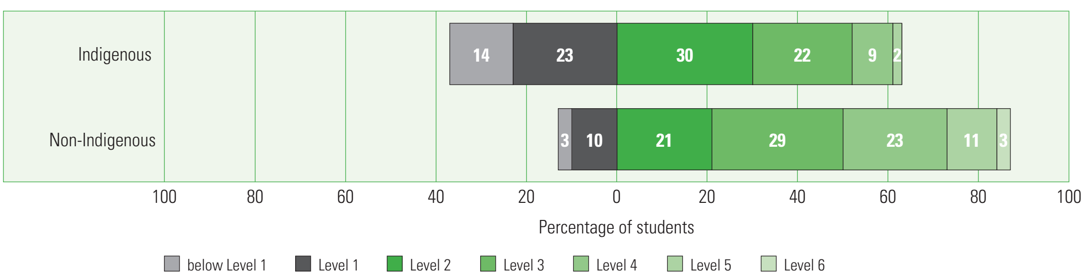


Figure 4.19 Percentage of students across the scientific literacy proficiency scale, by Indigenous background

Scientific literacy performance by sex and Indigenous background

Figure 4.20 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		Males	
	Mean score	SE	Mean score	SE
Indigenous	443	4.8	437	6.6
Non-Indigenous	522	2.1	527	2.5

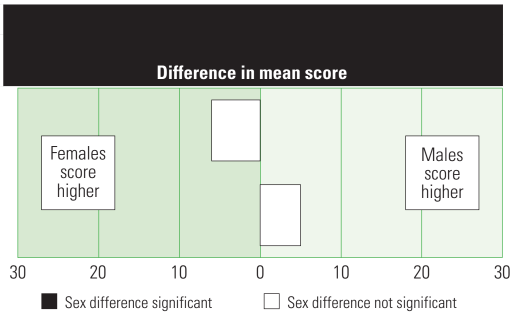


Figure 4.20 Mean scores and sex differences in students' performance on the scientific literacy scale, by Indigenous background

An equal proportion (2%) of Indigenous females and males were top performers, reaching Level 5 or 6 compared to the 12% of non-Indigenous females and 15% of non-Indigenous males.

A higher proportion of Indigenous males (41%) than Indigenous females (34%) failed to reach Level 2. Of those Indigenous students who were placed below Level 2, there were similar proportions of Indigenous females and males who reached Level 1; however, there were more Indigenous males (17%) than Indigenous females (12%) whose performance was below Level 1. As shown in Figure 4.21, there were similar proportions of non-Indigenous males and females who achieved below Level 2 (13%).

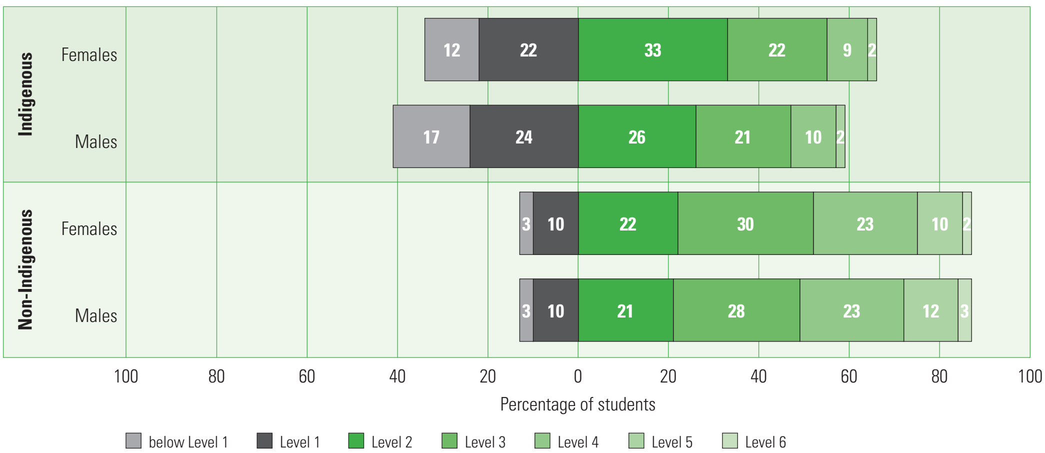


Figure 4.21 Percentage of students across the scientific literacy proficiency scale, by Indigenous background and sex

Scientific literacy performance by socioeconomic background

Socioeconomic background in PISA is measured by an index of ESCS, which captures the wider aspects of a student's family and home background.[7] Figure 4.22 shows socioeconomic background is related to student performance. Students in the highest socioeconomic quartile achieved an average of 88 score points higher than students in the lowest socioeconomic quartile. This difference was statistically significant and represents over one proficiency level or around two-and-a-half years of schooling. The difference between each socioeconomic quartile and the next was also significant, at around 30 score points on average (or the equivalent of almost one year of schooling).

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

Socioeconomic background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Lowest quartile	479	2.3	474–483	310
Second quartile	510	2.1	506–514	307
Third quartile	540	2.7	535–545	307
Highest quartile	567	2.6	562–572	300

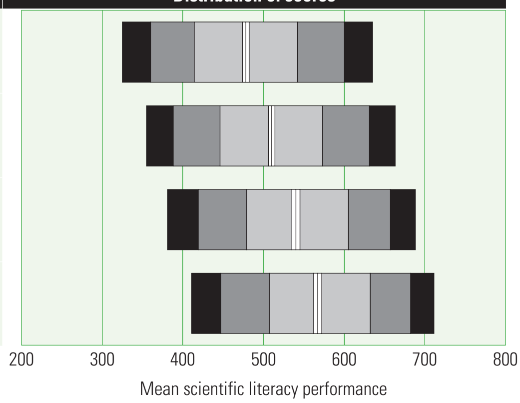


Figure 4.22 Mean scores and distribution of students' performance on the scientific literacy scale, by socioeconomic background

Figure 4.23 shows that, on average, students in the higher socioeconomic quartiles performed well, with a larger proportion of students at the higher proficiency levels and fewer students at the lower proficiency levels.

Almost one-quarter (23%) of students in the lowest socioeconomic quartile did not achieve Level 2 and just 5% achieved Level 5 or 6. In contrast, just 5% of students in the highest socioeconomic quartile did not reach proficiency Level 2, while almost one-quarter (24%) reached Level 5 or 6.

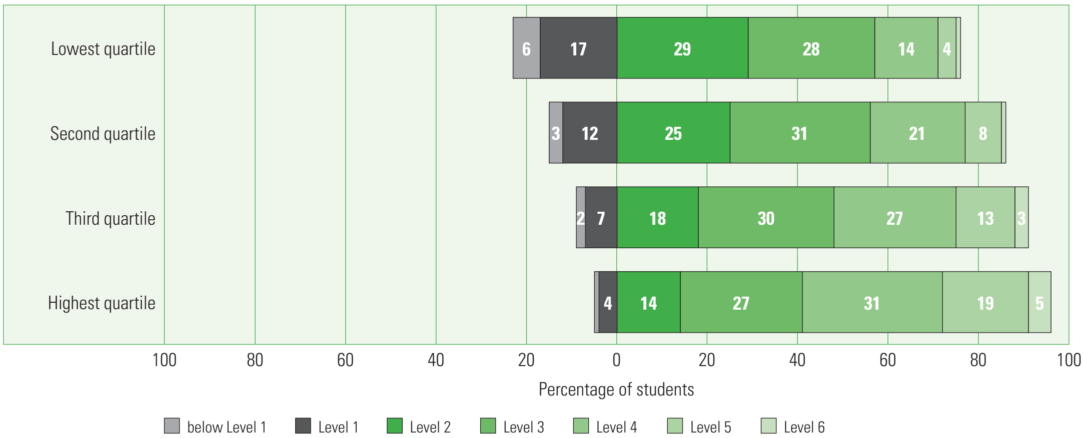


Figure 4.23 Percentage of students across the scientific literacy proficiency scale, by socioeconomic background

Scientific literacy performance by immigrant background

The results for scientific literacy performance based on students' immigrant background (a self-report of where they and their parents were born)[8] are shown in Figure 4.24. The mean score of 533 points for first-generation students was significantly higher than that of Australian-born students (521 score points) and that of foreign-born students (516 score points). In this instance, the difference in mean scores between first-generation and Australian-born students represents around one-third of a school year, while the difference in mean scores between first-generation and foreign-born students is about half of a school year. The mean performance of Australian-born students in scientific literacy was not statistically different from that of foreign-born students.

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

Australian-born students had the narrowest distribution between students in the 5th and 95th percentiles at 315 score points, while the spread of scores for first-generation students was wider at 332 score points. Foreign-born students had the widest variation in scientific literacy performance, with 341 score points between students in the 5th and 95th percentiles.

Immigrant background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Australian-born	521	1.8	518–525	315	
First-generation	533	3.0	527–539	332	
Foreign-born	516	3.5	509–523	341	

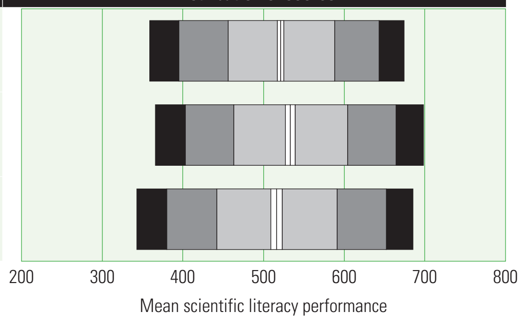


Figure 4.24 Mean scores and distribution of students' performance on the scientific literacy scale, by immigrant background

The proportion of students of different immigrant background who performed at each of the scientific literacy proficiency levels is shown in Figure 4.25. Twelve per cent of Australian-born students, 17% of first-generation students and 14% of foreign-born students achieved at Level 5 or 6. At the lower end of the proficiency scale, 13% of Australian-born, 11% of first-generation students and 16% of foreign-born students failed to reach Level 2.

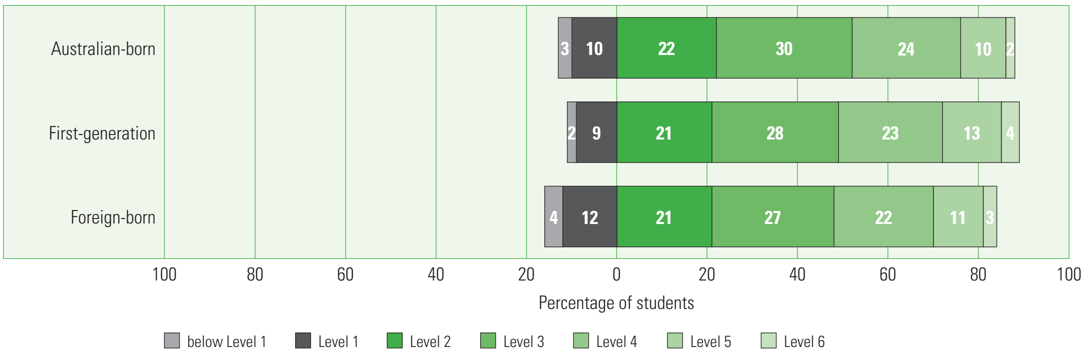


Figure 4.25 Percentage of students across the scientific literacy proficiency scale, by immigrant background

Scientific literacy performance by language background

Students who spoke English as their main language at home performed significantly higher in scientific literacy (with a mean score of 525 points) than those students whose main language at home was a language other than English (with a mean score of 508 points). This difference equates to about half of a school year. The spread of scores between students in the 5th and 95th percentiles was 321 score points for English speakers and 356 score points for those who do not speak English at home (Figure 4.26).

Language background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
English spoken at home	525	1.6	522–528	321
Language other than English spoken at home	508	5.0	499–518	356

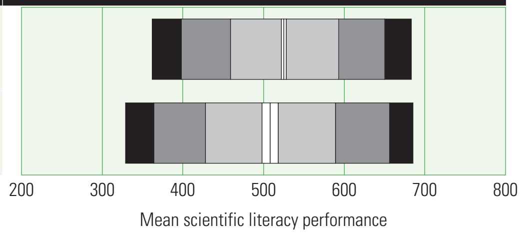


Figure 4.26 Mean scores and distribution of students' performance on the scientific literacy scale, by language background

Figure 4.27 shows there were similar proportions of students who spoke English at home and students who spoke a language other than English at home who were top performers in scientific literacy proficiency (with 14 and 15% respectively). At the other end of the scale, 12% of English-speaking students and 20% of those with a language background other than English failed to achieve Level 2.

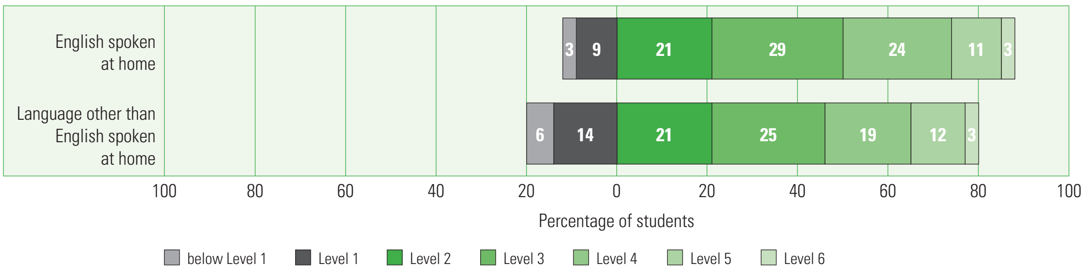


Figure 4.27 Percentage of students across the scientific literacy proficiency scale, by language background

Scientific literacy performance changes between PISA 2006 and PISA 2012

Although the optimal reporting of trends occurs between each full assessment of a literacy domain (e.g., in scientific literacy between PISA 2006 and PISA 2015, where the major focus will be on scientific literacy again), PISA has been designed so that it is possible to compare results between each three-year cycle.

Scientific literacy performance changes across countries

Table 4.4 shows the mean scores on scientific literacy performance for PISA 2006, PISA 2009 and PISA 2012, along with the difference in mean score between PISA 2006 and PISA 2012. Those countries with a mean performance in scientific literacy that was lower than the mean performance of the lowest scoring OECD country, Mexico, have not been included for comparison in Table 4.4.

There were 16 countries whose results have not been reported in the discussion of trends. These are: Albania, Argentina, Brazil, Colombia, Costa Rica, Indonesia, Jordan, Kazakhstan, Malaysia, Montenegro, Peru, Qatar, Shanghai–China, Singapore, Tunisia and the United Arab Emirates. In PISA 2012, the OECD average was 501 score points, which was not significantly different from the OECD average in PISA 2006.

Fourteen countries have seen a significant improvement in their scientific literacy performance between PISA 2006 and PISA 2012. Four countries improved their mean scientific literacy performance by at least 20 score points on average. These countries were: Turkey (39 score points increase); Poland (28 score points increase); Thailand (23 score points increase); and Romania

(21 score points increase). A number of other countries significantly improved their performance in scientific literacy by between 10 and 18 score points on average in PISA 2012. These countries were: Italy, Israel, Korea, Japan, Portugal, Ireland, Hong Kong–China, Latvia, Estonia and Macao–China.

Seven countries showed a significant decline between PISA 2006 and PISA 2012. These countries were: Sweden (19 score point decline); Finland (18 score point decline); the Slovak Republic (17 score point decline); New Zealand (14 score point decline); Iceland (13 score point decline); Uruguay (12 score point decline); and Canada (9 score point decline). In PISA 2012, Australia's mean score in scientific literacy was not significantly different from the mean score in PISA 2006.

Table 4.4 Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by country

	PISA 2006		PISA 2009		PISA 2012		Mean score difference between 2006 and 2012 (PISA 2012 – PISA 2006)	
Country	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
Australia	527	2.3	527	2.5	521	1.8	–5	4.5
Austria	511	3.9	✧	✧	506	2.7	–5	5.9
Belgium	510	2.5	507	2.5	505	2.1	–5	4.8
Bulgaria	434	6.1	439	5.9	446	4.8	12	8.5
Canada	534	2.0	529	1.6	525	1.9	**–9**	4.5
Chile	438	4.3	447	2.9	445	2.9	7	6.3
Chinese Taipei	532	3.6	520	2.6	523	2.3	–9	5.5
Costa Rica	✧	✧	430	2.8	429	2.9	✧	✧
Croatia	493	2.4	486	2.8	491	3.1	–2	5.3
Czech Republic	513	3.5	500	3.0	508	3.0	–5	5.8
Denmark	496	3.1	499	2.5	498	2.7	3	5.4
Estonia	531	2.5	528	2.7	541	1.9	**10**	4.7
Finland	563	2.0	554	2.3	545	2.2	**–18**	4.6
France	495	3.4	498	3.6	499	2.6	4	5.5
Germany	516	3.8	520	2.8	524	3.0	8	6.0
Greece	473	3.2	470	4.0	467	3.1	–7	5.7
Hong Kong–China	542	2.5	549	2.8	555	2.6	**13**	5.0
Hungary	504	2.7	503	3.1	494	2.9	–10	5.3
Iceland	491	1.6	496	1.4	478	2.1	**–13**	4.4
Ireland	508	3.2	508	3.3	522	2.5	**14**	5.3
Israel	454	3.7	455	3.1	470	5.0	**16**	7.1
Italy	475	2.0	489	1.8	494	1.9	**18**	4.5
Japan	531	3.4	539	3.4	547	3.6	**15**	6.1
Kazakhstan	✧	✧	400	3.1	425	3.0	✧	✧
Korea	522	3.4	538	3.4	538	3.7	**16**	6.1
Latvia	490	3.0	494	3.1	502	2.8	**13**	5.4
Liechtenstein	522	4.1	520	3.4	525	3.5	3	6.5
Lithuania	488	2.8	491	2.9	496	2.6	8	5.1
Luxembourg	486	1.1	484	1.2	491	1.3	5	3.9
Macao–China	511	1.1	511	1.0	521	0.8	**10**	3.8
Malaysia	✧	✧	422	2.7	420	3.0	✧	✧
Mexico	410	2.7	416	1.8	415	1.3	5	4.6
Netherlands	525	2.7	522	5.4	522	3.5	–3	5.7
New Zealand	530	2.7	532	2.6	516	2.1	**–14**	4.9
Norway	487	3.1	500	2.6	495	3.1	8	5.6
OECD average 2006	498	0.5	501	0.5	501	0.5	3	3.6
OECD average 2009			501	0.5	501	0.5		
Poland	498	2.3	508	2.4	526	3.1	**28**	5.3
Portugal	474	3.0	493	2.9	489	3.7	**15**	6.0
Romania	418	4.2	428	3.4	439	3.3	**21**	6.4
Russian Federation	479	3.7	478	3.3	486	2.9	7	5.8
Serbia	436	3.0	443	2.4	445	3.4	9	5.8
Shanghai–China	✧	✧	575	2.3	580	3.0	✧	✧
Singapore	✧	✧	542	1.4	551	1.5	✧	✧
Slovak Republic	488	2.6	490	3.0	471	3.6	**–17**	5.7
Slovenia	519	1.1	512	1.1	514	1.3	–5	3.9
Spain	488	2.6	488	2.1	496	1.8	8	4.7
Sweden	503	2.4	495	2.7	485	3.0	**–19**	5.2
Switzerland	512	3.2	517	2.8	515	2.7	4	5.4
Thailand	421	2.1	425	3.0	444	2.9	**23**	5.0
Turkey	424	3.8	454	3.6	463	3.9	**39**	6.5
United Kingdom	515	2.3	514	2.5	514	3.4	–1	5.4
United States	489	4.2	502	3.6	497	3.8	9	6.7
Uruguay	428	2.7	427	2.6	416	2.8	**–12**	5.2

Notes: In some cases, data were not available because they were not submitted by the country or were collected but subsequently removed for technical reasons. These cells have been denoted with the symbol ✧.

Values that are statistically signficant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 4.5 shows the relative position of the participating countries to Australia on scientific literacy performance in PISA 2006, PISA 2009 and PISA 2012. Countries are shown in order from the highest to the lowest performing country in scientific literacy in PISA 2012.

Japan, Estonia and Korea performed significantly higher than Australia in PISA 2012 but in a previous cycle of PISA these countries performed at a level not significantly different to Australia. In one or more previous cycles of PISA, Poland, Ireland, Macao–China, Germany, Switzerland and the United Kingdom performed significantly lower than Australia; however, in PISA 2012, these countries performed on par with Australia. In PISA 2009 and PISA 2012, Canada performed similarly to Australia, while in PISA 2006 Canada performed significantly higher than Australia. New Zealand performed significantly lower than Australia in PISA 2012, and similarly to Australia in PISA 2009 and PISA 2006.

Table 4.5 Relative trends in scientific literacy performance, by country

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

Notes:
▲ Performance statistically higher than Australia
● Performance not significantly different from Australia
▼ Performance statistically lower than Australia
– Did not participate in this cycle
— Not applicable

Australia's performance (mean score, confidence interval and distribution of scores) in scientific literacy across three PISA cycles is shown in Figure 4.28. Australia's mean score in PISA 2006 and PISA 2009 was 527 score points. There was no change in the mean scores and very little variation at each of the percentiles between PISA 2006 and PISA 2009, showing that Australia's performance remained constant. As noted above, Australia's mean score in scientific literacy in PISA 2012 was not significantly different from the mean score in PISA 2006. There was no change at each of the percentiles (10th, 25th, 75th and 90th) between PISA 2006 and PISA 2012.

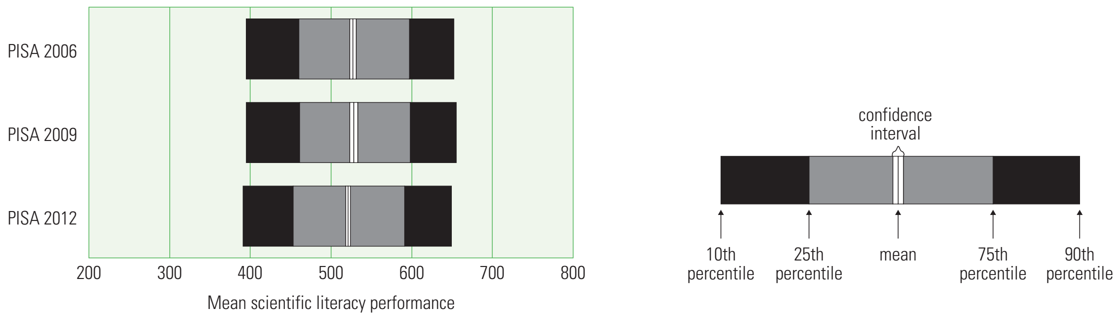


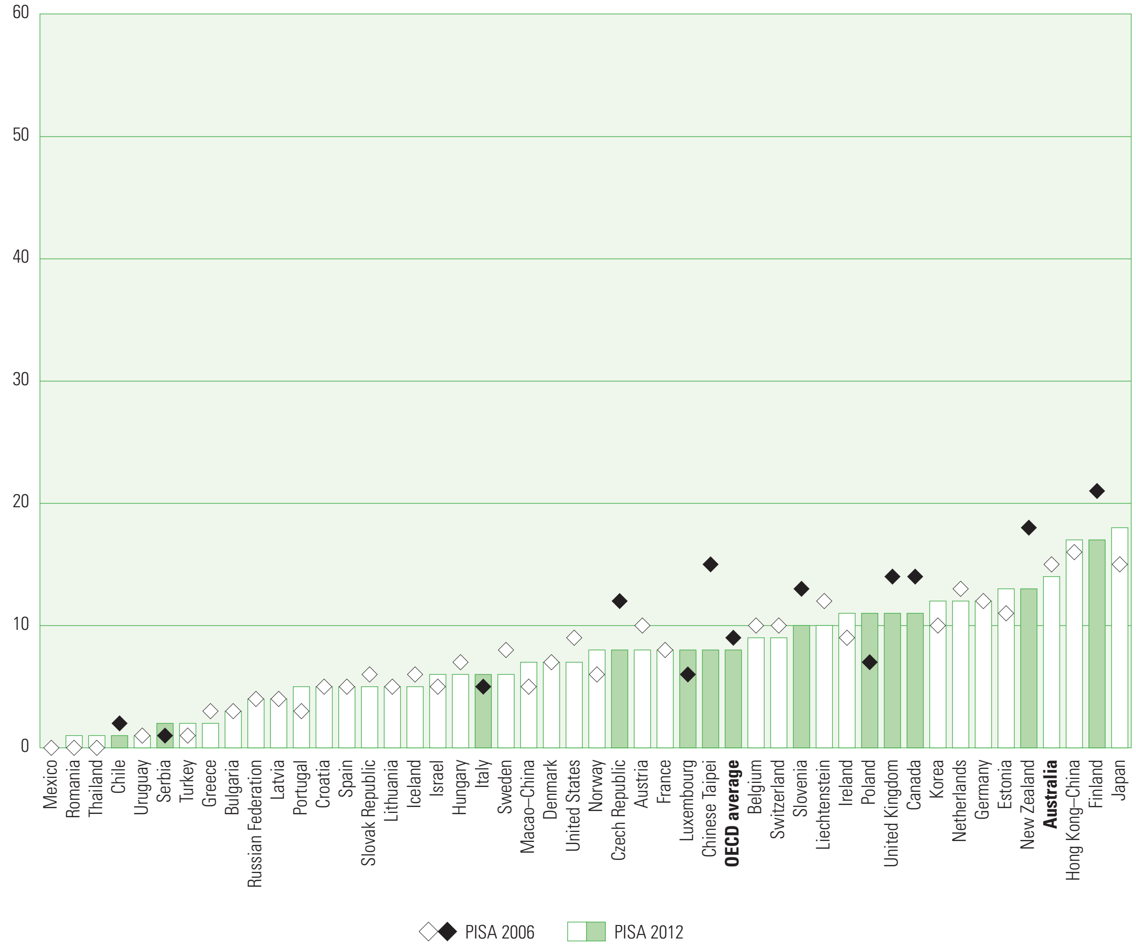
Figure 4.28 Percentiles on the scientific literacy scale for PISA 2006, PISA 2009 and PISA 2012 for Australia

The proportion of students who performed at Level 5 or 6 in scientific literacy for PISA 2006 and PISA 2012 (the top performers) is shown in Figure 4.29. Countries have been ordered from the lowest to highest proportion of students at Level 5 or 6. Countries with the lowest proportion of students at Level 5 or 6 in PISA 2012 have been placed at the left of the figure and countries with the highest proportion of students at Level 5 or 6 in PISA 2012 have been placed at the right.

From PISA 2006 to PISA 2012, there was less than a 1% decrease (from 8.9 to 8.4%) in the proportion of top performers across the OECD countries (for which data could be compared). Eight countries showed a significant decline in the proportion of students reaching Level 5 or 6, i.e., there were fewer top performers in PISA 2012 than in PISA 2006. These countries were: Chinese Taipei (a 6% reduction), New Zealand, Czech Republic and Finland (4%), Slovenia, Canada and the United Kingdom (3%) and Chile (1%).

Four countries showed a significant improvement in the proportion of students who reached Level 5 or 6 from PISA 2006 to PISA 2012. In Poland, the proportion increased by 4%, in Luxembourg, there was a 2% increase, and in Serbia and Italy, there was a 1% increase.

In Australia, the change in the proportion of top performers from PISA 2006 to PISA 2012 was not significant.



Note: A coloured bar and a coloured diamond indicate that the difference in the proportion of students between PISA 2006 and PISA 2012 was significant.

Figure 4.29 Percentage of students performing at Level 5 or 6 on scientific literacy in PISA 2006 and PISA 2012, by country[9]

Figure 4.30 is similar to Figure 4.29, except that it shows the proportion of students who were placed below Level 2 in scientific literacy for PISA 2006 and PISA 2012—the low performers. Across the OECD countries (those for which data could be compared), there was a 2% decrease in the proportion of low performers from PISA 2006 to PISA 2012.

A number of countries lifted the performance of their low performers. There were 16 countries in which the proportion of students achieving below Level 2 significantly decreased from PISA 2006 to PISA 2012. This occurred in: Turkey (a reduction of 20%); Thailand (12%); Romania (10%); Poland (8%); Israel and Italy (7%); the United States (6%); Portugal, Latvia and Korea (5%); Ireland, Lithuania, Spain and Japan (4%); and Switzerland, Hong Kong–China and Estonia (3%).

There were four countries in which the proportion of low performers significantly increased from PISA 2006 to PISA 2012. This occurred in: the Slovak Republic (an increase of 7%); Sweden (6%); Uruguay (5%); and Iceland (3%).

No significant changes were found in the proportion of low performers in Australia between PISA 2006 and PISA 2012.

9 A number of countries do not have data available for PISA 2006 and, subsequently, have not been included in this figure. These countries are: Costa Rica, Kazakhstan, Malaysia, Shanghai–China, Singapore and the United Arab Emirates.

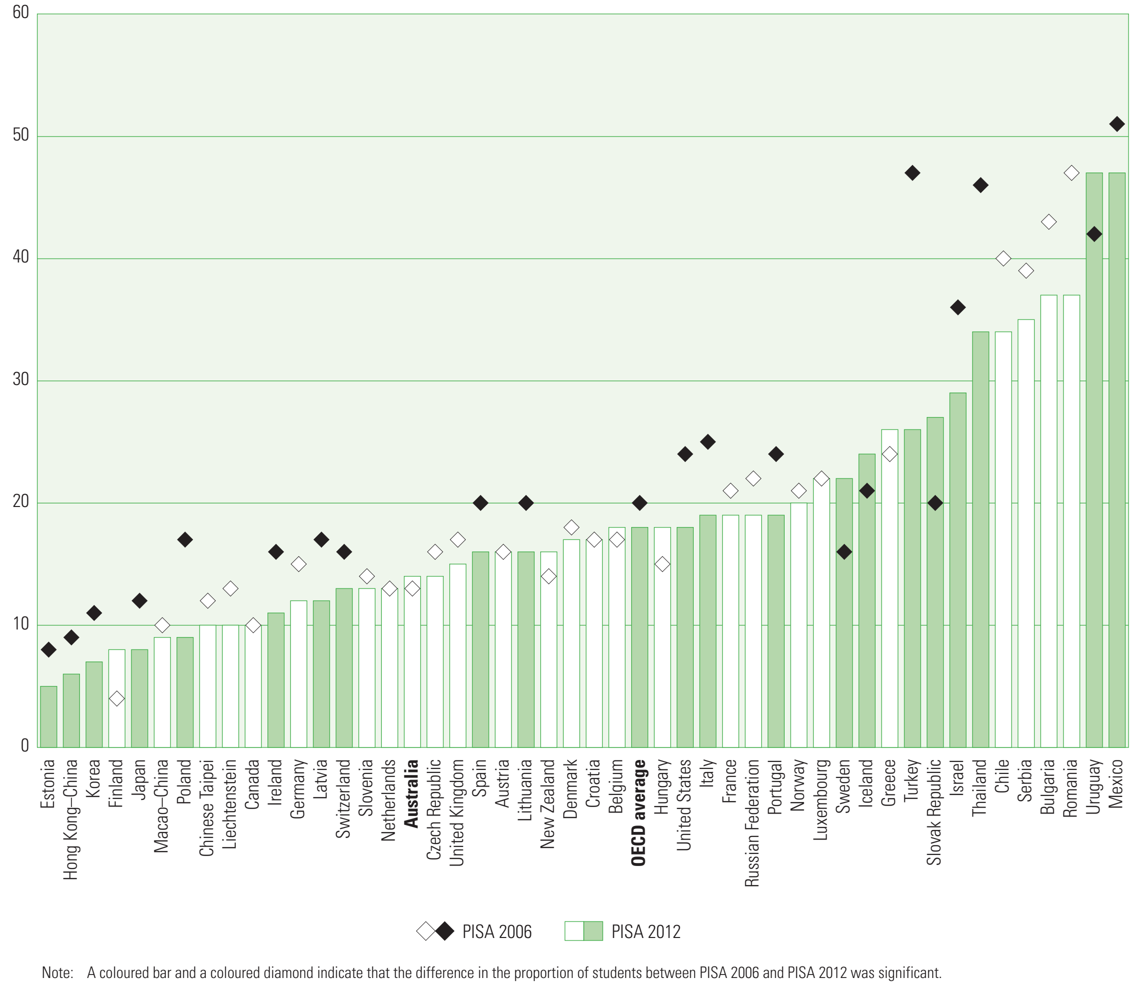


Figure 4.30 Percentage of students performing below Level 2 on scientific literacy in PISA 2006 and PISA 2012, by country[10]

The mean proportion of Australian students who performed at each scientific literacy proficiency level for PISA 2006, PISA 2009 and PISA 2012 is shown in Figure 4.31. This figure illustrates the similarities of the proportion of students at each level across the PISA cycles. The proportions of high performers and low performers have remained stable over all three assessments.

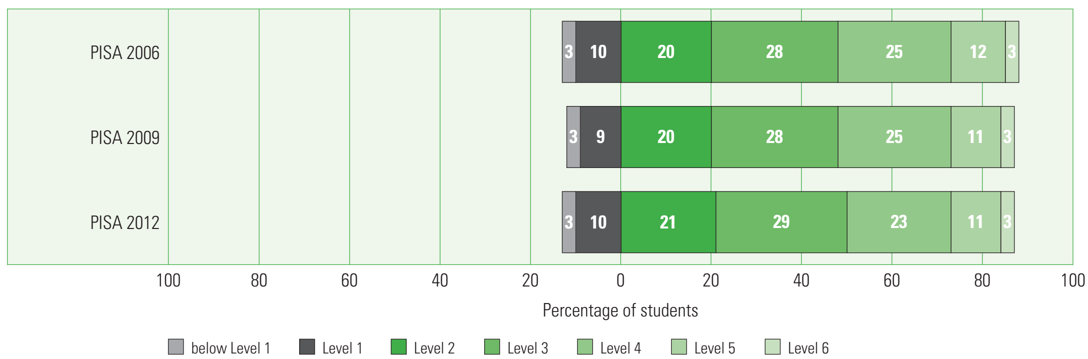


Figure 4.31 Percentage of students across the scientific literacy proficiency scale for PISA 2006, PISA 2009 and PISA 2012 in Australia

10 A number of countries do not have data available for PISA 2006 and, subsequently, have not been included in this figure. These countries are: Costa Rica, Kazakhstan, Malaysia, Shanghai–China, Singapore and the United Arab Emirates.

Scientific literacy performance changes by sex across countries

The mean scientific literacy scores for females and males for PISA 2006 and PISA 2012—along with the mean differences and the mean differences for females and males between PISA 2006 and PISA 2012—are shown in Table 4.6. Across OECD countries, the mean scores for females and males from PISA 2006 and PISA 2012 were not significantly different in scientific literacy.

In Finland, Iceland and Sweden, the mean performance for females and males significantly declined from PISA 2006 to PISA 2012. The decline in mean performance for females ranged from 11 score points in Finland to 14 score points in Iceland and Sweden, while the decline in mean performance for males ranged from 11 score points in Iceland to 24 score points in Finland.

In Slovenia, New Zealand, Uruguay and Greece, the mean performance for females declined significantly (ranging from 4 to 19 score points), while in Canada, Hungary and the Slovak Republic, the mean performance for males declined significantly (ranging from 10 to 17 score points). In Hong Kong–China, Ireland, Italy, Japan, Korea, Poland, Romania and Turkey, the mean performance for females and males significantly improved from PISA 2006 to PISA 2012. For females, the increase in performance ranged from 11 score points in Ireland and Japan to 38 score points in Turkey, while the mean performance for males increased from 12 score points in Hong Kong–China to 40 score points in Turkey.

In Chile, Denmark, Germany, Israel, Luxembourg, Macao–China, Mexico, Portugal and Spain, the mean performance for females improved significantly (ranging from 2 to 18 score points), while in Estonia and Thailand, males significantly improved their mean performance by 11 and 22 score points respectively.

Table 4.6 Mean scientific literacy scores and differences in PISA 2006 and PISA 2012 on the scientific literacy scale, by country and sex

	PISA 2006						PISA 2012						Difference in mean score between 2006 and 2012 (PISA 2012 – PISA 2006)			
	Females		Males		Females – Males		Females		Males		Females – Males		Females		Males	
Country	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score dif.	SE	Mean score dif.	SE
Australia	527	2.7	527	3.2	0	3.8	519	2.1	524	2.5	–5	3.0	–8	4.9	–3	5.4
Austria	507	4.9	515	4.2	–8	4.9	501	3.4	510	3.9	–9	5.0	–6	7.0	–4	6.8
Belgium	510	3.2	511	3.3	–1	4.1	506	2.6	505	2.9	0	3.6	–4	5.4	–5	5.6
Bulgaria	443	6.9	426	6.6	**17**	5.8	457	4.6	437	5.6	**20**	4.5	14	9.0	11	9.3
Canada	532	2.1	536	2.5	–4	2.2	524	2.0	527	2.4	–3	2.1	–8	4.5	**–10**	4.9
Chile	426	4.4	448	5.4	**–22**	4.8	442	2.9	448	3.7	**–7**	3.3	**15**	6.3	0	7.4
Chinese Taipei	529	5.1	536	4.3	–7	6.0	523	4.0	524	3.9	–1	6.4	–6	7.4	–12	6.7
Croatia	494	3.1	492	3.3	2	4.1	493	3.3	490	3.9	2	3.8	–2	5.7	–2	6.2
Czech Republic	510	4.8	515	4.2	–5	5.6	508	3.5	509	3.7	–1	4.0	–2	6.9	–6	6.6
Denmark	491	3.4	500	3.6	**–9**	3.2	493	2.5	504	3.5	**–10**	2.7	**2**	5.5	3	6.1
Estonia	533	2.9	530	3.1	4	3.1	543	2.3	540	2.5	2	2.7	9	5.1	**11**	5.3
Finland	565	2.4	562	2.6	3	2.9	554	2.3	537	3.0	**16**	3.0	**–11**	4.8	**–24**	5.3
France	494	3.6	497	4.3	–3	4.0	500	2.4	498	3.8	2	3.7	6	5.6	1	6.7
Germany	512	3.8	519	4.6	–7	3.7	524	3.5	524	3.1	1	3.0	**12**	6.3	5	6.6
Greece	479	3.4	468	4.5	**11**	4.7	473	3.0	460	3.8	**13**	3.1	**–6**	5.7	–8	6.8
Hong Kong–China	539	3.5	546	3.5	–7	4.9	551	3.1	558	3.6	–7	4.2	**13**	5.8	**12**	6.1
Hungary	501	3.5	507	3.3	–6	4.2	493	3.3	496	3.4	–3	3.3	–8	6.0	**–11**	5.9
Iceland	494	2.1	488	2.6	6	3.4	480	2.9	477	2.7	3	3.6	**–14**	5.0	**–11**	5.1
Ireland	509	3.3	508	4.3	0	4.3	520	3.1	524	3.4	–4	4.4	**11**	5.8	**16**	6.6
Israel	452	4.2	456	5.6	–3	6.5	470	4.0	470	7.9	1	7.6	**18**	6.7	14	10.3
Italy	474	2.5	477	2.8	–3	3.5	492	2.4	495	2.2	–3	2.5	**18**	4.9	**18**	5.0
Japan	530	5.1	533	4.9	–3	7.4	541	3.5	552	4.7	**–11**	4.3	**11**	7.2	**19**	7.6
Korea	523	3.9	521	4.8	2	5.5	536	4.2	539	4.7	–3	5.1	**13**	6.7	**18**	7.6
Latvia	493	3.2	486	3.5	**7**	3.1	510	2.8	495	3.6	**15**	3.6	17	5.5	9	6.1
Liechtenstein	527	6.3	516	7.6	11	11.1	516	5.7	533	5.8	–17	9.1	–12	9.2	17	10.2
Lithuania	493	3.1	483	3.1	**9**	2.8	503	2.6	488	3.0	**15**	2.3	11	5.4	5	5.5
Luxembourg	482	1.8	491	1.8	**–9**	2.9	483	1.7	499	1.7	**–15**	2.2	**2**	4.3	8	4.3
Macao–China	509	1.6	513	1.8	–4	2.7	521	1.2	520	1.3	1	1.7	**12**	4.0	7	4.2
Mexico	406	2.6	413	3.2	**–7**	2.2	412	1.3	418	1.5	**–6**	1.1	**5**	4.6	5	5.0
Netherlands	521	3.1	528	3.2	**–7**	3.0	520	3.9	524	3.7	–3	2.9	–1	6.1	–5	6.0
New Zealand	532	3.6	528	3.9	4	5.2	513	3.3	518	3.2	–5	4.9	**–19**	6.0	–11	6.2
Norway	489	3.2	484	3.8	4	3.4	496	3.7	493	3.2	4	3.2	8	6.0	8	6.1
OECD average	497	0.6	499	0.6	**–2**	0.7	500	0.5	502	0.6	**–1**	0.6	3	3.6	2	3.6
Poland	496	2.6	500	2.7	–3	2.5	527	3.2	524	3.7	3	3.0	**31**	5.4	**25**	5.8
Portugal	472	3.2	477	3.7	–5	3.3	490	3.8	488	4.1	2	2.6	**18**	6.1	11	6.5
Romania	419	4.8	417	4.1	2	3.3	441	3.5	436	3.7	5	3.2	**22**	6.9	**19**	6.6
Russian Federation	478	3.7	481	4.1	–3	2.7	489	2.9	484	3.5	6	2.9	11	5.9	3	6.4
Serbia	438	3.8	433	3.3	5	3.8	447	3.8	443	4.0	4	3.9	8	6.4	10	6.3
Slovak Republic	485	3.0	491	3.9	–6	4.7	467	4.2	475	4.3	–7	4.5	–18	6.2	**–17**	6.8
Slovenia	523	1.9	515	2.0	**8**	3.2	519	1.9	510	1.9	**9**	2.8	**–4**	4.4	–5	4.5
Spain	486	2.7	491	2.9	–4	2.4	493	1.9	500	2.3	**–7**	2.1	**6**	4.8	10	5.1
Sweden	503	2.9	504	2.7	–1	3.0	489	2.8	481	3.9	**7**	3.3	**–14**	5.3	**–23**	5.9
Switzerland	509	3.6	514	3.3	**–6**	2.7	512	2.7	518	3.3	**–6**	2.6	4	5.7	4	5.8
Thailand	428	2.5	411	3.4	**17**	3.9	452	3.4	433	3.3	**19**	3.4	24	5.5	**22**	5.9
Turkey	430	4.1	418	4.6	**12**	4.1	469	4.3	458	4.5	**10**	4.2	**38**	6.9	**40**	7.3
United Kingdom	510	2.8	520	3.0	**–10**	3.4	508	3.7	521	4.5	**–13**	4.7	–2	5.8	1	6.4
United States	489	4.0	489	5.1	–1	3.5	498	4.0	497	4.1	2	2.7	10	6.6	7	7.4
Uruguay	430	2.7	427	4.0	3	4.0	416	3.1	415	3.4	1	3.4	**–13**	5.4	–11	6.3

Notes: Values that are statistically signficant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

In addition to the mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, Table 4.7 shows the mean sex differences in Australia for the three PISA cycles. The performance of Australian females and males has changed little across the three PISA cycles. The mean score difference for females between PISA 2006 and PISA 2012 was not statistically different. This was also the case for males.

Table 4.7 Mean scores for PISA 2006, PISA 2009 and PISA 2012 on the scientific literacy scale for Australia

	Females		Males		Difference (Female – Male)	
PISA cycle	Mean score	SE	Mean score	SE	Score dif.	SE
PISA 2006	527	2.7	527	3.2	0	3.8
PISA 2009	528	2.8	527	3.1	1	3.2
PISA 2012	519	2.1	524	2.5	–5	3.0

Note: Values that are statistically significant are indicated in bold.

Scientific literacy performance changes across the Australian jurisdictions

The mean scientific literacy performance of students in two jurisdictions, the Australian Capital Territory and South Australia, declined significantly between PISA 2006 and PISA 2012 (Table 4.8). In PISA 2012, the Australian Capital Territory achieved a mean score 15 points lower than in PISA 2006. In South Australia the difference in mean performance between PISA 2006 and PISA 2012 was slightly larger with a decrease of 19 score points.

Table 4.8 Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by jurisdiction

	PISA 2006		PISA 2009		PISA 2012		Difference between 2006 and 2012 (PISA 2012 – PISA 2006)	
Jurisdiction	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
ACT	549	4.9	546	6.0	534	3.9	**–15**	7.2
NSW	535	4.6	531	5.7	526	3.6	–9	6.8
VIC	513	4.9	521	4.9	518	3.8	5	6.2
QLD	522	4.2	530	7.5	519	3.1	–3	5.2
SA	532	4.9	519	5.0	513	3.7	**–19**	6.1
WA	543	6.8	539	7.3	535	3.7	–8	7.7
TAS	507	4.6	497	5.3	500	3.8	–7	5.9
NT	490	6.6	492	7.7	483	10.2	–7	12.2

Note: Values that are statistically significant are indicated in bold.

Table 4.9 shows that sex differences played a role in South Australia's decline in mean scientific literacy performance between PISA 2006 and PISA 2012. In PISA 2012, South Australian females' performance declined significantly by 20 points, while the performance for South Australian males declined significantly by 18 points.

Table 4.9 Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by jurisdiction and sex

	Females								Males							
	PISA 2006		PISA 2009		PISA 2012		Difference between 2006 and 2012 (PISA 2012 – PISA 2006)		PISA 2006		PISA 2009		PISA 2012		Difference between 2006 and 2012 (PISA 2012 – PISA 2006)	
Jurisdiction	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE
ACT	545	7.2	549	10.6	533	5.2	–12	9.6	553	8.8	543	10.5	534	5.5	–19	11.0
NSW	539	4.8	535	5.4	527	4.1	–12	7.2	531	7.5	526	7.8	525	5.6	–6	10.0
VIC	508	6.4	521	6.6	512	3.7	4	8.2	517	5.9	522	6.4	523	5.3	6	8.7
QLD	522	5.7	525	7.0	517	3.7	–5	7.7	523	4.7	534	8.6	521	4.0	–2	7.1
SA	531	6.1	517	4.3	511	4.5	**–20**	8.4	533	5.6	521	6.8	515	4.5	**–18**	8.0
WA	540	7.0	540	7.7	528	5.2	–12	9.4	545	8.8	538	9.3	541	5.7	–4	11.0
TAS	508	6.1	499	8.9	499	5.8	–9	9.1	506	5.3	496	7.4	501	5.2	–5	8.2
NT	491	11.4	493	10.3	480	14.3	–11	18.6	489	5.8	492	7.7	486	10.7	–3	12.7

Note: Values that are statistically significant are indicated in bold.

Table 4.10 shows the proportion of low performers and top performers at each scientific literacy proficiency level by jurisdiction for PISA 2006, PISA 2009 and PISA 2012, and the differences between PISA 2006 and PISA 2012. In South Australia, the proportion of low performers increased significantly by 4% between PISA 2006 and PISA 2012. In New South Wales, the proportion of low performers increased significantly by 3%.

Table 4.10 Percentage of students performing below Level 2 and at Level 5 or above on the PISA 2006, PISA 2009 and PISA 2012 scientific literacy scale, and differences in the percentages between PISA 2006 and PISA 2012, by jurisdiction

	PISA 2006				PISA 2009				PISA 2012				Difference between 2006 and 2012 (PISA 2012 – PISA 2006)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	10	1.5	21	1.7	11	1.3	20	2.2	12	1.2	17	1.6	2	1.9	–4	2.3
NSW	11	1.0	17	1.5	12	1.3	15	1.8	14	0.9	16	1.3	**3**	1.3	0	2.0
VIC	16	1.5	11	1.1	13	1.4	13	1.3	13	1.0	11	1.3	–2	1.8	0	1.7
QLD	13	1.0	13	1.3	12	1.4	15	2.2	13	1.0	12	0.9	0	1.4	–1	1.6
SA	11	1.2	15	1.7	12	1.8	10	1.2	15	1.3	11	1.3	**4**	1.8	–4	2.1
WA	10	1.8	19	1.6	11	1.6	18	2.4	11	1.0	16	1.2	1	2.1	–3	2.0
TAS	18	1.8	11	1.1	20	1.9	8	1.3	20	1.4	10	1.3	2	2.3	–1	1.7
NT	26	2.3	13	1.6	22	2.5	10	1.8	26	2.8	9	2.6	0	3.6	–4	3.1

Notes: Values that are statistically significant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Scientific literacy performance changes for Indigenous students

The performance of Indigenous students on scientific literacy has not changed significantly between PISA 2006 and PISA 2012. The average scientific literacy performance for non-Indigenous students has also not changed significantly from PISA 2006 to PISA 2012 (Table 4.11).

Table 4.11 Mean scientific literacy scores for PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2006 and PISA 2012, by Indigenous background

Indigenous background	PISA 2006		PISA 2009		PISA 2012		Difference between 2006 and 2012 (PISA 2012 – PISA 2006)	
	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
Indigenous	441	7.8	449	6.2	440	4.3	–1	9.6
Non–Indigenous	529	2.3	530	2.4	524	1.7	–5	4.5

Note: Values that are statistically significant are indicated in bold.

Table 4.12 shows that the proportion of Indigenous low performers and high performers did not change significantly between PISA 2006 and PISA 2012. The proportion of non-Indigenous students at the lower and higher ends of the proficiency scale has also remained constant between PISA 2006 and PISA 2012.

Table 4.12 Percentage of students performing below Level 2 and at Level 5 or above on the PISA 2006, PISA 2009 and PISA 2012 scientific literacy scale, and differences in the percentages between PISA 2006 and PISA 2012, by Indigenous background

Indigenous background	PISA 2006				PISA 2009				PISA 2012				Difference between 2006 and 2012 (PISA 2012 – PISA 2006)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Indigenous	39	3.5	4	1.1	35	2.7	3	0.7	37	2.0	2	0.4	–2	4.0	–1	1.2
Non–Indigenous	12	0.6	15	0.7	12	0.6	15	0.8	13	0.5	14	0.6	1	0.7	–1	0.9

Notes: Values that are statistically significant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

CHAPTER 5

Australian students' performance in reading literacy

Key findings

- Australia achieved an average score of 512 points in the PISA 2012 reading literacy assessment, which was significantly higher than the OECD average of 496 score points.
- Australia was outperformed by nine countries in reading literacy: Shanghai–China, Hong Kong–China, Singapore, Japan, Korea, Finland, Ireland, Chinese Taipei and Canada. Australia's performance was not significantly different from 11 countries: Poland, Estonia, Liechtenstein, New Zealand, the Netherlands, Belgium, Switzerland, Macao–China, Vietnam, Germany and France. All other countries, including the United Kingdom and the United States, performed significantly lower than Australia.
- Twelve per cent of Australian students were top performers in reading literacy (reaching proficiency Level 5 or 6) compared to 8% of students across OECD countries.
- Fourteen per cent of Australian students were low performers in reading literacy (failing to reach Level 2, the baseline proficiency level) compared to 17% of students across the OECD.
- In all participating countries, females performed significantly higher than males in reading literacy. In Australia, females scored 35 score points on average higher than males, representing one year of schooling.
- Fourteen per cent of Australian females and 9% of Australian males were top performers in reading literacy compared to 10% of females and 6% of males on average across OECD countries.
- Nine per cent of Australian females and 18% of Australian males were low performers in reading literacy, while across OECD countries, 12% of females and 23% of males were low performers.
- Students in the Australian Capital Territory performed at a level not significantly different to students in Western Australia and Victoria, and significantly outperformed students in all other jurisdictions. Western Australia performed significantly higher than Queensland, South Australia, Tasmania and the Northern Territory. Victoria and New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and South Australia performed significantly higher than Tasmania and the Northern Territory, and Tasmania performed significantly higher than the Northern Territory.

- The Australian Capital Territory, Western Australia, Victoria, New South Wales and Queensland performed significantly higher than the OECD average in reading literacy. South Australia's score was similar to the OECD average. Tasmania and the Northern Territory achieved at a significantly lower level than the OECD average.
- Females achieved significantly higher in reading literacy than males across all jurisdictions. The largest difference by sex (of 49 score points), representing almost one-and-a-half years of schooling was found in the Australian Capital Territory, while the smallest difference by sex (of 26 score points) was found in Western Australia.
- No significant differences were found between school sectors (Catholic, government and independent) on reading literacy performance once a student's individual socioeconomic background and the socioeconomic background of peers at school are taken into account.
- The performance of students in metropolitan schools was significantly higher than students in provincial schools (the mean difference representing almost one year of schooling) and students in remote schools (the mean difference representing about two years of schooling). The performance of students in provincial schools was significantly higher than the performance of students in remote schools (the mean difference representing more than one year of schooling).
- Thirteen per cent of students in metropolitan schools were top performers in reading literacy compared to 7% of students in provincial schools and 5% in remote schools.
- Thirteen per cent of students in metropolitan schools were low performers in reading literacy compared to 18% of students in provincial schools and 30% of students in remote schools.
- Indigenous students performed significantly lower than non-Indigenous students in reading literacy, with a difference of 87 score points on average, which equates to two-and-a-half years of schooling.
- Two per cent of Indigenous students were top performers in reading literacy compared to 12% of non-Indigenous students.
- Thirty-nine per cent of Indigenous students were low performers in reading literacy compared to 14% of non-Indigenous students.
- Students in the highest socioeconomic quartile performed 86 score points on average higher than students in the lowest socioeconomic quartile in reading literacy. This difference equates to two-and-a-half years of schooling.
- Almost one-quarter (23%) of students in the highest socioeconomic quartile were top performers in reading literacy compared to 4% of students in the lowest quartile.
- Five per cent of students in the highest socioeconomic quartile were low performers in reading literacy compared to 23% of students in the lowest quartile.
- Australian-born students achieved significantly lower (with a mean score of 508 points) than first-generation students (with a mean score of 526 points) in reading literacy and not significantly different from foreign-born students (with a mean score of 515 points).
- Students who spoke English at home performed statistically higher than students who spoke a language other than English at home (with a mean score difference of 9 points).
- Australia's mean reading literacy performance declined significantly from PISA 2000 to PISA 2012 (by 16 score points on average). There was a significant decline in the performance of students at the 75th and 90th percentiles.
- In Australia, the proportion of top performers declined significantly (by 6%) between PISA 2000 and PISA 2012, while the proportion of low performers did not change significantly between PISA 2000 and PISA 2012 in reading literacy.
- Five jurisdictions (the Australian Capital Territory, New South Wales, South Australia, Tasmania and the Northern Territory) showed a significant decline in reading literacy performance between PISA 2000 and PISA 2012. The decline in performance ranged from 23 score points in the Northern Territory to 37 score points in South Australia.
- Between PISA 2000 and PISA 2012, the proportion of top performers in the Australian Capital Territory, South Australia, Western Australia and Tasmania decreased significantly

in reading literacy, while the proportion of low performers in the Australian Capital Territory, New South Wales and South Australia significantly increased.

- Reading literacy performance declined significantly for Indigenous students (by 20 score points on average) and for non-Indigenous students (by 16 score points on average) between PISA 2000 and PISA 2012.
- There were no significant differences between the proportion of Indigenous low performers and top performers in reading literacy between PISA 2000 and PISA 2012.
- The proportion of non-Indigenous top performers decreased (by 5%) between PISA 2000 and PISA 2012.

In PISA 2000 and PISA 2009, reading literacy was assessed as a major domain allowing for an in-depth analysis of the skills and knowledge of 15-year-old students. In PISA 2012, the reading literacy assessment was based on the framework that was used in PISA 2009. As reading literacy is a minor domain in PISA 2012, less assessment time was allocated to this domain, thereby only providing an update in performance on the overall reading literacy scale.

In PISA 2012, Australia participated in a paper-based and a computer-based assessment of reading literacy. This chapter presents results for the paper-based assessment of reading literacy, while Chapter 6 provides results for the computer-based assessment of reading literacy.

This chapter has a similar format to the corresponding performance chapters on mathematical and scientific literacy. The first section includes a summary of the reading literacy domain, including a definition of reading literacy, the assessment framework and a description of how PISA measures reading literacy. The next section presents results for the PISA 2012 assessment, comparing Australian students' performance internationally, nationally and for different social groups. The final section describes changes in reading literacy over time.

How is reading literacy defined in PISA?

The PISA concept of reading literacy emphasises the ability to use written information in situations that students 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, 2013, p. 61)*[1]

The definition is broader than decoding information and literal interpretation of what is written. 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). Furthermore, it recognises the awareness of and the ability to use a variety of appropriate strategies when processing texts.

How is reading literacy assessed in PISA?

The PISA concept of reading literacy can be described along three dimensions: *situations* (the range of contexts for which the text was constructed); *texts* (the range and format of the reading material); and *aspects* (the type of reading task or reading processes involved). The relationships between the major dimensions are shown in Figure 5.1.

1 Details about the reading literacy framework, structure of the assessment and proficiency scale have been assembled from the *PISA 2012 assessment and analytical framework* (OECD, 2013).

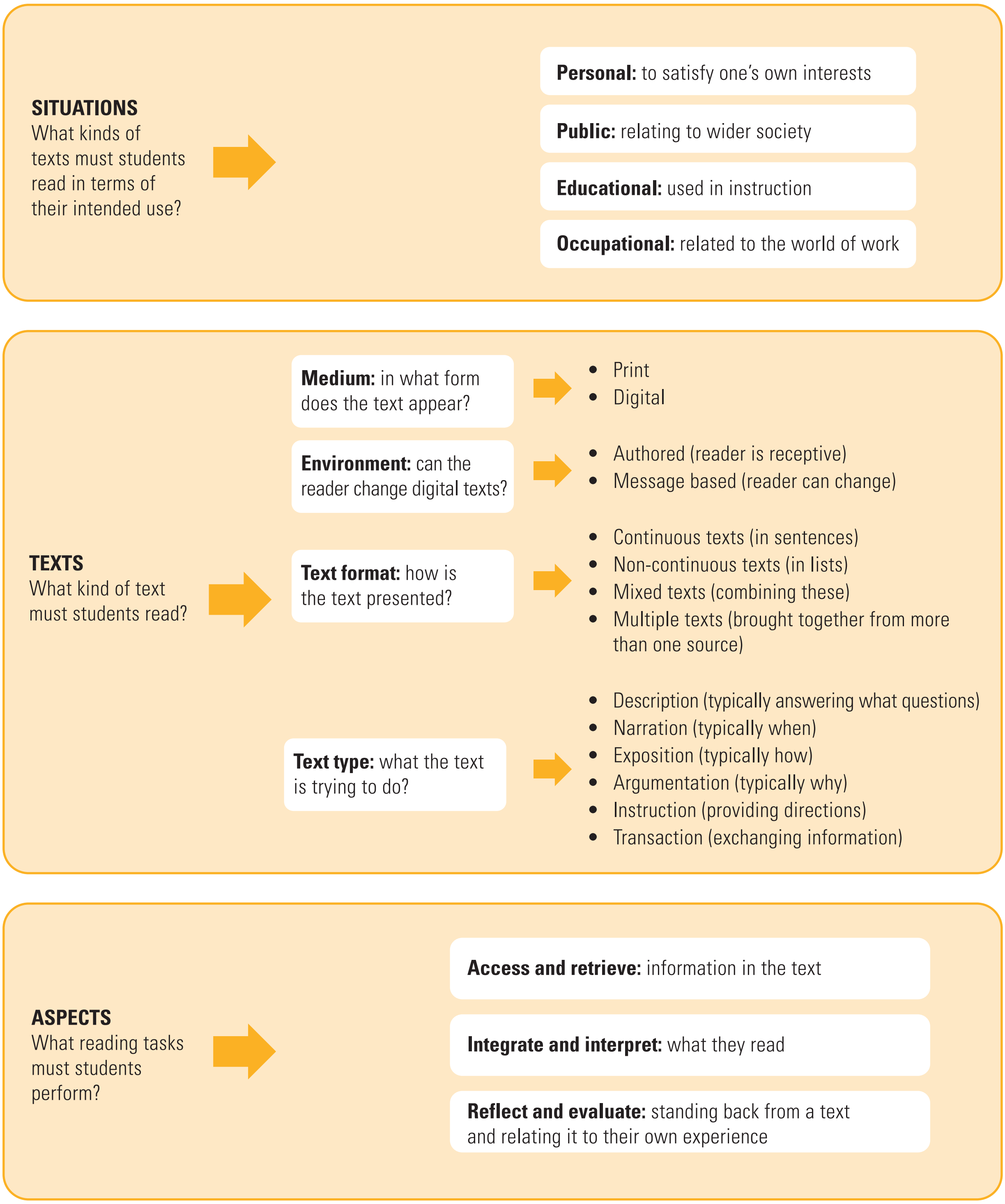


Figure 5.1 Main features of the reading literacy framework

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

Situations

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).

Texts

Four main classifications are included in the PISA reading literacy framework:

1. *Medium*: is 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 it applies only to digital medium texts in PISA. Only computer-based environments (web-environment and emails) are considered in the PISA assessment. An authored environment is one in which the content cannot be modified (e.g., home pages, government information sites and new 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:* refers to whether a text is continuous, non-continuous, mixed or multiple. 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. It is not conceived of as a variable that influences the difficulty of a task. Text type has been classified into six categories:

    4.1. *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).

    4.2. *Narration*: in which the information refers to properties of objects in time and typically answers questions relating to *when* or *in what sequence* (e.g., novels, short stories, plays, comic strips).

    4.3. *Exposition*: in which the information is presented as composite concepts or mental constructs and often answers questions about *how* (e.g., scholarly essays, diagrams showing a model of memory, graphs of population trends).

    4.4. *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).

4.5. *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).

4.6. *Transaction*: refers to the exchange of information in an interaction with the reader (e.g., personal letters to share family news, email exchanges to plan holidays, text messages to arrange a meeting).

Aspects

Aspects are the cognitive strategies, approaches or purposes that readers use to negotiate their way into, around and between texts. Five aspects guide the development of the reading literacy assessment task: retrieving information; forming a broad understanding; developing an interpretation; reflecting on and evaluating the content of a text; and reflecting on and evaluating the form of a text. Irrespective of their overall proficiency, it is expected that all readers will be able to demonstrate some level of competency in each of these aspects. In PISA 2009, when reading literacy was the major domain, these five aspects were organised into three broad categories and reported as subscales:

1. *Access and retrieve:* tasks involve drawing upon skills associated with finding, selecting and collecting relevant information, e.g., 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 draw upon 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 judgment about it, drawing on personal experience or on knowledge of the world that may be formal or content-based.

The three aspects are not conceived as entirely separate and independent, but rather as interrelated and interdependent (Figure 5.2; OECD, 2008, p. 35); however, in PISA the tasks are designed to emphasise one or another of the aspects.

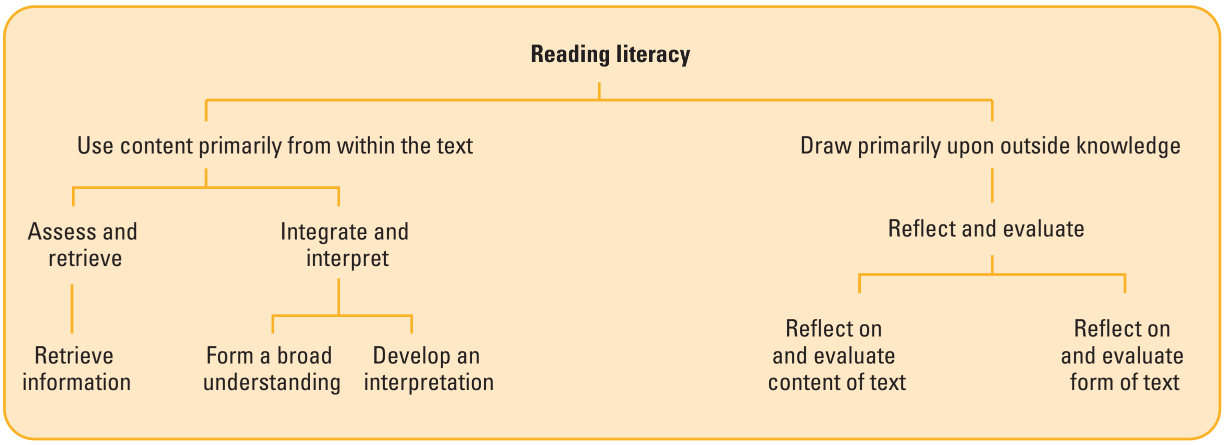


Figure 5.2 Relationship between the reading framework and the aspect subscales

A number of digital tasks involve the interaction of all three aspects as the tasks are intended to simulate the uncertainty of negotiating hyperspace. For this purpose, a fourth aspect—complex—has been defined to encompass the variety of skills that are required in this medium.

The PISA 2012 reading literacy assessment structure

As for mathematical and scientific literacy, reading literacy was assessed through a range of item-response formats to cover the full range of cognitive abilities and knowledge identified in the reading literacy framework. These included simple multiple-choice, complex multiple-choice, closed constructed-response and open constructed-response items.

The assessment framework serves as the conceptual basis for assessing students' proficiency in reading literacy. The PISA 2012 reading literacy paper-based assessment items were distributed across the four situations (personal, public, educational and occupational), the three text formats (continuous, non-continuous and mixed) and the three aspects (access and retrieve, integrate and interpret, and reflect and evaluate).

In PISA 2012, there were 45 reading literacy assessment items included in the assessment. This was around one-third of the assessment items included in PISA 2009, when reading literacy was the major domain.

Appendix G provides examples of reading literacy items and responses from PISA 2009.

How is reading literacy reported in PISA?

Mean scores and proficiency levels provide a summary about student performance and allow comparisons of the relative standing between different student subgroups.

In PISA 2012, with less assessment time devoted to reading literacy, results are reported on a single, overall reading literacy scale.

Mean scores and distribution of scores

The mean score on the PISA 2012 reading literacy scale across participating OECD countries was 496 score points, with a standard deviation of 94 points. This establishes the benchmark against which each country's reading literacy performance in PISA 2012 is compared.

Proficiency levels

The PISA 2012 reading literacy scale uses seven proficiency levels,[2] with Level 6 as the highest and Level 1b as the lowest. Figure 5.3 shows the seven reading literacy levels and details about the nature of the reading skills, knowledge and understanding required at each level of the reading literacy scale.

2 In PISA 2000 when reading literacy was the major domain, five levels of proficiency were developed. In PISA 2009, when reading literacy was revisited as a major domain, a broader range of reading literacy items were included in the assessment to expand the proficiency scale to seven levels. The new levels describe the reading literacy skills at each end of the proficiency scale—those students with very high or very low reading proficiency.

Proficiency level	What students can typically do at each level
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	
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	
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 5.3 Summary descriptions of the seven proficiency levels on the reading literacy scale

Students who scored between 626 and 698 points were placed at Level 5 and students who scored higher than 698 points were placed at Level 6. Students who performed at Level 5 or 6 were considered highly proficient in reading literacy and were considered top performers in this domain.

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 scored below Level 2 (i.e., below 408 score points) are considered low performers and their low levels of reading literacy skills and knowledge would limit them in participating fully in society.

The skills and knowledge of students who performed below the lower boundary of Level 1b (262 score 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 baseline (as agreed in the *Measurement Framework for Schooling in Australia*) is Level 3. This level has been identified as the baseline 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, 2013, p. 5).

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 to judge the magnitude of score differences.

In terms of proficiency levels

A difference of 73 score 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. E.g., 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 perform at Level 3 are proficient with the tasks at Level 2 and 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 the 34 OECD countries in which there are a sizeable number of 15-year-olds who were enrolled in at least two different year levels in the PISA 2012 sample. Analyses of these data indicate that the difference between two year levels is, on average, 37 score points on the PISA reading literacy scale. This implies that one school year corresponds to an average of 37 score points across all OECD countries. For Australia, more precisely one year of schooling corresponds to an average of 34 score points.

Australia's reading literacy performance from an international perspective

Reading literacy performance across countries

Australia achieved an average of 512 score points in the PISA 2012 reading literacy assessment, which was significantly higher than the OECD average of 496 score points. Australia was one of 22 countries—15 OECD countries (Japan, Korea, Finland, Ireland, Canada, Poland, Estonia, New Zealand, Australia, the Netherlands, Belgium, Switzerland, Germany, France and Norway) and seven partner countries (Shanghai–China, Hong Kong–China, Singapore, Chinese Taipei, Liechtenstein, Macao–China and Vietnam)—that achieved a mean score which was significantly higher than the OECD average. Four countries (the United Kingdom, the United States, Denmark and the Czech Republic) performed at a level not significantly different from the OECD average. All other countries performed significantly below the OECD average.

Figure 5.4 provides the mean reading literacy scores, along with the standard error, confidence intervals around the mean, and the difference between the 5th and 95th percentiles. This figure also provides a graphical distribution of student performance. Countries are shown in order from the highest to the lowest reading literacy mean, and the colour bands summarise Australia's performance compared to other participating countries. Although 65 countries participated in PISA 2012, only those countries that achieved a mean score higher than Mexico (the lowest performing OECD country) have been included in this figure.[3]

3 For brevity, results for those countries who achieved a mean score lower than Mexico (424 score points) have not been included in this chapter. These countries are: Albania, Argentina, Brazil, Colombia, Indonesia, Jordan, Kazakhstan, Malaysia, Montenegro, Peru, Qatar, Tunisia and Uruguay.

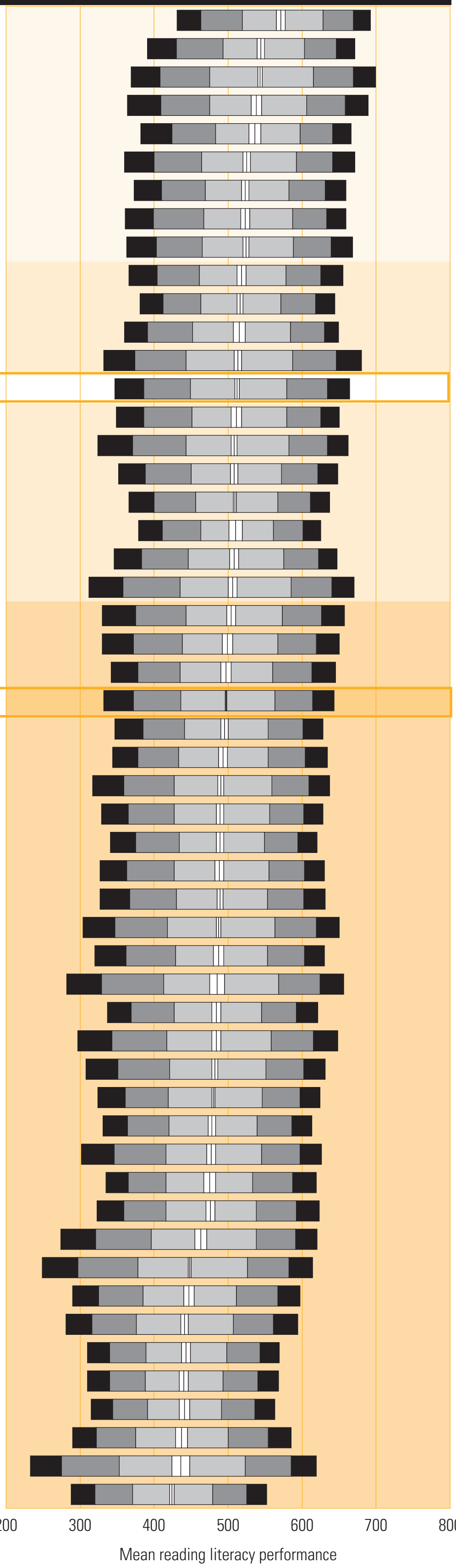
Nine countries, five of which were OECD countries, performed significantly higher than Australia: Shanghai–China, Hong Kong–China, Singapore, Japan, Korea, Finland, Ireland, Chinese Taipei and Canada.

Eleven countries, eight of which were OECD countries, had mean scores that were not significantly different from that of Australia. These countries were: Poland, Estonia, Liechtenstein, New Zealand, the Netherlands, Belgium, Switzerland, Macao–China, Vietnam, Germany and France. All other countries, including the United Kingdom and the United States, performed significantly lower than Australia.

The considerable variation in the range of scores between the low performers and top performers shown for mathematical and scientific literacy is also evident in reading literacy. The widest spreads of scores between students in the 5th and 95th percentiles were found in Bulgaria (386 score points) and Israel (374 score points), while the narrowest differences were found in Vietnam (245 score points) and Costa Rica (247 score points). Out of the countries that significantly outperformed Australia: the range of scores was much narrower for Shanghai–China, Hong Kong–China, Korea and Ireland (between 259 and 286 score points) compared to the OECD average of 310 score points; around the OECD average for Chinese Taipei, Canada and Finland (between 298 and 309 score points); and wider than the OECD average for Japan and Singapore (325 and 329 score points respectively).

Australia's spread of 318 score points was wider than the OECD average and the United States (303 score points) and narrower than the United Kingdom (320 score points) and New Zealand (347 score points).

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Significantly higher than Australia	Shanghai–China	570	2.9	563–575	259	
	Hong Kong–China	545	2.8	539–550	281	
	Singapore	542	1.4	539–544	329	
	Japan	538	3.7	530–545	325	
	Korea	536	3.9	528–543	282	
	Finland	524	2.4	519–528	309	
	Ireland	523	2.6	518–528	286	
	Chinese Taipei	523	3.0	517–529	298	
	Canada	523	1.9	519–526	305	
Not significantly different from Australia	Poland	518	3.1	512–524	289	
	Estonia	516	2.0	512–520	263	
	Liechtenstein	516	4.1	507–523	288	
	New Zealand	512	2.4	507–516	347	
	Australia	**512**	**1.6**	**508–514**	**318**	
	Netherlands	511	3.5	504–518	300	
	Belgium	509	2.2	504–513	339	
	Switzerland	509	2.6	504–514	296	
	Macao–China	509	0.9	507–510	270	
	Vietnam	508	4.4	499–516	245	
	Germany	508	2.8	502–513	300	
Significantly lower than Australia	France	505	2.8	499–511	357	
	Norway	504	3.2	497–510	328	
	United Kingdom	499	3.5	492–506	320	
	United States	498	3.7	490–504	303	
	OECD average	**496**	**0.5**	**495–497**	**310**	
	Denmark	496	2.6	490–501	281	
	Czech Republic	493	2.9	487–498	290	
	Italy	490	2.0	485–493	319	
	Austria	490	2.8	484–495	300	
	Latvia	489	2.4	484–493	278	
	Hungary	488	3.2	482–494	303	
	Spain	488	1.9	484–491	303	
	Luxembourg	488	1.5	484–490	347	
	Portugal	488	3.8	480–495	311	
	Israel	486	5.0	475–495	374	
	Croatia	485	3.3	478–491	284	
	Sweden	483	3.0	477–489	350	
	Iceland	483	1.8	478–486	323	
	Slovenia	481	1.2	478–483	301	
	Lithuania	477	2.5	472–482	281	
	Greece	477	3.3	470–483	325	
	Turkey	475	4.2	467–483	285	
	Russian Federation	475	3.0	469–480	300	
	Slovak Republic	463	4.2	454–470	346	
	Cyprus	449	1.2	446–451	366	
	Serbia	446	3.4	439–452	307	
	United Arab Emirates	442	2.5	436–446	314	
	Chile	441	2.9	435–447	258	
	Thailand	441	3.1	435–447	259	
	Costa Rica	441	3.5	433–447	247	
	Romania	438	4.0	429–445	296	
	Bulgaria	436	6.0	424–447	386	
	Mexico	424	1.5	420–426	264	



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

Figure 5.4 Mean scores and distribution of students' performance on the reading literacy scale, by country

The reading literacy proficiency scale describes what skills and knowledge students can typically demonstrate at each level. There are seven proficiency levels ranging from the lowest described level, Level 1b, to the highest described level, Level 6. The proportion of students at each reading literacy proficiency level by country is shown in Figure 5.5.

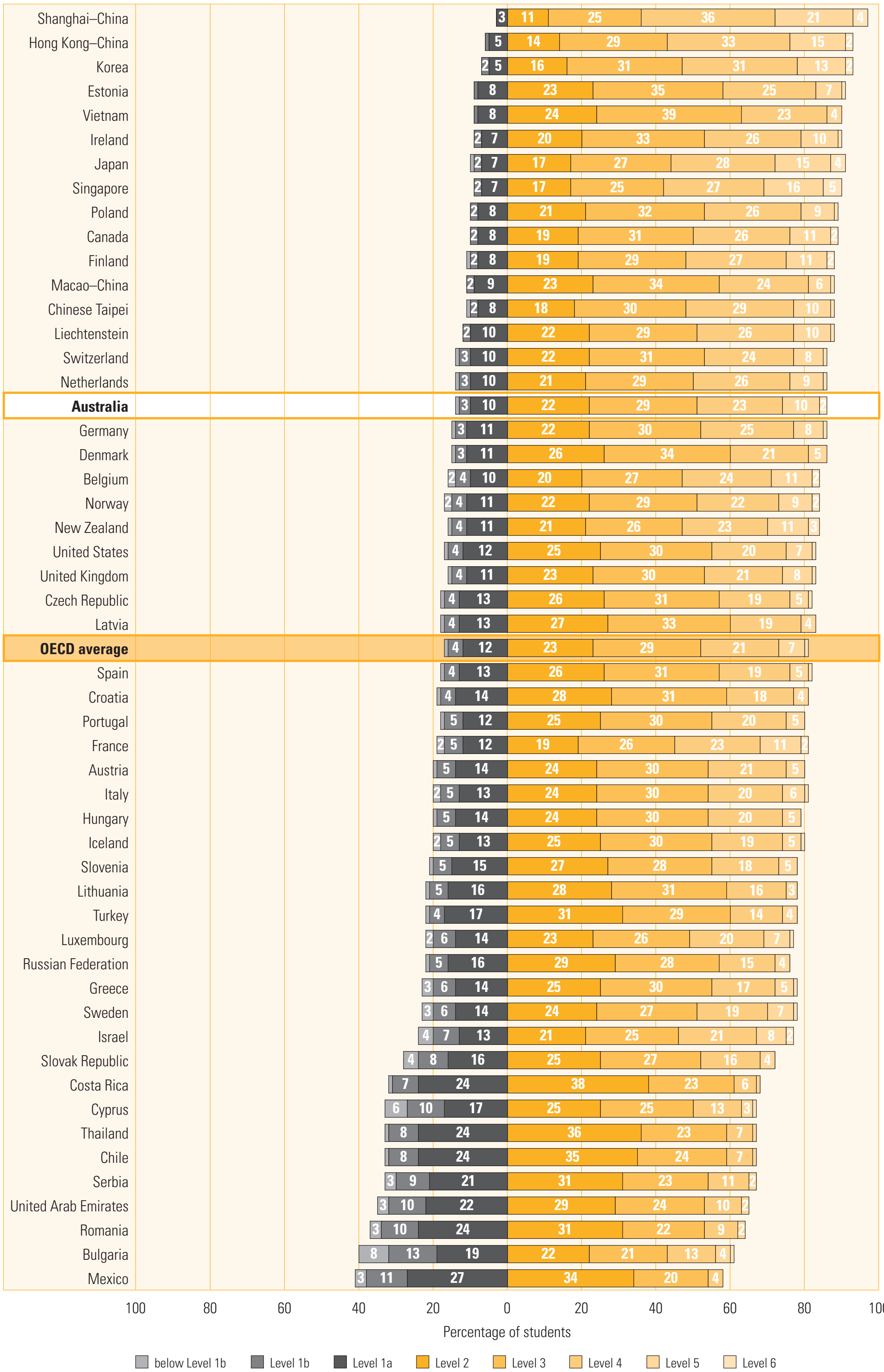
Across the OECD countries, there was an average of 1% of students who achieved the highest proficiency level, Level 6. The highest proportions of students at Level 6 were from Singapore (5%), Japan (4%), Shanghai–China (4%) and New Zealand (3%). In Australia, 2% of students reached the highest proficiency level, the same proportion as in France, Finland, Canada, Hong Kong–China, Norway, Belgium, Korea and Israel. All other countries had no more than 1% of students who reached Level 6.

In the top-performing countries, the proportion of students who reached Level 5 or 6 was around three times that of the OECD average. One-quarter of students in Shanghai–China and approximately one-fifth of students from Singapore and Japan reached Level 5 or 6. In Hong Kong–China, Korea, New Zealand, Finland, France, Canada and Belgium between 13 and 17% of students attained these levels. In Australia, 12% of students were top performers, which was a higher proportion than the OECD average of 8%. There were a number of countries with very few students achieving the higher end of the reading literacy proficiency scale. In Mexico, Costa Rica, Chile and Thailand, only 1% of students reached Level 5 or 6.

In contrast, those students who performed below Level 2 are considered low performers and are at jeopardy of having inadequate reading literacy competencies to be able to participate effectively and productively in life.

On average, 17% of students across OECD countries did not reach Level 2, the OECD's baseline proficiency level. Three per cent of students in Shanghai–China and between 6 and 9% of students in Vietnam, Estonia, Korea and Hong Kong–China did not reach Level 2. Out of the low-performing countries, around 40% of students in Mexico and Bulgaria did not attain this level. In Australia, the Netherlands and Switzerland, 14% of students failed to reach Level 2.

In Australia, Level 3 is the nationally agreed baseline level. Thirty-six per cent of Australian students were placed below Level 3, which was lower than the 40% of students across OECD countries. For the high-performing countries, 14% of students had not reached Level 3 in Shanghai–China, while 20% of students in Hong Kong–China and around one-quarter of students in Singapore, Japan and Korea had not reached Level 3.



Note: In cases in which 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 5.5 Percentage of students across the reading literacy proficiency scale, by country[4]

4 Countries have been ordered by the percentage of students classified as below Level 2, the internationally assigned benchmark, with countries with the lowest proportion of students below Level 2 placed at the top of the figure and countries with the highest proportion of students below Level 2 at the bottom.

Reading literacy performance by sex across countries

Figure 5.6 provides the mean scores and standard errors for females and males on the reading literacy scale, and shows graphically the difference by sex and whether the difference is statistically significant.

In all participating countries, females performed significantly higher than males in reading literacy. Across the OECD, females outperformed males by 37 score points on average. In Australia, the mean performance for females was 530 score points and the mean performance for males was 495 score points. This difference represents around a half of a proficiency level or around one year of schooling.

Countries with the widest differences by sex were Bulgaria (69 score points), Cyprus (63 score points) and the high-performing country Finland (62 score points). Korea, another high-performing country, had one of the narrowest differences by sex (22 score points), along with Chile (23 score points), Mexico, Shanghai–China and Japan (24 score points), and Liechtenstein (25 score point difference).

The proportion of females and males for Australia and the OECD average at each level of the reading literacy proficiency scale is shown in Figure 5.7. At the top end of the scale, 14% of Australian females and 9% of Australian males performed at Level 5 or 6, compared to 10% of females and 6% of males on average across OECD countries. At the lower end of the scale, 9% of Australian females and 18% of Australian males, compared to 12% of females and 23% of males on average across OECD countries failed to achieve Level 2.

Country	Females		Males	
	Mean score	SE	Mean score	SE
Chile	452	2.9	430	3.8
Korea	548	4.5	525	5.0
Mexico	435	1.6	411	1.7
Shanghai–China	581	2.8	557	3.3
Japan	551	3.6	527	4.7
Liechtenstein	529	5.8	504	6.2
United Kingdom	512	3.8	487	4.5
Costa Rica	452	3.5	427	3.9
Hong Kong–China	558	3.3	533	3.8
Netherlands	525	3.5	498	4.0
Ireland	538	3.0	509	3.5
Spain	503	1.9	474	2.3
Luxembourg	503	1.8	473	1.9
Denmark	512	2.6	481	3.3
United States	513	3.8	482	4.1
Vietnam	523	4.0	492	5.0
Belgium	525	2.6	493	2.9
Singapore	559	1.9	527	1.9
Chinese Taipei	539	4.3	507	4.3
New Zealand	530	3.5	495	3.3
Australia	**530**	**2.0**	**495**	**2.3**
Canada	541	2.1	506	2.3
Macao–China	527	1.1	492	1.4
Switzerland	527	2.5	491	3.1
Austria	508	3.4	471	4.0
OECD average	**515**	**0.5**	**478**	**0.6**
Czech Republic	513	3.4	474	3.3
Italy	510	2.3	471	2.5
Portugal	508	3.7	468	4.2
Slovak Republic	483	5.1	444	4.6
Hungary	508	3.3	468	3.9
Russian Federation	495	3.2	455	3.5
Romania	457	4.2	417	4.5
Poland	539	3.1	497	3.7
Estonia	538	2.3	494	2.4
France	527	3.0	483	3.8
Israel	507	3.9	463	8.2
Germany	530	3.1	486	2.9
Turkey	499	4.3	453	4.6
Serbia	469	3.8	423	3.9
Norway	528	3.9	481	3.3
Croatia	509	3.3	461	4.1
Greece	502	3.1	452	4.1
Iceland	508	2.5	457	2.4
Sweden	509	2.8	458	4.0
Latvia	516	2.7	462	3.3
Thailand	465	3.3	410	3.6
Lithuania	505	2.6	450	2.8
United Arab Emirates	469	3.2	413	3.9
Slovenia	510	1.8	454	1.7
Finland	556	2.4	494	3.1
Cyprus	481	1.9	418	1.9
Bulgaria	472	5.6	403	6.3

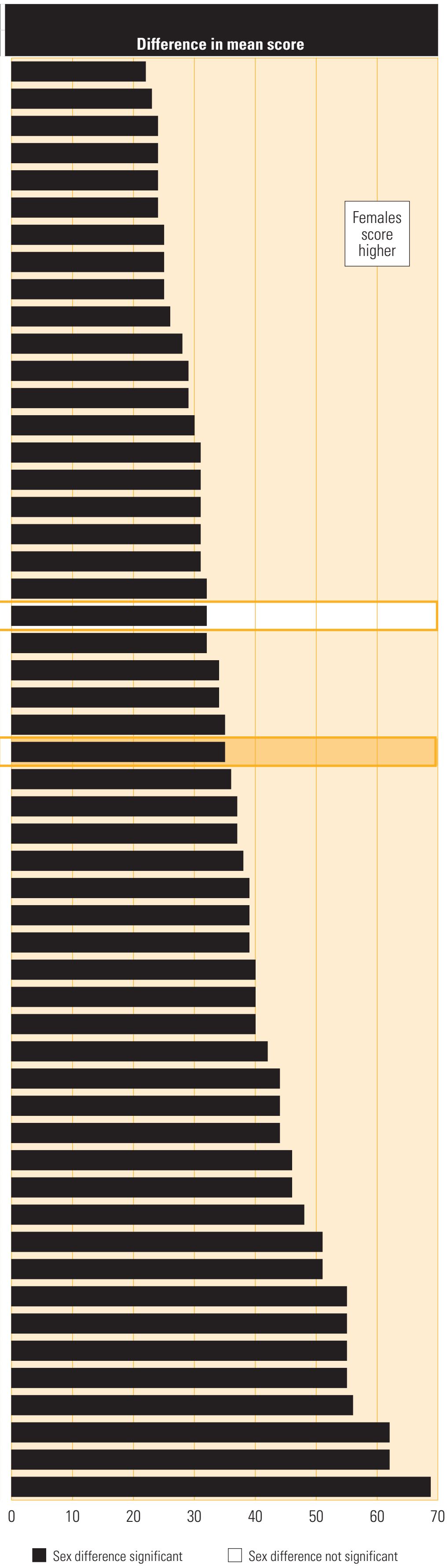


Figure 5.6 Mean scores and differences in students' performance on the reading literacy scale, by country and sex

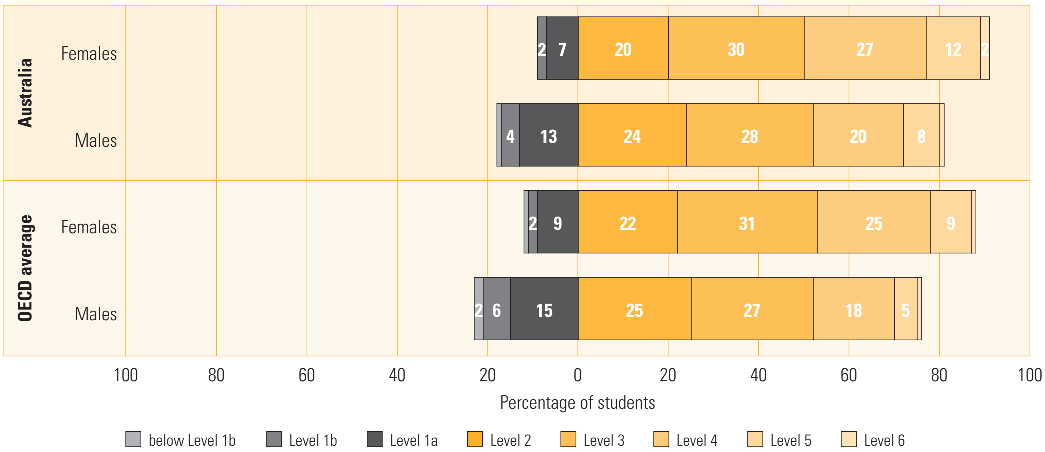


Figure 5.7 Percentage of students across the reading literacy proficiency scale by sex, for Australia and the OECD average

Australia's reading literacy performance in a national context

Reading literacy performance across the Australian jurisdictions

Figure 5.8 shows the mean reading literacy performance and distributions in the each of the Australian jurisdictions, along with the results for Australia overall, Shanghai–China (the highest performing country) and the OECD average for comparison. In addition, Table 5.1 provides further insight into jurisdiction-level performance by indicating significant differences in performance between the jurisdictions and also the OECD average.

Students from the Australian Capital Territory achieved the highest mean score of 525 points, followed by Western Australia with a mean score of 519 points and Victoria with a mean score of 517 points. The Australian Capital Territory, Western Australia and Victoria performed at a level not significantly different to each other, with the Australian Capital Territory significantly outperforming all the other jurisdictions.

Western Australia performed significantly higher than Queensland, South Australia, Tasmania and the Northern Territory, while Victoria and New South Wales performed significantly higher than South Australia, Tasmania and the Northern Territory. Queensland and South Australia performed significantly higher than Tasmania and the Northern Territory, and Tasmania performed significantly higher than the Northern Territory. The Northern Territory achieved the lowest mean score of 466 points, significantly lower than all other jurisdictions.

The Australian Capital Territory, Western Australia, Victoria, New South Wales and Queensland achieved significantly higher than the OECD average, while the achievement of South Australia was not significantly different to the OECD average. Tasmania and the Northern Territory achieved at a significantly lower level than the OECD average.

South Australia and Victoria had the narrowest distribution between students in the 5th and 95th percentiles of around 300 score points. For Western Australia and Queensland, the spread of scores was 307 and 317 points respectively. In Tasmania and New South Wales the distribution of scores was around 330 points, and in Australian Capital Territory there were 339 score points between the low performers and top performers. The Northern Territory had the widest variation in reading literacy performance with 413 score points between the 5th and 95th percentiles.

Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
ACT	525	3.6	518–532	339	
NSW	513	3.3	506–519	332	
VIC	517	3.5	510–524	302	
QLD	508	3.4	501–515	317	
SA	500	4.0	493–508	301	
WA	519	3.1	513–525	307	
TAS	485	3.6	477–492	329	
NT	466	8.3	499–482	413	
Australia	512	1.6	508–514	318	
Shanghai–China	570	2.9	563–575	259	
OECD average	496	0.5	495–497	310	

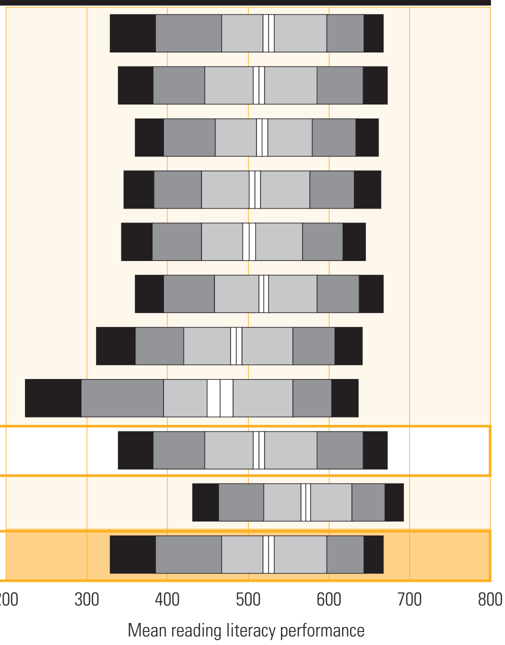


Figure 5.8 Mean scores and distribution of students' performance on the reading literacy scale, by jurisdiction

Table 5.1 Multiple comparisons of mean reading literacy performance, by jurisdiction[5]

Jurisdiction	Mean score	SE	ACT	WA	VIC	NSW	QLD	SA	TAS	NT	OECD average
ACT	525	3.6		●	●	▲	▲	▲	▲	▲	▲
WA	519	3.1	●		●	●	▲	▲	▲	▲	▲
VIC	517	3.5	●	●		●	●	▲	▲	▲	▲
NSW	513	3.3	▼	●	●		●	▲	▲	▲	▲
QLD	508	3.4	▼	▼	●	●		●	▲	▲	▲
SA	500	4.0	▼	▼	▼	▼	●		▲	▲	●
TAS	485	3.6	▼	▼	▼	▼	▼	▼		▲	▼
NT	466	8.3	▼	▼	▼	▼	▼	▼	▼		▼
OECD average	**496**	**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

The mean proportion of students at each of the reading literacy proficiency levels in each jurisdiction, together with the percentages for Australia, Shanghai–China and the OECD average, are shown in Figure 5.9.

At the higher end of the proficiency scale, 15% of students in the Australian Capital Territory, 13% of students in New South Wales and Western Australia, and 11% of students in Victoria and Queensland were top performers in reading literacy. In South Australia, Tasmania and the Northern Territory, there were fewer than 9% of students achieving Level 5 or 6.

5 Appendix H provides information about the reading literacy performance of each jurisdiction compared to participating countries.

At the lower end of the proficiency scale, almost 30% of students in the Northern Territory and one-fifth of students in Tasmania failed to reach Level 2. Fifteen per cent of students in New South Wales, Queensland and South Australia, 13% of students in the Australian Capital Territory and 12% of students in Western Australia were low performers in reading literacy. Victoria had the lowest proportion of students across the jurisdictions who achieved below Level 2, with 11%.

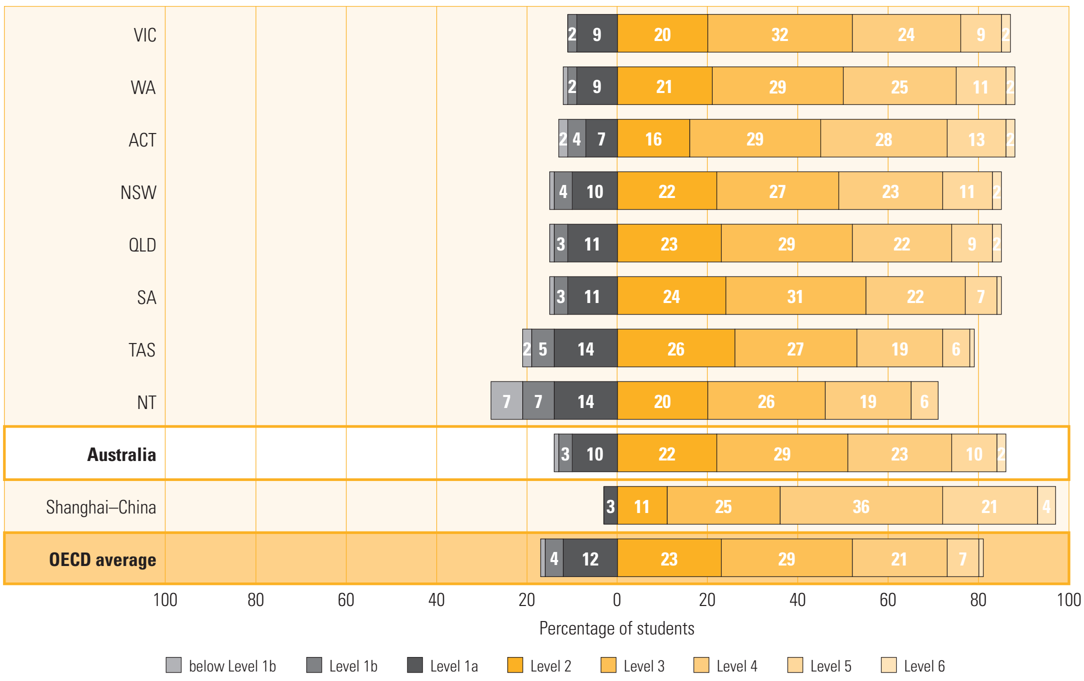


Figure 5.9 Percentage of students across the reading literacy proficiency scale, by jurisdiction

Reading literacy performance by sex across the Australian jurisdictions

Figure 5.10 shows the mean score for females and males, together with the standard errors and differences by sex (ordered from the largest to the smallest differences) in reading literacy. In all jurisdictions, females performed significantly higher than males.

The Australian Capital Territory had the widest difference by sex with 49 score points, representing more than half a proficiency level or almost one-and-a-half years of schooling. New South Wales had the next widest gap with 40 score points. The mean score difference for five of the jurisdictions was similar, ranging between 31 and 35 score points and representing approximately one year of schooling. Of these jurisdictions, in Tasmania the gap was 35 score points, in Queensland, South Australia and the Northern Territory, there was a 33 score point difference, while in Victoria, there was a 32 score point difference. The narrowest difference by sex, with a mean of 26 score points was in Western Australia, which was equivalent to about one-third of a proficiency level or about three-quarters of a year of schooling.

	Females		Males	
Jurisdction	Mean score	SE	Mean score	SE
ACT	550	4.8	501	5.5
NSW	533	3.7	493	5.5
TAS	503	5.1	468	4.8
QLD	525	4.0	491	4.3
SA	517	4.5	484	4.4
NT	482	11.4	449	10.1
VIC	534	3.5	502	5.1
WA	533	4.4	507	5.3

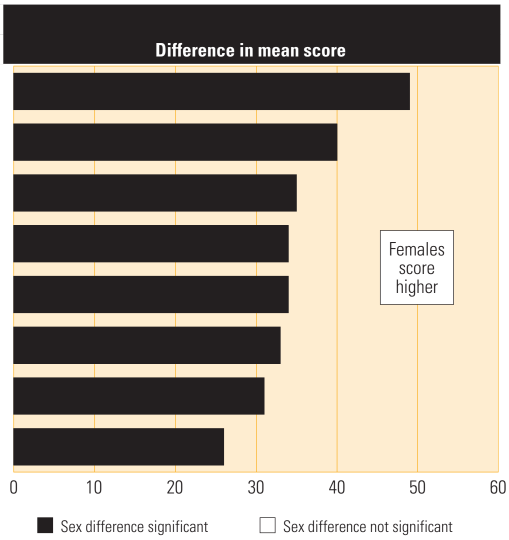


Figure 5.10 Mean scores and differences by sex in students' performance on the reading literacy scale, by jurisdiction

Figure 5.11 shows that there was a higher proportion of females who achieved Level 5 or 6 than males and a lower proportion of females who failed to achieve Level 2 than males in every jurisdiction. The proportion of females in the Northern Territory (8%) and Tasmania (9%) who achieved Level 5 or 6 in reading literacy was lower than the OECD average (10%). The proportion of females in all other jurisdictions was equal to or higher than the OECD average; the highest was the Australian Capital Territory (19%). The proportion of male top performers ranged from 4% in Tasmania to 11% in the Australian Capital Territory and New South Wales. In Tasmania, South Australia and the Northern Territory, the proportion of males reaching Level 5 or 6 was lower than the OECD average (6%). Comparing jurisdictions, there was more than twice the proportion of females as males achieving at this level in Tasmania, and twice the proportion of females as males in South Australia. The smallest difference by sex for those top performers was found in the Northern Territory (3%) and the largest difference by sex was found in the Australian Capital Territory (8%).

The proportion of females who failed to reach Level 2 ranged from 6% in the Australian Capital Territory to almost one-quarter (24%) of female students in the Northern Territory, with the proportion of females in Tasmania and the Northern Territory higher than that for OECD countries (12%). Western Australia was found to have the lowest proportion of males (15%) who failed to reach Level 2, followed by 16% in Victoria, 18% in the Australian Capital Territory, 19% in Queensland, and 21% in New South Wales and South Australia. Tasmania and the Northern Territory had the highest proportion of males not reaching Level 2, with 25 and 33% respectively, both higher than the OECD average (23%). The largest difference in the proportion of low performers in reading literacy was found in the Australian Capital Territory, with three times as many males than females not achieving Level 2. In New South Wales, Victoria and South Australia there were more than twice as many male low performers than females. The smallest difference by sex was found in Western Australia with 6%.

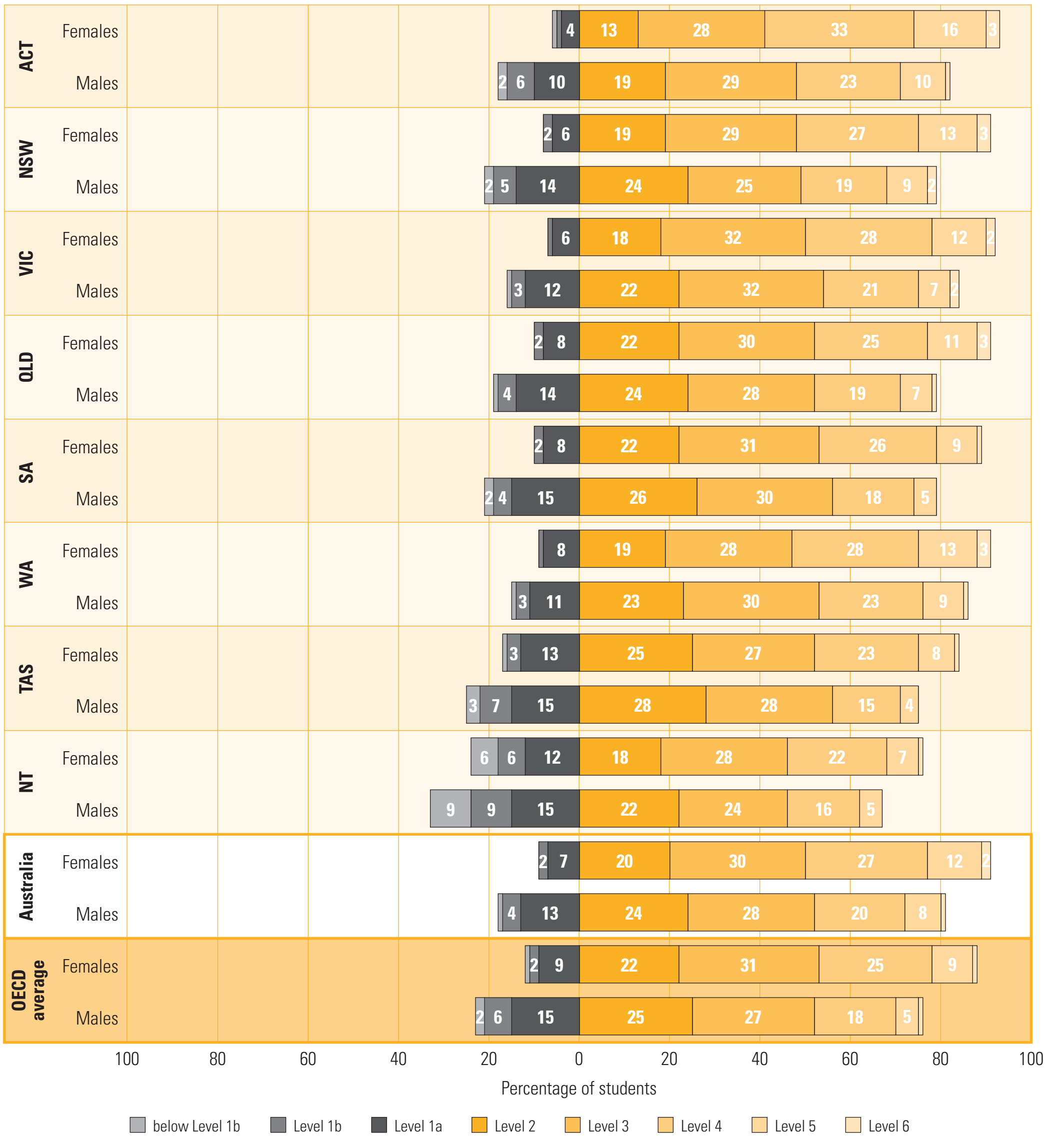


Figure 5.11 Percentage of students across the reading literacy proficiency scale, by jurisdiction and sex

Reading literacy performance by the Australian school sectors

The unadjusted means for reading literacy by school sector are provided in Figure 5.12 and show that, on average, students in the independent school sector performed significantly higher than those in the Catholic or government school sectors, and students in the Catholic school sector scored significantly higher than students in the government school sector. The mean scores for students in Catholic and independent schools were significantly higher than the OECD average, while the mean score for students in government schools was not significantly different from the OECD average.

The broader range of students that are catered for in government schools was reflected by the wider spread of scores between the students at the 5th and 95th percentiles, with 327 score points. Catholic schools had the narrowest spread of scores, with 278 score points between the low performers and top performers, whereas the difference for independent schools was slightly wider at 290 score points.

School sector	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Government	495	2.4	419–500	327	
Catholic	523	3.1	517–529	278	
Independent	551	3.4	544–557	290	

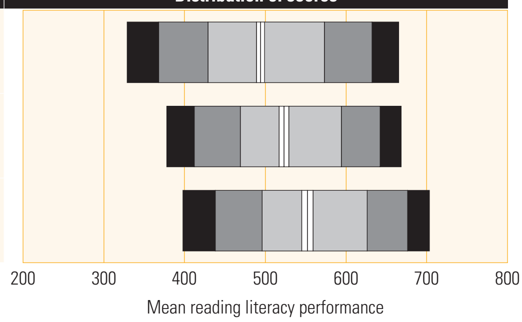


Figure 5.12 Mean scores and distribution of students' performance on the reading literacy scale, unadjusted for student and school background, by school sector

While significant differences in reading literacy performance were still evident after taking student-level socioeconomic background into account, the mean score differences between the different school sectors were reduced (Table 5.2). Once school-level socioeconomic background was taken into account, there were no significant differences between performance levels in the different school sectors.

Table 5.2 Differences in mean reading literacy scores after adjustment for student and school socioeconomic background

	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
Government – Catholic	**27**	**19**	2
Government – Independent	**55**	**37**	3
Catholic – Independent	**28**	**18**	1

Note: Values that are statistically significant are indicated in bold.

Figure 5.13 shows the distribution of students across the reading literacy proficiency levels by school sector.[6] The proportion of students in government and Catholic schools who were top performers was similar at 10 and 11% respectively, and lower than the proportion of students in independent schools (20%).

The proportion of students who were low performers (those who failed to achieve Level 2) in government schools was higher (18%) than the proportion of students in Catholic (9%) or independent schools (5%).

6 Proficiency level percentages are unadjusted. To adjust for student and school socioeconomic background (ESCS) requires complicated analysis that would need to take into account ESCS within each proficiency level and this is deemed impracticable. Furthermore, adjusting for ESCS at either end of the proficiency scale adds additional uncertainty to these levels.

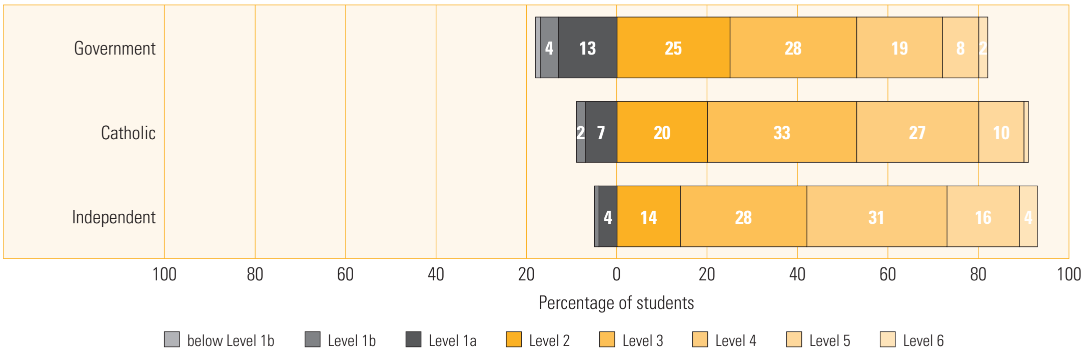


Figure 5.13 Percentage of students across the reading literacy proficiency scale, by school sector

Reading literacy performance by geographic location of school

Students in metropolitan schools performed at a significantly higher level in reading literacy (520 score points on average) than students in provincial schools (490 score points on average) and students in remote schools (452 score points on average).[7] Students in provincial schools performed significantly higher than students in remote schools. The performance of students in metropolitan schools was significantly higher than the OECD average (496 points), whereas the performance of students in provincial and remote schools was significantly below the OECD average.

In terms of proficiency levels and schooling, the difference between the mean scores of students in metropolitan and remote schools was 68 score points on average, which was equivalent to almost one proficiency level or about two years of schooling. The difference between the mean scores of students in metropolitan and provincial schools was 30 score points on average, representing almost half a proficiency level or almost one year of schooling. The difference between the mean scores of students in provincial and remote schools was 38 score points on average, which represents about half a proficiency level or more than one year of schooling.

As shown in Figure 5.14, the spread of scores between the 5th and 95th percentiles was wider for students in remote schools than for students in metropolitan and provincial schools.

Geographic location	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Metropolitan	520	1.9	517–524	317
Provincial	490	2.8	485–496	308
Remote	452	13.7	426–479	400

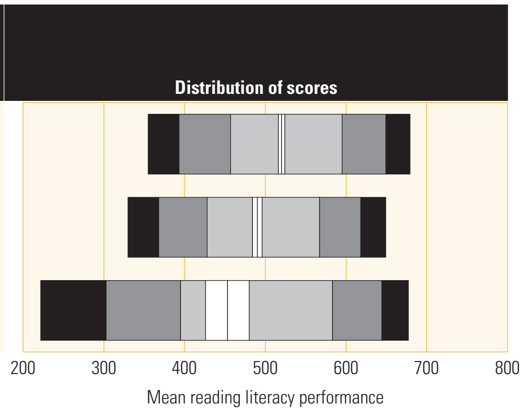


Figure 5.14 Mean scores and distribution of students' performance on the reading literacy scale, by geographic location

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

Figure 5.15 shows the proportion of students at each reading literacy proficiency level by geographic location of school. Similar proportions of students in provincial and remote schools performed at the highest levels of reading literacy (at 7 and 5% respectively), while the proportion of students in metropolitan schools who were top performers was about twice that (at 13%).

Thirty per cent of students in remote schools failed to reach Level 2 compared to 18% of students in provincial schools and 13% of students in metropolitan schools.

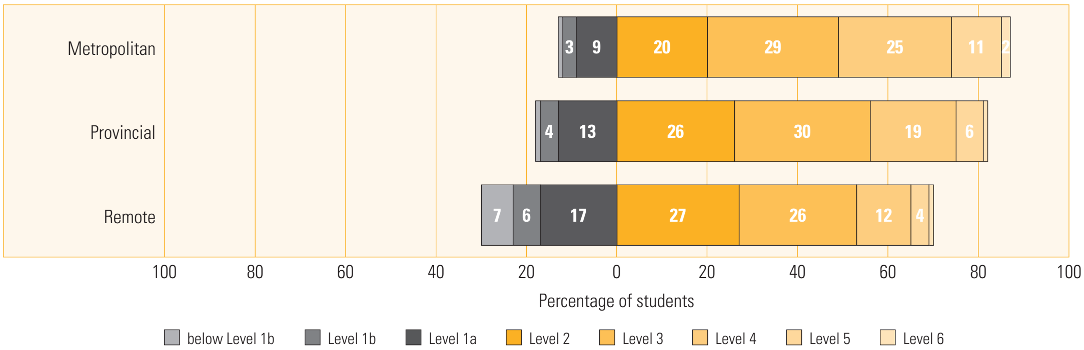


Figure 5.15 Percentage of students across the reading literacy proficiency scale, by geographical location

Reading literacy performance by Indigenous background

The performance of Indigenous and non-Indigenous students in reading literacy is shown in Figure 5.16. Indigenous students performed significantly lower (by 87 score points on average) than non-Indigenous students and significantly lower than the OECD average (by 68 score points on average). The mean score difference between Indigenous and non-Indigenous students' performance in reading literacy represents more than one proficiency level or two-and-a-half years of schooling.

The spread of scores between students in the 5th and 95th percentiles was wider for Indigenous students (at 337 score point on average) than that found for non-Indigenous students (at 313 score points on average).

Indigenous background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Indigenous	428	4.4	419–436	337
Non-Indigenous	515	1.6	512–518	313

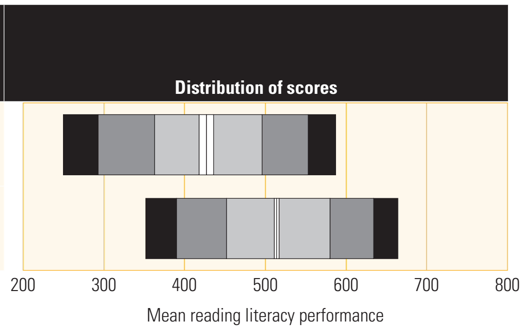


Figure 5.16 Mean scores and distribution of students' performance on the reading literacy scale, by Indigenous background

Only 2% of Indigenous students were top performers (achieving Level 5 or 6) in reading literacy. This proportion was one-sixth of that for non-Indigenous students (12%) and four times fewer than for students across OECD countries (8%).

Almost 40% of Indigenous students were low performers (achieving below Level 2) in reading literacy compared to 14% of non-Indigenous students and an average of 17% of students across the OECD (Figure 5.17).

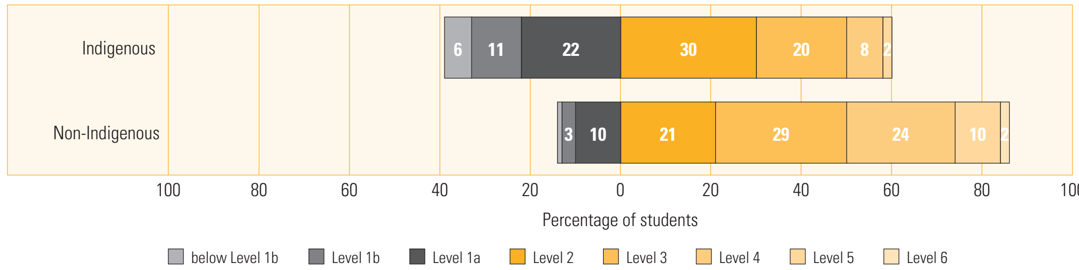


Figure 5.17 Percentage of students across the reading literacy proficiency scale, by Indigenous background

Reading literacy performance by sex and Indigenous background

Figure 5.18 shows student performance for Indigenous and non-Indigenous females and males in reading literacy. There were statistically significant differences by sex, with Indigenous females significantly outperforming Indigenous males by 45 score points on average. This mean score difference represented more than one-half of a proficiency level or about one-and-a-third years of schooling. For non-Indigenous students, females performed significantly higher than males by 35 score points on average.

Indigenous females achieved a mean score of 450 points, which was significantly lower than non-Indigenous females by 83 score points, which equates to more than one proficiency level or about two-and-a-half school years. Indigenous males scored 405 points on average, which was significantly lower than non-Indigenous males by 93 score points.

Indigenous females scored significantly lower than the average of female students across the OECD (by 66 score points), while the difference between Indigenous males and the mean performance of male students across the OECD average was greater than that of females, at 72 score points.

	Females		Males	
Indigenous background	Mean score	SE	Mean score	SE
Indigenous	450	4.6	405	6.2
Non-Indigenous	533	2.0	498	2.3

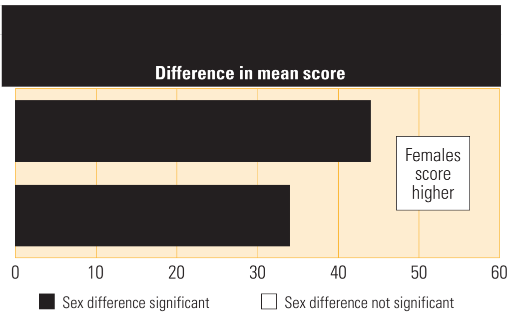


Figure 5.18 Mean scores and differences by sex in students' performance on the reading literacy scale, by Indigenous background

Only 2% of Indigenous females and 1% of Indigenous males were top performers in reading literacy compared to 15% of non-Indigenous females and 10% of non-Indigenous males.

Thirty per cent of Indigenous females failed to achieve Level 2, which was lower than the proportion of Indigenous males (49%). Almost twice as many Indigenous males (15%) were placed at Level 1b compared to Indigenous females (7%), and there were three times more Indigenous males who had not achieved Level 1b than Indigenous females. Eight per cent of non-Indigenous females achieved below Level 2 compared to 18% of non-Indigenous males (Figure 5.19).

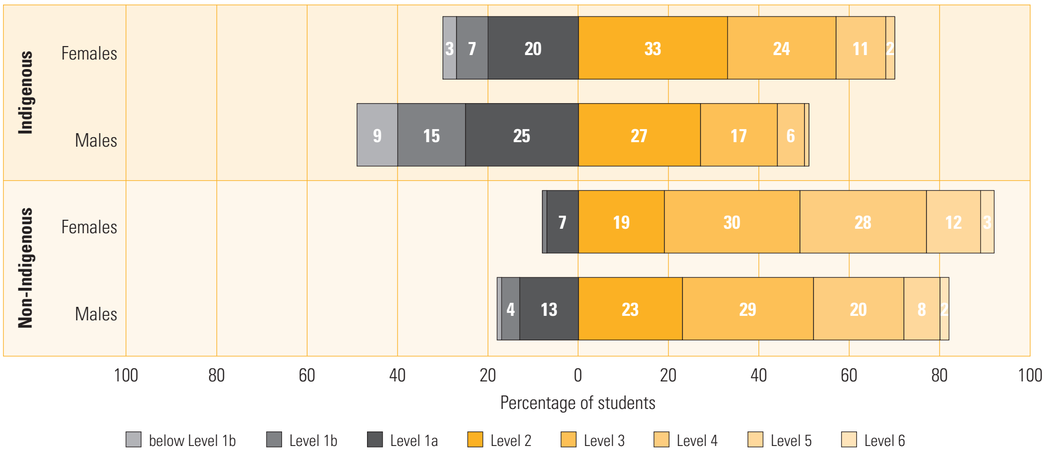


Figure 5.19 Percentage of students across the reading literacy proficiency scale, by Indigenous background and sex

Reading literacy performance by socioeconomic background

Socioeconomic background in PISA is measured by an index of ESCS, which captures the wider aspects of a student's family and home background.[8] As seen previously in the mathematical and scientific literacy chapters, there was a positive relationship between socioeconomic background and student performance. This was also the case for reading literacy, with students from higher socioeconomic backgrounds achieving higher scores in reading literacy. Students in the highest socioeconomic quartile achieved a mean score of 557 points, compared to a mean score of 471 points for students in the lowest socioeconomic quartile. The mean score difference of 86 points on average equates to more than one proficiency level or two-and-a-half years of schooling. The difference between one socioeconomic quartile and the next was significant at around 30 score points on average, which represents almost half a proficiency level or almost one year of schooling. Students' reading literacy performance in the lowest socioeconomic quartile was significantly lower than the OECD average (496 points), while reading literacy performance for students in the other quartiles was significantly higher than the average for students across the OECD.

Figure 5.20 shows the range of performance in reading literacy between the low performers and top performers for each socioeconomic quartile. Evident from this is that the spread of scores for students in the lowest socioeconomic quartile, 301 points, was wider than the spread of scores for the other socioeconomic quartiles.

Socioeconomic background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
Lowest quartile	471	2.2	467–475	301	
Second quartile	501	2.1	497–505	293	
Third quartile	529	2.3	525–534	296	
Highest quartile	557	2.4	552–562	289	

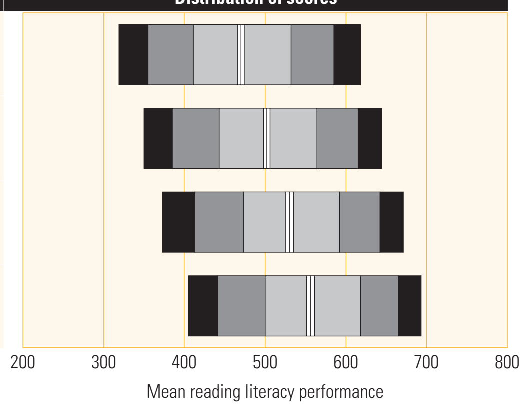


Figure 5.20 Mean scores and distribution of students' performance on the reading literacy scale, by socioeconomic background

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

As shown in Figure 5.21, only 4% of students in the lowest socioeconomic quartile were top performers in reading literacy compared to 8% in the second quartile, 14% in the third quartile and 23% in the highest quartile. At the other end of the scale, 23% of students in the lowest socioeconomic quartile were low performers, compared to 15% in the second quartile, 9% in the third quartile and 5% in the highest quartile.

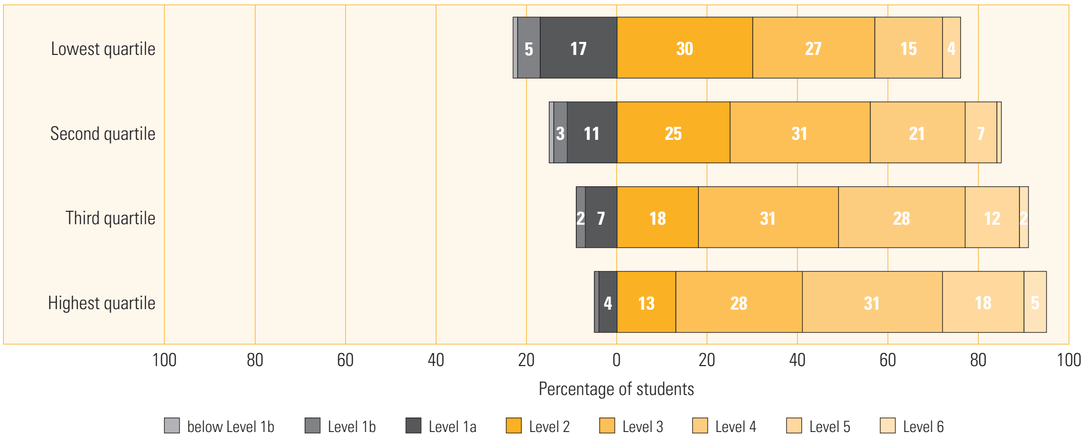


Figure 5.21 Percentage of students across the reading literacy proficiency scale, by socioeconomic background

Reading literacy performance by immigrant background

Australian-born students achieved a mean score of 508 points, which was significantly lower than the mean score for first-generation students (with a mean score of 526 points) and not significantly different from foreign-born students (with a mean score of 515 points).[9] The mean score difference between Australian-born students and first-generation students represents around half a year of schooling. The range of scores between students in the 5th and 95th percentiles was similar for Australian-born and first-generation students whereas the spread of scores for foreign-born students was wider (Figure 5.22).

Immigrant background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Australian-born	508	1.8	505–512	306
First-generation	526	2.5	522–531	309
Foreign-born	515	3.3	508–521	336

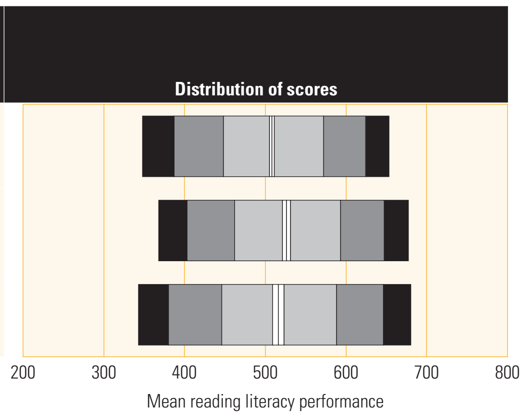


Figure 5.22 Mean scores and distribution of students' performance on the reading literacy scale, by immigrant background

The proportion of top performers was higher for foreign-born (14%) and first-generation students (15%) than for Australian-born students (10%). These proportions were all higher than for students across the OECD (8%). For the low performers (students who achieved below Level 2), there were 17% of foreign-born students, followed by 14% of Australian-born students and 10% of first-generation students.

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

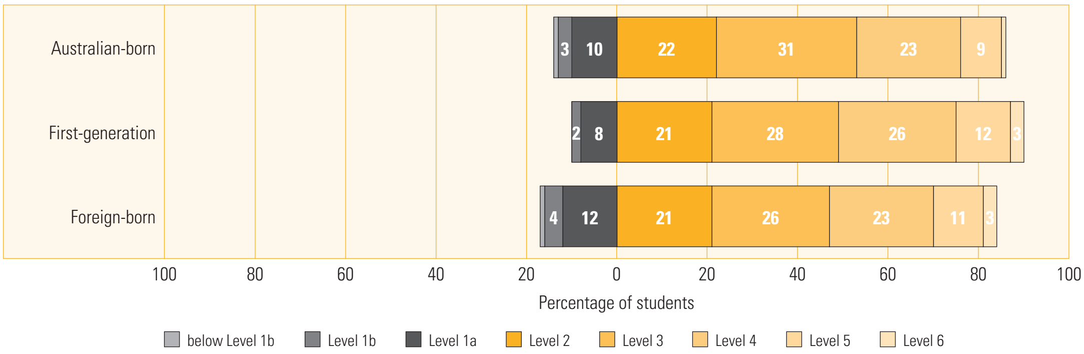


Figure 5.23 Percentage of students across the reading literacy proficiency scale, by immigrant background

The proportion of first-generation and Australian-born low performers was lower than the OECD average (17%); however, the proportion of foreign-born low performers was the same as that for the OECD (Figure 5.23).

Reading literacy performance by language background

Students who spoke English as their main language at home achieved a mean score of 515 points, which was significantly higher than students who spoke a language other than English with a mean score of 506 points.

Figure 5.24 shows that the variation in reading literacy between students in the 5th and 95th percentiles was wider for students who spoke a language other than English at home (351 score points) compared to students who spoke English at home (308 score points).

Language background	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles	Distribution of scores
English spoken at home	515	1.5	512–518	308	
Language other than English spoken at home	506	4.3	498–515	351	

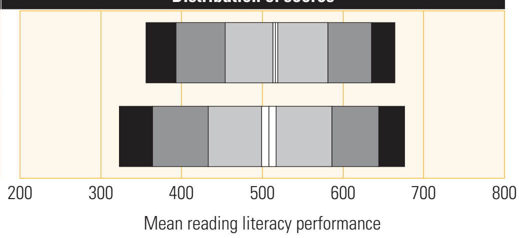


Figure 5.24 Mean scores and distribution of students' performance on the reading literacy scale, by language background

Figure 5.25 shows there were some slight differences between the two language background groups in terms of proficiency levels. At the lower end of the proficiency scale, 19% of students who spoke a language other than English at home failed to reach Level 2, compared to 14% of students who spoke English at home. At the higher end of the proficiency scale, 14% of students who spoke a language other than English at home reached Level 5 or 6 compared to 12% of students who spoke English at home.

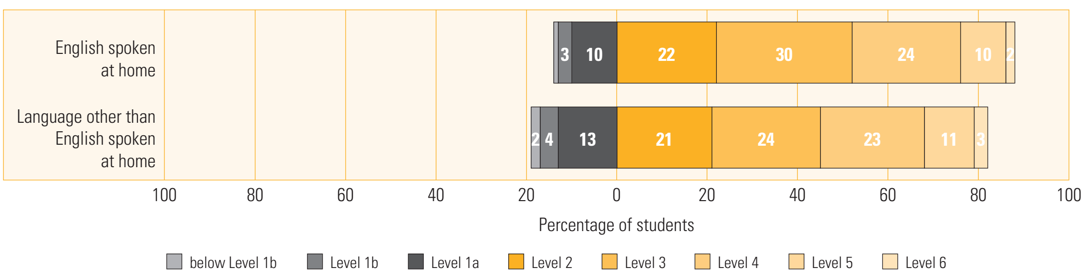


Figure 5.25 Percentage of students across the reading literacy proficiency scale, by language background

Reading literacy performance changes between PISA 2000 and PISA 2012

PISA has been designed to compare performance between cycles and monitor the skills and knowledge of 15-year-old students over time. As reading literacy was the first major domain in PISA 2000, it is possible to examine student performance across five cycles of PISA.

Reading literacy performance changes across countries

Table 5.3 shows the mean scores on reading literacy performance for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and the mean score difference between PISA 2000 and PISA 2012. Countries whose data have not been collected (e.g., a country may not have participated in one cycle of PISA) or is not comparable between cycles, as well as those countries with a mean performance in reading literacy that was lower than the mean performance of the lowest scoring OECD country, Mexico, have not been included in the comparisons between PISA 2000 and PISA 2012.[10]

Eleven countries, including one high-performing country (Hong Kong–China) that performed significantly higher than Australia in PISA 2012, have seen a significant improvement in their reading literacy performance between PISA 2000 and PISA 2012. The performance of Poland increased by 39 score points, Israel by 34 score points, Liechtenstein by 33 score points, Chile by 32 score points and Latvia by 31 score points. Thailand, the Russian Federation, Switzerland, Portugal, Hong Kong–China and Germany improved their performance by between 11 and 24 score points.

Six countries, including Australia, Finland and New Zealand, showed a significant decline between PISA 2000 and PISA 2012. The performance of Sweden declined by 33 score points, Iceland by 24 score points, Finland by 22 score points, Austria by 18 score points, New Zealand by 17 score points and Australia by 16 score points.

10 There were 13 countries whose mean score was lower than that for Mexico. The countries are: Albania, Argentina, Brazil, Colombia, Indonesia, Jordan, Kazakhstan, Malaysia, Montenegro, Peru, Qatar, Tunisia and Uruguay.

Table 5.3 Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by country

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Mean score difference between 2000 and 2012 (PISA 2012 – PISA 2000)	
Country	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
Australia	528	3.5	525	2.1	513	2.1	515	2.3	512	1.6	**–16**	7.1
Austria	507	2.4	491	3.8	490	4.1	✧	✧	490	2.8	**–18**	7.0
Belgium	507	3.6	507	2.6	501	3.0	506	2.3	509	2.2	2	7.2
Bulgaria	430	4.9	✧	✧	402	6.9	429	6.7	436	6.0	6	9.8
Canada	534	1.6	528	1.7	527	2.4	524	1.5	523	1.9	–11	6.4
Chile	410	3.6	✧	✧	442	5.0	449	3.1	441	2.9	**32**	7.5
Chinese Taipei	✧	✧	✧	✧	496	3.4	495	2.6	523	3.0	✧	✧
Costa Rica	✧	✧	✧	✧	✧	✧	443	3.2	441	3.5	✧	✧
Croatia	✧	✧	✧	✧	477	2.8	476	2.9	485	3.3	✧	✧
Czech Republic	492	2.4	489	3.5	483	4.2	478	2.9	493	2.9	1	7.0
Denmark	497	2.4	492	2.8	494	3.2	495	2.1	496	2.6	–1	6.9
Estonia	✧	✧	✧	✧	501	2.9	501	2.6	516	2.0	✧	✧
Finland	546	2.6	543	1.6	547	2.1	536	2.3	524	2.4	**–22**	6.9
France	505	2.7	496	2.7	488	4.1	496	3.4	505	2.8	1	7.1
Germany	484	2.5	491	3.4	495	4.4	497	2.7	508	2.8	**24**	7.0
Greece	474	5.0	472	4.1	460	4.0	483	4.3	477	3.3	3	8.4
Hong Kong–China	525	2.9	510	3.7	536	2.4	533	2.1	545	2.8	**19**	7.2
Hungary	480	4.0	482	2.5	482	3.3	494	3.2	488	3.2	8	7.8
Iceland	507	1.5	492	1.6	484	1.9	500	1.4	483	1.8	**–24**	6.4
Ireland	527	3.2	515	2.6	517	3.5	496	3.0	523	2.6	–3	7.2
Israel	452	8.5	✧	✧	439	4.6	474	3.6	486	5.0	**34**	11.5
Italy	487	2.9	476	3.0	469	2.4	486	1.6	490	2.0	2	6.9
Japan	522	5.2	498	3.9	498	3.6	520	3.5	538	3.7	16	8.7
Korea	525	2.4	534	3.1	556	3.8	539	3.5	536	3.9	11	7.5
Latvia	458	5.3	491	3.7	479	3.7	484	3.0	489	2.4	**31**	8.3
Liechtenstein	483	4.1	525	3.6	510	3.9	499	2.8	516	4.1	**33**	8.3
Lithuania	✧	✧	✧	✧	470	3.0	468	2.4	477	2.5	✧	✧
Luxembourg	✧	✧	479	1.5	479	1.3	472	1.3	488	1.5	✧	✧
Macao–China	✧	✧	498	2.2	492	1.1	487	0.9	509	0.9	✧	✧
Mexico	422	3.3	400	4.1	410	3.1	425	2.0	424	1.5	2	7.0
Netherlands	✧	✧	513	2.9	507	2.9	508	5.1	511	3.5	✧	✧
New Zealand	529	2.8	522	2.5	521	3.0	521	2.4	512	2.4	**–17**	7.0
Norway	505	2.8	500	2.8	484	3.2	503	2.6	504	3.2	–1	7.3
OECD average 2000	496	0.7	497	0.6	490	0.7	496	0.5	498	0.6	2	6.0
OECD average 2003			494	0.6	492	0.6	497	0.5	498	0.5		
OECD average 2006					489	0.6	494	0.5	496	0.5		
OECD average 2009							494	0.5	497	0.5		
Poland	479	4.5	497	2.9	508	2.8	500	2.6	518	3.1	**39**	8.0
Portugal	470	4.5	478	3.7	472	3.6	489	3.1	488	3.8	**18**	8.3
Romania	428	3.5	✧	✧	396	4.7	424	4.1	438	4.0	10	7.9
Russian Federation	462	4.2	442	3.9	440	4.3	459	3.3	475	3.0	**13**	7.8
Serbia	✧	✧	✧	✧	401	3.5	442	2.4	446	3.4	✧	✧
Shanghai–China	✧	✧	✧	✧	✧	✧	556	2.4	570	2.9	✧	✧
Singapore	✧	✧	✧	✧	✧	✧	526	1.1	542	1.4	✧	✧
Slovak Republic	✧	✧	469	3.1	466	3.1	477	2.5	463	4.2	✧	✧
Slovenia	✧	✧	✧	✧	494	1.0	483	1.0	481	1.2	✧	✧
Spain	493	2.7	481	2.6	461	2.2	481	2.0	488	1.9	–5	6.8
Sweden	516	2.2	514	2.4	507	3.4	497	2.9	483	3.0	**–33**	7.0
Switzerland	494	4.2	499	3.3	499	3.1	501	2.4	509	2.6	**15**	7.7
Thailand	431	3.2	420	2.8	417	2.6	421	2.6	441	3.1	**11**	7.4
Turkey	✧	✧	441	5.8	447	4.2	464	3.5	475	4.2	✧	✧
United Kingdom	✧	✧	✧	✧	495	2.3	494	2.3	499	3.5	✧	✧
United States	504	7.0	495	3.2	✧	✧	500	3.7	498	3.7	–7	9.9

Notes: In some cases, data were not available because they were not submitted by the country or were collected but subsequently removed for technical reasons. These cells have been denoted with the symbol ✧.

Values that are statistically signficant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

The relative position of the participating countries in PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012 to Australia are shown in Table 5.4. Countries are shown in order from the highest to the lowest performing country in reading literacy in PISA 2012.

A number of high-performing countries in PISA 2012 have, in a previous PISA cycle, performed at a similar level to Australia. This includes Japan, Korea, Finland, Ireland and Canada. In PISA 2012, Poland, Estonia, Liechtenstein, the Netherlands, Belgium, Switzerland, Macao–China, Germany and France performed at a level equal to Australia, but in one or more cycles of PISA performed significantly lower than Australia.

Table 5.4 Relative trends in reading literacy performance, by country

	Position relative to Australia in				
Country	**PISA 2012**	**PISA 2009**	**PISA 2006**	**PISA 2003**	**PISA 2000**
Shanghai–China	▲	▲	–	–	–
Hong Kong–China	▲	▲	▲	▼	▼
Singapore	▲	▲	–	–	–
Japan	▲	●	▼	▼	▲
Korea	▲	▲	▲	●	●
Finland	▲	▲	▲	▲	
Ireland	▲	▼	●	●	▼
Chinese Taipei	▲	▼	▼	–	–
Canada	▲	▲	▲	●	●
Poland	●	▼	●	▼	▼
Estonia	●	▼	▼	–	–
Liechtenstein	●	▼	●	●	●
New Zealand	●	●	▲	●	●
Australia					
Netherlands	●	●	●	▼	*
Belgium	●	▼	▼	▼	●
Switzerland	●	▼	▼	▼	●
Macao–China	●	▼	▼	▼	–
Vietnam	●	–	–	–	–
Germany	●	▼	▼	▼	▼
France	●	▼	▼	▼	▼
Norway	▼	▼	▼	▼	▼
OECD average 2000	—	—	—	—	▼
United Kingdom	▼	▼	▼	–	●
United States	▼	▼	–	▼	▼
OECD average 2012	▼	—	—	—	—
Denmark	▼	▼	▼	▼	▼
OECD average 2003	—	—	—	▼	—
OECD average 2009	—	▼	—	—	—
Czech Republic	▼	▼	▼	▼	▼
OECD average 2006	—	—	▼	—	—
Italy	▼	▼	▼	▼	▼
Austria	▼	▼	▼	▼	▼
Latvia	▼	▼	▼	▼	▼
Hungary	▼	▼	▼	▼	▼
Spain	▼	▼	▼	▼	▼
Luxembourg	▼	▼	▼	▼	▼
Portugal	▼	▼	▼	▼	▼
Israel	▼	▼	▼	–	▼
Croatia	▼	▼	▼	–	–
Sweden	▼	▼	●	▼	▼
Iceland	▼	▼	▼	▼	▼
Slovenia	▼	▼	▼	–	–
Lithuania	▼	▼	▼	–	–
Greece	▼	▼	▼	▼	▼
Turkey	▼	▼	▼	▼	–
Russian Federation	▼	▼	▼	▼	▼
Slovak Republic	▼	▼	▼	▼	–
Cyprus	▼	–	–	–	–
Serbia	▼	▼	▼	▼	–
United Arab Emirates	▼	▼	–	–	–
Chile	▼	▼	▼	–	▼
Thailand	▼	–	▼	▼	▼
Costa Rica	▼	–	–	–	–
Romania	▼	–	▼	–	▼
Bulgaria	▼	▼	▼	–	▼
Mexico	▼	▼	▼	▼	▼

Notes:
▲ Performance statistically higher than Australia
● Performance not significantly different from Australia
▼ Performance statistically lower than Australia
– Did not participate in this cycle
— Not applicable
* Participated in this cycle but data cannot be compared

As previously mentioned, from PISA 2000 to PISA 2012 there was a decline in the mean reading literacy scores for Australia. There was no significant difference between Australia's mean performance in PISA 2000 and PISA 2003; however, there was a significant decline between PISA 2003 and PISA 2006. Australia's performance in PISA 2009 and PISA 2012 was statistically similar to Australia's performance in PISA 2006. To examine whether the scores for high, average and low achievers are changing, the mean reading literacy score, confidence intervals and distribution of scores at the 10th, 25th, 75th and 90th percentiles for Australia are shown in Figure 5.26.

Figure 5.26 shows the decline in reading literacy performance has occurred gradually over time. Between PISA 2003 and PISA 2006, the scores at the 50th, 75th and 90th percentiles declined significantly (by about 15 points at each percentile) and between PISA 2003 and PISA 2009 performance at the 25th and 50th percentiles declined significantly (by 16 and 18 points respectively). Between PISA 2000 and PISA 2012 there were significant declines at the 75th and 90th percentiles (by 23 and 21 points respectively), while for students at the 10th or 25th percentiles no significant differences were found between PISA 2000 and PISA 2012.

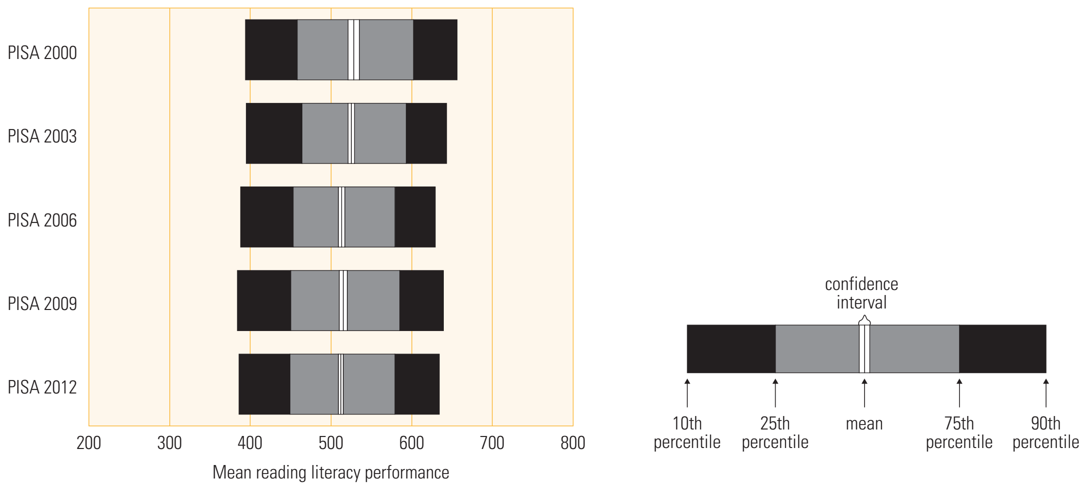
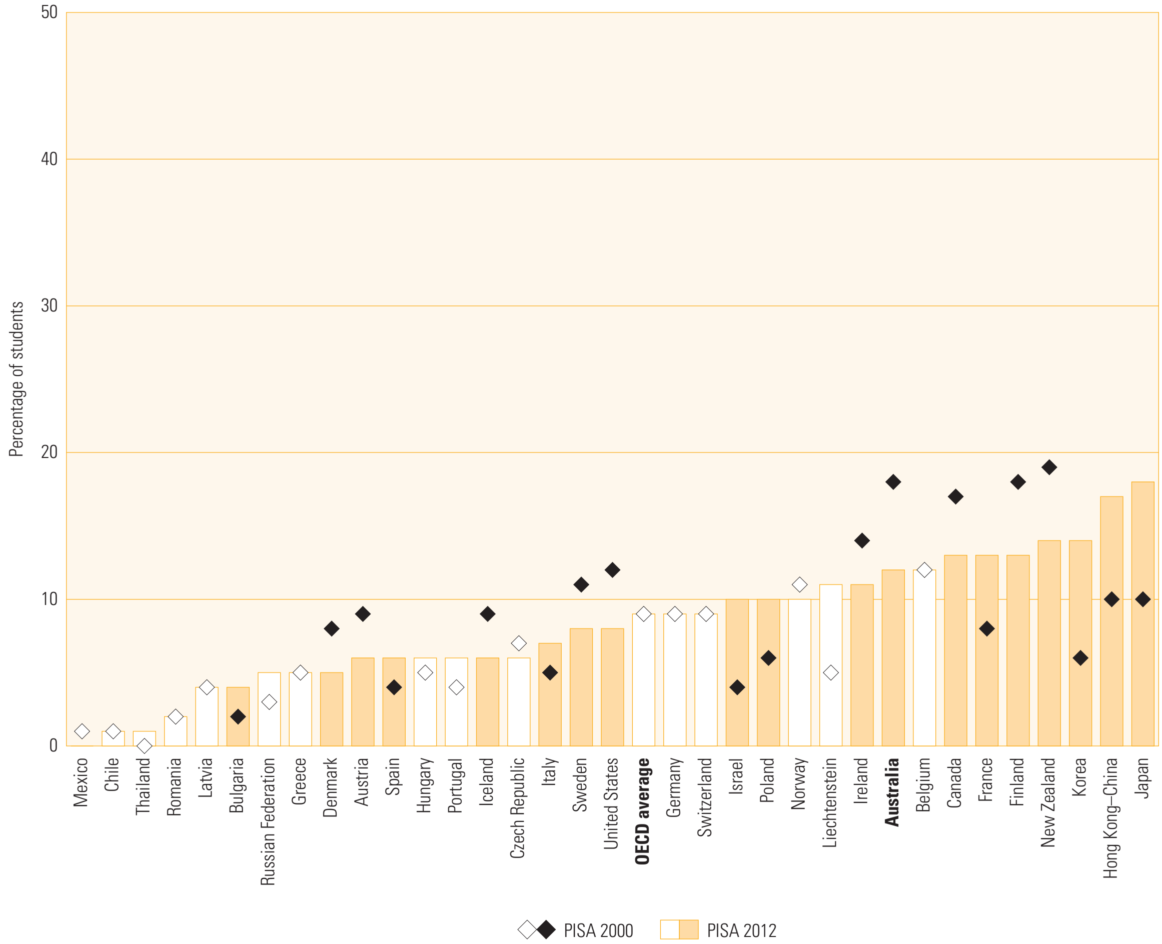


Figure 5.26 Means and percentiles on the reading literacy scale for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, for Australia

Figure 5.27 shows the proportion of students who performed at Level 5 or 6 in reading literacy for PISA 2000 and PISA 2012: the top performers. In this figure, countries have been ordered from the lowest to highest proportion of students at Level 5 or 6 (with countries with the lowest proportion of students at Level 5 or 6 in PISA 2012 placed at the left of the figure and countries with the highest proportion of students at Level 5 or 6 in PISA 2012 at the right).

Ten countries showed a significant decline in the proportion of students who reached Level 5 or 6 between PISA 2000 and PISA 2012. In Australia, there were fewer top performers (6%) in PISA 2012 than in PISA 2000 (a decrease from 18% in PISA 2000 to 12% in PISA 2012). In Finland and New Zealand the proportion of top performers decreased by 5%, in the United States and Canada there was a 4% decrease, and in Austria, Sweden, Iceland, Ireland and Demark there was a 3% decrease in the proportion of students achieving Level 5 or 6.

Nine countries, of which three were high-performing countries, showed a significant increase in the proportion of students who reached Level 5 or 6 between PISA 2000 and PISA 2012. The proportion increased in Japan by 9%, in Korea by 8%, in Hong Kong–China by 7%, in Israel by 5%, in France and Poland by 4%, in Bulgaria by 2%, and in Italy and Spain by 1%.



Note: A coloured bar and a coloured diamond indicate that the difference in the proportion of students between PISA 2000 and PISA 2012 was significant.

Figure 5.27 Percentage of students performing at Level 5 or above on reading literacy in PISA 2000 and PISA 2012, by country[11]

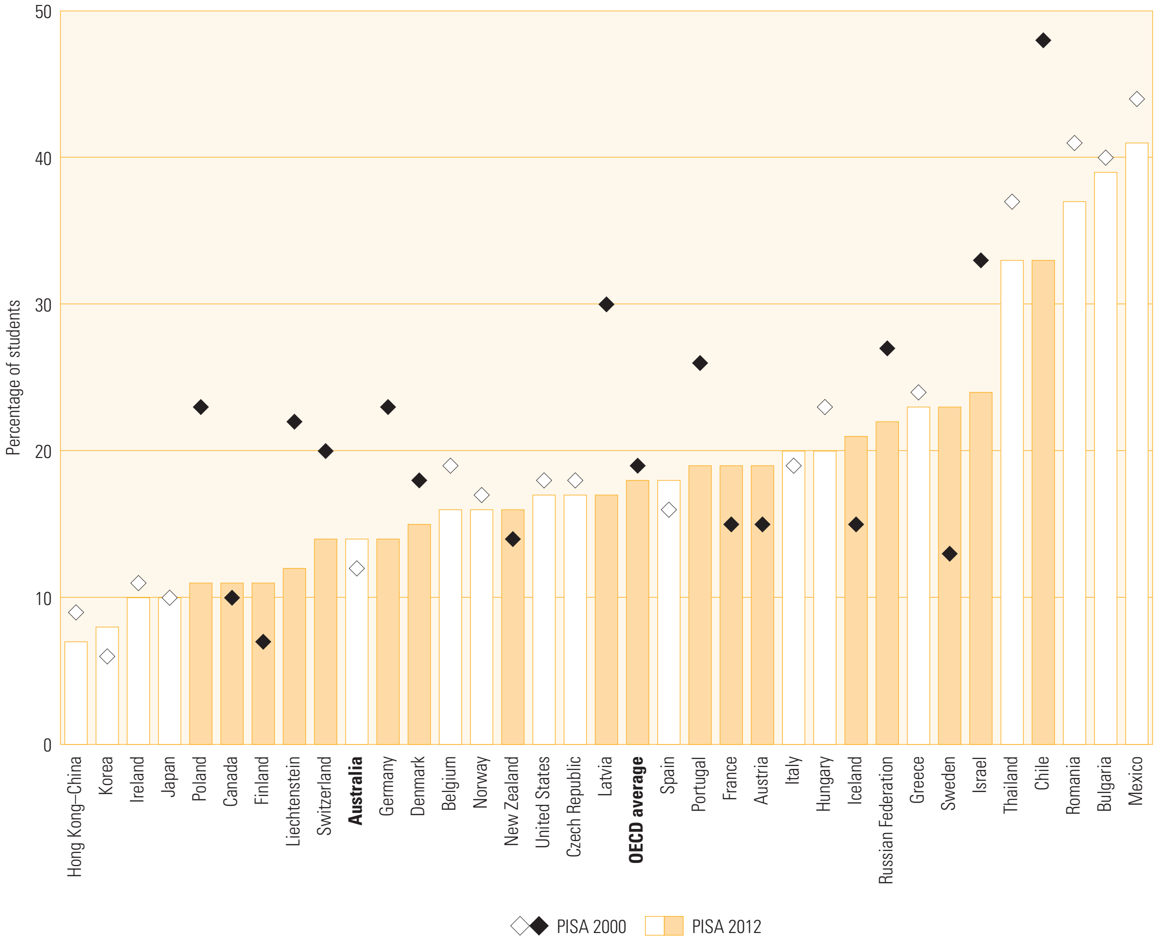
Figure 5.28 shows the proportion of students who did not reach Level 2 in reading literacy for PISA 2000 and PISA 2012: the low performers. Across OECD countries (for which data could be compared), there was a 1.4% decrease in the proportion of low performers from PISA 2000 to PISA 2012.

In seven countries, the proportion of low performers significantly increased from PISA 2000 to PISA 2012. In Sweden, the proportion of students who failed to achieve Level 2 increased by 7%, in Iceland by 6%, in Austria by 5%, in Finland and France by 4%, in New Zealand by 2% and in Canada by 1%.

There were a number of countries in which the proportion of low performers significantly decreased between PISA 2000 and PISA 2012. For five countries, the proportion of low performers decreased by 10% or more. In PISA 2012, there was a decrease of 15% of students in Chile, 13% in Latvia and Poland, and 10% of students in Liechtenstein and Israel who achieved below Level 2 compared to PISA 2000. The proportion of low performers also decreased significantly from PISA 2000 to PISA 2012 in Germany (an 8% reduction), Portugal and Switzerland (7%), the Russian Federation (5%) and Denmark (3%).

In Australia, 12% of Australian students failed to reach Level 2 in PISA 2000, which was not significantly different to the 14% of students in PISA 2012 who were low performers.

11 A number of countries do not have data available for PISA 2000 and, subsequently, have not been included in this figure. These countries are: Chinese Taipei, Costa Rica, Croatia, Estonia, Lithuania, Luxembourg, Macao–China, the Netherlands, Serbia, Shanghai–China, Singapore, the Slovak Republic, Slovenia, Turkey and the United Kingdom.



Note: A coloured bar and a coloured diamond indicate that the difference in the proportion of students between PISA 2000 and PISA 2012 was significant.

Figure 5.28 Percentage of students performing below Level 2 on reading literacy in PISA 2000 and PISA 2012, by country[12]

Figure 5.29 provides further details about the proportion of Australian low performers and high performers across the five cycles of PISA. From PISA 2000 to PISA 2012, there was a decline in the proportion of top performers and a slight increase in the proportion of low performers. The proportion of top performers in reading literacy was 17% in PISA 2000, 15% in PISA 2003, 11% in PISA 2006, 13% in PISA 2009 and 12% in PISA 2012. For the low performers, there were 12% of students in PISA 2000 and PISA 2003, and 14% of students in PISA 2006, PISA 2009 and PISA 2012 who failed to reach Level 2.

12 A number of countries do not have data available for PISA 2000 and, subsequently, have not been included in this figure. These countries are: Chinese Taipei, Costa Rica, Croatia, Estonia, Lithuania, Luxembourg, Macao–China, the Netherlands, Serbia, Shanghai–China, Singapore, the Slovak Republic, Slovenia, Turkey and the United Kingdom.

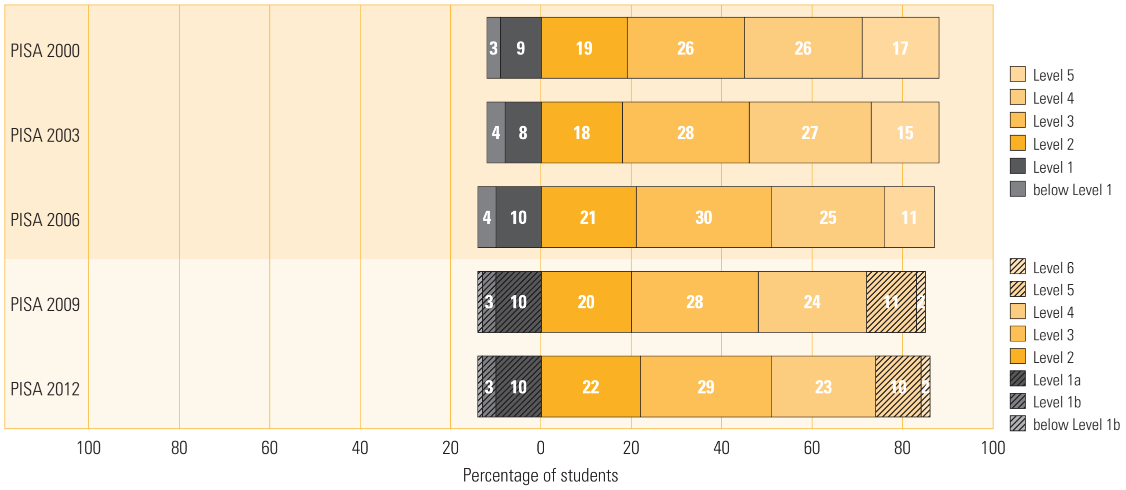


Figure 5.29 Percentage of students across the reading literacy proficiency scale for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, in Australia[13]

Reading literacy performance changes by sex across countries

Table 5.5 shows the mean reading literacy scores for females and males in PISA 2000 and PISA 2012, along with the mean differences for females and males.

In four countries, the mean performance for females and males has declined significantly from PISA 2000 to PISA 2012. The mean performance for females decreased by 16 score points in Finland, 17 score points in Australia, 20 score points in Iceland and 26 score points in Sweden, while the mean performance for males decreased by 18 score points in Australia, 26 score points in Finland, 31 score points in Iceland and 41 score points in Sweden.

In Canada the performance of males significantly declined by 13 score points and in New Zealand the performance of females significantly declined by 23 score points from PISA 2000 to PISA 2012.

There were a number of countries whose performance for females and males significantly improved from PISA 2000 and PISA 2012. The mean performance for females improved by around 30 score points in Liechtenstein, Chile and Latvia, and 41 score points in Poland. The mean performance for males improved by 30 score points in Latvia, 33 score points in Chile, and around 35 score points in Poland and Liechtenstein.

In Switzerland, Thailand, Romania, Hong Kong–China, Portugal and Israel, the mean performance for females improved significantly from PISA 2000 to PISA 2012. This ranged from 17 score points in Switzerland to 48 score points in Israel.

13 The reporting of reading literacy proficiency level has changed since PISA 2009. In the first cycle of PISA, five levels of reading literacy proficiency were defined (Level 1 to Level 5) with student performance reported on these levels until PISA 2009, when the reading literacy framework was updated and the proficiency scale expanded to seven levels (below Level 1b to Level 6).

Table 5.5 Mean reading literacy scores for PISA 2000 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by country

	PISA 2000						PISA 2012						Difference in mean score between 2000 and 2012 (PISA 2012 – PISA 2000)			
	Females		Males		Females – Males		Females		Males		Females – Males		Females		Males	
Country	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score	SE	Mean score	SE	Mean score dif.	SE	Mean score dif.	SE	Mean score dif.	SE
Australia	546	4.7	513	4.0	**34**	5.4	530	2.0	495	2.3	**34**	2.9	**–17**	7.8	**–18**	7.5
Austria	509	4.0	476	3.6	**33**	5.7	508	3.4	471	4.0	**37**	5.0	–1	7.9	–5	8.0
Bulgaria	455	6.3	407	4.9	**47**	5.6	472	5.6	403	6.3	**70**	5.2	17	10.3	–5	10.0
Canada	551	1.7	519	1.8	**32**	1.6	541	2.1	506	2.3	**35**	2.1	–10	6.5	**–13**	6.6
Chile	421	4.6	396	4.3	**25**	5.6	452	2.9	430	3.8	**23**	3.3	**31**	8.1	**33**	8.3
Czech Republic	510	2.5	473	4.1	**37**	4.7	513	3.4	474	3.3	**39**	3.7	3	7.3	1	7.9
Denmark	510	2.9	485	3.0	**25**	3.3	512	2.6	481	3.3	**31**	2.8	1	7.1	–5	7.4
Finland	571	2.8	520	3.0	**51**	2.6	556	2.4	494	3.1	**62**	3.1	**–16**	7.0	**–26**	7.3
France	519	2.7	490	3.5	**29**	3.4	527	3.0	483	3.8	**44**	4.2	8	7.2	–7	7.9
Greece	493	4.6	456	6.1	**37**	5.0	502	3.1	452	4.1	**50**	3.7	9	8.1	–4	9.4
Hong Kong–China	533	3.6	518	4.8	**16**	6.1	558	3.3	533	3.8	**25**	4.7	**25**	7.7	15	8.5
Hungary	496	4.3	465	5.3	**32**	5.7	508	3.3	468	3.9	**40**	3.6	11	8.0	3	8.9
Iceland	528	2.1	488	2.1	**40**	3.1	508	2.5	457	2.4	**51**	3.3	**–20**	6.8	**–31**	6.7
Ireland	542	3.6	513	4.2	**29**	4.6	538	3.0	509	3.5	**29**	4.2	–4	7.5	–4	8.0
Israel	459	8.1	444	10.9	16	9.1	507	3.9	463	8.2	**44**	7.9	**48**	10.7	20	14.9
Italy	507	3.6	469	5.1	**38**	7.0	510	2.3	471	2.5	**39**	2.6	3	7.3	2	8.2
Japan	537	5.4	507	6.7	**30**	6.4	551	3.6	527	4.7	**24**	4.1	14	8.8	19	10.1
Korea	533	3.7	519	3.8	**14**	6.0	548	4.5	525	5.0	**23**	5.4	15	8.3	6	8.6
Latvia	485	5.4	432	5.5	**53**	4.2	516	2.7	462	3.3	**55**	4.0	**32**	8.5	**30**	8.7
Liechtenstein	500	6.8	468	7.3	**31**	11.5	529	5.8	504	6.2	**24**	8.7	**29**	10.7	**36**	11.3
Mexico	432	3.8	411	4.2	**20**	4.3	435	1.6	411	1.7	**24**	1.4	4	7.2	0	7.4
New Zealand	553	3.8	507	4.2	**46**	6.3	530	3.5	495	3.3	**34**	5.0	**–23**	7.9	–11	8.0
Norway	529	2.9	486	3.8	**43**	4.0	528	3.9	481	3.3	**46**	3.3	–1	7.6	–4	7.8
OECD average	512	0.8	480	0.9	**32**	1.0	517	0.6	479	0.7	**38**	0.7	**5**	1.5	–1	1.6
Poland	497	5.5	461	6.0	**36**	7.0	539	3.1	497	3.7	**42**	2.9	**41**	8.7	**35**	9.2
Portugal	482	4.6	458	5.0	**25**	3.8	508	3.7	468	4.2	**39**	2.7	**25**	8.4	11	8.8
Romania	434	4.2	421	4.3	**14**	4.9	457	4.2	417	4.5	**40**	4.1	**23**	8.4	–4	8.6
Russian Federation	481	4.1	443	4.5	**38**	2.9	495	3.2	455	3.5	**40**	3.0	14	7.9	12	8.2
Spain	505	2.8	481	3.4	**24**	3.2	503	1.9	474	2.3	**29**	2.0	–3	6.8	–7	7.2
Sweden	536	2.5	499	2.6	**37**	2.7	509	2.8	458	4.0	**51**	3.6	**–26**	7.0	**–41**	7.6
Switzerland	510	4.5	480	4.9	**30**	4.2	527	2.5	491	3.1	**36**	2.6	**17**	7.9	11	8.2
Thailand	448	3.1	406	3.9	**41**	3.8	465	3.3	410	3.6	**55**	3.2	**18**	7.5	4	7.9
United States	518	6.2	490	8.4	**29**	4.1	513	3.8	482	4.1	**31**	2.6	–5	9.4	–7	11.1

Notes: Values that are statistically signficant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 5.6 provides further details of the mean reading literacy scores for females and males across each PISA cycle. In PISA 2000, Australian females achieved a mean score of 546 score points, 16 score points on average higher than their mean performance in PISA 2012, while for Australian males, their mean performance of 513 score points in PISA 2000 was 18 score points on average higher than their mean reading literacy performance in PISA 2012. Significant differences by sex in reading literacy in favour of females have been found in every PISA assessment.

Table 5.6 Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012 for Australia

	Females		Males		Difference (Female – Male)	
PISA cycle	Mean score	SE	Mean score	SE	Score dif.	SE
PISA 2000	546	4.7	513	4.0	**34**	5.3
PISA 2003	545	2.6	506	2.8	**39**	3.6
PISA 2006	532	2.2	495	3.0	**37**	3.6
PISA 2009	533	2.6	496	2.9	**37**	3.1
PISA 2012	530	2.0	495	2.3	**34**	2.9

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Reading literacy performance changes across the Australian jurisdictions

When reading literacy was the major literacy domain in PISA 2009, four jurisdictions (the Australian Capital Territory, New South Wales, South Australia and Tasmania) had mean scores that had declined significantly since PISA 2000. Comparing the differences in mean scores between PISA 2000 and PISA 2012, five jurisdictions performed significantly lower in PISA 2012 than in PISA 2000 (Table 5.7). In South Australia, there was a decline of 37 score points, which equates to about half a proficiency level or around one year of schooling. In Tasmania, there was a decline of 30 score points. In the Australian Capital Territory and New South Wales, the decline was 27 and 26 score points respectively, while in the Northern Territory, the decline was 23 score points. The performance of Queensland and Victoria has remained statistically similar since PISA 2000.

Table 5.7 Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by jurisdiction

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2000 and 2012 (PISA 2012 – PISA 2000)	
Jurisdiction	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
ACT	552	4.6	549	6.0	535	5.0	531	6.0	525	3.6	**–27**	8.3
NSW	539	6.3	530	4.3	519	4.4	516	5.6	513	3.3	**–26**	9.3
VIC	516	7.6	514	5.0	504	4.3	513	4.7	517	3.5	1	10.3
QLD	521	8.6	517	8.1	509	3.5	519	7.0	508	3.4	–13	10.9
SA	537	7.7	532	4.3	514	4.9	506	4.8	500	4.0	**–37**	10.5
WA	538	8.0	546	4.3	524	6.0	522	6.3	519	3.1	–19	10.4
TAS	514	9.7	508	7.2	496	4.6	483	5.8	485	3.6	**–30**	11.9
NT	489	5.6	496	6.1	460	10.6	481	5.6	466	8.3	**–23**	11.6

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 5.8 Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by jurisdiction and sex

	Females												Males											
	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2000 and 2012 (PISA 2012 – PISA 2000)		PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2000 and 2012 (PISA 2012 – PISA 2000)	
Jurisdiction	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Score dif.	SE
ACT	565	10.1	569	12.2	549	6.1	550	9.0	550	4.8	–14	12.6	542	14.0	527	9.2	522	10.3	513	9.5	501	5.5	**–41**	16.2
NSW	555	6.9	549	4.1	542	3.9	536	5.3	533	3.7	**–21**	9.8	525	8.9	510	6.6	496	7.7	495	7.6	493	5.5	**–32**	12.0
VIC	532	13.3	530	5.9	520	5.0	531	5.7	534	3.5	1	14.9	504	6.7	499	6.8	492	5.3	495	6.1	502	5.1	–2	10.3
QLD	545	11.6	544	8.2	528	5.1	534	6.8	525	4.0	–20	13.6	498	8.6	495	8.9	491	3.9	503	8.0	491	4.3	–7	11.3
SA	551	9.3	551	8.0	531	5.9	524	4.3	517	4.5	**–33**	11.9	522	10.7	517	5.9	494	6.1	490	7.3	484	4.5	**–38**	13.0
WA	557	9.5	565	4.8	539	6.0	539	6.4	533	4.4	**–24**	12.0	523	9.6	526	5.7	511	8.2	504	8.1	507	5.3	–16	12.4
TAS	541	9.1	532	8.0	514	6.1	505	8.9	503	5.1	**–38**	12.0	491	12.1	487	10.0	477	5.6	463	7.5	468	4.8	–23	14.3
NT	505	7.1	523	9.0	478	17.3	501	8.9	482	11.4	–23	14.6	475	9.0	466	7.3	445	7.0	460	5.4	449	10.2	–26	14.8

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 5.9 Percentage of students performing below Level 2 and at Level 5 or above on reading literacy in PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences between PISA 2000 and PISA 2012, by jurisdiction

	PISA 2000				PISA 2003				PISA 2006				PISA 2009				PISA 2012				Difference between 2000 and 2012 (PISA 2012 – PISA 2000)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	8	1.3	25	2.2	8	1.5	22	3.0	10	1.5	16	1.8	13	1.4	18	2.1	13	1.4	4	6.6	**5**	1.9	**–21**	7.0
NSW	10	1.5	18	2.3	11	1.0	16	1.5	13	1.2	13	1.3	14	1.3	13	1.9	15	0.9	13	1.2	**5**	1.7	–5	2.6
VIC	14	2.4	14	3.0	13	1.5	11	1.4	15	1.2	8	1.3	14	1.5	12	1.1	12	0.9	11	1.2	–2	2.5	–3	3.2
QLD	14	2.0	16	2.4	15	2.1	13	2.0	14	1.0	10	1.0	14	1.5	14	2.3	15	1.1	11	1.1	1	2.2	–5	2.7
SA	10	1.5	19	3.6	10	1.0	15	2.3	12	1.4	10	1.3	15	1.7	10	1.1	16	1.6	8	1.0	**6**	2.2	**–11**	3.7
WA	11	2.0	21	2.6	8	1.0	20	1.6	10	1.7	12	1.5	13	1.6	14	1.7	12	1.0	13	1.1	1	2.3	**–9**	2.8
TAS	17	2.6	15	2.8	16	2.0	10	1.8	19	2.0	8	1.0	23	2.0	7	1.3	21	1.6	7	1.2	4	3.1	**–9**	3.0
NT	22	2.5	10	1.9	19	2.1	10	2.2	29	2.3	7	1.4	24	2.2	9	1.3	28	2.9	7	2.3	6	3.8	–4	3.0

Notes: Values that are statistically significant are indicated in bold.
The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 5.8 (page 200) shows the mean reading literacy scores from PISA 2000 to PISA 2012, as well as the mean difference in performance between PISA 2000 and PISA 2012 for females and males by jurisdiction. For females, there was a significant decline in reading literacy performance between PISA 2000 and PISA 2012 in four jurisdictions. In Tasmania, reading literacy performance declined by 38 points, in South Australia by 33 score points, in Western Australia by 24 score points and in New South Wales by 21 score points, between PISA 2000 and PISA 2012. For males, there was a significant decline in reading literacy performance in the Australian Capital Territory (by 41 score points), in South Australia (by 38 score points) and in New South Wales (by 32 score points) between PISA 2000 and PISA 2012.

Table 5.9 (page 200) provides further details about the low and top performers between PISA 2000 and PISA 2012. There was a significant decline in the proportion of top performers in four jurisdictions. In PISA 2012, there was a reduction of 21% in the proportion of the top perfomers in the Australian Capital Territory, 11% in South Australia, and 9% in Western Australia and Tasmania, than in PISA 2000.

Between PISA 2000 and PISA 2012, the proportion of low performers significantly increased in the Australian Capital Territory (5%), New South Wales (5%) and South Australia (6%).

Reading literacy performance changes for Indigenous students

The reading literacy performance for Indigenous students declined significantly from a mean score of 448 score points in PISA 2000 to a mean score of 428 points in PISA 2012. This mean-score difference of 20 points represents about one-third of a proficiency level or around half a school year. Reading literacy performance also declined significantly for non-Indigenous students between PISA 2000 and PISA 2012 by a similar 16 score points (Table 5.10).

Table 5.10 Mean reading literacy scores for PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by Indigenous background

	PISA 2000		PISA 2003		PISA 2006		PISA 2009		PISA 2012		Difference between 2000 and 2012 (PISA 2012 – PISA 2000)	
Indigenous background	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Mean score	SE	Score dif.	SE
Indigenous	448	5.8	444	8.6	434	6.9	436	6.3	428	4.4	**–20**	9.4
Non-Indigenous	531	3.4	527	2.0	515	2.1	518	2.2	515	1.6	**–16**	7.0

Note: Values that are statistically significant are indicated in bold.

At the lower end of the proficiency scale, there were no significant differences between the proportion of Indigenous or non-Indigenous students who performed below Level 2 between PISA 2000 and PISA 2012. At the higher end of the proficiency scale, there were no significant differences between the proportion of Indigenous students who performed at Level 5 or above between PISA 2000 and PISA 2012 (Table 5.11, page 202). For non-Indigenous students, there was a significant decrease (of 5%) in the proportion of students who performed at Level 5 or above, from 17% in PISA 2000 to 12% in PISA 2012.

Table 5.11 Percentage of students performing below Level 2 and at Level 5 or above on reading literacy in PISA 2000, PISA 2003, PISA 2006, PISA 2009 and PISA 2012, and differences in performance between PISA 2000 and PISA 2012, by Indigenous background

Indigenous background	PISA 2000				PISA 2003				PISA 2006				PISA 2009				PISA 2012				Difference between 2000 and 2012 (PISA 2012 – PISA 2000)			
	Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above		Below Level 2		Level 5 or above	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Indigenous	33	3.4	4	1.3	38	5.2	4	1.1	38	3.1	3	0.9	39	2.6	2	0.6	39	1.9	2	0.5	6	3.9	–2	1.4
Non-Indigenous	12	0.9	17	1.2	11	0.5	15	0.7	13	0.6	11	0.6	13	0.5	13	0.8	13	0.4	12	0.6	1	1.0	**–5**	1.3

Notes: Values that are statistically significant are indicated in bold.

The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

CHAPTER 6

Australian students' performance in computer-based mathematical literacy and digital reading literacy

Key findings: Computer-based mathematical literacy

- Australia achieved an average score of 508 points in the PISA 2012 computer-based mathematical literacy assessment, which was significantly higher than the OECD average of 497 score points.
- Australia was significantly outperformed by nine countries: Singapore, Shanghai–China, Korea, Hong Kong–China, Macao–China, Japan, Chinese Taipei, Canada and Estonia. Australia's performance was not significantly different from four countries: Belgium, Germany, France and Austria. All other countries performed at a level significantly lower than Australia.
- Thirteen per cent of Australian students were top performers (reaching proficiency Level 5 or above), a similar proportion to students across OECD countries (12%).
- Seventeen per cent of Australian students were low performers (failing to reach Level 2, the international baseline proficiency level) compared to 20% of students across the OECD.
- In almost all countries, differences between the sexes were found to be in favour of males. In Australia, males performed significantly higher than females by 9 score points.
- In Australia, 15% of male students and 11% of female students were top performers compared to 13% of male students and 9% of female students across the OECD.
- In Australia, 16% of males and 17% of females were low performers compared to 19% of males and 21% of females across the OECD.
- Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland performed at a level not significantly different from one another. Western Australia, the Australian Capital Territory and Victoria performed significantly higher than South Australia, Tasmania and the Northern Territory. New South Wales and Queensland performed at a level not significantly different from South Australia, and performed significantly higher than Tasmania and the Northern Territory. Tasmania and the Northern Territory performed significantly lower than the other jurisdictions, but were not significantly different from one another.
- Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland performed significantly higher than the OECD average. South Australia

achieved at a level not significantly different to the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.

» Males achieved significantly higher than females in Western Australia, Victoria, South Australia and Queensland.

Key findings: Digital reading literacy

» Australia achieved an average score of 521 points in the digital reading literacy assessment, which was significantly higher than the OECD average of 497 score points.

» Australia was significantly outperformed by six countries: Singapore, Korea, Hong Kong–China, Japan, Canada and Shanghai–China. Australia's performance was not significantly different from four countries: Estonia, Ireland, Chinese Taipei and the United States. All other countries performed at a level significantly lower than Australia.

» Thirteen per cent of Australian students were top performers, which was a higher proportion than the OECD average (8%).

» Thirteen per cent of Australian students were low performers compared to 17% of students across the OECD.

» Differences between the sexes were found to be significantly in favour of females in all countries, except two. In Australia, females performed significantly higher than males by 30 score points.

» In Australia, 17% of females and 11% of males were top performers compared to 9% of females and 7% of males across the OECD.

» In Australia, 8% of females and 17% of males were low performers compared to 13% of females and 22% of males across the OECD.

» The mean scores for the Australian Capital Territory, Western Australia, New South Wales and Victoria were not significantly different from one another. The Australian Capital Territory, Western Australia and New South Wales outperformed Queensland, South Australia, Tasmania and the Northern Territory. Victoria outperformed South Australia, Tasmania and the Northern Territory, while South Australia and Queensland outperformed the Northern Territory and Tasmania.

» The Australian Capital Territory, Western Australia, New South Wales, Victoria, Queensland and South Australia achieved significantly higher than the OECD average. The Northern Territory achieved at a level equal to the OECD average, while Tasmania achieved significantly lower than the OECD average.

» Females from the Australian Capital Territory, New South Wales, Queensland, Victoria, Tasmania and South Australia achieved significantly higher than males.

In PISA 2012, all countries were assessed on mathematical, scientific and reading literacy through a paper-and-pen assessment. Thirty-two countries undertook an additional computer-based assessment of mathematical literacy, digital reading literacy and problem solving.[1] The first half of this chapter describes students' performance on the computer-based mathematical literacy assessment, while the second half of this chapter describes students' performance on the digital reading literacy assessment. Results are reported at an international level, comparing the performance of Australian students with other participating countries on the computer-based assessment, and at a national level, comparing the performance of students across the Australian jurisdictions.

1 The results of the computer-based problem-solving assessment will be released in a separate report in 2014.

Computer-based assessments in PISA

The PISA mathematical and reading literacy assessment framework identifies the importance of using real-life contexts to assess students' skills and knowledge. Since PISA 2006, the OECD has offered computer-based assessments to participating countries as an international option.

Digital texts (including emails, manuals and e-publications) and digital equipment, such as software (including spreadsheets) and tools (including calculators and currency converters), are increasingly available in today's schools, homes and workplaces. Computers have become an essential tool in today's society.

Computer-based items are innovative and dynamic in nature, allowing for a higher degree of student interaction and engagement with the stimulus material and items compared to the static nature of paper-based items.

Participating countries

In PISA 2012, 32 of the 65 countries participated in the computer-based assessment of mathematical literacy and digital reading literacy. Participating countries included 23 OECD countries (Australia, Austria, Belgium, Canada, Chile, Denmark, Estonia, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Korea, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden and the United States) and nine partner countries (Brazil, Chinese Taipei, Colombia, Hong Kong–China, Macao–China, the Russian Federation, Shanghai–China, Singapore and the United Arab Emirates).

Structure of the computer-based assessment

The PISA 2012 computer-based assessment consisted of 41 mathematical literacy, digital reading literacy and problem-solving items. The computer-based items were specifically designed to take advantage of the digital environment. The assessment was composed of two 20-minute forms selected from a rotated design of mathematical literacy, digital reading literacy and problem-solving item clusters. Prior to the assessment, students undertook a 20-minute practice tutorial to familiarise themselves with the test environment; e.g., they were shown how to respond to items and how to access the help function.

How are computer-based mathematical literacy and digital reading literacy reported in PISA?

Computer-based mathematical literacy uses the same scale as the paper-based mathematical literacy (as described in Chapter 2) to report students' performance and students' proficiencies in mathematical literacy. Likewise, the reporting of digital reading literacy is based on the paper-based reading literacy scale (as described in Chapter 5).[2]

Australia's computer-based mathematical literacy performance from an international perspective

Computer-based mathematical literacy performance across countries

Australian students achieved an average score of 508 points on the computer-based mathematical literacy scale, which was significantly higher than the OECD average of 497 score points. Australia was one of 14 countries (9 OECD and 5 partner countries) that achieved a mean score which was significantly

2 For further details on the computer-based assessment, please refer to the *PISA 2012 Technical Report* (OECD, forthcoming).

higher than the OECD average. These countries were: Singapore, Shanghai–China, Korea, Hong Kong–China, Macao–China, Japan, Chinese Taipei, Canada, Estonia, Belgium, Germany, France, Australia and Austria. Six countries (Italy, the United States, Norway, the Slovak Republic, Denmark and Ireland) performed at an equal level to the OECD average, while all other countries performed significantly lower than the OECD average.

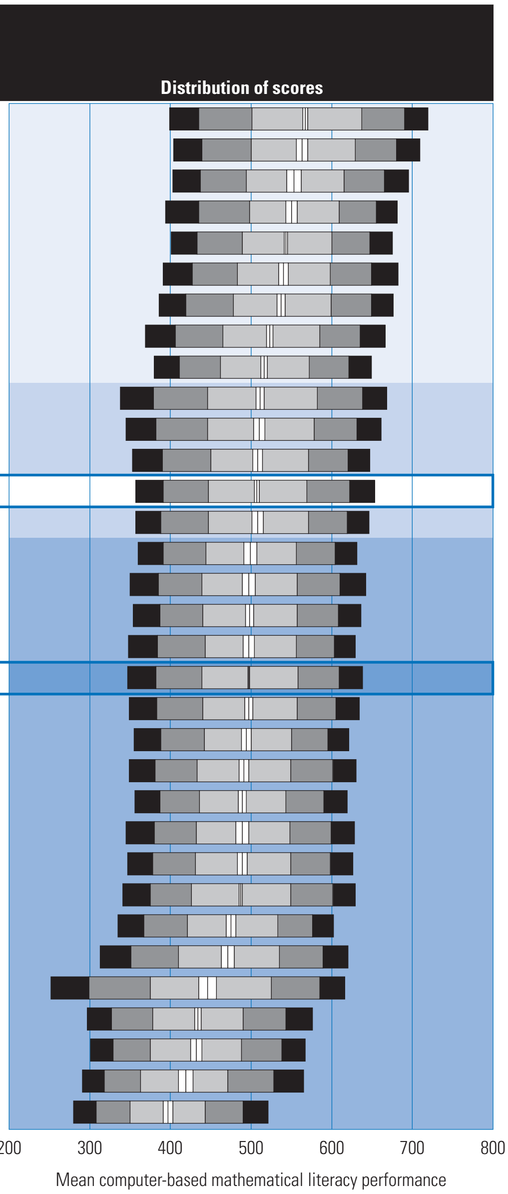
Figure 6.1 provides the mean computer-based mathematical literacy scores along with the standard errors, confidence intervals around the mean and the difference between the 5th and 95th percentiles. Countries are shown in order from the highest to the lowest mean score and the colour bands indicate whether a particular country has performed at a level significantly higher or lower than Australia, or whether their performance was not significantly different to Australia's performance.

Singapore achieved the highest score (566 points), which was not significantly different from Shanghai–China's score (562 points). Other countries that achieved high scores were Korea, Hong Kong–China, Macao–China, Japan and Chinese Taipei. The high-performing countries in this assessment were also high-performing countries in paper-based mathematical literacy assessment.

Nine countries (Singapore, Shanghai–China, Korea, Hong Kong–China, Macao–China, Japan, Chinese Taipei, Canada and Estonia) performed significantly higher than Australia. Belgium, Germany, France and Austria performed at a level not significantly different to Australia, while all other countries performed at a level significantly lower than Australia.

The average range of computer-based mathematical literacy scores between students in the 5th and 95th percentiles across OECD countries was 291 points. Across countries, there was considerable variation between students in the 5th and 95th percentiles. The widest spread of scores was found in Israel (365 points) and Belgium (329 points), while the narrowest spread of scores was found in Colombia (241 points) and the Russian Federation, Ireland and Chile (around 260 points). In Australia, there were 297 score points between the lowest and highest achieving students.

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Singapore	566	1.3	563–569	319
	Shanghai–China	562	3.4	556–569	304
	Korea	553	4.5	544–561	292
	Hong Kong–China	550	3.4	543–556	286
	Macao–China	543	1.1	541–545	274
	Japan	539	3.3	533–546	291
	Chinese Taipei	537	2.8	532–543	290
	Canada	523	2.2	518–527	297
	Estonia	516	2.2	512–520	270
Not significantly different from Australia	Belgium	511	2.4	507–516	329
	Germany	509	3.3	503–516	315
	France	508	3.3	502–514	294
	Australia	**508**	**1.6**	**504–511**	**297**
	Austria	507	3.5	500–514	289
Significantly lower than Australia	Italy	499	4.2	491–507	272
	United States	498	4.1	490–506	292
	Norway	498	2.8	492–503	283
	Slovak Republic	497	3.5	490–504	282
	OECD average	**497**	**0.7**	**496–498**	**291**
	Denmark	496	2.7	491–501	284
	Ireland	493	2.9	487–499	264
	Sweden	490	2.9	484–496	281
	Russian Federation	489	2.6	484–494	263
	Poland	489	4.0	481–497	283
	Portugal	489	3.1	483–495	279
	Slovenia	487	1.2	485–489	288
	Spain	475	3.2	469–481	269
	Hungary	470	3.9	462–477	306
	Israel	447	5.6	436–458	365
	United Arab Emirates	434	2.2	430–438	278
	Chile	432	3.3	425–439	266
	Brazil	421	4.7	412–430	276
	Colombia	397	3.2	391–403	241



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

Figure 6.1 Mean scores and distribution of students' performance on the computer-based mathematical literacy scale, by country

Across OECD countries, students found it relatively easier to deal with the computer-based mathematical literacy than paper-based mathematical literacy.[3] The OECD average for computer-based mathematical literacy was 497 score points, which is significantly higher than the OECD average for mathematical literacy of 494 score points. For Australia, the mean score on computer-based mathematical literacy was not significantly different to the mean score on mathematical literacy. For a number of countries, students favoured one of the delivery modes more than the other. In Shanghai–China, students favoured the paper-based mathematical literacy assessment, scoring 51 points higher on mathematical literacy than on computer-based mathematical literacy. Other countries that scored higher on mathematical literacy than computer-based mathematical literacy were Poland (29 score point difference), Chinese Taipei (23 score point difference), Israel (19 score point difference), Slovenia (14 score point difference) and Hong Kong–China (11 score point difference).

On the other hand, there were a number of countries that favoured the computer-based mathematics assessment, scoring higher than mathematical literacy. The countries showing the largest differences were: Brazil (29 score points); Colombia (20 score points); the United States (17 score points); the Slovak Republic (15 score points); Italy (14 score points); France (13 score points); and Sweden (12 score points).

3 In this chapter, the distinction is made between paper-based mathematical literacy (referred to as mathematical literacy, as was described in Chapter 2) and computer-based mathematical literacy.

Students' proficiencies in computer-based mathematics across countries

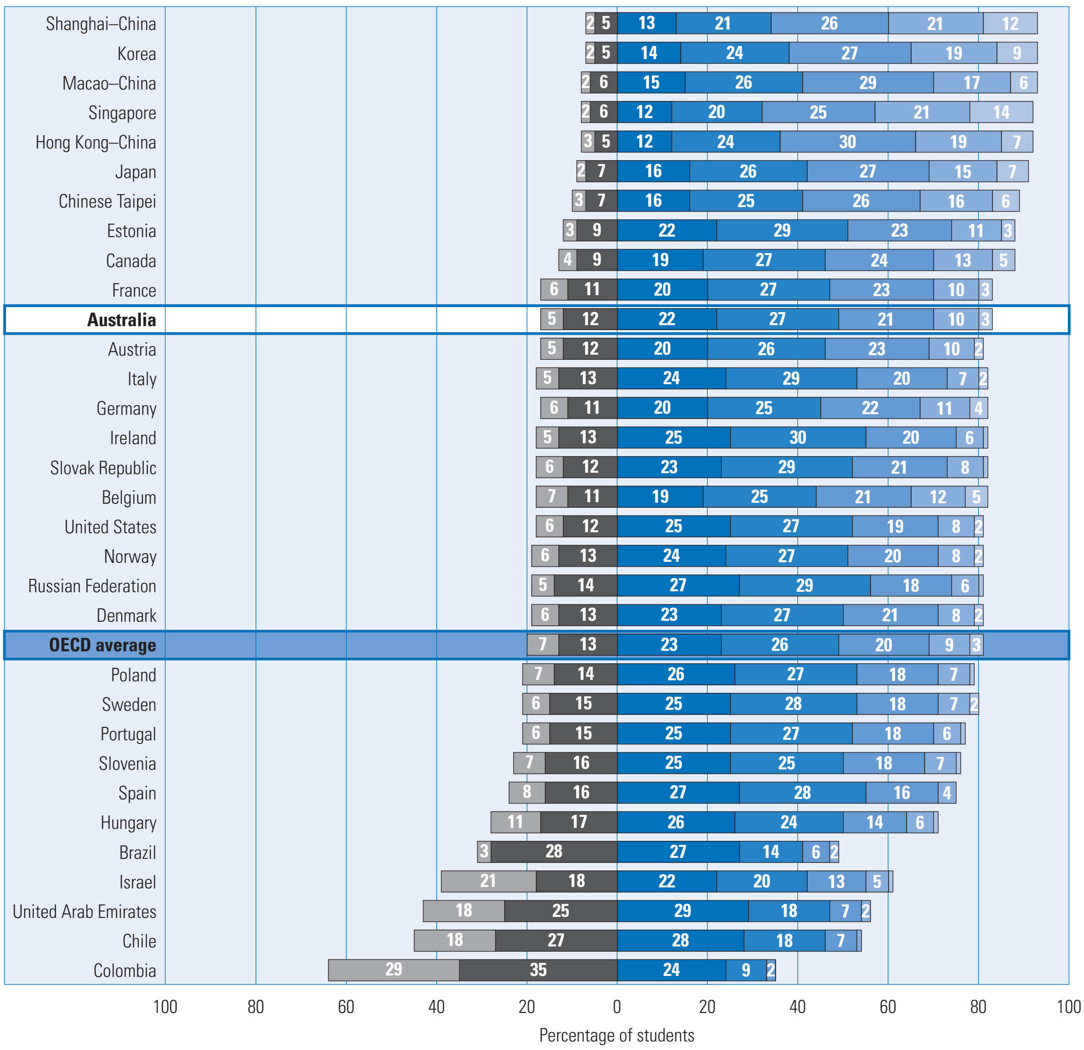
Figure 6.2 shows the mean proportion of students at each level of computer-based mathematical literacy from below Level 1 to Level 6 by country. Countries have been ordered by the percentage of students classified as below Level 2, the international minimum proficiency standard. Countries with the lowest proportion of students below Level 2 have been placed at the top of the figure and countries with the highest proportion of students below Level 2 have been placed at the bottom.

Thirty-five per cent of students in Singapore and 33% of students in Shanghai–China performed at Level 5 or 6. In other high-performing countries (Korea, Hong Kong–China, Macao–China, Japan and Chinese Taipei), the proportion of students ranged from 22 to 28%. In Australia, 13% of students—a similar proportion to the OECD average (12%)—performed at Level 5 or 6.

In Australia, Level 3 has been defined as the baseline proficiency standard for the three core PISA domains. For the purposes of this report, Level 3 is assumed to be the baseline standard for the computer-based assessments.

Almost 40% of Australian students were placed below Level 3, which was lower than the OECD average of 43%. For the high-performing countries, around one-fifth of students did not reach Level 3.

On average, one-fifth of students across OECD countries did not attain Level 2, the international minimum proficiency standard for mathematical literacy. For the high-performing countries, fewer than 7% of students were placed below Level 2; while for low-performing countries, such as Chile and the United Arab Emirates, the proportion of students below Level 2 was close to half. In Australia, 17% of students failed to reach Level 2.



Note: In cases in which 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 6.2 Percentage of students across the computer-based mathematical literacy proficiency scale, by country

Computer-based mathematical literacy performance by sex across countries

Significant differences between the sexes were found in all but five of the countries, in favour of males, and in one country (the United Arab Emirates) in favour of females.

On average across OECD countries, males performed significantly higher than females in computer-based mathematical literacy by 12 score points. The largest differences by sex were found in Brazil and Austria, with differences of 22 and 21 score points respectively. Among the highest performing countries, males in Shanghai–China, Korea and Hong Kong–China performed significantly higher than females by around 18 score points. In Australia, males achieved a mean score of 512 points, which was significantly higher than the mean score of 503 points for females (Figure 6.3).

	Females		Males	
Country	Mean score	SE	Mean score	SE
United Arab Emirates	440	2.6	428	3.6
United States	498	4.2	498	4.4
Singapore	566	1.6	566	1.8
Slovenia	486	1.8	488	1.9
Israel	445	4.3	448	9.2
Norway	496	3.1	499	3.1
Belgium	507	2.8	516	2.8
Estonia	512	2.5	521	2.6
Australia	**503**	**2.1**	**512**	**2.2**
Germany	504	3.5	514	3.7
Poland	484	4.2	495	4.4
Slovak Republic	491	4.0	503	4.0
Hungary	464	4.1	476	4.5
Colombia	391	3.6	403	3.5
Spain	469	3.4	481	3.4
OECD average	**491**	**0.7**	**503**	**0.9**
Macao–China	536	1.7	549	1.3
Sweden	483	3.0	497	3.4
Russian Federation	482	2.9	496	3.0
Japan	531	3.0	546	4.4
France	501	3.5	516	3.7
Chinese Taipei	530	4.1	545	4.6
Hong Kong–China	540	3.5	558	4.4
Canada	514	2.3	532	2.5
Korea	543	5.2	561	6.0
Shanghai–China	553	3.3	572	4.1
Italy	489	4.9	507	4.6
Ireland	484	3.0	502	3.9
Chile	423	3.7	442	3.9
Denmark	486	2.8	506	3.2
Portugal	479	3.1	499	3.5
Austria	497	3.7	518	4.7
Brazil	410	4.7	432	5.0

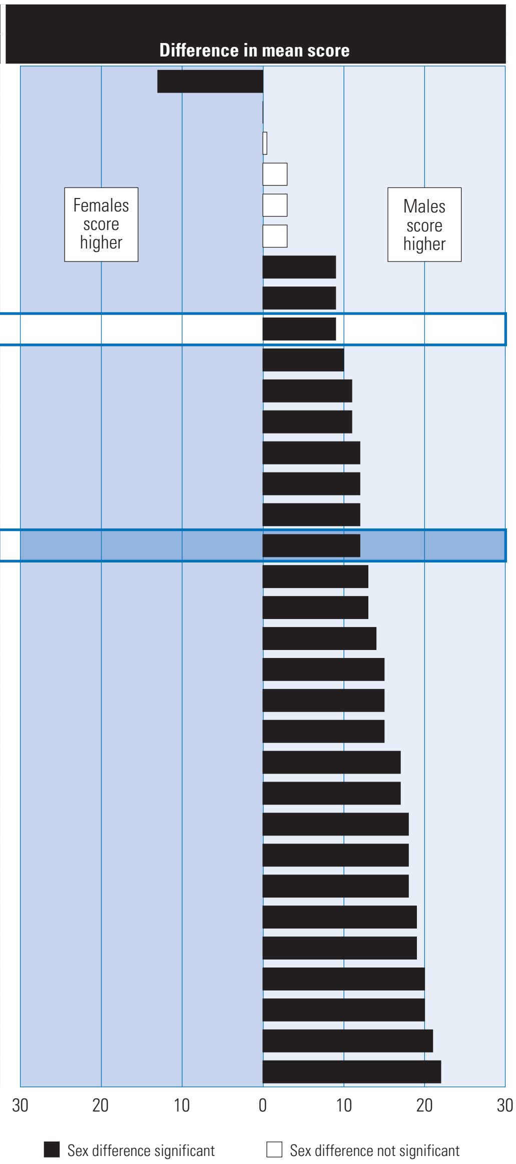


Figure 6.3 Mean scores and differences between the sexes in students' performance on the computer-based mathematical literacy scale, by country

Figure 6.4 provides the proportions of females and males on the computer-based mathematical literacy proficiency scale for Australia and the OECD average. In Australia, there were slightly more males than females (15 and 11% respectively) who were top performers compared to the 13% of males and 9% of females who achieved Level 5 or above across the OECD.

The proportions of Australian males and females who did not reach Level 2 were smaller than the OECD average—16% of Australian males compared to 19% across OECD countries, and 17% of Australian females compared to 21% across OECD countries.

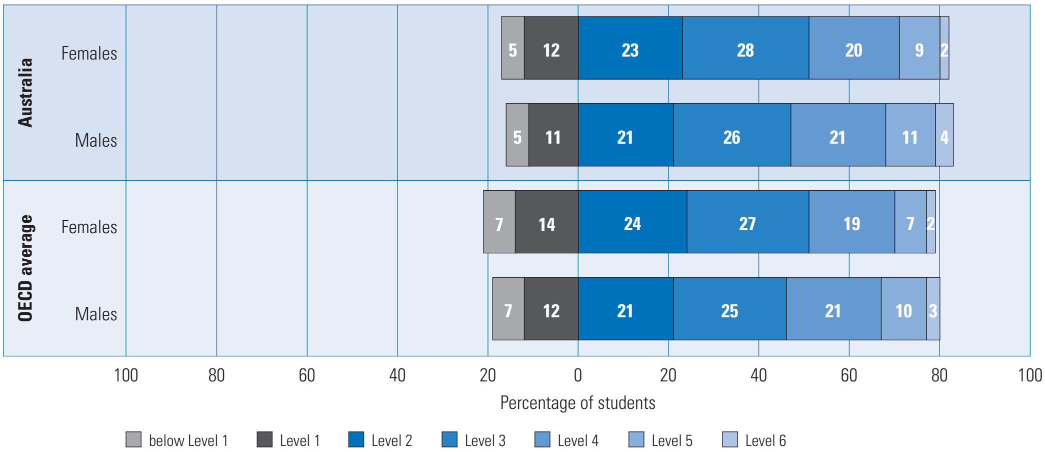


Figure 6.4 Percentage of students across the computer-based mathematical literacy proficiency scale by sex, for Australia and the OECD average

Australia's computer-based mathematical literacy performance in a national context

Computer-based mathematical literacy performance across the Australian jurisdictions

Figure 6.5 and Table 6.1 show the computer-based mathematical literacy performance for students in each of the Australian jurisdictions. Figure 6.5 shows the mean scores and distribution of computer-based mathematical literacy scores for each jurisdiction. The mean score and distribution for Australia, the highest performing country (Singapore) and the OECD average have also been included for comparison. Table 6.1 provides a multiple-comparison table that provides further details about the performance of each jurisdiction compared to the other jurisdictions.

Five jurisdictions (Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland) performed at a significantly higher level than the OECD average. South Australia performed on par with the OECD average, while Tasmania and the Northern Territory performed significantly lower than the OECD average.

Western Australia, the Australian Capital Territory, Victoria, New South Wales and Queensland performed at a similar level to one another. Western Australia, the Australian Capital Territory and Victoria performed significantly higher than South Australia, Tasmania and the Northern Territory. New South Wales and Queensland performed at an equal level to South Australia, and performed significantly higher than Tasmania and the Northern Territory. On average, Tasmania and the Northern Territory performed significantly lower than the other jurisdictions, but were not statistically different from one another.

The Northern Territory had the widest spread of scores (346 score points) between students at the 5th and 95th percentiles, while Victoria had the narrowest spread of scores (277 score points).

Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
ACT	512	3.2	506–518	309
NSW	508	3.6	500–515	312
VIC	512	4.0	504–520	277
QLD	506	3.3	500–513	289
SA	498	4.4	490–507	292
WA	515	4.6	506–524	305
TAS	479	3.4	473–486	320
NT	470	8.3	454–486	346
Australia	**508**	**1.6**	**504–511**	**297**
Singapore	566	1.3	563–569	319
OECD average	**497**	**0.7**	**496–498**	**291**

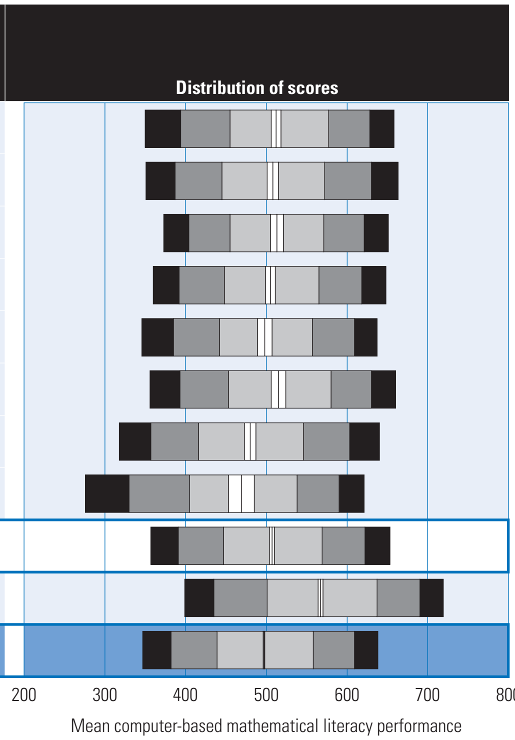


Figure 6.5 Mean scores and distribution of students' performance on the computer-based mathematical literacy scale, by jurisdiction

Table 6.1 Multiple comparisons of mean computer-based mathematical literacy performance, by jurisdiction

Jurisdiction	Mean score	SE	WA	ACT	VIC	NSW	QLD	SA	TAS	NT	OECD average
WA	515	4.6		●	●	●	●	▲	▲	▲	▲
ACT	512	3.2	●		●	●	●	▲	▲	▲	▲
VIC	512	4.0	●	●		●	●	▲	▲	▲	▲
NSW	508	3.6	●	●	●		●	●	▲	▲	▲
QLD	506	3.3	●	●	●	●		●	▲	▲	▲
SA	498	4.4	▼	▼	▼	●	●		▲	▲	●
TAS	479	3.4	▼	▼	▼	▼	▼	▼		●	▼
NT	470	8.3	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**497**	**0.7**	▼	▼	▼	▼	▼	●	▲	▲	

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

Figure 6.6 shows the proportion of students at each of the computer-based mathematical literacy proficiency levels in each jurisdiction, along with the percentages for Australia overall, Singapore and the OECD average.

Around 15% of students in Western Australia, the Australian Capital Territory and New South Wales were top performers, reaching Level 5 or 6. Nine per cent of students in Tasmania and 6% of students in the Northern Territory achieved Level 5 or 6, which was lower than the OECD average (12%).

Almost 30% of students in the Northern Territory and 26% of students in Tasmania failed to reach Level 2, which was higher than the OECD average (20%). In other jurisdictions, the percentage of students who were placed below Level 2 ranged from 14% in Victoria to 18% in New South Wales and South Australia.

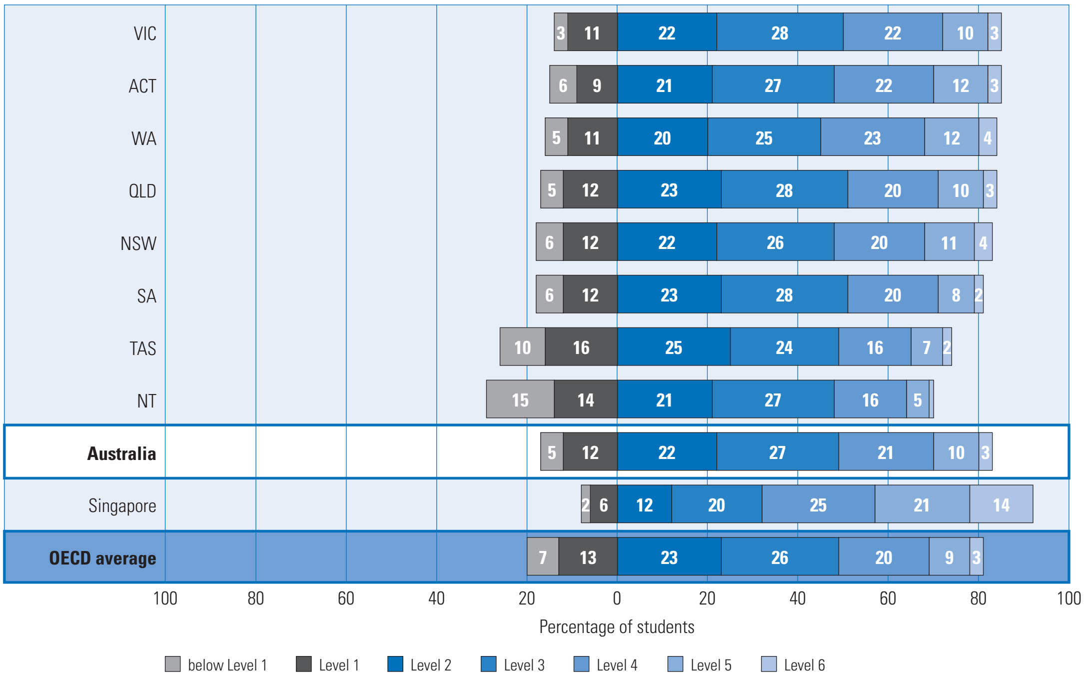


Figure 6.6 Percentage of students across the computer-based mathematical literacy proficiency scale, by jurisdiction

Computer-based mathematical literacy performance by sex across the Australian jurisdictions

The mean computer-based scores for females and males are shown in Figure 6.7, with the associated standard errors and the differences in mean scores. There were significant differences between the sexes in favour of males seen in four jurisdictions: in Western Australia, there was a 21 score point difference; in Victoria, a 15 score point difference; in South Australia, an 11 score point difference; and in Queensland, a 9 score point difference.

Greater proportions of males than females were top performers in all of the jurisdictions (Figure 6.8). In Western Australia 19% of males and in the Australian Capital Territory and New South Wales 16% of males reached Level 5 or 6; higher than the OECD average of 13% of males. The proportions of males

Jurisdiction	Females		Males	
	Mean score	SE	Mean score	SE
WA	504	5.9	525	6.4
VIC	504	3.6	519	5.5
NT	463	13.0	477	8.0
SA	493	4.9	504	4.9
QLD	502	4.0	511	3.8
TAS	476	4.9	482	4.6
NSW	508	4.3	507	5.2
ACT	515	4.2	510	5.0

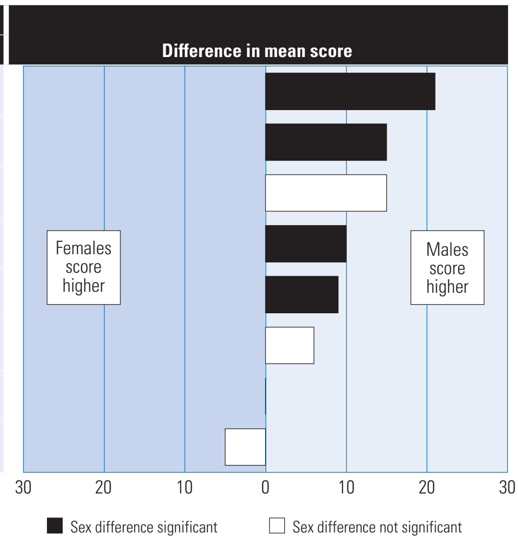


Figure 6.7 Mean scores and differences in students' performance on the computer-based mathematical literacy scale, by jurisdiction and sex

in other jurisdictions who were top performers ranged from 8% in the Northern Territory to 15% in Victoria. There were higher proportions of females in the Australian Capital Territory and New South Wales (14%) who were top performers, followed by 13% of females in Western Australia and 11% in Victoria and Queensland. In South Australia, 9% of females achieved Level 5 or 6 (the same proportion for females across the OECD); while for females in Tasmania (8%) and the Northern Territory (5%), the proportions were lower than for females across the OECD.

Across the OECD, 19% of males failed to reach Level 2, which was lower than the proportions of males in Tasmania (26%) and in the Northern Territory (27%), and similar to the proportion of males in New South Wales (19%). The proportions of males in other jurisdictions who did not achieve Level 2 ranged from 13% in Victoria to 17% in the Australian Capital Territory and South Australia.

Around 30% of females in the Northern Territory and Tasmania did not reach Level 2, compared to the OECD average of 21%. The proportions of females from other jurisdictions who were low performers were smaller: 19% in South Australia and Western Australia; 17% in Queensland; 16% in New South Wales and Victoria; and 13% in the Australian Capital Territory.

Interestingly, there were slightly more males than females in the Australian Capital Territory and New South Wales who failed to reach Level 2; whereas in all the other jurisdictions, the proportion of males not reaching Level 2 was lower than females not reaching Level 2.

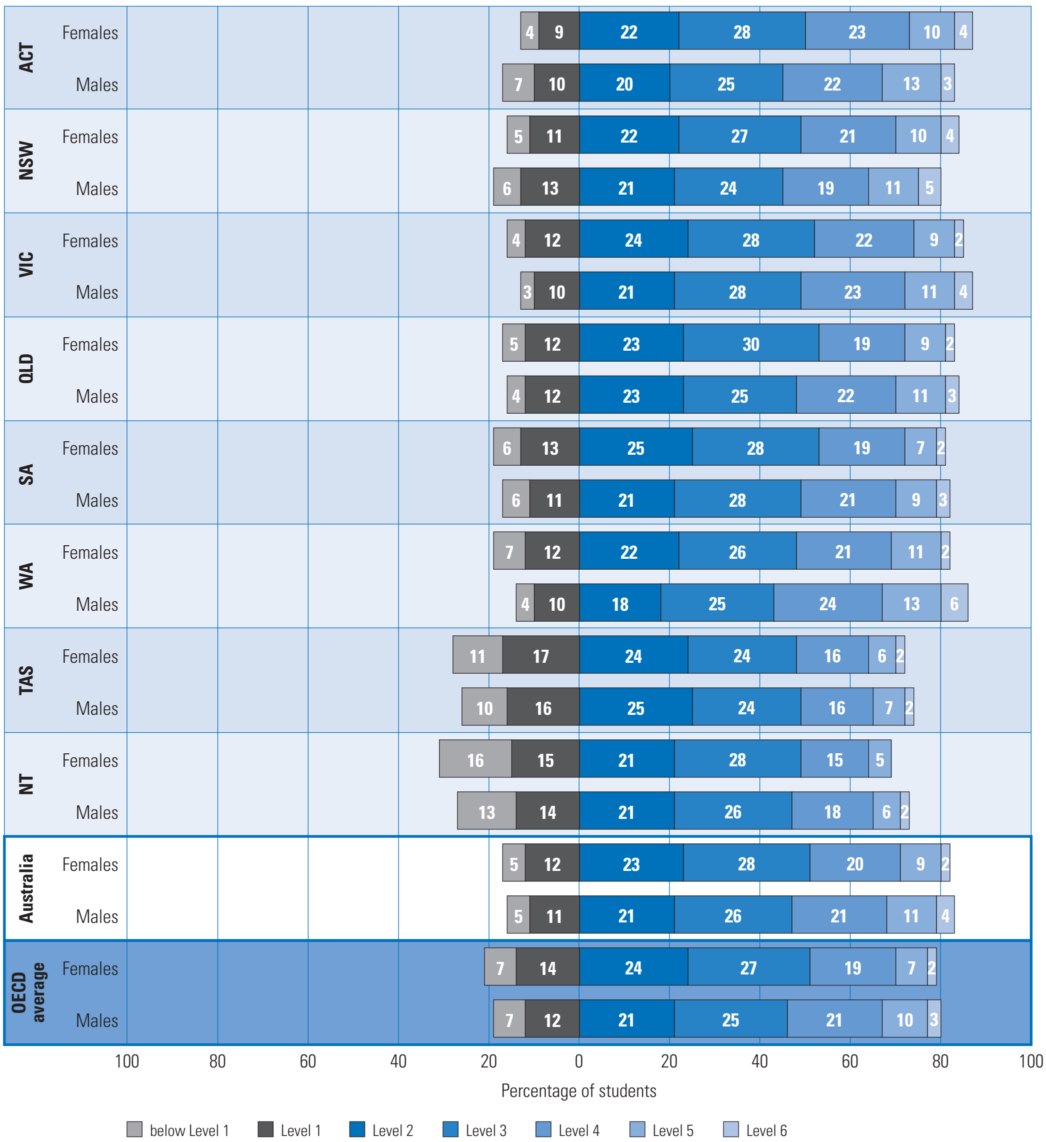


Figure 6.8 Percentage of students across the computer-based mathematical literacy proficiency scale, by jurisdiction and sex

Australia's digital reading literacy performance from an international perspective

Digital reading literacy performance across countries

Figure 6.9 shows the mean digital reading literacy scores, along with the standard errors, confidence intervals around the mean, the differences between the 5th and 95th percentiles, and the distribution of students' performance for participating countries.

Australian students achieved an average score of 521 points on the digital reading literacy scale, which was significantly higher than the OECD average of 497 score points. Fourteen countries—nine OECD countries (Korea, Japan, Canada, Estonia, Australia, Ireland, the United States, France and Belgium) and five partner countries (Singapore, Hong Kong–China, Shanghai–China, Chinese Taipei and Macao–China)—achieved a mean score that was significantly higher than the OECD average. There were five countries (Italy, Norway, Sweden, Denmark and Germany) that performed on par with the OECD average and 13 countries that performed significantly lower than the OECD average.

The highest performing country on the digital reading literacy assessment was Singapore, achieving a mean score of 567 points, followed by Korea and Hong Kong–China, which performed at a statistically similar level with 555 and 550 score points on average respectively. The high-performing countries in the digital reading literacy assessment were also high-performing countries in reading literacy.

Six countries (Singapore, Korea, Hong Kong–China, Japan, Canada and Shanghai–China) performed significantly higher than Australia, while four countries (Estonia, Ireland, Chinese Taipei and the United States) performed at a level not significantly different to Australia. All other countries performed at a level significantly lower than Australia.

The distribution of scores between the highest and lowest performing students in digital reading literacy varied, ranging from 232 score points in Macao–China to 377 score points in Israel. Among the highest performing countries, the narrowest distributions between the 5th and 95th percentiles were found in Japan (255 score points) and Korea (257 score points). Singapore (296 score points) and Hong Kong–China (309 score points) were high-performing countries with wide distributions between the low performers and high performers. There were 317 score points between the high performers and low performers in Australia.

On average across the OECD, students performed at an equal level on digital reading literacy and reading literacy.[4] Australia's mean score for digital reading literacy was significantly higher than Australia's mean score for reading literacy by 9 score points. Canada, Chile, the Slovak Republic, the United States, Italy, Sweden, Korea and Singapore also achieved higher mean scores on digital reading literacy than on reading literacy. The difference between the mean digital reading literacy and reading literacy scores ranged from 9 score points in Canada to 25 score points in Singapore.

There were a number of countries that favoured the reading literacy assessment, scoring significantly higher on the paper-based assessment than on the digital reading literacy assessment. These countries were Germany, Spain, Israel, the United Arab Emirates, Hungary, Shanghai–China and Poland—scoring between 14 and 41 score points higher on reading literacy than on digital reading literacy.

4 In this chapter, the distinction is made between paper-based reading literacy (referred to as reading literacy, as described in Chapter 5) and digital reading literacy.

	Country	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
Significantly higher than Australia	Singapore	567	1.2	565–569	296
	Korea	555	3.6	548–562	257
	Hong Kong–China	550	3.6	543–557	309
	Japan	545	3.3	538–551	255
	Canada	532	2.3	528–537	287
	Shanghai–China	531	3.7	524–539	277
Not significantly different from Australia	Estonia	523	2.8	517–528	302
	Australia	**521**	**1.7**	**517–524**	**317**
	Ireland	520	3.0	514–526	272
	Chinese Taipei	519	3.0	514–525	290
	Macao–China	515	0.9	513–517	232
	United States	511	4.5	502–520	292
Significantly lower than Australia	France	511	3.6	504–518	315
	Italy	504	4.3	496–513	310
	Belgium	502	2.5	497–507	327
	Norway	500	3.5	493–507	325
	Sweden	498	3.4	492–505	315
	OECD average	**497**	**0.7**	**495–498**	**307**
	Denmark	495	2.9	489–500	270
	Germany	494	4.0	486–501	321
	Portugal	486	4.4	477–494	288
	Austria	480	3.9	472–488	313
	Poland	477	4.5	468–486	317
	Slovak Republic	474	3.5	467–481	312
	Slovenia	471	1.3	469–474	323
	Spain	466	3.9	459–474	320
	Russian Federation	466	3.9	458–473	283
	Israel	461	5.1	451–471	377
	Chile	452	3.6	445–459	269
	Hungary	450	4.4	442–459	370
	Brazil	436	4.9	426–445	302
	United Arab Emirates	407	3.3	400–413	366
	Colombia	396	4.0	388–404	298

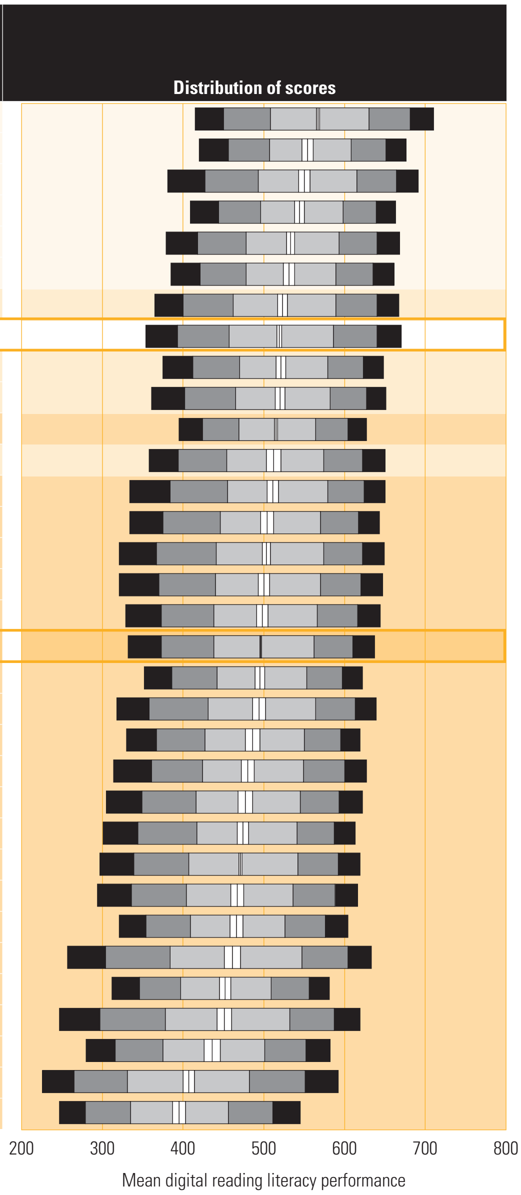


Figure 6.9 Mean scores and distribution of students' performance on the digital reading literacy scale, by country

Students' proficiencies in digital reading literacy across countries

The proportion of students at each digital reading literacy level from below Level 1b to Level 6 by country is shown in Figure 6.10. In the highest performing countries, the proportion of students who reached Level 5 or 6 was more than twice that of the OECD average (8%). Over one-quarter (27%) of students in Singapore and around one-fifth of students in Korea and Hong Kong–China attained these levels. Fourteen per cent of students in Japan and Canada were placed at Level 5 or 6, while 13% of students in Australia and 12% of students in Shanghai–China reached these proficiency levels.

Thirty-three per cent of Australian students were placed below Level 3, which was lower than the 39% of students across the OECD. For the high-performing countries, around 17% of students in Korea and Singapore and around 20% of students in Japan and Hong Kong–China had not reached Level 3, while 25% of students in Canada and Shanghai–China failed to reach Level 3.

On average, 17% of students across OECD countries did not reach Level 2. Four per cent of students in Korea, 5% of students in Japan and Singapore, 7% of students in Macao–China and Shanghai–China, and 8% of students in Hong Kong–China and Canada did not reach Level 2. For the low-performing countries, half of the students in the United Arab Emirates and more than half of the students (55%) in

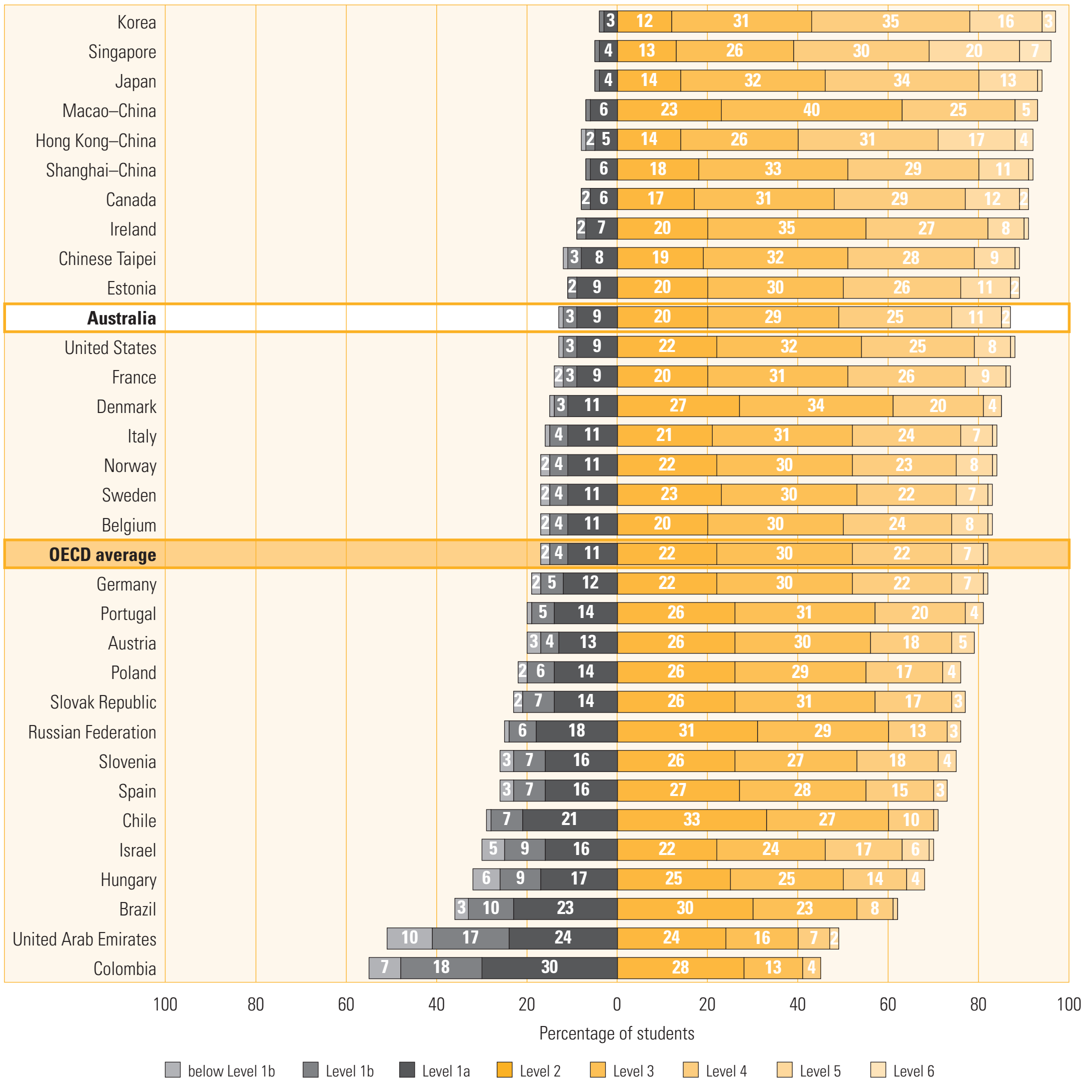


Figure 6.10 Percentage of students across the digital reading literacy proficiency scale, by country

Colombia did not attain this level. Thirteen per cent of students from Australia and the United States failed to reach Level 2.

Digital reading literacy performance by sex across countries

Figure 6.11 provides the mean scores and standard errors for females and males by country and displays the difference between average male and female performance in digital reading literacy graphically. There were significant differences by sex, in favour of females, in digital reading literacy performance in all except two participating countries (Colombia and Korea). Across the OECD countries, females significantly outperformed males by 26 score points on average.

The United Arab Emirates and Norway had the widest differences by sex, at 50 and 46 score points respectively, followed by Slovenia (40 score points), Estonia (37 score points) and Poland (34 score points). In Australia, females achieved a mean score of 536 points, which was 30 score points higher than the mean score for males (506 score points). Those countries with the narrowest significant gap include Shanghai–China and Chile (10 score points), Korea (7 score points) and Colombia (5 score points).

Country	Females Mean score	Females SE	Males Mean score	Males SE
Colombia	398	4.4	393	4.7
Korea	559	3.9	552	4.8
Chile	457	4.1	447	4.4
Shanghai–China	536	3.7	526	4.3
Japan	553	3.3	537	4.2
Chinese Taipei	528	3.8	511	4.2
Portugal	495	4.2	477	4.9
Singapore	576	1.6	558	1.8
Russian Federation	474	4.1	457	4.2
Macao–China	525	1.1	506	1.4
Slovak Republic	484	4.5	465	3.8
Hong Kong–China	560	4.2	541	4.4
Brazil	445	4.7	426	5.6
Canada	543	2.5	522	2.5
Italy	516	5.0	494	5.4
France	522	4.0	499	4.0
Denmark	506	2.9	483	3.3
Belgium	515	3.3	490	3.2
Ireland	533	3.3	508	4.0
OECD average	**510**	**0.8**	**484**	**0.9**
Austria	493	4.6	467	5.3
Spain	480	3.6	453	4.7
Israel	474	4.7	447	7.1
United States	526	4.5	497	4.8
Germany	509	4.1	479	4.3
Australia	**536**	**2.0**	**506**	**2.5**
Hungary	466	4.7	433	5.2
Sweden	515	3.2	482	4.3
Poland	493	4.7	459	4.7
Estonia	541	3.0	504	3.2
Slovenia	492	2.2	452	1.3
Norway	523	3.6	477	3.9
United Arab Emirates	431	3.9	381	5.2

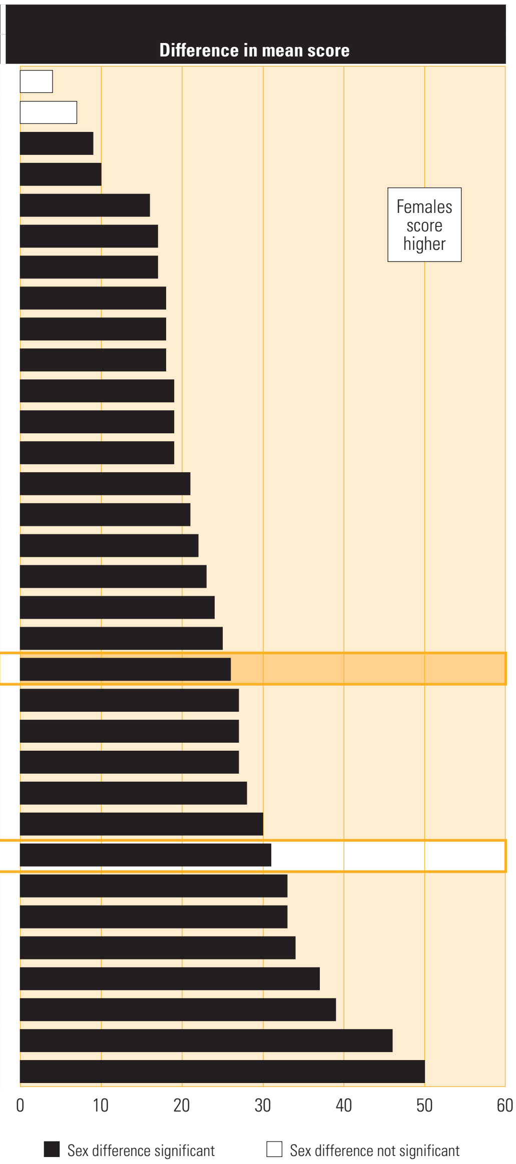


Figure 6.11 Mean scores and differences between the sexes in students' performance on the digital reading literacy scale, by country

The proportion of females and males at each of the digital reading literacy proficiency levels for Australia and the OECD average is shown in Figure 6.12. The proportion of females tended to be higher in the higher proficiency levels and lower at the lower proficiency levels. In Australia, 17% of females and 11% of males were top performers, compared to 9% of females and 7% of males across OECD countries.

There were twice as many Australian males (17%) as females (8%) who were low performers. These figures compare favourably with the OECD average of 22% of males and 13% of females who failed to reach Level 2.

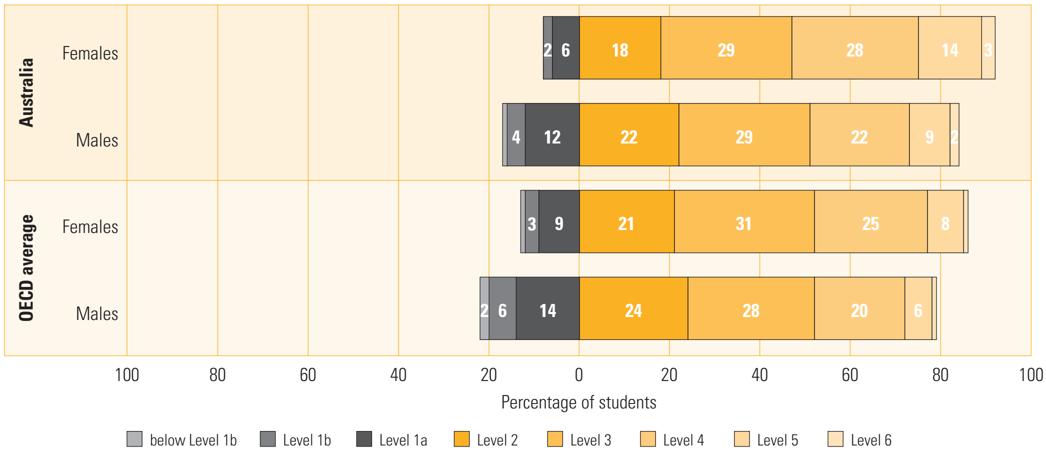


Figure 6.12 Percentage of students across the digital reading literacy proficiency scale by sex, for Australia and the OECD average

Australia's digital reading literacy performance in a national context

Digital reading literacy performance across the Australian jurisdictions

The digital reading literacy performance for students in each of the Australian jurisdictions is shown in Figure 6.13, together with the standard errors, confidence intervals, the spread of scores between the 5th and 95th percentiles and the distribution of performance. In addition, Table 6.2 provides a comparison of digital reading literacy performance between each of the jurisdictions.

Six jurisdictions (the Australian Capital Territory, Western Australia, New South Wales, Victoria, Queensland and South Australia) achieved significantly higher than the OECD average. The Northern Territory achieved at a level equal to the OECD average, while Tasmania achieved significantly lower than the OECD average.

The mean scores for the Australian Capital Territory, Western Australia, New South Wales and Victoria were not statistically different from one another. The Australian Capital Territory, Western Australia and New South Wales outperformed four jurisdictions (Queensland, South Australia, Tasmania and the Northern Territory), Victoria outperformed three jurisdictions (South Australia, Tasmania and the Northern Territory), while South Australia and Queensland (which performed similarly to one another) outperformed the Northern Territory and Tasmania. Tasmania and the Northern Territory scored significantly lower on average than the other jurisdictions, but were not statistically different from one another.

The Northern Territory had the widest spread of scores with 431 score points between the students at the 5th and 95th percentiles, whereas Victoria had the narrowest spread of scores, with 302 score points.

Jurisdiction	Mean score	SE	Confidence interval	Difference between 5th and 95th percentiles
ACT	533	3.4	526–539	320
NSW	526	4.0	518–534	323
VIC	523	4.0	516–531	302
QLD	513	4.1	505–522	312
SA	512	4.5	503–520	328
WA	526	4.9	517–536	319
TAS	480	4.8	471–490	361
NT	482	8.9	464–499	431
Australia	**521**	**1.7**	**517–524**	**317**
Singapore	567	1.2	495–498	307
OECD average	**497**	**0.7**	**565–569**	**296**

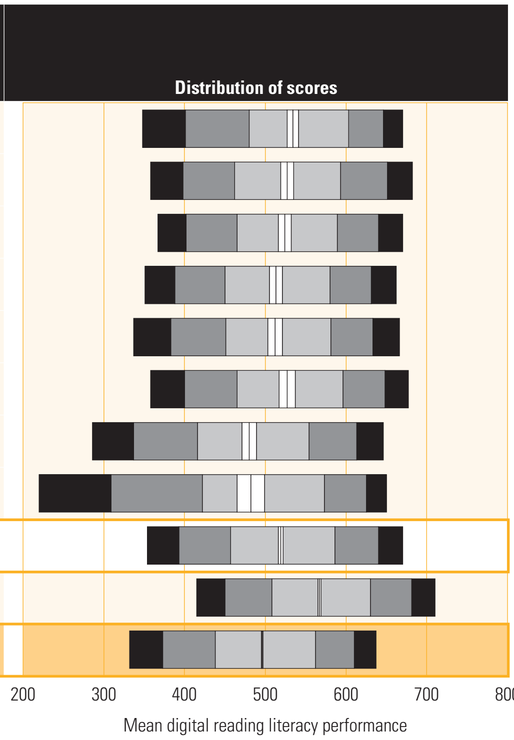


Figure 6.13 Mean scores and distribution of students' performance on the digital reading literacy scale, by jurisdiction

Table 6.2 Multiple comparisons of mean digital reading literacy performance, by jurisdiction

Jurisdiction	Mean score	SE	ACT	WA	NSW	VIC	QLD	SA	NT	TAS	OECD average
ACT	533	3.4		●	●	●	▲	▲	▲	▲	▲
WA	526	4.9	●		●	●	▲	▲	▲	▲	▲
NSW	526	4.0	●	●		●	▲	▲	▲	▲	▲
VIC	523	4.0	●	●	●		●	▲	▲	▲	▲
QLD	513	4.1	▼	▼	▼	●		●	▲	▲	▲
SA	512	4.5	▼	▼	▼	▼	●		▲	▲	▲
NT	482	8.9	▼	▼	▼	▼	▼	▼		●	●
TAS	480	4.8	▼	▼	▼	▼	▼	▼	●		▼
OECD average	**497**	**0.7**	▼	▼	▼	▼	▼	▼	▲	●	

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

The proportion of students at each of the digital reading literacy proficiency levels in each jurisdiction, along with the percentages for Australia overall, the OECD average and the highest scoring country (Singapore) for comparison, is shown in Figure 6.14.

Fourteen per cent of students in the Australian Capital Territory and 13% of students in Western Australia and New South Wales were top performers in digital reading literacy. Seven per cent of students in Tasmania and the Northern Territory achieved Level 5 or 6, which was similar to the proportion achieved across the OECD (8%).

Seventeen per cent of students across the OECD were low performers, less than the proportions of students from the Northern Territory or Tasmania at these levels (25 and 20% respectively). Eleven per

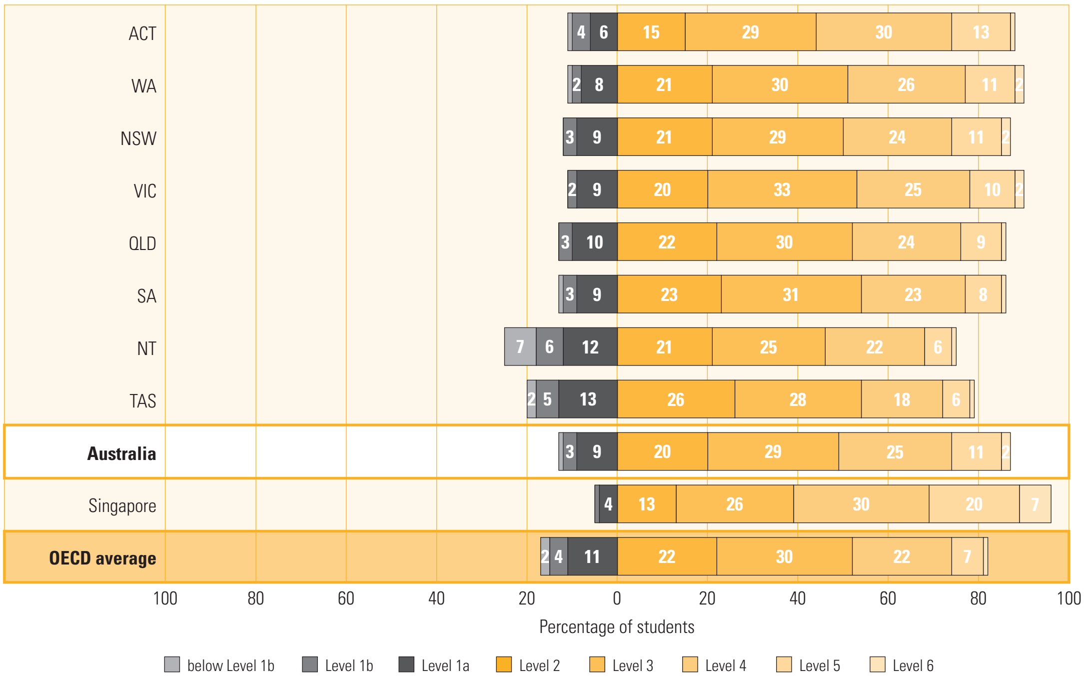


Figure 6.14 Percentage of students across the digital reading literacy proficiency scale, by jurisdiction

cent of students in the Australian Capital Territory, Western Australia and Victoria, 12% in New South Wales and 13% in Queensland and South Australia failed to reach Level 2.

Digital reading literacy performance by sex across the Australian jurisdictions

Females in six jurisdictions (the Australian Capital Territory, New South Wales, Queensland, Victoria, Tasmania and South Australia) performed at a significantly higher level on average than males in digital reading literacy. The mean digital reading literacy scores for females and males are shown in Figure 6.15 with the associated standard errors and the difference in mean scores. The largest difference of 46 score points was found in the Australian Capital Territory, closely followed by New South Wales and Queensland, with differences between the sexes of 37 and 35 score points respectively.

Jurisdiction	Females		Males	
	Mean score	SE	Mean score	SE
ACT	556	4.5	510	5.1
NSW	545	4.2	508	6.1
QLD	531	4.9	496	4.7
VIC	539	4.2	509	5.1
TAS	495	6.1	466	5.8
SA	526	4.8	498	5.1
NT	494	13.0	469	10.1
WA	532	5.6	521	6.7

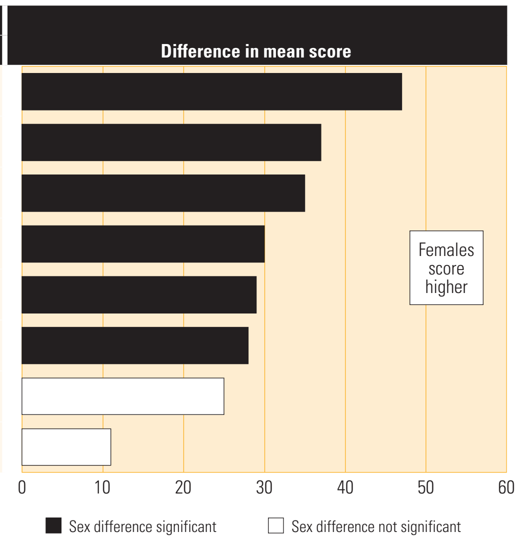


Figure 6.15 Mean scores and differences between the sexes in students' performance on the digital reading literacy scale, by jurisdiction

The average proportion of females and males at each level on the digital reading proficiency scale for jurisdictions is shown in Figure 6.16. All jurisdictions had a higher proportion of females who achieved Level 5 or 6 than the OECD average (9%). Around one-fifth of females in the Australian Capital Territory and New South Wales, 17% in Victoria, around 15% in Queensland, South Australia and Western Australia, and 10% in Tasmania and the Northern Territory were top performers in digital reading literacy.

There were higher proportions of males from New South Wales and Western Australia (13%) who were placed at Level 5 or 6 compared to the other jurisdictions, where the proportion of males who performed at these high levels of digital reading literacy proficiency ranged from 6% in Tasmania to 10% in Victoria and the Northern Territory. All jurisdictions, except Tasmania, had a higher proportion of males placed at Level 5 or 6 than the OECD average (7%).

The proportion of females in Tasmania and the Northern Territory (18%) who failed to reach Level 2 was higher than the proportion of females who failed to reach Level 2 across the OECD (13%). In other jurisdictions, the proportion of females who were low performers ranged from 5% in the Australian Capital Territory to 11% in South Australia.

Over one-quarter of males from Tasmania and the Northern Territory did not reach Level 2, which was higher than the 22% of males across the OECD. In other jurisdictions, there were 13% of males in Western Australia, 14% in Victoria, around 16% in the Australian Capital Territory, New South Wales and South Australia, and 19% in Queensland who were low performers.

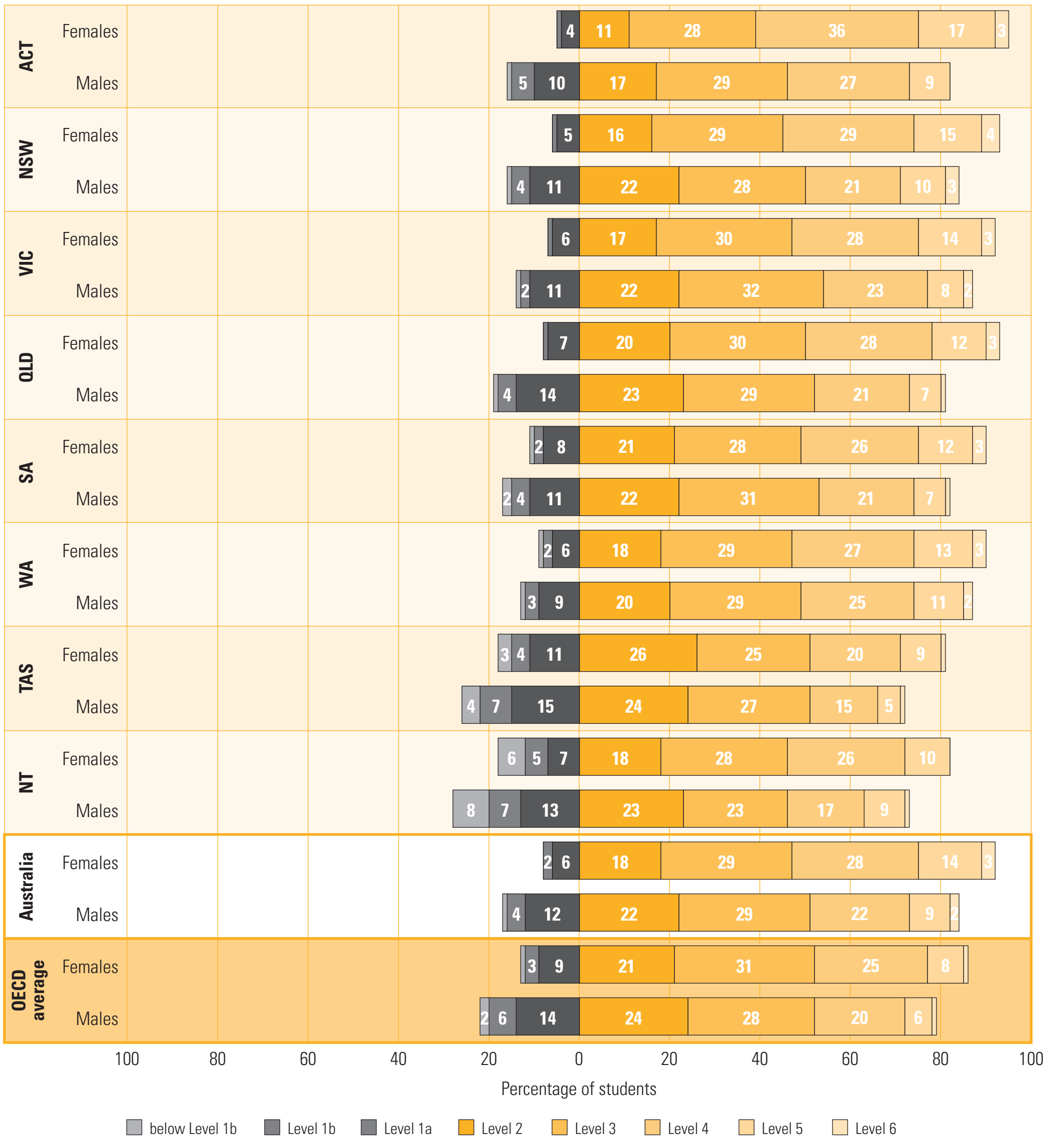


Figure 6.16 Percentage of students across the digital reading literacy proficiency scale, by jurisdiction and sex

CHAPTER 7

Australian students' motivation to learn and succeed in mathematics

Key findings

- On average, Australian students demonstrated a higher level of intrinsic motivation than the OECD average. The levels reported by Australian students were similar to the levels reported by students in the United States, New Zealand and Canada, but below the levels of enjoyment reported by the high-performing countries Shanghai–China and, in particular, Singapore. In Australia, 61% of males were interested in the things they learnt about mathematics compared to only approximately 46% of females.
- The percentages of Australian students who agreed that learning mathematics would enhance employment, career and study opportunities were higher than the OECD averages. More than two-fifths of students from Hong Kong–China and approximately one-third of students from Shanghai–China disagreed that they would learn things in mathematics that would help them get a job, compared to around one-fifth of students in Australia, the United Kingdom and the United States.
- Approximately one-third of females in Australia reported that they did not think that mathematics was important for later study compared to one-fifth of males.
- Australian students' average level of self-concept (how competent they perceived themselves to be in mathematics) was just above the OECD average. Australia and all comparison countries had a significant difference between the sexes in reported self-concept in favour of males, with the biggest gap found in Shanghai–China.
- Of the countries selected for comparison, students from New Zealand had the lowest levels of self-efficacy, whereas students from Shanghai–China reported levels of self-efficacy almost a standard deviation higher than the OECD average. Australian students scored at a similar level to students from the United Kingdom, just above the OECD average. Females scored significantly lower than males on the self-efficacy index in all countries, with Australia and New Zealand reporting the largest gap between the sexes.
- In all comparison countries and Australia, at least 90% of students believed that investing effort would lead to success at school. However, more than 40% of students in Australia, New Zealand and Singapore reported that family demands or other problems prevented them from putting time into school work compared to 25% of students in Shanghai–China. More Indigenous students in Australia (53%) compared to non-Indigenous students (41%) noted that family demands and other problems impacted on the time they spent on school work.

- In Australia and all comparison countries, there was a pattern of students taking responsibility for their failure in mathematics rather than attributing it to external factors. In Australia, male and Indigenous students reported more of a tendency to attribute failure in mathematics to their own efforts compared to females and non-Indigenous students, who were more likely to attribute failure to factors beyond their control.
- Across all countries, higher levels of anxiety were reported on items that assessed worry about mathematics classes and achieving poor grades; two-fifths of Australian students worried that mathematics classes would be difficult for them. On average, more students from the high-performing countries Singapore, Shanghai–China and Hong Kong–China worried about achieving poor grades in mathematics than students from other countries. Across all countries, females had higher levels of mathematics anxiety than males.
- Singaporean students reported that their peers and parents respected and valued mathematics more than did students in other participating PISA countries. Australia had a positive index score, while Hong Kong–China's was just below the OECD average. A significant difference between sexes was found in all countries except for the United Kingdom, with males more likely to report that their peers and parents have positive attitudes towards mathematics.

Students' motivation and engagement can have a profound impact on their classroom performance in the short term and can affect the quality of their learning in the long term. Research has demonstrated that students' level of motivation changes from subject to subject (Bong, 2004) depending on their level of interest or how useful they believe a subject will be for their future. Eccles and Wigfield (2002) reviewed the research literature and proposed that motivational theories can be classified into four groups. The first group of theories focuses on the reasons why students choose to pursue a subject, while the second group emphasises the importance of students' beliefs about how well they can perform or understand subject matter. The third group of theories combines the previous two groups to analyse why students engage with subjects, in addition to how competent students feel about their capabilities. The fourth group looks at the relationship between motivation and behaviour and takes into account social factors.

In this chapter, Eccles and Wigfield's (2002) four categories were used as a framework to consider the motivational constructs investigated in PISA 2012. Results for Australian students were investigated at national and jurisdictional levels, and according to geographic location, Indigenous background, socioeconomic background and sex. Furthermore, in order to place Australian students' responses in a wider context, seven countries were selected for comparison with Australia. The high-performing countries Shanghai–China, Hong Kong–China and Singapore were chosen, in addition to the culturally similar English-speaking OECD countries Canada, New Zealand, the United Kingdom and the United States. Students' motivation was also considered in relation to mathematical literacy scores in order to explore the relationship between motivation and mathematics performance.

The results presented relate to the percentage of respondents who agreed or disagreed with measures of each construct. Scores are also provided for constructed indices designed to standardise responses onto one scale, where the mean of 0 represents the mean of the OECD student population.

Enjoying and valuing mathematics

According to Eccles and Wigfield's (2002) framework, the first group of motivational theories centres on why students choose to pursue a subject and relates to levels of value and enjoyment. In PISA 2012, measures of intrinsic and instrumental motivation to learn mathematics address this idea.

Intrinsic motivation to learn mathematics

Students' level of intrinsic motivation was measured in PISA 2012 as the amount of interest or enjoyment students felt in relation to mathematics. Four statements were used to measure intrinsic motivation. Students were asked to rate their level of agreement on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

» I enjoy reading about mathematics
» I look forward to my mathematics lessons
» I do mathematics because I enjoy it
» I am interested in the things I learn in mathematics.

Table 7.1 shows the percentages of students who agreed with each of the four statements, on average, for Australia and internationally. On average, Australian students demonstrated a higher level of intrinsic motivation than the OECD average. The levels reported by Australian students were similar to the levels reported by students in the United States, New Zealand and Canada, but below the levels of enjoyment reported by high-performing countries, particularly Singapore. More than three-quarters of Singaporean students reported looking forward to mathematics classes compared to less than half of Australian students.

Table 7.1 Students' intrinsic motivation to learn mathematics: Australian and international results

	Percentage of students who 'agree' or 'strongly agree' with the following statements							
	I enjoy reading about mathematics		I look forward to my mathematics lessons		I do mathematics because I enjoy it		I am interested in the things I learn in mathematics	
Country	%	SE	%	SE	%	SE	%	SE
Australia	**35**	**0.6**	**45**	**0.6**	**39**	**0.7**	**54**	**0.7**
United States	34	1.3	45	1.5	37	1.4	50	1.3
Hong Kong–China	44	1.0	50	1.0	55	1.0	52	1.1
New Zealand	33	1.0	46	1.1	38	1.1	55	1.3
United Kingdom	34	1.0	51	1.1	41	0.9	56	0.8
Canada	35	0.5	40	0.6	37	0.6	54	0.6
Singapore	68	0.9	77	0.8	72	0.8	77	0.8
Shanghai–China	50	1.0	54	1.0	49	1.0	61	1.0
OECD average	**31**	**0.2**	**36**	**0.2**	**38**	**0.2**	**53**	**0.2**

The index of intrinsic motivation to learn mathematics was created by standardising responses to the four items across the countries. A higher score on the index represents a higher level of intrinsic motivation; i.e., a higher level of enjoyment associated with mathematics. Table 7.2 shows results for countries on the index of intrinsic motivation to learn mathematics. It shows the mean index scores across countries along with differences by sex.

The index score for Australia and all comparison countries was near or above the OECD average. Matching with the previous percentage results, Singaporean students had the highest level of intrinsic motivation to learn mathematics. Australian students had one of the lower index scores. Across all countries, males reported significantly higher levels of intrinsic motivation to learn mathematics than females with the biggest differences by sex reported in Hong Kong–China. Australian females reported a level of intrinsic motivation that was below the OECD average for all students.

Table 7.2 Index of intrinsic motivation to learn mathematics: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.11	0.0	–0.06	0.0	0.26	0.0	**0.32**	0.0
United States	0.08	0.0	0.00	0.0	0.16	0.0	**0.16**	0.0
Hong Kong–China	0.30	0.0	0.10	0.0	0.47	0.0	**0.38**	0.0
New Zealand	0.11	0.0	–0.04	0.0	0.26	0.0	**0.31**	0.0
United Kingdom	0.19	0.0	0.13	0.0	0.24	0.0	**0.11**	0.0
Canada	0.05	0.0	–0.07	0.0	0.16	0.0	**0.23**	0.0
Singapore	0.84	0.0	0.79	0.0	0.88	0.0	**0.08**	0.0
Shanghai–China	0.43	0.0	0.29	0.0	0.57	0.0	**0.28**	0.0
OECD average	0.00	0.0	–0.11	0.0	0.10	0.0	**0.21**	0.0

Note: Bolded values indicate a statistically significant difference.

The index of intrinsic motivation to learn mathematics was divided into quartiles. Figure 7.1 shows the relationship between quartiles of intrinsic motivation and mathematical literacy performance for Australia and the OECD average.

For Australia and the OECD average, the pattern between intrinsic motivation and mathematical literacy followed a linear pattern, with students who reported a higher level of intrinsic motivation (i.e., who enjoyed learning mathematics) tending to have higher average mathematical literacy scores.

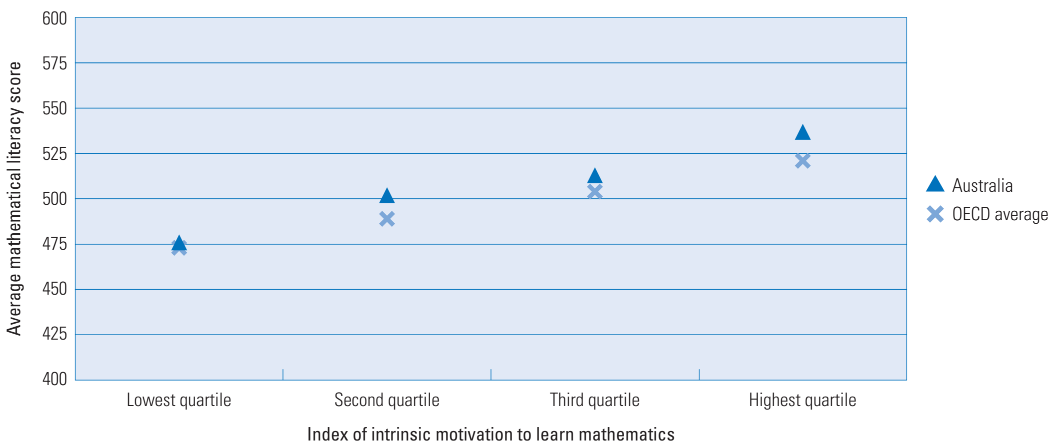


Figure 7.1 Relationship between students' intrinsic motivation to learn mathematics and mathematical literacy performance for Australian students and the OECD average

Table 7.3 breaks down Australian students' scores on the index of intrinsic motivation to learn mathematics and item percentages according to jurisdiction, geographic location, Indigenous background, socioeconomic background and sex.

Table 7.3 Students' intrinsic motivation to learn mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree' with the following statements								Index of intrinsic motivation to learn mathematics	
	I enjoy reading about mathematics		I look forward to my mathematics lessons		I do mathematics because I enjoy it		I am interested in the things I learn in mathematics			
	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction										
ACT	38	2.2	48	2.3	42	2.3	55	2.0	0.14	0.0
NSW	36	1.3	44	1.4	39	1.4	55	1.3	0.12	0.0
VIC	37	1.3	50	1.5	43	1.5	56	1.5	0.15	0.0
QLD	33	1.4	44	1.4	38	1.4	53	1.5	0.08	0.0
SA	28	1.9	40	1.9	33	1.6	50	2.0	–0.02	0.0
WA	34	1.5	43	1.3	36	1.5	50	1.5	0.07	0.0
TAS	34	2.0	47	1.9	39	2.1	56	1.7	0.15	0.0
NT	37	3.3	49	4.1	44	3.3	59	3.4	0.21	0.1
Geographic location										
Metropolitan	36	0.8	47	0.8	40	0.8	54	0.8	0.12	0.0
Provincal	31	1.0	41	1.4	36	1.3	51	1.3	0.05	0.0
Rural	36	3.7	51	3.2	43	2.5	61	3.5	0.25	0.1
Indigenous background										
Indigenous	32	2.1	44	2.3	37	2.4	52	2.3	0.06	0.0
Non-Indigenous	35	0.6	45	0.6	39	0.7	54	0.7	0.11	0.0
Socioeconomic background										
Lowest quartile	32	1.3	42	1.2	36	1.3	50	1.3	0.04	0.0
Second quartile	33	1.3	44	1.3	37	1.3	50	1.3	0.06	0.0
Third quartile	35	1.1	45	1.1	40	1.2	53	1.3	0.09	0.0
Highest quartile	40	1.3	50	1.4	40	1.3	61	1.2	0.24	0.0
Sex										
Males	42	0.7	51	0.9	45	0.9	61	0.9	0.26	0.0
Females	27	0.9	40	0.9	33	0.9	46	1.0	–0.06	0.0
Country										
Australia	**35**	**0.6**	**45**	**0.6**	**39**	**0.7**	**54**	**0.7**	**0.11**	**0.0**
OECD average	**31**	**0.2**	**36**	**0.2**	**38**	**0.2**	**53**	**0.2**	**0.00**	**0.0**

The percentage of students reporting that they enjoyed mathematics was highest for the Northern Territory and the lowest for South Australia. A higher proportion of students from rural areas agreed or strongly agreed with the items about intrinsic motivation than students from metropolitan or provincial locations. Of all the subgroup breakdowns, females and students from South Australia were the only groups to have an index score below the OECD average. Sixty-one per cent of males were interested in the things they learnt about mathematics compared to only 46% of females.

Instrumental motivation to learn mathematics

In addition to being motivated by how much they enjoy the subject, students are also influenced to participate in mathematics if they perceive it to be useful for their future. This was measured in PISA 2012 by four statements comprising the instrumental motivation to learn mathematics scale. Students rated their level of agreement with each statement on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

» Making an effort in mathematics is worth it because it will help me in the work that I want to do later on

» Learning mathematics is worthwhile for me because it will improve my career prospects and chances
» Mathematics is an important subject for me because I need it for what I want to study later on
» I will learn many things in mathematics that will help me get a job.

Table 7.4 shows the average percentage of students from Australia and all comparison countries that agree or strongly agree with the statements.

The percentages of Australian students who agreed that learning mathematics would enhance employment, career and study opportunities were higher than the OECD average. Interestingly, the lowest percentage of students who believed in the utility of mathematics for later career prospects was found in Hong Kong–China. More than two-fifths of students from Hong Kong–China and approximately one-third of students from Shanghai–China disagreed that they would learn things in mathematics that would help them get a job compared to around one-fifth of students in Australia, the United Kingdom and the United States.

Table 7.4 Students' instrumental motivation to learn mathematics: Australian and international results

	Percentage of students who 'agree' or 'strongly agree' with the following statements							
	Making an effort in mathematics is worth it because it will help me in the work that I want to do later on		Learning mathematics is worthwhile for me because it will improve my career prospects and chances		Mathematics is an important subject for me because I need it for what I want to study later on		I will learn many things in mathematics that will help me get a job	
Country	%	SE	%	SE	%	SE	%	SE
Australia	**84**	**0.4**	**86**	**0.4**	**74**	**0.5**	**80**	**0.4**
United States	81	0.7	80	0.7	70	0.9	80	0.8
Hong Kong–China	69	0.9	72	0.8	66	0.9	59	1.0
New Zealand	86	0.8	88	0.7	76	0.9	83	0.8
United Kingdom	88	0.6	91	0.5	73	0.9	81	0.6
Canada	82	0.5	86	0.5	73	0.6	79	0.5
Singapore	90	0.6	88	0.6	87	0.6	85	0.7
Shanghai–China	78	0.7	73	0.9	79	0.9	66	1.0
OECD average	**75**	**0.1**	**78**	**0.1**	**66**	**0.2**	**70**	**0.2**

Students' responses to these four items were standardised and then used to create the index of instrumental motivation to learn mathematics. Higher index scores indicate higher levels of instrumental motivation. Table 7.5 shows Australia's index results and those of the comparison countries.

Singaporean students had the highest index score indicating that they demonstrated high levels of instrumental motivation in comparison to the OECD average. They were followed by students from the United Kingdom, New Zealand, Canada and, then, Australia. Shanghai–China's index score was close to the OECD average, while Hong Kong–China's was below the OECD average. A statistically significant difference by sex was found for all countries except the United States, with males reporting significantly higher levels of instrumental motivation than females. In Australia, females' level of instrumental motivation, while being less than that for Australian males, was still above the OECD average for all students, whereas the level of instrumental motivation for both females and males from Hong Kong–China scored significantly below the OECD average for all students.

Table 7.5 Index of instrumental motivation to learn mathematics: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.24	0.0	0.08	0.0	0.39	0.0	**0.30**	0.0
United States	0.14	0.0	0.10	0.0	0.17	0.0	0.07	0.0
Hong Kong–China	–0.23	0.0	–0.35	0.0	–0.11	0.0	**0.24**	0.0
New Zealand	0.28	0.0	0.17	0.0	0.38	0.0	**0.21**	0.0
United Kingdom	0.32	0.0	0.25	0.0	0.40	0.0	**0.15**	0.0
Canada	0.25	0.0	0.18	0.0	0.32	0.0	**0.13**	0.0
Singapore	0.40	0.0	0.33	0.0	0.46	0.0	**0.13**	0.0
Shanghai–China	0.01	0.0	–0.03	0.0	0.05	0.0	**0.08**	0.0
OECD average	0.00	0.0	–0.10	0.0	0.09	0.0	**0.19**	0.0

Note: Bolded values indicate a statistically significant difference.

Figure 7.2 investigates the relationships between instrumental motivation to learn mathematics and mathematical literacy performance. As was found for intrinsic motivation, higher levels of instrumental motivation tended to be associated with higher mathematical literacy scores. Thus, students who perceived mathematics to be more useful for their careers and later study options were more likely to achieve better results in the mathematical literacy assessment.

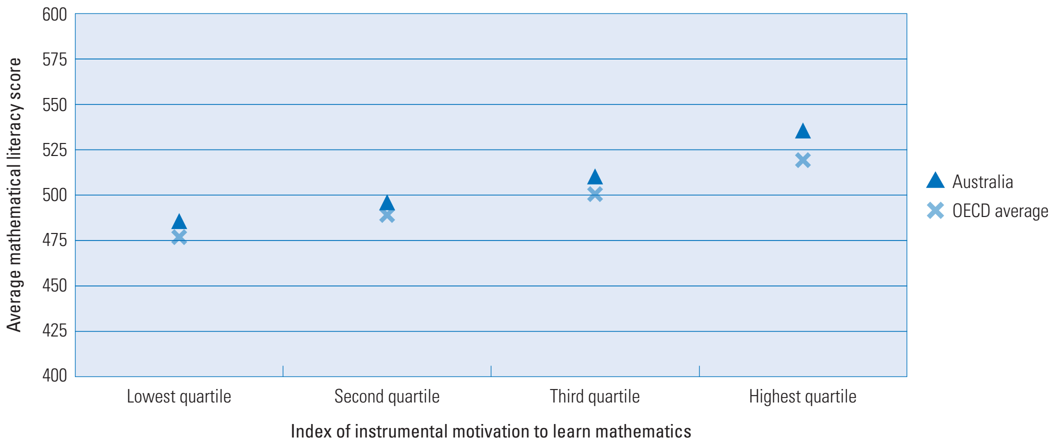


Figure 7.2 Relationship between students' instrumental motivation to learn mathematics and mathematical literacy performance for Australian students and the OECD average

In Table 7.6, Australian students' scores on the index of instrumental motivation to learn mathematics and item percentages according to jurisdiction, geographic location, Indigenous background, socioeconomic background and sex are presented.

Index scores for all jurisdictions were higher than the OECD average, indicating that students agreed more strongly than on average across the OECD that mathematics was useful for future opportunities. Students from the Northern Territory, Tasmania and Victoria had the highest index scores. Students from rural areas had slightly higher index scores than students from metropolitan and provincial areas; as did non-Indigenous students compared to Indigenous students and students from the highest socioeconomic quartile compared to students from the lowest socioeconomic quartile. The lowest subgroup index score was calculated for Australian females. Approximately one-third of females in Australia reported that they did not think that mathematics was important for later study compared to one-fifth of males.

Table 7.6 Students' instrumental motivation to learn mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree' with the following statements									
	Making an effort in mathematics is worth it because it will help me in the work that I want to do later on		Learning mathematics is worthwhile for me because it will improve my career prospects and chances		Mathematics is an important subject for me because I need it for what I want to study later on		I will learn many things in mathematics that will help me get a job		Index of instrumental motivation to learn mathematics	
	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction										
ACT	84	1.7	87	1.6	74	2.1	80	1.9	0.24	0.0
NSW	83	0.7	86	0.7	74	0.8	80	0.9	0.22	0.0
VIC	86	0.8	87	0.8	76	1.3	81	0.9	0.33	0.0
QLD	84	0.9	85	0.8	72	1.0	80	1.0	0.19	0.0
SA	85	1.2	84	1.1	71	1.6	79	1.5	0.17	0.0
WA	83	1.2	86	1.1	73	1.3	78	1.4	0.19	0.0
TAS	90	1.2	91	1.1	80	1.4	87	1.5	0.40	0.0
NT	89	1.6	93	1.7	81	2.9	83	2.1	0.40	0.1
Geographic location										
Metropolitan	84	0.6	86	0.5	74	0.6	79	0.6	0.24	0.0
Provincial	85	0.7	87	0.6	74	1.0	82	0.9	0.24	0.0
Rural	86	2.5	89	2.7	81	5.1	84	3.0	0.32	0.1
Indigenous background										
Indigenous	84	1.3	82	1.5	73	1.9	82	1.4	0.14	0.0
Non-Indigenous	84	0.4	86	0.4	74	0.5	80	0.5	0.24	0.0
Socioeconomic background										
Lowest quartile	85	0.9	85	0.9	72	1.0	82	0.9	0.16	0.0
Second quartile	84	0.9	85	0.9	73	1.1	79	1.0	0.21	0.0
Third quartile	84	0.9	86	0.7	73	1.0	79	0.8	0.23	0.0
Highest quartile	86	0.8	89	0.7	77	0.9	81	1.0	0.36	0.0
Sex										
Males	87	0.6	89	0.6	80	0.6	84	0.6	0.39	0.0
Females	81	0.7	83	0.6	67	0.8	76	0.6	0.08	0.0
Country										
Australia	**84**	**0.4**	**86**	**0.4**	**74**	**0.5**	**80**	**0.4**	**0.24**	**0.0**
OECD average	**75**	**0.1**	**78**	**0.1**	**66**	**0.2**	**70**	**0.2**	**0.00**	**0.0**

Mathematics competency and control beliefs

Eccles and Wigfield's (2002) second group of theories about motivation focuses on students' belief in their own mathematical ability. In PISA 2012, three constructs were measured that fit this group: self-concept; self-efficacy; and perceived control beliefs.

Mathematics self-concept

Self-concept and self-efficacy can be thought of as constructs that relate to students' competency-related beliefs at different levels of generality. Mathematics self-concept relates to how confident a student feels in mathematics in general; while mathematics self-efficacy relates to how confident a student feels with particular mathematics tasks. Self-concept was assessed in PISA 2012 by asking students to rate their level of agreement with statements on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

» I am just not good at mathematics
» I get good grades in mathematics
» I learn mathematics quickly
» I have always believed that mathematics is one of my best subjects
» In my mathematics class, I understand even the most difficult work.

Table 7.7 shows the average percentage of students who agreed or disagreed with each statement for Australia and all comparison countries. More students from the United States than any of the comparison countries reported higher levels of agreement on the self-concept items, which was interesting given that the United States was not a high-performing country in PISA 2012. Singapore had the second-largest group of students reporting high levels of self-concept. Students from the other high-performing countries of Hong Kong–China and Shanghai–China had the lowest percentages of students agreeing with the items about self-concept.

Table 7.7 Students' self-concept in mathematics: Australian and international results

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements									
	I am just not good at mathematics		I get good grades in mathematics		I learn mathematics quickly		I have always believed that mathematics is one of my best subjects		In my mathematics class, I understand even the most difficult work	
Country	Disagree %	SE	Agree %	SE	Agree %	SE	Agree %	SE	Agree %	SE
Australia	**63**	**0.6**	**64**	**0.6**	**54**	**0.6**	**40**	**0.6**	**40**	**0.6**
United States	67	1.0	77	0.9	60	1.1	49	0.9	49	1.3
Hong Kong–China	50	1.1	33	1.1	55	1.1	37	1.0	35	1.1
New Zealand	59	1.1	69	1.0	51	0.9	38	0.9	37	1.1
United Kingdom	68	0.9	73	0.9	58	1.1	43	1.2	49	1.2
Canada	63	0.7	66	0.7	58	0.7	44	0.7	46	0.8
Singapore	62	0.8	63	0.8	63	0.8	57	0.9	45	0.9
Shanghai–China	53	1.0	34	0.8	49	0.9	42	0.9	32	0.8
OECD average	**57**	**0.2**	**59**	**0.2**	**52**	**0.2**	**38**	**0.2**	**37**	**0.2**

Student responses to the items were standardised in order to create the index of mathematics self-concept, with higher index scores representative of higher levels of self-concept. Table 7.8 shows index scores for Australian and the comparison countries, and it replicates the pattern seen in Table 7.7. Australian students' average level of self-concept, or how competent they perceived themselves to be in mathematics, was just above the OECD average. Australia and all comparison countries had a significant difference by sex in reported self-concept in favour of males, with the largest gap in Shanghai–China. Across the comparison countries and Australia, males tended to believe that they were more competent in mathematics than females.

Table 7.8 Index of mathematics self-concept: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.06	0.0	–0.13	0.0	0.25	0.0	**0.38**	0.0
United States	0.30	0.0	0.20	0.0	0.40	0.0	**0.19**	0.0
Hong Kong–China	–0.16	0.0	–0.39	0.0	0.04	0.0	**0.43**	0.0
New Zealand	0.02	0.0	–0.18	0.0	0.21	0.0	**0.38**	0.0
United Kingdom	0.18	0.0	–0.02	0.0	0.39	0.0	**0.41**	0.0
Canada	0.19	0.0	0.00	0.0	0.39	0.0	**0.39**	0.0
Singapore	0.22	0.0	0.10	0.0	0.33	0.0	**0.23**	0.0
Shanghai–China	–0.05	0.0	–0.28	0.0	0.20	0.0	**0.48**	0.0
OECD average	0.00	0.0	–0.17	0.0	0.17	0.0	**0.35**	0.0

Note: Bolded values indicate a statistically significant difference.

Figure 7.3 plots the relationship between quartiles of the index of mathematics self-concept and average mathematical literacy performance to illustrate that, for Australia and the OECD average, higher levels of self-concept were linked to higher levels of performance on the PISA 2012 mathematics assessment. This relationship is much stronger than the relationship between instrumental motivation and achievement (Figure 7.2). Scores were particularly high for students in the highest quartile of both instrumental motivation and self-concept.

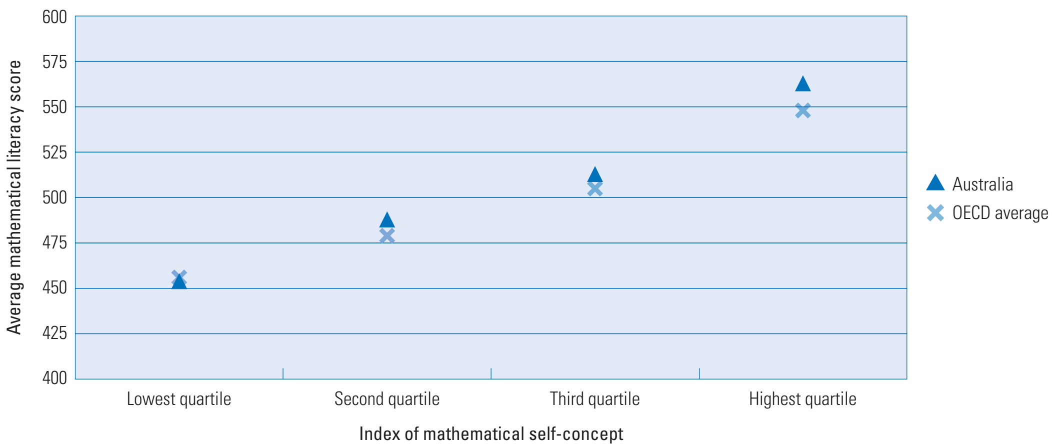


Figure 7.3 Relationship between students' self-concept in mathematics and mathematical literacy performance for Australian students and the OECD average

Australia's results for the self-concept construct were broken down into subgroups, as presented in Table 7.9. All jurisdictions had index scores higher than the OECD average, with students from the Australian Capital Territory reporting the highest levels of self-concept. Students from rural locations had higher self-concept than students from other areas and students from the highest quartile of socioeconomic background believed they were more competent at maths than students from all other quartiles, particularly those in the lowest and second quartiles. While non-Indigenous students had an index score above the OECD average, Indigenous students' index score was below the OECD average and Australia's overall average.

Table 7.9 Students' self-concept in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements										Index of mathematics self-concept	
	I am just not good at mathematics		I get good grades in mathematics		I learn mathematics quickly		I have always believed that mathematics is one of my best subjects		In my mathematics class, I understand even the most difficult work			
	Disagree %	SE	Agree %	SE	Agree %	SE	Agree %	SE	Agree %	SE	Mean index	SE
Jurisdiction												
ACT	69	2.3	70	2.1	58	2.5	42	2.3	43	2.2	0.16	0.0
NSW	64	1.2	62	1.2	55	1.3	39	1.3	42	1.2	0.05	0.0
VIC	64	1.4	63	1.3	54	1.2	42	1.4	40	1.4	0.07	0.0
QLD	62	1.5	66	1.3	53	1.5	38	1.5	38	1.6	0.05	0.0
SA	60	1.7	68	1.8	53	1.8	37	1.6	38	1.5	0.04	0.0
WA	65	1.5	67	1.8	55	1.4	42	1.5	39	1.5	0.09	0.0
TAS	65	2.2	71	1.7	54	2.1	42	2.2	40	2.0	0.12	0.0
NT	62	3.6	69	3.3	55	5.0	40	4.5	40	4.8	0.08	0.1
Geographic location												
Metropolitan	64	0.7	65	0.7	55	0.7	40	0.8	41	0.7	0.08	0.0
Provincial	60	1.3	64	1.3	52	1.1	38	1.2	37	1.2	0.01	0.0
Rural	70	5.5	80	3.6	65	2.6	48	3.9	50	3.9	0.31	0.1
Indigenous background												
Indigenous	51	1.6	53	2.0	48	1.6	33	1.9	34	1.9	–0.14	0.0
Non-Indigenous	64	0.6	65	0.6	54	0.6	40	0.6	40	0.7	0.07	0.0
Socioeconomic background												
Lowest quartile	57	1.1	58	1.3	50	1.2	38	1.2	35	1.1	–0.08	0.0
Second quartile	59	1.3	62	1.2	52	1.3	35	1.0	38	1.0	–0.02	0.0
Third quartile	67	1.2	67	1.2	56	1.2	42	1.4	41	1.3	0.10	0.0
Highest quartile	72	1.0	72	1.0	59	1.1	45	1.1	47	1.2	0.25	0.0
Sex												
Males	71	0.7	69	0.8	62	0.8	48	0.9	47	0.8	0.25	0.0
Females	56	0.9	60	0.9	46	0.9	31	0.9	33	0.9	–0.13	0.0
Country												
Australia	**63**	**0.6**	**64**	**0.6**	**54**	**0.6**	**40**	**0.6**	**40**	**0.6**	**0.06**	**0.0**
OECD average	**57**	**0.2**	**59**	**0.2**	**52**	**0.2**	**38**	**0.2**	**37**	**0.2**	**0.00**	**0.0**

Mathematics self-efficacy

Self-concept and self-efficacy are forms of competency beliefs. Self-efficacy is more specific and measures how competent students anticipate they will be on a defined task. In PISA 2012, mathematics self-efficacy was measured by asking students to rate how confident they would feel completing eight tasks on a four-point Likert scale: very confident; confident; not very confident; and not at all confident.

- Using a train timetable to work out how long it would take to get from one place to another
- Calculating how much cheaper a TV would be after a 30% discount
- Calculating how many square metres of tiles you need to cover a floor
- Understanding graphs presented in newspapers
- Solving an equation like $3x + 5 = 17$
- Finding the actual distance between two places on a map with a 1:10,000 scale
- Solving an equation like $2(x + 3) = (x + 3)(x – 3)$
- Calculating the petrol-consumption rate of a car.

Table 7.10 presents students' responses for Australia and the selected comparison countries. Interestingly, while the average level of agreement to the self-concept items was lower among students from Shanghai–China than among other comparison countries, these students were the most confident in their ability to complete specific mathematics tasks. The proportion of Australian students who were confident or very confident in their ability to complete the mathematical tasks was similar to the OECD average, except for the tasks involving calculating the percentage discount for a TV and calculating the petrol-consumption rate of a car. In these two cases, fewer Australian students reported feeling confident than the OECD average.

Table 7.10 Students' self-efficacy in mathematics: Australian and international results

	Percentage of students who report that they feel 'confident' or 'very confident' about having to do the following tasks in mathematics															
	Using a train timetable to work out how long it would take to get from one place to another		Calculating how much cheaper a TV would be after a 30% discount		Calculating how many square metres of tiles you need to cover a floor		Understanding graphs presented in newspapers		Solving an equation like 3x + 5 = 17		Finding the actual distance between two places on a map with a 1:10,000 scale		Solving an equation like 2(x + 3) = (x + 3) (x – 3)		Calculating the petrol-consumption rate of a car	
Country	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**87**	**0.5**	**76**	**0.6**	**73**	**0.6**	**85**	**0.4**	**87**	**0.4**	**56**	**0.6**	**73**	**0.6**	**54**	**0.6**
United States	79	0.9	76	1.0	73	1.1	84	0.8	94	0.5	55	1.2	84	0.9	69	0.9
Hong Kong–China	80	0.7	93	0.6	79	0.8	82	0.8	93	0.5	65	1.1	81	0.8	51	1.1
New Zealand	80	0.9	77	0.9	67	1.0	82	0.7	80	0.9	49	0.9	63	1.1	47	1.0
United Kingdom	87	0.7	84	0.7	69	1.1	84	0.9	87	0.6	49	1.3	70	0.8	51	1.1
Canada	81	0.6	79	0.6	77	0.6	84	0.5	90	0.4	58	0.7	79	0.5	57	0.7
Singapore	80	0.7	94	0.4	80	0.7	78	0.9	93	0.4	81	0.5	87	0.5	73	0.7
Shanghai–China	91	0.7	95	0.5	92	0.6	90	0.5	97	0.4	93	0.6	95	0.5	80	1.0
OECD average	**81**	**0.1**	**80**	**0.1**	**68**	**0.2**	**80**	**0.1**	**85**	**0.1**	**56**	**0.2**	**73**	**0.2**	**56**	**0.2**

Students' responses were standardised to calculate the index for mathematics self-efficacy with higher index scores illustrative of higher levels of self-efficacy. Table 7.11 shows that students from New Zealand had the lowest levels of self-efficacy, whereas students from Shanghai–China reported self-efficacy almost 1 standard deviation higher than the OECD average. Students from Australia and the United Kingdom scored just above the OECD average. Females scored significantly lower than males on the self-efficacy index in all countries, with Australia and New Zealand having the largest gap between sexes.

Table 7.11 Index of self-efficacy mathematics: Australian and international results

	All students		Females		Males		Sex difference (M – F)	
Country	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.06	0.0	–0.17	0.0	0.27	0.0	**0.44**	0.0
United States	0.13	0.0	0.00	0.0	0.26	0.0	**0.26**	0.0
Hong Kong–China	0.22	0.0	–0.01	0.0	0.42	0.0	**0.43**	0.0
New Zealand	–0.15	0.0	–0.38	0.0	0.06	0.0	**0.44**	0.0
United Kingdom	0.03	0.0	–0.17	0.0	0.23	0.0	**0.40**	0.0
Canada	0.11	0.0	–0.05	0.0	0.27	0.0	**0.33**	0.0
Singapore	0.47	0.0	0.37	0.0	0.58	0.0	**0.21**	0.0
Shanghai–China	0.94	0.0	0.85	0.0	1.03	0.0	**0.19**	0.0
OECD average	0.00	0.0	–0.16	0.0	0.17	0.0	**0.33**	0.0

Note: Bolded values indicate a statistically significant difference.

The relationship between the quartiles of the self-efficacy index and average mathematical literacy performance is illustrated in Figure 7.4. This relationship is even stronger than the relationship found for self-concept. In Australia and across the OECD, students in higher self-efficacy quartiles scored higher average levels of mathematical literacy. Again, this was particularly true for students at the highest quartile of self-efficacy and more so for Australian students than the OECD average.

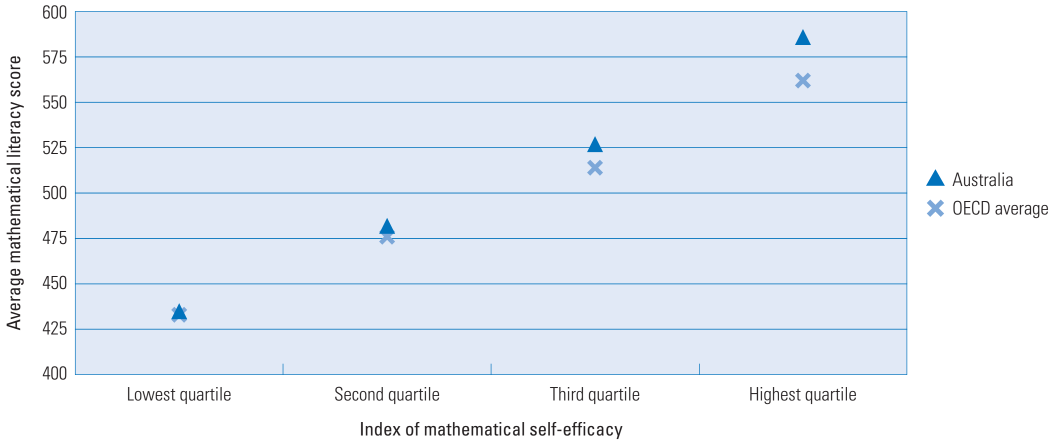


Figure 7.4 Relationship between students' self-efficacy in mathematics and mathematical literacy performance for Australian students and the OECD average

Table 7.12 presents Australian students' self-efficacy according to jurisdiction, geographic location, Indigenous background, socioeconomic background and sex. Students from the Australian Capital Territory had the highest reported self-efficacy index score, while students from South Australia and the Northern Territory scored below the OECD average. Students from rural locations had self-efficacy scores below the OECD average, at odds with the self-concept results for this subgroup. Indigenous students scored almost half a standard deviation below the OECD average, demonstrating a lack of confidence when faced with specific mathematical tasks. Students from the highest socioeconomic quartile had an index score almost three-quarters of a standard deviation above the score of students in the lowest socioeconomic quartile.

Table 7.12 Students' self-efficacy in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who report that they feel 'confident' or 'very confident' about having to do the following tasks in mathematics																Index of mathematics self-efficacy	
	Using a train timetable to work out how long it would take to get from one place to another		Calculating how much cheaper a TV would be after a 30% discount		Calculating how many square metres of tiles you need to cover a floor		Understanding graphs presented in newspapers		Solving an equation like 3x + 5 = 17		Finding the actual distance between two places on a map with a 1:10,000 scale		Solving an equation like 2(x + 3) = (x + 3)(x – 3)		Calculating the petrol-consumption rate of a car			
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction																		
ACT	83	1.7	82	1.8	79	1.8	89	1.3	95	1.1	59	2.1	81	1.7	57	2.2	0.21	0.0
NSW	87	0.6	79	0.9	72	1.1	86	0.8	87	0.9	58	1.1	73	1.1	56	1.2	0.12	0.0
VIC	88	1.0	72	1.4	70	1.4	85	0.9	89	0.9	49	1.5	74	1.4	50	1.5	0.01	0.0
QLD	85	1.0	78	1.1	74	1.3	84	0.9	85	1.0	60	1.4	71	1.3	58	1.3	0.06	0.0
SA	80	1.4	70	1.6	71	1.7	82	1.3	84	1.2	50	1.6	70	1.6	45	1.6	–0.17	0.0
WA	90	1.0	79	1.2	78	1.6	87	1.1	88	1.1	64	1.5	74	1.4	55	1.8	0.16	0.0
TAS	80	1.7	73	1.6	74	2.1	84	1.4	85	1.5	53	2.1	76	1.5	52	2.4	–0.08	0.0
NT	80	3.6	71	3.8	65	3.5	83	2.6	81	2.7	54	3.3	64	4.4	52	4.1	–0.15	0.1
Geographic location																		
Metropolitan	88	0.5	77	0.6	73	0.7	86	0.5	88	0.5	57	0.8	75	0.7	55	0.7	0.12	0.0
Provincial	83	0.8	73	1.1	72	1.1	84	0.8	85	0.9	52	1.1	67	1.1	52	1.3	–0.12	0.0
Rural	81	4.4	68	2.7	70	5.6	79	3.8	74	4.8	48	6.2	66	3.6	43	2.6	–0.29	0.1
Indigenous background																		
Indigenous	75	1.5	61	1.6	61	1.7	73	1.7	73	1.9	43	1.8	57	2.1	45	1.8	–0.45	0.0
Non-Indigenous	87	0.5	77	0.6	73	0.6	86	0.4	88	0.4	56	0.7	74	0.6	54	0.7	0.08	0.0
Socioeconomic background																		
Lowest quartile	79	0.9	67	1.0	64	1.2	77	0.9	81	0.9	44	1.1	64	1.0	45	1.1	–0.30	0.0
Second quartile	84	1.0	74	1.3	70	1.2	83	1.0	85	0.9	51	1.4	70	1.1	52	1.3	–0.08	0.0
Third quartile	90	0.7	78	1.2	77	1.1	89	0.8	90	0.8	61	1.4	76	1.0	55	1.4	0.16	0.0
Highest quartile	93	0.6	86	0.9	81	1.0	92	0.6	93	0.6	68	1.1	84	1.0	65	1.1	0.46	0.0
Sex																		
Males	89	0.6	83	0.6	80	0.6	88	0.5	88	0.5	68	0.9	75	0.7	66	0.8	0.27	0.0
Females	84	0.7	69	0.9	65	0.9	82	0.7	86	0.6	43	0.8	71	0.9	41	0.8	–0.17	0.0
Country																		
Australia	**87**	**0.5**	**76**	**0.6**	**73**	**0.6**	**85**	**0.4**	**87**	**0.4**	**56**	**0.6**	**73**	**0.6**	**54**	**0.6**	**0.06**	**0.0**
OECD average	**81**	**0.1**	**80**	**0.1**	**68**	**0.2**	**80**	**0.1**	**85**	**0.1**	**56**	**0.2**	**73**	**0.2**	**56**	**0.2**	**0.00**	**0.0**

Perceived control in school

Another factor that can influence how competent students believe they are in mathematics is how much control they feel they have over their ability, performance and future growth. In PISA 2012, perceived control was measured in terms of general control beliefs in school and control beliefs specifically related to mathematics. Perceived control in school was assessed with four statements on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

» If I put in enough effort, I can succeed in school
» It is completely my choice whether or not I do well in school
» Family demands or other problems prevent me from putting a lot of time into my school work
» If I had different teachers, I would try harder at school
» If I wanted to, I could perform well at school
» I do badly at school whether or not I study for my exams.

Table 7.13 presents Australian students' responses along with those of the selected comparison countries. In general, students tended to agree that they had control over their success at school. In all comparison countries and Australia, at least 90% of students believed that investing effort would lead to success. There was less student agreement when it came to the impact of external factors. More than 40% of students in Australia, New Zealand and Singapore reported that family demands or other problems prevented them from putting a lot of time into school work compared to 25% of students from Shanghai–China.

Table 7.13 Students' perceived control in school: Australian and international results

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements											
	If I put in enough effort, I can succeed in school		It is completely my choice whether or not I do well in school		Family demands or other problems prevent me from putting a lot of time into my school work		If I had different teachers, I would try harder at school		If I wanted to, I could perform well at school		I do badly at school whether or not I study for my exams	
Country	Agree %	SE	Agree %	SE	Disagree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE
Australia	**97**	**0.2**	**87**	**0.5**	**58**	**0.6**	**58**	**0.6**	**93**	**0.3**	**79**	**0.5**
United States	98	0.3	87	0.7	63	0.9	68	1.1	92	0.5	80	0.9
Hong Kong–China	92	0.6	80	0.7	65	1.0	55	0.9	94	0.5	84	0.6
New Zealand	98	0.3	88	0.7	54	1.0	53	1.0	92	0.7	80	0.9
United Kingdom	98	0.3	84	0.6	65	0.9	59	0.8	91	0.5	86	0.6
Canada	97	0.2	84	0.5	62	0.6	61	0.7	93	0.3	81	0.5
Singapore	97	0.3	88	0.5	57	0.9	51	0.8	95	0.4	78	0.6
Shanghai–China	90	0.6	86	0.6	75	0.8	78	0.8	88	0.6	83	0.7
OECD average	**96**	**0.1**	**86**	**0.1**	**65**	**0.2**	**59**	**0.2**	**90**	**0.1**	**80**	**0.1**

Table 7.14 presents national results for perceived control in school statements. Across all subgroups, students tended to agree that effort and choice were important determinants of success at school. Lower levels of agreement were found when statements related to the effect of external pressures. More Indigenous students (53%) compared to non-Indigenous students (41%) noted that family demands and other problems impacted on the time they spent on school work. Similarly, 48% of students from the lowest socioeconomic quartile noted the influence of these factors compared to 36% of students from the highest quartile. On average, more females reported the impact of family demands and other factors as problematic (45% compared to males' reported 38%).

Table 7.14 Students' perceived control in school: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements											
	If I put in enough effort, I can succeed in school		It is completely my choice whether or not I do well in school		Family demands or other problems prevent me from putting a lot of time into my school work		If I had different teachers, I would try harder at school		If I wanted to, I could perform well at school		I do badly at school whether or not I study for my exams	
	Agree %	SE	Agree %	SE	Disagree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE
Jurisdiction												
ACT	97	0.9	88	1.4	58	2.4	61	2.5	92	1.3	81	1.8
NSW	97	0.3	88	0.8	56	1.0	53	1.2	94	0.5	79	0.9
VIC	97	0.5	86	1.1	63	1.3	58	1.3	94	0.7	81	1.2
QLD	97	0.4	89	0.9	55	1.4	61	1.3	92	0.9	79	1.1
SA	96	0.8	87	1.3	59	1.4	58	1.4	93	0.7	78	1.7
WA	98	0.4	86	1.1	59	1.5	61	1.6	94	0.7	79	1.4
TAS	96	0.8	88	1.3	59	2.0	64	2.0	92	1.0	84	1.6
NT	97	1.3	87	2.6	57	3.6	56	3.4	94	1.4	79	3.0
Geographic location												
Metropolitan	97	0.2	87	0.5	59	0.7	58	0.7	94	0.3	80	0.6
Provincial	96	0.5	87	0.9	58	1.1	57	1.2	92	0.6	76	1.0
Rural	95	1.8	86	3.4	58	6.1	58	4.2	92	3.0	76	4.8
Indigenous background												
Indigenous	95	0.8	88	1.3	47	1.6	53	2.0	93	0.8	64	1.8
Non-Indigenous	97	0.2	87	0.5	59	0.6	58	0.6	93	0.3	80	0.5
Socioeconomic background												
Lowest quartile	96	0.5	85	0.8	52	1.2	56	1.1	92	0.5	72	1.1
Second quartile	97	0.4	87	0.9	56	1.0	57	1.3	93	0.6	77	1.0
Third quartile	98	0.3	89	0.7	61	1.0	56	1.2	94	0.5	82	1.0
Highest quartile	98	0.3	87	0.9	64	1.1	63	1.1	95	0.6	86	0.8
Sex												
Males	97	0.3	88	0.6	62	0.9	55	0.7	93	0.4	78	0.8
Females	97	0.2	87	0.7	55	0.8	60	0.9	94	0.4	81	0.7
Country												
Australia	**97**	**0.2**	**87**	**0.5**	**58**	**0.6**	**58**	**0.6**	**93**	**0.3**	**79**	**0.5**
OECD average	**96**	**0.1**	**86**	**0.1**	**65**	**0.2**	**59**	**0.2**	**90**	**0.1**	**80**	**0.1**

Perceived control in mathematics

Perceived control beliefs were also measured specifically in mathematics via six statements on a four-point Likert scale: strongly agree; agree; disagree; strongly disagree.

- If I put in enough effort, I can succeed in mathematics
- Whether or not I do well in mathematics is completely up to me
- Family demands or other problems prevent me from putting a lot of time into my mathematics work
- If I had different teachers, I would try harder in mathematics
- If I wanted to, I could do well in mathematics
- I do badly in mathematics whether or not I study for my exams.

Australian students' responses along with those of the selected comparison countries are shown in Table 7.15. Results for perceived control beliefs in mathematics were similar to those found for beliefs in school: students tended to agree that they had control and could invest effort to succeed in mathematics. Again, lower agreement levels were found for the impact of external pressures. In Shanghai–China, 76% of students believed that family demands and other problems did not affect the amount of time they put into mathematics work compared to 65% of Australian students, 63% of Singaporean students and 62% of students from New Zealand.

Table 7.15 Students' perceived control in mathematics: Australian and international results

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements											
	If I put in enough effort, I can succeed in mathematics		Whether or not I do well in mathematics is completely up to me		Family demands or other problems prevent me from putting a lot of time into my mathematics work		If I had different teachers, I would try harder in mathematics		If I wanted to, I could do well in mathematics		I do badly in mathematics whether or not I study for my exams	
Country	Agree %	SE	Agree %	SE	Disagree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE
Australia	**93**	**0.4**	**86**	**0.5**	**65**	**0.6**	**61**	**0.6**	**89**	**0.4**	**72**	**0.6**
United States	95	0.4	84	0.6	68	1.0	66	1.3	87	0.6	72	1.0
Hong Kong–China	90	0.6	80	0.7	69	0.9	66	1.1	88	0.7	76	0.9
New Zealand	95	0.4	86	0.7	62	0.9	59	1.2	88	0.6	72	0.9
United Kingdom	96	0.3	83	0.6	71	0.8	69	0.9	87	0.8	77	0.7
Canada	94	0.3	83	0.5	67	0.7	63	0.7	87	0.4	75	0.6
Singapore	98	0.2	90	0.5	63	1.0	60	0.8	94	0.4	76	0.7
Shanghai–China	92	0.5	88	0.6	76	0.7	75	0.8	84	0.5	81	0.8
OECD average	**92**	**0.1**	**83**	**0.1**	**73**	**0.1**	**64**	**0.2**	**83**	**0.1**	**73**	**0.1**

Table 7.16 disaggregates results down further for Australia. It shows less variation for perceived control in mathematics among subgroups in general than was observed for perceived control in school. However, 42% of Indigenous students believed they did badly in mathematics exams irrespective of how much they studied compared to 28% of non-Indigenous students. For the same item, more female students believed that study did not help (32% compared to 25% of males), while 36% of students from the lowest socioeconomic quartile compared to 19% of students from the highest socioeconomic quartile felt the same. Thus, females and students from more disadvantaged backgrounds were more likely to think that study would not help improve their exam performance in mathematics.

Table 7.16 Students' perceived control in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree'/'disagree' or 'strongly disagree' with the following statements											
	If I put in enough effort, I can succeed in mathematics		Whether or not I do well in mathematics is completely up to me		Family demands or other problems prevent me from putting a lot of time into my mathematics work		If I had different teachers, I would try harder in mathematics		If I wanted to, I could do well in mathematics		I do badly in mathematics whether or not I study for my exams	
	Agree %	SE	Agree %	SE	Disagree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE
Jurisdiction												
ACT	94	1.1	88	1.4	61	2.1	64	2.2	87	1.4	78	1.7
NSW	92	0.7	86	0.9	64	1.1	59	1.3	89	0.8	69	0.9
VIC	93	0.6	86	0.9	71	1.4	59	1.5	89	0.9	73	1.4
QLD	94	0.6	87	0.9	59	1.4	66	1.4	89	0.7	73	1.3
SA	93	1.0	85	1.2	64	1.5	60	2.0	87	1.2	69	1.7
WA	93	0.8	85	1.0	65	1.5	63	1.7	89	1.0	73	1.4
TAS	96	0.7	87	1.3	65	2.1	65	1.9	90	1.5	74	1.8
NT	94	1.4	84	3.0	66	4.1	60	3.1	91	1.8	72	2.7
Geographic location												
Metropolitan	93	0.4	86	0.6	65	0.8	60	0.7	89	0.5	72	0.7
Provincial	93	0.5	86	0.9	64	1.0	64	1.3	87	0.8	70	1.2
Rural	94	2.2	88	3.3	64	5.4	55	3.8	95	2.0	68	6.0
Indigenous background												
Indigenous	90	1.0	87	1.1	54	1.5	59	1.6	86	1.1	58	1.7
Non-Indigenous	93	0.4	86	0.5	65	0.6	61	0.7	89	0.4	72	0.6
Socioeconomic background												
Lowest quartile	92	0.6	84	0.8	61	1.2	61	1.2	86	0.8	64	1.2
Second quartile	92	0.7	87	0.9	63	1.1	60	1.3	88	0.9	67	1.1
Third quartile	93	0.6	87	0.8	65	1.1	60	1.3	90	0.7	75	1.1
Highest quartile	94	0.5	86	1.0	70	1.2	64	1.3	91	0.7	81	0.9
Sex												
Males	94	0.5	88	0.6	66	0.9	60	0.9	90	0.5	75	0.7
Females	92	0.5	84	0.7	63	0.8	63	0.8	87	0.6	68	0.8
Country												
Australia	**93**	**0.4**	**86**	**0.5**	**65**	**0.6**	**61**	**0.6**	**89**	**0.4**	**72**	**0.6**
OECD average	**92**	**0.1**	**83**	**0.1**	**73**	**0.1**	**64**	**0.2**	**83**	**0.1**	**73**	**0.1**

Attributions of failure and mathematics anxiety

Eccles and Wigfield's (2002) third group of theories focus on the interaction between why students choose to pursue a subject and how competent they feel in that subject. In PISA 2012, measures of attributions of failure and mathematics anxiety fit within this category, as they are both the product of the interaction between value, and control and competency beliefs.

Attributions of failure in mathematics

Of their attributions of failure, students' self-responsibility for failure in mathematics was measured in PISA 2012 by asking students to imagine that they had performed badly on a weekly mathematics quiz and, given this situation, to consider how likely it would be for them to have any of these six thoughts, as measured on a four-point Likert scale: very likely; likely; slightly likely; and not at all.

- I'm not very good at solving mathematics problems
- My teacher did not explain the concepts well this week

» This week I made bad guesses on the quiz
» Sometimes the course material is too hard
» The teacher did not get students interested in the material
» Sometimes I am just unlucky.

Table 7.17 presents the average percentage agreement students reported for Australia and all comparison countries. Australia and all comparison countries reported percentages of agreement that were lower than across OECD countries on average.

Table 7.17 Students' self-responsibility for failing in mathematics: Australian and international results

Country	Percentage of students who reported that they would be 'likely' or 'very likely' to have the following thoughts											
	I'm not very good at solving mathematics problems		My teacher did not explain the concepts well this week		This week I made bad guesses on the quiz		Sometimes the course material is too hard		The teacher did not get students interested in the material		Sometimes I am just unlucky	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**52**	**0.5**	**47**	**0.6**	**38**	**0.6**	**57**	**0.6**	**49**	**0.7**	**38**	**0.7**
United States	46	1.1	45	1.2	32	0.9	57	0.9	47	1.2	35	1.0
Hong Kong–China	56	1.1	39	0.9	25	0.9	61	1.1	41	1.0	22	0.7
New Zealand	52	1.0	47	1.1	37	0.9	59	0.8	50	1.0	36	0.8
United Kingdom	55	0.9	44	1.1	39	0.9	61	0.9	44	0.9	39	0.9
Canada	50	0.6	46	0.8	46	0.5	58	0.7	52	0.8	37	0.6
Singapore	50	0.8	30	0.7	31	0.8	57	0.8	35	0.8	37	0.9
Shanghai–China	50	0.9	35	0.9	24	0.8	52	1.1	41	0.9	33	0.7
OECD average	**58**	**0.2**	**48**	**0.2**	**46**	**0.2**	**71**	**0.1**	**53**	**0.2**	**49**	**0.2**

Standardising student responses led to the creation of the index of self-responsibility for failure in mathematics. Higher values on this index are linked to students attributing responsibility for failure to external factors rather than to themselves. Table 7.18 presents the index results for Australia and all selected comparison countries. In all countries, except Singapore, a significant difference between sexes was observed, suggesting that females were more likely to attribute failure to external factors or chance and less likely to attribute it to their own efforts. The difference was largest in Australia. Females in Australia, Canada, New Zealand and the United Kingdom had similar scores, which were higher than for females in other comparison countries.

Table 7.18 Index of self-responsibility for failure in mathematics: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	–0.24	0.0	–0.09	0.0	–0.38	0.0	**–0.29**	0.0
United States	–0.35	0.0	–0.27	0.0	–0.44	0.0	**–0.16**	0.0
Hong Kong–China	–0.39	0.0	–0.34	0.0	–0.44	0.0	**–0.10**	0.0
New Zealand	–0.23	0.0	–0.12	0.0	–0.34	0.0	**–0.22**	0.0
United Kingdom	–0.23	0.0	–0.13	0.0	–0.34	0.0	**–0.21**	0.0
Canada	–0.20	0.0	–0.10	0.0	–0.30	0.0	**–0.20**	0.0
Singapore	–0.48	0.0	–0.49	0.0	–0.48	0.0	0.01	0.0
Shanghai–China	–0.49	0.0	–0.40	0.0	–0.59	0.0	**–0.19**	0.0
OECD average	0.00	0.0	0.08	0.0	–0.07	0.0	**–0.15**	0.0

Note: Bolded values indicate a statistically significant difference.

The relationship between index scores and average mathematical literacy performance is plotted in Figure 7.5. For Australian students and the OECD average, the higher the index score (or the more that failure was attributed to external factors), the lower the average mathematical literacy score. In other words, students who tended to take responsibility for problems with mathematics also had higher scores on the PISA 2012 mathematical tasks. These students would likely also attribute success to their own efforts to improve and, therefore, have a more positive attitude about the potential for growth in mathematical learning.

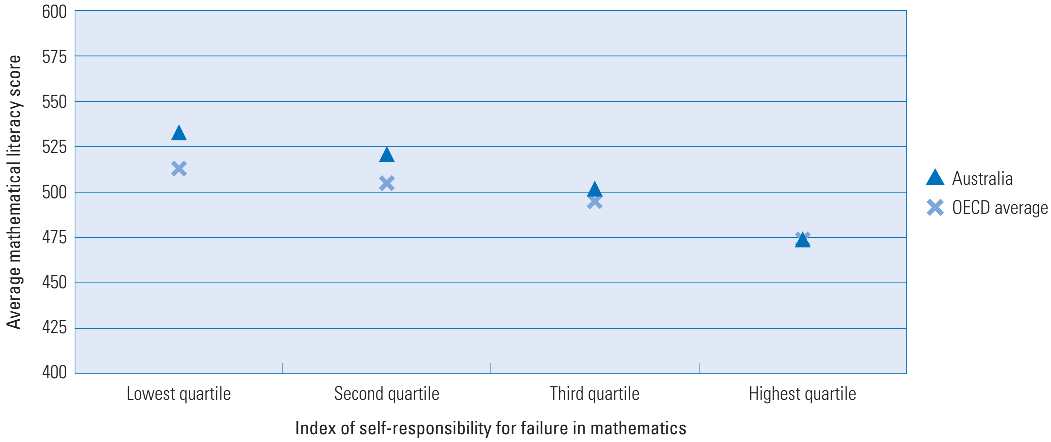


Figure 7.5 Relationship between students' self-responsibility for failure in mathematics and mathematical literacy performance for Australian students and the OECD average

Results for the self-responsibility items and index were calculated for Australian subgroups and are shown in Table 7.19. Sixty per cent of females believed they were not good at solving mathematics problems compared to 44% of males. Furthermore, 64% of females believed that sometimes the course material is too hard compared to 50% of males. Students from higher socioeconomic quartiles had lower index scores and, therefore, were more likely to take responsibility for not succeeding in mathematics, as compared to those from lower socioeconomic quartiles. Indigenous students also had a lower index score, indicating a tendency to attribute failure in mathematics to their own efforts, compared to non-Indigenous students, who were more likely to attribute failure to factors beyond their control. This is an unusual pattern, as lower performing subgroups tended to have the opposite attitude towards failure and Indigenous students were outperformed by non-Indigenous students.

Table 7.19 Students' self-responsibility for failure in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who reported that they would be 'likely' or 'very likely' to have the following thoughts												Index of self-responsibility for failure in mathematics	
	I'm not very good at solving mathematics problems		My teacher did not explain the concepts well this week		This week I made bad guesses on the quiz		Sometimes the course material is too hard		The teacher did not get students interested in the material		Sometimes I am just unlucky			
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction														
ACT	48	2.2	48	2.6	36	2.1	50	2.0	47	2.6	33	2.2	–0.37	0.1
NSW	52	0.9	45	1.1	39	1.1	59	1.1	48	1.3	38	1.2	–0.24	0.0
VIC	53	1.2	49	1.3	37	1.4	56	1.7	50	1.3	35	1.3	–0.23	0.0
QLD	51	1.4	45	1.2	36	1.2	55	1.5	49	1.4	41	1.3	–0.26	0.0
SA	55	1.9	49	2.1	41	1.8	57	2.1	50	2.1	37	1.9	–0.20	0.1
WA	51	1.4	50	1.7	38	1.5	58	1.7	46	2.0	36	1.5	–0.23	0.0
TAS	51	2.0	49	2.1	39	2.0	60	1.9	52	2.1	44	2.1	–0.15	0.0
NT	47	3.8	45	5.2	40	3.3	47	4.9	43	3.9	47	4.5	–0.28	0.1
Geographic location														
Metropolitan	52	0.6	47	0.7	37	0.7	57	0.7	48	0.7	37	0.7	–0.24	0.0
Provincial	51	1.1	48	1.3	40	1.2	56	1.4	51	1.2	40	1.2	–0.23	0.0
Rural	55	3.5	46	6.6	47	4.4	53	4.4	52	8.2	45	4.3	–0.13	0.2
Indigenous background														
Indigenous	59	1.4	46	2.2	47	1.5	62	1.5	54	1.9	51	1.5	–0.25	0.0
Non-Indigenous	52	0.5	47	0.6	38	0.6	57	0.7	49	0.7	37	0.7	–0.04	0.0
Socioeconomic background														
Lowest quartile	55	1.0	45	1.2	42	1.0	62	1.3	49	1.1	43	1.2	–0.16	0.0
Second quartile	52	1.1	45	1.3	40	1.2	59	1.1	50	1.3	39	1.2	–0.19	0.0
Third quartile	52	1.2	49	1.3	36	1.2	55	1.3	50	1.5	37	1.3	–0.25	0.0
Highest quartile	48	1.1	48	1.2	33	1.1	52	1.2	46	1.0	32	1.2	–0.36	0.0
Sex														
Males	44	0.7	44	0.8	35	0.8	50	0.9	49	0.8	38	0.9	–0.38	0.0
Females	60	0.8	50	0.9	41	0.9	64	0.9	49	1.0	37	0.9	–0.09	0.0
Country														
Australia	**52**	**0.5**	**47**	**0.6**	**38**	**0.6**	**57**	**0.6**	**49**	**0.7**	**38**	**0.7**	**–0.24**	**0.0**
OECD average	**58**	**0.2**	**48**	**0.2**	**46**	**0.2**	**71**	**0.1**	**53**	**0.2**	**49**	**0.2**	**0.00**	**0.0**

Mathematics anxiety

Mathematics anxiety (or the worry and tension felt when confronted with mathematical tasks) can have a negative impact on students' ability to demonstrate their potential in the subject. In PISA 2012, anxiety was measured by asking students to rate their level of agreement on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

- I often worry that it will be difficult for me in mathematics classes
- I get very tense when I have to do mathematics homework
- I get very nervous doing mathematics problems
- I feel helpless when doing a mathematics problem
- I worry that I will get poor grades in mathematics.

The average percentage agreement reported by students from Australia and all comparison countries is shown in Table 7.20. Across all countries, there were higher levels of agreement reported on items that assessed worry about mathematics classes and achieving poor grades; three-fifths of Australian students worried that mathematics classes would be difficult for them. On average, more students from the high-performing countries of Singapore, Shanghai–China and Hong Kong–China worried about achieving poor grades in mathematics than students from other countries and at a level around 10% higher than the OECD average. It is important to note that as there was no measure of general academic anxiety in PISA 2102, it is impossible to disentangle whether levels of anxiety reported here in relation to mathematics would be similar to levels reported for general anxiety experienced at school.

Table 7.20 Students' mathematics anxiety: Australian and international results

Country	Percentage of students who 'agree' or 'strongly agree' with the following statements									
	I often worry that it will be difficult for me in mathematics classes		I get very tense when I have to do mathematics homework		I get very nervous doing mathematics problems		I feel helpless when doing a mathematics problem		I worry that I will get poor grades in mathematics	
	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**60**	**0.6**	**37**	**0.6**	**29**	**0.6**	**25**	**0.5**	**62**	**0.7**
United States	57	1.0	37	1.1	29	0.9	22	0.9	49	0.9
Hong Kong–China	69	1.2	27	0.9	26	1.0	32	1.1	71	0.9
New Zealand	62	1.1	38	1.0	33	1.0	27	1.0	64	0.9
United Kingdom	47	0.9	28	0.8	26	1.0	20	0.7	58	0.9
Canada	60	0.8	38	0.7	31	0.6	26	0.6	61	0.7
Singapore	61	0.8	36	0.8	37	0.8	27	0.7	73	0.7
Shanghai–China	53	1.0	31	0.9	27	0.8	28	0.9	71	0.8
OECD average	**59**	**0.2**	**33**	**0.2**	**31**	**0.1**	**30**	**0.2**	**61**	**0.2**

Index scores for mathematics anxiety were created by standardising student responses. Higher index scores are indicative of higher levels of mathematics anxiety. Table 7.21 shows results for Australia and the comparison countries. On average, students from Singapore had the highest levels of anxiety for all students across the comparison countries. However, when the average index scores were calculated separately for females and males, females from Hong Kong–China recorded the highest levels of mathematics anxiety of any group of students. Across all countries, including Australia, females had higher levels of mathematics anxiety than males.

Table 7.21 Index of mathematics anxiety: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.03	0.0	0.20	0.0	–0.14	0.0	**–0.33**	0.0
United States	–0.11	0.0	–0.01	0.0	–0.20	0.0	**–0.19**	0.0
Hong Kong–China	0.11	0.0	0.30	0.0	–0.05	0.0	**–0.34**	0.0
New Zealand	0.10	0.0	0.27	0.0	–0.07	0.0	**–0.34**	0.0
United Kingdom	–0.14	0.0	0.06	0.0	–0.35	0.0	**–0.42**	0.0
Canada	0.01	0.0	0.20	0.0	–0.19	0.0	**–0.39**	0.0
Singapore	0.16	0.0	0.23	0.0	0.10	0.0	**–0.13**	0.0
Shanghai–China	0.03	0.0	0.22	0.0	–0.17	0.0	**–0.39**	0.0
OECD average	0.00	0.0	0.14	0.0	–0.15	0.0	**–0.29**	0.0

Note: Bolded values indicate a statistically significant difference.

Figure 7.6 plots the relationship between anxiety and mathematical literacy performance in PISA 2012 and shows that as mathematics anxiety increased, the average mathematical literacy score decreased. Thus, students who were less anxious about mathematics tended to perform better on the PISA 2012 mathematical literacy tasks.

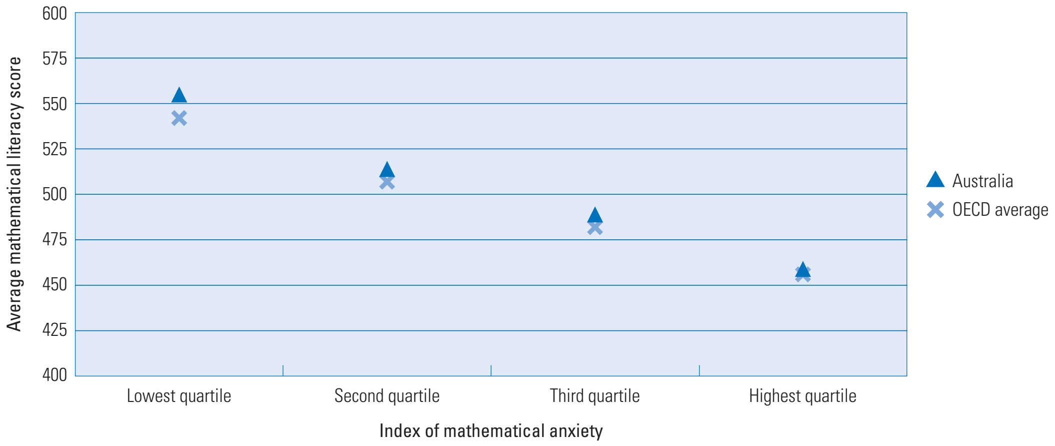


Figure 7.6 Relationship between students' mathematics anxiety and mathematical literacy performance for Australian students and the OECD average

Australia's results for mathematics anxiety were disaggregated into national subgroups as presented in Table 7.22. Levels of mathematics anxiety were highest among students in the Northern Territory. Students from the Australian Capital Territory, Western Australia, Victoria and Tasmania had index scores slightly below the OECD average. Students from lower socioeconomic quartiles reported more anxiety than students from higher socioeconomic quartiles. Of all subgroups, Indigenous students had the highest index score for anxiety.

Table 7.22 Students' mathematics anxiety: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree' with the following statements										Index of mathematics anxiety	
	I often worry that it will be difficult for me in mathematics classes		I get very tense when I have to do mathematics homework		I get very nervous doing mathematics problems		I feel helpless when doing a mathematics problem		I worry that I will get poor grades in mathematics			
	%	SE	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction												
ACT	57	2.0	34	2.0	25	1.8	22	2.1	59	2.3	–0.06	0.0
NSW	61	1.2	36	1.3	29	1.2	25	0.9	64	1.1	0.04	0.0
VIC	59	1.3	37	1.6	27	1.3	23	1.4	61	1.6	–0.01	0.0
QLD	60	1.2	36	1.4	32	1.2	28	1.4	63	1.2	0.07	0.0
SA	62	1.5	42	1.7	31	1.8	26	1.5	59	1.5	0.07	0.0
WA	55	1.7	36	1.5	27	1.4	23	1.4	58	1.6	–0.03	0.0
TAS	59	1.9	38	1.9	26	2.0	22	1.7	57	2.1	–0.01	0.0
NT	65	3.0	45	4.0	39	4.6	24	3.6	59	3.4	0.13	0.1
Geographic location												
Metropolitan	59	0.7	36	0.7	29	0.7	25	0.6	62	0.8	0.02	0.0
Provincial	61	1.0	39	1.2	28	1.2	25	0.9	60	1.0	0.05	0.0
Rural	56	7.9	36	4.7	29	4.1	24	4.8	59	5.7	–0.02	0.1
Indigenous background												
Indigenous	68	1.5	45	1.7	41	1.8	35	1.5	69	1.7	0.26	0.0
Non-Indigenous	59	0.6	37	0.6	28	0.6	24	0.5	62	0.7	0.02	0.0
Socioeconomic background												
Lowest quartile	64	1.1	42	1.3	33	1.1	30	1.1	64	1.1	0.15	0.0
Second quartile	62	1.2	39	1.1	30	1.2	26	1.0	64	1.1	0.08	0.0
Third quartile	57	1.2	35	1.3	26	1.1	23	1.0	60	1.2	–0.01	0.0
Highest quartile	56	1.2	31	1.1	26	1.2	19	1.0	59	1.4	–0.11	0.0
Sex												
Male	52	0.8	34	0.9	23	0.8	20	0.7	55	0.8	–0.14	0.0
Female	67	0.7	40	0.9	35	0.9	30	0.7	69	0.9	0.20	0.0
Country												
Australia	**60**	**0.6**	**37**	**0.6**	**29**	**0.6**	**25**	**0.5**	**62**	**0.7**	**0.03**	**0.0**
OECD average	**59**	**0.2**	**33**	**0.2**	**31**	**0.1**	**30**	**0.2**	**61**	**0.2**	**0.00**	**0.0**

Social factors and behavioural intentions towards mathematics

In the last group of Eccles and Wigfield's (2002) framework, the theories focus on the relationship between motivation and behaviour. They also acknowledge the role that social factors play in the development and maintenance of motivation. PISA 2012 investigated subjective norms, a construct that fits within this fourth group of Eccles and Wigfield's framework.

Subjective norms

Subjective norms relate to the importance that significant others place on academic factors and are significant as they can influence students' own beliefs. In PISA 2012, these norms were measured with six statements on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

- Most of my friends do well in mathematics
- Most of my friends work hard at mathematics
- My friends enjoy taking mathematics tests

» My parents believe it's important for me to study mathematics
» My parents believe that mathematics is important for my career
» My parents like mathematics.

Table 7.23 presents Australian students' responses along with those of the selected comparison countries. In Australia, New Zealand and Canada, around one-third of students reported that their friends were not working hard at mathematics. Whereas a large proportion of students across all countries agreed that their parents believed it was important for them to study mathematics, a smaller proportion reported that their parents liked mathematics. Interestingly, 25% of students from Hong Kong–China and Shanghai–China did not believe that their parents thought that mathematics was important for their career. This was compared to 15% of students in Australia and the United Kingdom, 14 % in the United States, 13% in Canada and 12% in New Zealand.

Table 7.23 Students' subjective norms in mathematics: Australian and international results

	Percentage of students who 'agree' or 'strongly agree' with the following statements											
	Most of my friends do well in mathematics		Most of my friends work hard at mathematics		My friends enjoy taking mathematics tests		My parents believe it's important for me to study mathematics		My parents believe that mathematics is important for my career		My parents like mathematics	
Country	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**80**	**0.5**	**66**	**0.6**	**14**	**0.4**	**94**	**0.3**	**85**	**0.4**	**66**	**0.6**
United States	74	0.9	70	1.0	15	0.8	94	0.4	86	0.7	57	1.1
Hong Kong–China	64	1.0	70	1.2	27	1.0	83	0.8	75	0.8	41	1.1
New Zealand	81	0.9	64	0.9	20	1.1	94	0.4	88	0.7	68	1.1
United Kingdom	85	0.6	73	0.9	13	0.7	95	0.4	85	0.6	59	1.1
Canada	73	0.6	67	0.7	15	0.5	95	0.3	87	0.5	68	0.7
Singapore	82	0.6	86	0.6	44	0.9	97	0.3	92	0.5	72	0.7
Shanghai–China	62	0.9	72	0.9	21	0.9	89	0.6	75	0.9	47	1.1
OECD average	**60**	**0.2**	**51**	**0.2**	**13**	**0.1**	**90**	**0.1**	**80**	**0.1**	**58**	**0.2**

Students' responses to the subjective norm statements were standardised in order to create the index of subjective norms. Table 7.24 presents results on this index for Australia and selected comparison countries. Singaporean students had the highest index score, suggesting that these students felt that their peers and parents respected and valued mathematics more than students in other participating PISA countries. Australia had a positive index score, indicating students were more likely to report that significant others influenced their own beliefs than for students across the OECD, while Hong Kong–China's was just below the OECD average. A significant difference by sex was found in all countries except for the United Kingdom, with males more likely to report that their peers and parents have positive attitudes towards mathematics.

Table 7.24 Index of subjective norms in mathematics: Australian and international results

Country	All students		Females		Males		Sex difference (M – F)	
	Mean index	SE	Mean index	SE	Mean index	SE	Dif.	SE
Australia	0.31	0.0	0.23	0.0	0.39	0.0	**0.15**	0.0
United States	0.23	0.0	0.18	0.0	0.28	0.0	**0.10**	0.0
Hong Kong–China	–0.02	0.0	–0.08	0.0	0.03	0.0	**0.11**	0.0
New Zealand	0.39	0.0	0.33	0.0	0.45	0.0	**0.12**	0.0
United Kingdom	0.31	0.0	0.29	0.0	0.33	0.0	0.04	0.0
Canada	0.38	0.0	0.34	0.0	0.41	0.0	**0.07**	0.0
Singapore	0.80	0.0	0.76	0.0	0.84	0.0	**0.07**	0.0
Shanghai–China	0.11	0.0	0.07	0.0	0.15	0.0	**0.09**	0.0
OECD average	0.00	0.0	–0.06	0.0	0.06	0.0	**0.12**	0.0

Note: Bolded values indicate a statistically significant difference.

Figure 7.7 plots the relationship between quartiles of the index of subjective norms and average mathematical literacy performance to illustrate that in Australia higher scores on the index were linked to higher levels of performance on the PISA 2012 mathematics assessment. The pattern for the OECD was not as clear.

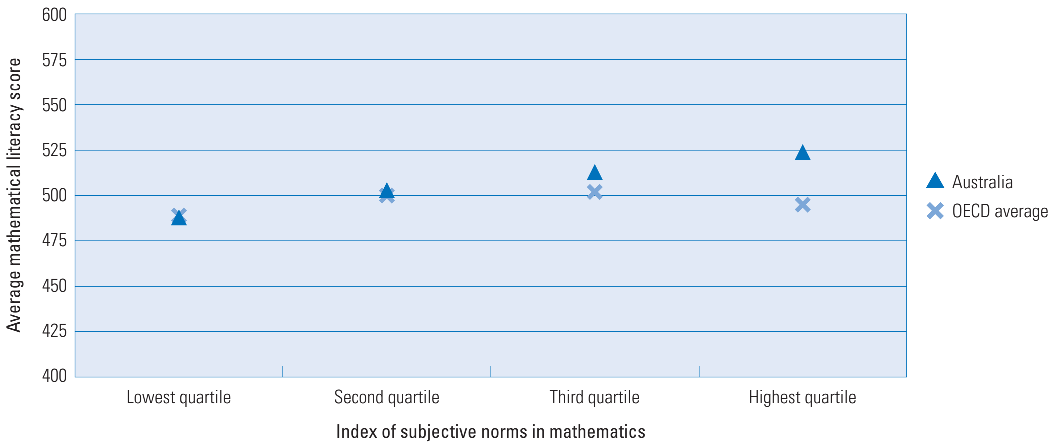


Figure 7.7 Relationship between students' subjective norms in mathematics and mathematical literacy performance for Australian students and the OECD average

In Table 7.25, Australian students' scores on the index of subjective norms and item percentages according to jurisdiction, geographic location, Indigenous background, socioeconomic background and sex are presented. Scores on the subjective norms index were higher in the Northern Territory compared to other jurisdictions. Indigenous students indicated higher valuing of mathematics among their peers and parents than did non-Indigenous students, as did student from the highest socioeconomic quartile compared to those from the lowest socioeconomic quartile.

Table 7.25 Students' subjective norms in mathematics: Results by jurisdiction, geographic location, Indigenous background, socioeconomic background and sex

	Percentage of students who 'agree' or 'strongly agree' with the following statements												Index of subjective norms in mathematics	
	Most of my friends do well in mathematics		Most of my friends work hard at mathematics		My friends enjoy taking mathematics tests		My parents believe it's important for me to study mathematics		My parents believe that mathematics is important for my career		My parents like mathematics			
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Jurisdiction														
ACT	80	1.8	64	2.2	14	1.4	95	0.9	86	1.5	70	2.1	0.33	0.0
NSW	79	1.1	67	1.3	16	0.9	93	0.6	84	0.8	69	1.2	0.34	0.0
VIC	81	1.1	69	1.3	14	1.0	95	0.5	88	0.9	70	1.4	0.40	0.0
QLD	77	1.1	64	1.3	13	0.9	96	0.5	85	1.0	59	1.4	0.23	0.0
SA	82	1.3	66	1.8	11	1.2	94	0.7	84	1.2	60	1.6	0.22	0.0
WA	81	1.3	63	1.6	12	1.2	93	0.9	85	1.1	61	2.0	0.24	0.0
TAS	82	1.5	68	1.6	13	1.1	96	0.7	90	1.0	60	1.9	0.33	0.0
NT	83	4.1	69	5.0	17	3.2	95	1.0	90	1.7	66	5.5	0.48	0.1
Geographic location														
Metropolitan	80	0.6	67	0.7	15	0.5	94	0.3	85	0.5	68	0.7	0.35	0.0
Provincial	79	1.0	63	1.3	12	0.8	94	0.5	87	0.8	59	1.3	0.20	0.0
Rural	80	3.0	61	4.3	12	4.1	93	1.4	87	2.8	65	3.7	0.29	0.0
Indigenous background														
Indigenous	78	1.6	64	1.9	17	1.7	92	0.9	86	1.3	54	2.4	0.32	0.0
Non-Indigenous	80	0.5	66	0.6	14	0.4	94	0.3	85	0.4	66	0.6	0.18	0.1
Socioeconomic background														
Lowest quartile	79	1.0	62	1.1	14	0.9	93	0.6	86	0.9	56	1.3	0.20	0.0
Second quartile	79	0.8	64	1.1	15	0.9	94	0.6	85	1.0	60	1.1	0.25	0.0
Third quartile	80	0.9	68	1.1	13	0.8	95	0.4	85	0.8	69	1.2	0.33	0.0
Highest quartile	81	0.9	70	1.1	14	0.8	96	0.5	87	0.7	78	1.0	0.47	0.0
Sex														
Males	79	0.7	63	0.8	17	0.6	95	0.4	90	0.4	69	0.8	0.39	0.0
Females	80	0.7	69	0.8	10	0.6	93	0.4	80	0.7	62	1.0	0.23	0.0
Country														
Australia	**80**	**0.5**	**66**	**0.6**	**14**	**0.4**	**94**	**0.3**	**85**	**0.4**	**66**	**0.6**	**0.31**	**0.0**
OECD average	**60**	**0.2**	**51**	**0.2**	**13**	**0.1**	**90**	**0.1**	**80**	**0.1**	**58**	**0.2**	**0.00**	**0.0**

CHAPTER 8

The Australian school environment and conditions for learning

Key findings

- Australian students, on average, reported a higher frequency of students not listening, noise and disorder, and teachers needing to wait a long time for students to quieten down when compared to the OECD average and all other comparison countries, except New Zealand.
- Australian students were more likely than students from all comparison countries to report skipping days of school in the two weeks prior to the PISA assessment. However, Australian students were less likely than the OECD average to report skipping classes.
- Almost 20% of Australian students' principals reported bullying or peer intimidation as impacting learning to 'some extent' or 'a lot' and 30% of principals reported student truancy from school events as problematic.
- Shanghai–China and Singapore had the highest percentages of students reporting participation in out-of-school lessons per week in mathematics and science (for mathematics, 71 and 68% respectively, and for science, 55 and 54% respectively). In Australia, 27% of students reported out-of-school mathematics lessons and 15% reported out-of-school lessons for science.
- Australia and all selected comparison countries had positive index scores for teacher–student relations, indicating that students view their relationships with teachers positively. This pattern was also found among Australia's jurisdictions.
- Australia's jurisdictions, in general, had access to a high quality of resources compared to the OECD average. However, 38% of Northern Territory principals reported that a lack of access to science laboratory equipment affected learning to 'some extent' or 'a lot'; while 52% of principals in the Australian Capital Territory and 30% of principals in Tasmania reported learning being affected to 'some extent' or 'a lot' by inadequate Internet connections. Thirty-two per cent of principals in the Australian Capital Territory and 29% of principals in the Northern Territory reported problems with a shortage or inadequacy of instructional materials.
- The average class size reported by Australian students was smaller than all comparison countries and the OECD average.
- On average, over 20% of Australian students felt that they did not belong, were not happy or were not satisfied at school. In Tasmania, 37% of students reported that things were not

ideal in their school and 28% of Northern Territory students felt that they did not belong at their school.

» Principals from the United Kingdom and New Zealand reported the highest levels of teacher morale. While teacher morale is perceived by principals to be high in Australian Capital Territory schools, it is low (below the OECD average) in Northern Territory schools.

School climate shapes the environment of students' learning. Zullig, Koopman, Patton and Ubbes (2010) conducted a literature review of relevant research and noted that five domains were commonly investigated in order to evaluate school climate. These were: order, safety and discipline; academic outcomes; social relationships; school facilities; and school connectedness. This chapter presents data from PISA 2012 that address these domains.

Results for Australian students were investigated at national and jurisdictional levels. In addition, results for the same seven countries selected in Chapter 7 (Shanghai–China, Hong Kong–China, Singapore, Canada, New Zealand, the United Kingdom and the United States) are also reported on, in order to put Australian students' responses in an international context.

The results presented relate to the percentage of respondents who agreed or disagreed with measures of each construct. Scores are also provided for constructed indices designed to standardise responses onto one scale, where the mean of 0 represents the mean of the OECD student population.

Order, safety and discipline

Zullig et al.'s (2010) review identified order, safety and discipline as important aspects of school climate. PISA 2012 investigated these issues via assessment of disciplinary climate, student truancy and student factors affecting school climate.

Disciplinary climate

Disciplinary climate was assessed by asking students how often five events occurred in their mathematics lessons, with responses given on a four-point Likert scale: every lesson; most lessons; some lessons; and never or hardly ever.

» Students don't listen to what the teacher says
» There is noise and disorder
» The teacher has to wait a long time for students to quiet down
» Students cannot work well
» Students don't start working for a long time after the lesson begins.

For OECD countries, responses were standardised to have a mean of 0 and a standard deviation of 1, in order to create the index of disciplinary climate. Higher index values suggest a more positively perceived disciplinary climate. Table 8.1 shows that, on average, Australian students reported a higher frequency of students not listening, noise and disorder, and teachers having to wait for students to quieten down compared to the OECD average and all other comparison countries except New Zealand. This pattern was also reflected in each country's index score, with Australia and New Zealand scoring below the OECD average while the high-performing countries of Shanghai–China and Hong Kong–China scored well above the average.

Table 8.1 Index of disciplinary climate: Australian and international results

Country	Percentage of students who reported that the following phenomena occurred 'most lessons' or 'every lesson'					Index of disciplinary climate	
	Students don't listen to what the teacher says	There is noise and disorder	The teacher has to wait a long time for students to quiet down	Students cannot work well	Students don't start working for a long time after the lesson begins	Mean index	SE
Australia	**38**	**43**	**32**	**22**	**27**	**–0.14**	**0.0**
United States	33	30	24	18	22	0.06	0.0
Hong Kong–China	20	19	14	15	17	0.29	0.0
New Zealand	43	45	35	25	31	–0.25	0.0
United Kingdom	30	32	26	16	19	0.15	0.0
Canada	29	34	25	18	28	0.01	0.0
Singapore	24	28	23	15	17	0.21	0.0
Shanghai–China	15	13	9	11	11	0.57	0.0
OECD average	**32**	**32**	**28**	**22**	**27**	**0.00**	**0.0**

Table 8.2 shows the disciplinary climate results by jurisdiction. Scores on the index show that the standardised scores for all jurisdictions were (like the national result) lower than the OECD average, suggesting that Australian students' perceived the disciplinary climate at their school less positively than on average across OECD countries. Students from the Australian Capital Territory had the lowest index score. Students from Western Australia, the Northern Territory and Queensland, on average, were more likely to report positive perceptions of disciplinary climate.

Table 8.2 Disciplinary climate by jurisdiction

Jurisdiction	Percentage of students who reported that the following phenomena occurred 'most lessons' or 'every lesson'					Index of disciplinary climate	
	Students don't listen to what the teacher says	There is noise and disorder	The teacher has to wait a long time for students to quiet down	Students cannot work well	Students don't start working for a long time after the lesson begins	Mean index	SE
ACT	44	47	36	24	31	–0.26	0.1
NSW	40	45	34	24	29	–0.16	0.0
VIC	37	43	31	22	27	–0.14	0.0
QLD	40	41	30	23	26	–0.13	0.0
SA	36	43	32	20	27	–0.14	0.0
WA	35	40	27	19	25	–0.06	0.0
TAS	39	44	34	22	30	–0.19	0.0
NT	39	39	27	18	23	–0.11	0.1
Australia	**38**	**43**	**32**	**22**	**27**	**–0.14**	**0.0**
OECD average	**32**	**32**	**28**	**22**	**27**	**0.00**	**0.0**

Student truancy

Student truancy was investigated by asking students the number of times they had skipped a day of school and the number of times they had skipped some classes in the two weeks prior to the PISA assessment. Students were required to pick an option from no times, one or two times, three or four times, or five or more times. Note that while the intention of these two questions was that responses would be mutually exclusive, it is possible that students did not respond in this way (e.g., students may have skipped a day of school and believed that as this day included classes that, therefore, they should respond positively to both items). Results should therefore be interpreted with caution.

Table 8.3 presents results for Australia and the international comparison countries. Australian students were more likely to report skipping days of school than those in all comparison countries in the two weeks prior to the PISA assessment. However, Australian students were less likely than the OECD average to report skipping classes in the two weeks prior to the PISA assessment. Almost 20% of Canadian students reported skipping one or two classes compared to 10% of Australian students. The average for skipping one or two classes across OECD countries was 14%.

Table 8.3 Student truancy: Australian and international results

	Percentage of students who reported having skipped a day of school in the two weeks prior to the PISA assessment								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		No times		One or two times		Three or four times		Five or more times	
Country	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**68**	**0.6**	**26**	**0.5**	**4**	**0.2**	**2**	**0.1**	**86**	**0.4**	**10**	**0.3**	**2**	**0.1**	**1**	**0.1**
United States	79	0.8	18	0.7	2	0.3	1	0.1	87	0.6	10	0.6	2	0.2	1	0.1
Hong Kong–China	96	0.3	3	0.3	0	0.1	0	0.1	97	0.3	3	0.3	0	0.1	0	0.0
New Zealand	83	0.6	13	0.5	3	0.3	2	0.2	85	0.7	12	0.6	2	0.3	1	0.2
United Kingdom	82	0.6	15	0.5	2	0.2	1	0.1	88	0.5	9	0.4	1	0.2	1	0.2
Canada	78	0.6	19	0.4	2	0.2	1	0.1	75	0.5	19	0.4	4	0.2	2	0.2
Singapore	85	0.4	13	0.4	1	0.2	1	0.1	88	0.5	11	0.5	1	0.1	1	0.1
Shanghai–China	99	0.1	1	0.1	0	0.0	0	0.1	97	0.4	3	0.3	0	0.1	0	0.1
OECD average	**85**	**0.1**	**12**	**0.1**	**2**	**0.0**	**1**	**0.0**	**82**	**0.1**	**14**	**0.1**	**2**	**0.0**	**1**	**0.0**

Note: The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 8.4 presents student truancy results by jurisdiction. Students from the Australian Capital Territory, Tasmania, New South Wales and Victoria reported the lowest rates of absenteeism in terms of days of school skipped. In particular, more than three-quarters of students from the Australian Capital Territory had attended all school days and almost nine-tenths of students had attended all their classes. For all jurisdictions other than the Australian Capital Territory, more than 20% of students reported skipping at least one day of school in the previous two weeks. Furthermore, students from all jurisdictions except the Northern Territory had attended more classes than the average reported across OECD countries. Together with the international data, these results suggest that Australian students tend to report higher levels of student truancy in terms of days of school skipped; however, once at school, they are more likely to attend most of their classes compared to the OECD average.

Table 8.4 Student truancy by jurisdiction

	Percentage of students who reported having skipped a day of school in the two weeks prior to the PISA assessment								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		No times		One or two times		Three or four times		Five or more times	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	79	1.5	17	1.3	3	0.7	1	0.4	90	1.1	8	0.9	1	0.4	1	0.4
NSW	69	1.1	25	0.9	4	0.4	2	0.3	87	0.9	9	0.7	2	0.3	1	0.2
VIC	70	1.2	25	1.2	3	0.4	2	0.2	85	0.9	12	0.8	2	0.3	1	0.2
QLD	64	1.3	28	1.1	6	0.5	2	0.3	87	0.8	10	0.7	2	0.3	1	0.2
SA	66	1.6	27	1.5	5	0.6	2	0.4	85	0.8	11	0.7	2	0.4	2	0.3
WA	68	1.1	27	1.1	4	0.6	1	0.3	87	1.0	11	0.9	1	0.3	1	0.2
TAS	70	1.5	21	1.3	5	0.7	3	0.5	84	1.2	12	1.1	2	0.4	1	0.4
NT	62	2.4	27	1.8	5	1.2	5	1.7	79	2.5	13	1.7	3	1.0	5	1.7
Australia	**68**	**0.6**	**26**	**0.5**	**4**	**0.2**	**2**	**0.1**	**86**	**0.4**	**10**	**0.3**	**2**	**0.1**	**1**	**0.1**
OECD average	**85**	**0.1**	**12**	**0.1**	**2**	**0.0**	**1**	**0.0**	**82**	**0.1**	**14**	**0.1**	**2**	**0.0**	**1**	**0.0**

Note: The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Student-related factors affecting school climate

To investigate the impact of student-related factors on school climate from another perspective, school principals were asked to report the extent to which eight factors impeded school learning on a four-point Likert scale: not at all; very little; to some extent; and a lot.

- Student truancy
- Students skipping classes
- Students arriving late for school
- Students not attending compulsory school events (e.g., sports day) or excursions
- Students lacking respect for teachers
- Disruption of classes by students
- Student use of alcohol or illegal drugs
- Students intimidating or bullying other students.

Principals' responses were standardised to create an index of student-related factors affecting school climate. Table 8.5 presents results for Australia and selected comparison countries. Hong Kong–China, Singapore and the United Kingdom had positive index scores, indicating that principals from these countries believed these phenomena hindered learning to a lesser extent than the OECD average. Canada had the most negative index score, followed by New Zealand and Australia. Almost 20% of Australian students' principals reported student bullying or intimidation of peers as impacting learning 'to some extent' or 'a lot' and 30% of Australian students' principals reported student truancy at school events as problematic. In Australia, 32% of students had principals that reported student truancy as affecting learning, compared to 8% in the United Kingdom, 42% in New Zealand and 61% in Canada.

Table 8.5 Student-related factors affecting school climate: Australian and international results

Country	Percentage of students in schools whose principals reported that the following phenomena hindered learning 'to some extent' or 'a lot'								Index of student-related factors affecting school climate	
	Student truancy	Students skipping classes	Students arriving late for school	Students not attending compulsory school events (e.g., sports day) or excursions	Students lacking respect for teachers	Disruption of classes by students	Student use of alcohol or illegal drugs	Students intimidating or bullying other students	Mean index	SE
Australia	**32**	**25**	**34**	**30**	**23**	**32**	**4**	**19**	**–0.18**	**0.0**
United States	40	31	34	5	15	16	17	12	–0.14	0.1
Hong Kong–China	9	6	24	9	14	13	1	6	0.37	0.1
New Zealand	42	33	31	14	12	23	7	12	–0.25	0.1
United Kingdom	8	6	15	4	10	10	1	3	0.40	0.1
Canada	61	57	53	18	11	19	20	15	–0.47	0.0
Singapore	9	5	12	5	9	12	0	5	0.47	0.0
Shanghai–China	–	–	–	–	–	–	–	–	–	–
OECD average	**32**	**31**	**31**	**13**	**19**	**32**	**6**	**11**	**–0.08**	**0.0**

Note: Data for Shanghai–China is not comparable.

Table 8.6 presents results for the index of student-related factors affecting school climate by jurisdiction. Northern Territory students were more likely to have principals that reported most of the student factors (particularly, students skipping classes) as impacting learning 'to some extent' or 'a lot'. Tasmanian students' principals were the most likely to report students lacking respect for teachers and students intimidating or bullying other students as problematic, while principals of students from New South Wales were the most likely to report students disrupting classes as impacting on learning.

The Australian Capital Territory, Victoria and Western Australia reported a mean index score that was around the OECD average, while all other jurisdictions reported a lower mean score, indicating

Table 8.6 Student-related factors affecting school climate by jurisdiction

Jurisdiction	Percentage of students in schools whose principals reported that the following phenomena hindered learning 'to some extent' or 'a lot'								Index of student-related factors affecting school climate	
	Student truancy	Students skipping classes	Students arriving late for school	Students not attending compulsory school events (e.g., sports day) or excursions	Students lacking respect for teachers	Disruption of classes by students	Student use of alcohol or illegal drugs	Students intimidating or bullying other students	Mean index	SE
ACT	23	25	30	23	13	29	0	20	0.05	0.0
NSW	36	29	38	35	28	39	5	23	–0.31	0.1
VIC	22	15	38	28	17	25	1	9	0.03	0.1
QLD	40	29	37	30	26	35	5	19	–0.24	0.1
SA	36	24	37	26	18	23	8	28	–0.27	0.1
WA	28	23	30	22	21	28	5	20	–0.05	0.1
TAS	31	24	34	34	32	35	8	36	–0.41	0.0
NT	49	55	34	42	31	36	13	15	–0.71	0.2
Australia	**32**	**25**	**34**	**30**	**23**	**32**	**4**	**19**	**–0.18**	**0.0**
OECD average	**32**	**31**	**31**	**13**	**19**	**32**	**6**	**11**	**–0.08**	**0.0**

principals believed these factors affecting school climate hindered learning to a greater extent compared to the OECD average.

Academic outcomes

Zullig et al.'s (2010) review also emphasised the importance of academic factors as a component of school climate. Constructs investigated in PISA 2012 that address this idea were attitudes to school, learning time in school and learning time out of school.

Attitudes to school

PISA 2012 assessed attitudes to school in two areas: learning activities; and learning outcomes. For learning activities, students were asked to rate their level of agreement to four statements according to a four-point Likert scale: strongly agree; agree; disagree and strongly disagree.

» Trying hard at school will help me get a good job
» Trying hard at school will help me get into a good university
» I enjoy receiving good grades
» Trying hard at school is important.

Students' responses were standardised to have a mean of 0 and a standard deviation of 1 to create the index of attitudes towards school (learning activities). Table 8.7 shows the results for this index for Australia and the comparison countries. Australian students' positive index score suggests that, relative to the OECD average, they had positive attitudes towards school with the average index score for Australian students being higher than the score for students from Hong Kong–China and Shanghai–China. Students from the United States and the United Kingdom reported the most positive attitudes. At least 95% of Australian students, on average, agreed that investing effort at school was important for job opportunities and tertiary study. For Shanghai–China and Hong Kong–China, only 89 and 88% of students respectively, on average, believed that job opportunities would be helped by trying hard at school.

Table 8.7 Attitudes towards school (learning activities): Australian and international results

Country	Percentage of students who 'agree' or 'strongly agree' with the following statements								Index of attitudes towards school (learning activities)	
	Trying hard at school will help me get a good job		Trying hard at school will help me get into a good university		I enjoy receiving good grades		Trying hard at school is important			
	%	SE	%	SE	%	SE	%	SE	Mean index	SE
Australia	**95**	**0.2**	**96**	**0.2**	**97**	**0.2**	**96**	**0.3**	**0.15**	**0.0**
United States	96	0.4	98	0.2	98	0.4	97	0.3	0.31	0.0
Hong Kong–China	88	0.6	92	0.5	96	0.3	94	0.5	–0.31	0.0
New Zealand	95	0.4	97	0.3	98	0.3	96	0.4	0.24	0.0
United Kingdom	96	0.3	96	0.4	98	0.3	98	0.3	0.27	0.0
Canada	93	0.3	97	0.3	98	0.2	95	0.3	0.17	0.0
Singapore	88	0.7	97	0.3	98	0.2	97	0.3	0.07	0.0
Shanghai–China	89	0.5	94	0.5	85	0.6	95	0.4	–0.30	0.0
OECD average	**91**	**0.1**	**94**	**0.1**	**95**	**0.1**	**93**	**0.1**	**0.00**	**0.0**

Table 8.8 presents these results by jurisdiction. Students from Victoria reported the most positive attitudes; however, across all jurisdictions there were larger percentages of students agreeing with items than the OECD average, indicating that (in general) Australian students had a positive attitude towards school learning activities.

Table 8.8 Attitudes towards school (learning activities) by jurisdiction

Jurisdiction	Percentage of students who 'agree' or 'strongly agree' with the following statements								Index of attitudes towards school (learning activities)	
	Trying hard at school will help me get a good job		Trying hard at school will help me get into a good university		I enjoy receiving good grades		Trying hard at school is important			
	%	SE	%	SE	%	SE	%	SE	Mean index	SE
ACT	93	1.3	97	0.7	98	0.7	95	1.2	0.15	0.1
NSW	94	0.4	97	0.4	97	0.3	95	0.5	0.14	0.0
VIC	96	0.6	97	0.5	97	0.4	95	0.6	0.24	0.0
QLD	94	0.7	95	0.6	97	0.4	96	0.6	0.07	0.0
SA	94	0.8	96	0.5	97	0.5	95	0.8	0.12	0.0
WA	95	0.8	96	0.5	98	0.5	97	0.6	0.10	0.0
TAS	95	0.9	95	0.8	97	0.8	96	0.9	0.11	0.0
NT	95	1.9	97	1.2	98	1.1	97	1.3	0.17	0.1
Australia	**95**	**0.2**	**96**	**0.2**	**97**	**0.2**	**96**	**0.3**	**0.15**	**0.0**
OECD average	**91**	**0.1**	**94**	**0.1**	**95**	**0.1**	**93**	**0.1**	**0.00**	**0.0**

For learning outcomes, students' attitudes were also examined via their level of agreement to four statements on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

- School has done little to prepare me for adult life when I leave school
- School has been a waste of time
- School has helped give me confidence to make decisions
- School has taught me things which could be useful in a job.

Responses were combined and standardised to create the index of attitudes towards school (learning outcomes). Results for Australia and the comparison countries are presented in Table 8.9. Australian students reported some of the most positive attitudes towards the learning outcomes of school. Australia's index score and percentage agreement for the items were all above the OECD average. The high-performing countries of Hong Kong–China and Shanghai–China had scores below the OECD average, indicating that students from these countries, on average, were less positive about the learning outcomes of school. The United States, New Zealand, the United Kingdom and Canada also had scores above the OECD index. While results in general were positive relative to other countries participating in PISA, 25% of Australian students believed that school had done little to prepare them for adult life after school.

Table 8.9 Attitudes towards school (learning outcomes): Australian and international results

Country	Percentage of students who 'agree'/ 'disagree' or 'strongly agree'/ 'strongly disagree' with the following statements								Index of attitudes towards school (learning outcomes)	
	School has done little to prepare me for adult life when I leave school		School has been a waste of time		School has helped give me confidence to make decisions		School has taught me things which could be useful in a job			
	Disagree %	SE	Disagree %	SE	Agree %	SE	Agree %	SE	Mean index	SE
Australia	**75**	**0.5**	**90**	**0.4**	**83**	**0.4**	**90**	**0.3**	**0.09**	**0.0**
United States	72	1.0	89	0.6	85	0.6	88	0.6	0.12	0.0
Hong Kong–China	60	1.1	86	0.7	73	0.9	79	0.9	–0.42	0.0
New Zealand	72	0.9	90	0.6	82	0.8	90	0.6	0.08	0.0
United Kingdom	74	0.9	94	0.4	83	0.7	86	0.7	0.13	0.0
Canada	74	0.7	89	0.4	77	0.5	89	0.4	0.05	0.0
Singapore	64	0.7	89	0.4	85	0.6	88	0.6	–0.05	0.0
Shanghai–China	68	1.0	92	0.5	72	0.9	75	0.8	–0.23	0.0
OECD average	**71**	**0.2**	**88**	**0.1**	**77**	**0.1**	**87**	**0.1**	**0.00**	**0.0**

Table 8.10 breaks down the attitudes towards school (learning outcomes) by jurisdiction. It shows that students from the Australian Capital Territory had the most positive attitudes, while students from the Northern Territory reported the most negative attitudes. Almost 30% of students from the Northern Territory believed that school had done little to prepare them for adult life after school. Over 10% of students in New South Wales, the Northern Territory and Tasmania believed that school was a waste of time.

Table 8.10 Attitudes towards school (learning outcomes) by jurisdiction

Jurisdiction	Percentage of students who 'agree'/ 'disagree' or 'strongly agree'/ 'strongly disagree' with the following statements								Index of attitudes towards school (learning outcomes)	
	School has done little to prepare me for adult life when I leave school		School has been a waste of time		School has helped give me confidence to make decisions		School has taught me things which could be useful in a job			
	Disagree %	SE	Disagree %	SE	Agree %	SE	Agree %	SE	Mean index	SE
ACT	76	2.2	93	1.2	84	1.8	91	1.2	0.17	0.0
NSW	74	1.0	88	0.7	83	0.8	90	0.6	0.07	0.0
VIC	78	0.9	91	0.7	84	1.0	90	0.8	0.15	0.0
QLD	75	1.4	90	0.8	84	1.0	91	0.8	0.08	0.0
SA	75	1.6	90	1.0	83	1.6	91	1.0	0.09	0.0
WA	74	1.5	91	0.8	83	1.3	90	0.8	0.02	0.0
TAS	75	2.0	89	1.2	83	1.5	91	1.2	0.08	0.0
NT	71	2.7	89	1.9	84	2.9	93	2.3	–0.07	0.1
Australia	**75**	**0.5**	**90**	**0.4**	**83**	**0.4**	**90**	**0.3**	**0.09**	**0.0**
OECD average	**71**	**0.2**	**88**	**0.1**	**77**	**0.1**	**87**	**0.1**	**0.00**	**0.0**

Learning time in school

In order to investigate the amount of learning students participated in at school, students were asked the total number of class periods they had per week, in addition to the number of periods per week they had for language-of-instruction (e.g., English), mathematics and science. Students were also asked about the average length of their class periods for each subject. Using this data, it was possible to calculate the amount of class time that was dedicated to each of the three subjects. Note that there was large variability in students' responses regarding the average length of their class periods, suggesting that these data should be interpreted with caution. These data will be investigated further in later reports by triangulating student responses with data from principals. As students participating in PISA in Australia were from different grade levels and their participation time in subjects like mathematics and science may have been dependent on subject-elective choices, later examination of these data will also explore relationships with the level of mathematics studied (i.e., general or specialist).

Table 8.11 shows how much learning time in school Australian students reported in comparison to other countries. Australia scored just below the OECD average for total class periods per week at approximately 27, while students from the high-performing countries of Hong Kong–China, Singapore and Shanghai–China all reported an average of over 40 class periods per week. Australia and the comparison countries reported an average time spent per week in mathematics, language-of-instruction and science lessons that was above the OECD average. Canadian students reported the most time spent per week in all three categories.

Table 8.11 Learning time in school: Australian and international results

	Number of all class periods in a normal full week of school (class periods)		Time per week spent learning (minutes)					
			Regular mathematics lessons		Regular language-of-instruction lessons		Regular science lessons	
Country	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Australia	**26.5**	**0.2**	**236.3**	**0.9**	**233.3**	**1.0**	**227.2**	**1.3**
United States	19.7	0.4	254.1	4.9	257.7	5.0	254.9	4.9
Hong Kong–China	40.7	0.4	267.6	2.6	279.7	2.6	235.4	4.2
New Zealand	24.5	0.2	240.8	2.0	242.6	2.0	247.9	3.5
United Kingdom	27.2	0.3	230.0	2.2	231.8	2.6	295.0	3.7
Canada	19.4	0.1	313.8	2.8	316.1	2.9	306.2	2.7
Singapore	45.6	0.2	287.8	1.3	223.6	1.4	302.2	2.3
Shanghai–China	41.3	0.3	269.5	2.9	248.1	2.7	264.1	5.6
OECD average	**29.9**	**0.0**	**217.8**	**0.4**	**214.7**	**0.4**	**200.2**	**0.6**

Table 8.12 breaks down results for learning time in school according to jurisdiction. South Australian students reported the highest total for class periods per week. Northern Territory students reported the most time spent learning mathematics and English. Western Australian students reported the largest amount of time spent learning science per week. Students from the Australian Capital Territory reported the least amount of time in each subject, with more than 30 minutes separating their average from the highest averages reported by students from the Northern Territory and Western Australia.

Table 8.12 Learning time in school by jurisdiction

Jurisdiction	Number of all class periods in a normal full week of school (class periods)		Time per week spent learning (minutes): Regular mathematics lessons		Regular English lessons		Regular science lessons	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
ACT	28.1	0.4	219.1	2.4	217.3	2.6	217.9	2.8
NSW	28.6	0.3	233.8	1.7	231.0	1.6	223.6	1.7
VIC	28.2	0.5	241.9	2.5	240.7	2.6	219.6	3.1
QLD	24.8	0.5	227.3	3.0	222.0	2.7	231.5	3.1
SA	30.4	0.6	233.2	3.5	230.9	3.5	229.9	3.8
WA	27.4	0.4	248.9	2.8	245.0	2.3	252.4	3.7
TAS	26.1	0.4	245.0	3.5	237.9	2.8	219.7	3.7
NT	26.3	0.8	251.1	4.1	252.2	4.0	243.5	6.4
Australia[1a]	**27.6**	**0.2**	**236.3**	**0.9**	**233.3**	**1.0**	**227.2**	**1.3**
OECD average	**29.9**	**0.0**	**217.8**	**0.4**	**214.7**	**0.4**	**200.2**	**0.6**

[1] Values reported here for Australia are slightly different to those reported in the international PISA report due to varying treatment of missing data.

Learning time out of school

The PISA 2012 assessment also investigated the amount of learning students reported as occurring outside of school hours. Students were asked to record the amount of hours they spent out of school in lessons for language-of-instruction, mathematics, science and other subjects.

Table 8.13 presents results for Australia and the comparison countries. Shanghai–China and Singapore had the highest percentages of students participating in out-of-school lessons in mathematics and science. For language of instruction and for other subjects, Shanghai–China and Singapore had the highest percentages. For mathematics, language of instruction and science, more than 10% of students from Shanghai–China reported spending at least 4 hours per week in out-of-school lessons. Furthermore, only 29% of student from Shanghai–China reported no attendance at out-of-school mathematics lessons compared to approximately 73% of Australian students.

Results for learning time out of school by jurisdiction are shown in Table 8.14. Tasmania had the highest percentage of students who spent at least 4 hours per week in out-of-school lessons across all subject areas. South Australia had the highest percentage of students who reported no attendance at out-of-school mathematics and English lessons, along with students from the Australian Capital Territory for science and students from New South Wales and South Australia in other subjects.

Table 8.13 Learning time out of school: Australian and international results

	Mathematics						Language of instruction						Science						Other subjects					
	No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more	
Country	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Australia	**73**	**0.6**	**23**	**0.6**	**4**	**0.2**	**80**	**0.5**	**17**	**0.5**	**3**	**0.2**	**85**	**0.5**	**13**	**0.5**	**3**	**0.2**	**74**	**0.6**	**19**	**0.5**	**7**	**0.3**
United States	70	1.0	24	1.0	6	0.4	75	0.9	20	0.9	5	0.4	75	0.9	20	0.9	5	0.4	67	1.0	23	0.9	10	0.5
Hong Kong–China	53	1.2	41	1.1	6	0.4	76	1.1	22	1.2	2	0.3	71	1.0	24	0.8	5	0.5	58	1.2	37	1.2	5	0.4
New Zealand	73	1.2	21	1.1	6	0.5	79	1.1	15	0.9	6	0.6	81	0.9	13	0.7	6	0.5	71	0.8	19	0.8	10	0.7
United Kingdom	58	1.2	33	1.3	9	0.7	67	1.0	25	1.1	9	0.7	65	1.0	24	1.1	10	0.8	50	1.0	37	1.0	14	0.6
Canada	73	0.7	22	0.6	5	0.3	80	0.5	15	0.4	4	0.2	80	0.6	16	0.5	4	0.3	72	0.6	20	0.5	8	0.4
Singapore	32	1.0	50	0.8	18	0.6	54	0.9	37	0.9	8	0.5	46	1.0	41	0.9	13	0.5	49	1.0	41	0.9	11	0.5
Shanghai–China	29	1.1	55	1.1	16	0.6	49	0.9	41	0.9	11	0.6	45	1.1	44	1.1	12	0.6	43	1.0	47	0.9	10	0.6
OECD average	**62**	**0.2**	**30**	**0.2**	**8**	**0.1**	**73**	**0.2**	**22**	**0.1**	**5**	**0.1**	**74**	**0.2**	**22**	**0.1**	**5**	**0.1**	**63**	**0.2**	**28**	**0.1**	**8**	**0.1**

Note: The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Table 8.14 Learning time out of school by jurisdiction

	Mathematics						English						Science						Other subjects					
	No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more		No attendance		Less than 4 hours a week		Four hours a week or more	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	76	2.0	21	1.7	3	0.9	83	1.8	14	1.6	3	0.8	87	1.7	11	1.6	2	0.5	75	2.2	19	2.0	6	1.1
NSW	69	1.5	26	1.4	5	0.5	79	1.1	17	1.1	4	0.5	84	1.0	12	0.9	3	0.4	77	1.1	17	1.0	6	0.5
VIC	75	1.4	22	1.2	4	0.4	81	1.2	16	1.2	3	0.4	86	1.0	12	0.9	2	0.4	74	1.3	20	1.2	6	0.6
QLD	72	1.2	24	1.2	3	0.4	80	1.0	18	1.0	2	0.3	84	0.9	14	0.9	3	0.4	70	1.1	22	1.1	8	0.7
SA	82	1.5	14	1.3	4	0.6	86	1.3	10	1.1	4	0.7	86	1.2	10	1.0	4	0.6	77	1.4	16	1.2	7	0.9
WA	73	1.4	23	1.4	4	0.6	79	1.3	18	1.2	4	0.7	82	1.2	15	1.1	3	0.6	73	1.8	20	1.6	7	0.9
TAS	78	1.9	16	1.7	6	1.0	82	1.7	14	1.6	4	0.8	84	1.6	12	1.4	4	0.7	69	2.0	22	1.5	9	1.4
NT	80	3.3	17	3.2	3	1.3	79	2.5	17	2.4	4	1.6	83	3.7	15	4.0	2	1.0	75	2.7	19	3.0	6	2.4
Australia	**73**	**0.6**	**23**	**0.6**	**4**	**0.2**	**80**	**0.5**	**17**	**0.5**	**3**	**0.2**	**85**	**0.5**	**13**	**0.5**	**3**	**0.2**	**74**	**0.6**	**19**	**0.5**	**7**	**0.3**
OECD average	**62**	**0.2**	**30**	**0.2**	**8**	**0.1**	**73**	**0.2**	**22**	**0.1**	**5**	**0.1**	**74**	**0.2**	**22**	**0.1**	**5**	**0.1**	**63**	**0.2**	**28**	**0.1**	**8**	**0.1**

Note: The mean score difference (the difference between the average scores for the group) has been calculated without rounding off decimal places, but are presented as whole numbers.

Social relationships

According to Zullig et al.'s (2010) review, social relationships—in particular, relationships between teachers and students—are an important part of school climate.

Teacher–student relationships

PISA 2012 assessed teacher–student relationships by asking students to rate their level of agreement with five statements on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

- » I get along well with most of my teachers
- » Most teachers are interested in students' wellbeing
- » Most of my teachers really listen to what I have to say
- » If I need extra help, I will receive it from my teachers
- » Most of my teachers treat me fairly.

Responses were combined and standardised to form the index of teacher–student relations. Higher index scores suggest that students have a more positive perception of teacher–student relationships.

Results for Australia and the comparison countries are shown in Table 8.15. All countries in the table had positive index scores, indicating that students viewed their relationships with teachers positively. Shanghai–China, Singapore and Canada had the highest index scores. Ninety per cent of Australian students believed they would receive extra help from teachers if it was needed. Eighty per cent of Australian students believed their teachers really listened to what they had to say, compared to only 71% of students from Hong Kong–China.

Table 8.15 Teacher–student relations: Australian and international results

	Percentage of students who 'agreed' or 'strongly agreed' with the following statements					Index of teacher–student relations	
Country	I get along well with most of my teachers	Most teachers are interested in students' wellbeing	Most of my teachers really listen to what I have to say	If I need extra help, I will receive it from my teachers	Most of my teachers treat me fairly	Mean index	SE
Australia	**84**	**87**	**80**	**90**	**87**	**0.15**	**0.0**
United States	83	86	78	90	90	0.21	0.0
Hong Kong–China	92	79	71	91	83	0.03	0.0
New Zealand	84	85	78	89	88	0.11	0.0
United Kingdom	85	86	76	91	86	0.15	0.0
Canada	86	86	81	92	90	0.28	0.0
Singapore	92	92	83	93	89	0.36	0.0
Shanghai–China	93	91	81	93	90	0.46	0.0
OECD average	**82**	**77**	**74**	**82**	**81**	**0.00**	**0.0**

As shown in Table 8.16, the results by jurisdiction show that the perceptions of student–teacher relationships were more positive among students in the Australian Capital Territory, Queensland and Victoria. The percentage agreement of students from all jurisdictions, on average, was higher than the OECD average. Therefore, more students across Australia perceived their relationship with teachers positively compared to students across the OECD, on average.

Table 8.16 Teacher–student relations by jurisdiction

Jurisdiction	Percentage of students who 'agreed' or 'strongly agreed' with the following statements					Index of teacher–student relations	
	I get along well with most of my teachers	Most teachers are interested in students' wellbeing	Most of my teachers really listen to what I have to say	If I need extra help, I will receive it from my teachers	Most of my teachers treat me fairly	Mean index	SE
ACT	86	89	83	89	91	0.25	0.1
NSW	82	86	78	88	86	0.14	0.0
VIC	85	88	82	91	87	0.17	0.0
QLD	85	90	80	91	87	0.18	0.0
SA	83	84	78	88	86	0.12	0.0
WA	85	89	78	90	86	0.08	0.0
TAS	84	89	78	88	86	0.11	0.0
NT	86	89	78	92	87	0.05	0.0
Australia	**84**	**87**	**80**	**90**	**87**	**0.15**	**0.0**
OECD average	**82**	**77**	**74**	**82**	**81**	**0.00**	**0.0**

School facilities

Zullig et al. (2010) noted that school climate was also determined in part by the quality of school facilities. In PISA 2012, school facilities were assessed by investigating school resources and class size.

School resources

School resources were assessed by asking principals to report whether their schools' capacity to provide instruction was hindered by a shortage or inadequacy of six resources, with responses made on a four-point Likert scale: not at all; very little; to some extent; and a lot.

- » Science laboratory equipment
- » Instructional materials (e.g., textbooks)
- » Computers for instruction
- » Internet connectivity
- » Computer software for instruction
- » Library materials.

Results were combined and standardised to create the index of quality of schools' educational resources. Table 8.17 shows results for Australia and selected comparison countries. Singapore's index score was the highest, indicating a high quality of educational resources as reported by their school principals. The high-performing country Shanghai–China had the lowest index score, with these principals more likely to report that an inadequacy of educational resources interfered with student learning. Australia's scores were well above the OECD average, indicating that, relative to other OECD countries, Australian schools on average had access to a high quality of educational resources.

Table 8.17 Quality of schools' educational resources: Australian and international results

Country	Percentage of students in schools whose principals reported that the following phenomena hindered student learning 'to some extent' or 'a lot'						Index of quality of schools' educational resources	
	Shortage or inadequacy of science laboratory equipment	Shortage or inadequacy of instructional materials (e.g., textbooks)	Shortage or inadequacy of computers for instruction	Lack or inadequacy of Internet connectivity	Shortage or inadequacy of computer software for instruction	Shortage or inadequacy of library materials	Mean index	SE
Australia	**14**	**9**	**11**	**18**	**14**	**11**	**0.68**	**0.0**
United States	21	15	33	15	23	18	0.38	0.1
Hong Kong–China	4	13	21	8	23	17	0.44	0.1
New Zealand	11	8	44	38	31	9	0.20	0.1
United Kingdom	18	11	24	19	17	16	0.51	0.1
Canada	17	16	36	23	27	14	0.27	0.0
Singapore	3	2	7	5	6	3	1.19	0.0
Shanghai–China	39	22	28	29	38	28	0.13	0.1
OECD average	**31**	**20**	**34**	**21**	**32**	**26**	**0.05**	**0.0**

The index scores in Table 8.18 suggest that schools across Australia's jurisdictions in general had access to a high quality of resources compared to the OECD average. However, 38% of Northern Territory principals reported lack of access to science laboratory equipment affected learning 'to some extent' or 'a lot', while 52% of principals in the Australian Capital Territory and 30% of Tasmanian principals reported learning being affected 'to some extent' or 'a lot' by inadequate Internet connections. Thirty-two per cent of principals in the Australian Capital Territory and 29% of principals in the Northern Territory reported a shortage or inadequacy of instructional materials. Western Australian and Victorian schools had the highest index scores, suggesting that these principals reported the least shortages in educational resources relative to principals in other jurisdictions.

Table 8.18 Quality of schools' educational resources by jurisdiction

Jurisdiction	Percentage of students in schools whose principals reported that the following phenomena hindered student learning 'to some extent' or 'a lot'						Index of quality of schools' educational resources	
	Shortage or inadequacy of science laboratory equipment	Shortage or inadequacy of instructional materials (e.g., textbooks)	Shortage or inadequacy of computers for instruction	Lack or inadequacy of Internet connectivity	Shortage or inadequacy of computer software for instruction	Shortage or inadequacy of library materials	Mean index	SE
ACT	21	32	19	52	30	12	0.28	0.0
NSW	16	12	11	14	14	13	0.71	0.1
VIC	12	6	9	16	9	11	0.81	0.1
QLD	14	6	13	17	17	9	0.54	0.1
SA	14	8	16	23	19	9	0.42	0.1
WA	11	9	10	22	22	8	0.87	0.1
TAS	12	11	9	30	21	8	0.42	0.0
NT	38	29	13	21	21	5	0.14	0.1
Australia	**14**	**9**	**11**	**18**	**14**	**11**	**0.68**	**0.0**
OECD average	**31**	**20**	**34**	**21**	**21**	**26**	**0.05**	**0.0**

Class size

Class size was examined in PISA 2012 by asking students to report how many students were in their English class. Table 8.19 shows average class sizes for Australia and the comparison countries. The student-reported average class size for Australia was the lowest class size of all comparison countries and was below the OECD average. New Zealand, the United Kingdom, Canada and the United States had similar class sizes. Average class sizes for the high-performing countries were 33 students or larger.

As shown in Table 8.20, class sizes across the Australian jurisdictions were spread from an average of 19 students in the Northern Territory to approximately 24 students in New South Wales.

Table 8.19 Class size: Australian and international results

Country	Class size	
	Mean	SE
Australia	**22.6**	**0.1**
United States	24.5	0.4
Hong Kong–China	33.2	0.3
New Zealand	23.9	0.2
United Kingdom	24.2	0.1
Canada	24.3	0.1
Singapore	33.0	0.1
Shanghai–China	35.9	0.4
OECD average	**23.9**	**0.0**

Table 8.20 Class size by jurisdiction

Jurisdiction	Class size	
	Mean	SE
ACT	23.0	0.2
NSW	23.7	0.3
VIC	22.4	0.4
QLD	22.3	0.2
SA	22.2	0.2
WA	21.3	0.3
TAS	21.6	0.3
NT	19.0	0.4
Australia	**22.6**	**0.1**
OECD average	**23.9**	**0.0**

School connectedness

The final component of school climate identified by Zullig et al. (2010) was school connectedness, measured in PISA 2012 through students' sense of belonging and teacher morale.

Sense of belonging

Students were asked to rate their level of agreement on nine statements designed to assess their sense of belonging at their school, with responses made on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

» I feel like an outsider (or left out of things) at school
» I make friends easily at school
» I feel like I belong at school
» I feel awkward and out of place in my school
» Other students seem to like me
» I feel lonely at school
» I feel happy at school
» Things are ideal in my school
» I am satisfied with my school.

Responses were combined and standardised to have a mean of 0 and a standard deviation of 1. Higher index scores are illustrative of students feeling a stronger sense of belonging. Table 8.21 presents results for Australia and the comparison countries. All countries had index scores below the OECD average. Hong Kong–China and Shanghai–China had the most negative scores, indicating that students from these countries were least likely to feel a sense of belonging at school. Of the comparison countries, students from the United Kingdom and the United States had the least negative index scores. On average, over 20% of Australian students felt that they did not belong, were not happy or were not satisfied at school.

Table 8.22 presents the results for sense of belonging according to jurisdiction. Students from the Australian Capital Territory had the most positive sense of belonging at school. Students from all other jurisdictions had index scores below the OECD average. Thirty-seven per cent of Tasmanian students disagreed that things were ideal in their school and almost 28% of Northern Territory students felt that they did not belong at their school.

Table 8.21 Sense of belonging: Australian and international results

Country	Percentage of students who 'agree' or 'strongly agree'/ 'disagree' or 'strongly disagree' with the following statements																		Index of sense of belonging	
	I feel like an outsider (or left out of things) at school		I make friends easily at school		I feel like I belong at school		I feel awkward and out of place in my school		Other students seem to like me		I feel lonely at school		I feel happy at school		Things are ideal in my school		I am satisfied with my school			
	Disagree %	SE	Agree %	SE	Agree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE	Agree %	SE	Agree %	SE	Agree %	SE	Mean index	SE
Australia	**85**	**0.5**	**85**	**0.4**	**78**	**0.5**	**85**	**0.4**	**92**	**0.4**	**88**	**0.4**	**80**	**0.5**	**69**	**0.6**	**79**	**0.5**	**–0.15**	**0.0**
United States	86	0.7	88	0.6	81	0.8	83	0.7	93	0.5	88	0.7	80	0.9	74	0.9	81	1.1	–0.05	0.0
Hong Kong–China	82	0.9	86	0.6	73	1.0	87	0.7	80	0.7	86	0.6	86	0.6	60	1.2	77	1.1	–0.39	0.0
New Zealand	86	0.7	87	0.7	78	0.9	86	0.7	91	0.5	88	0.5	81	0.8	70	1.0	78	1.0	–0.14	0.0
United Kingdom	89	0.6	88	0.6	79	0.8	88	0.5	93	0.4	92	0.5	83	0.8	71	0.8	84	0.7	–0.02	0.0
Canada	87	0.5	87	0.5	78	0.5	85	0.4	93	0.3	89	0.4	81	0.5	65	0.5	80	0.6	–0.09	0.0
Singapore	84	0.7	88	0.4	84	0.7	83	0.6	86	0.5	84	0.6	88	0.7	75	0.8	81	0.7	–0.15	0.0
Shanghai–China	87	0.6	87	0.5	67	0.9	87	0.7	77	0.7	86	0.6	85	0.7	47	1.0	69	1.1	–0.32	0.0
OECD average	**89**	**0.1**	**87**	**0.1**	**81**	**0.1**	**88**	**0.1**	**89**	**0.1**	**91**	**0.1**	**80**	**0.1**	**61**	**0.2**	**78**	**0.2**	**0.00**	**0.0**

Table 8.22 Sense of belonging by jurisdiction

Jurisdiction	Percentage of students who 'agree' or 'strongly agree'/ 'disagree' or 'strongly disagree' with the following statements																		Index of sense of belonging	
	I feel like an outsider (or left out of things) at school		I make friends easily at school		I feel like I belong at school		I feel awkward and out of place in my school		Other students seem to like me		I feel lonely at school		I feel happy at school		Things are ideal in my school		I am satisfied with my school			
	Disagree %	SE	Agree %	SE	Agree %	SE	Disagree %	SE	Agree %	SE	Disagree %	SE	Agree %	SE	Agree %	SE	Agree %	SE	Mean index	SE
ACT	88	1.4	88	1.4	85	1.7	89	1.5	93	1.1	90	1.5	86	1.6	70	2.1	82	1.7	0.01	0.0
NSW	84	0.8	86	0.7	77	0.8	84	0.9	92	0.6	87	0.7	79	1.1	68	1.1	76	1.0	–0.17	0.0
VIC	87	1.0	86	1.0	81	1.1	86	0.9	93	0.7	89	0.9	82	1.2	70	1.4	80	1.3	–0.07	0.0
QLD	85	1.0	86	1.0	76	1.1	83	1.0	91	0.9	89	0.9	81	1.0	73	1.4	82	0.9	–0.18	0.0
SA	86	1.2	84	1.5	78	1.6	85	1.4	90	1.4	88	1.1	78	1.6	70	1.6	80	1.3	–0.16	0.0
WA	85	1.1	84	1.3	76	1.5	86	1.2	90	1.1	89	1.1	77	1.4	65	1.7	78	1.5	–0.24	0.0
TAS	84	1.6	82	1.5	77	1.8	84	1.5	89	1.1	87	1.3	77	1.8	63	2.1	77	1.7	–0.24	0.0
NT	82	3.1	84	2.6	72	3.4	85	2.5	89	2.2	84	3.2	76	3.2	71	3.6	81	2.9	–0.23	0.1
Australia	**85**	**0.5**	**85**	**0.4**	**78**	**0.5**	**85**	**0.4**	**92**	**0.4**	**88**	**0.4**	**80**	**0.5**	**69**	**0.6**	**79**	**0.5**	**–0.15**	**0.0**
OECD average	**89**	**0.1**	**87**	**0.1**	**81**	**0.1**	**88**	**0.1**	**89**	**0.1**	**91**	**0.1**	**80**	**0.1**	**61**	**0.2**	**78**	**0.2**	**0.00**	**0.0**

Teacher morale

Teacher morale was assessed by principals' level of agreement with four statements, reported on a four-point Likert scale: strongly agree; agree; disagree; and strongly disagree.

- » The morale of teachers in this school is high
- » Teachers work with enthusiasm
- » Teachers take pride in this school
- » Teachers value academic achievement.

Responses were standardised and used to create the index of teacher morale, with higher index scores representing higher levels of teacher morale. Table 8.23 presents results for Australia and selected comparison countries. All participating PISA principals from the United States, Hong Kong–China, New Zealand, the United Kingdom and Canada and 99% of principals from Australia and Singapore agreed that teachers at their schools valued academic achievement. This was compared to 95% of principals from Shanghai–China. In terms of index scores, principals from the United Kingdom and New Zealand reported the highest levels of teacher morale. The United States, Shanghai–China and, particularly, Hong Kong–China had the lowest teacher morale index scores.

Table 8.23 Teacher morale: Australian and international results

	Percentage of students in schools whose principals reported to 'agree' or 'strongly agree' with the following statements				Index of teacher morale	
Country	The morale of teachers in this school is high	Teachers work with enthusiasm	Teachers take pride in this school	Teachers value academic achievement	Mean index	SE
Australia	**93**	**98**	**98**	**99**	**0.14**	**0.0**
United States	81	95	98	100	–0.03	0.1
Hong Kong–China	78	98	89	100	–0.42	0.1
New Zealand	94	100	99	100	0.36	0.1
United Kingdom	91	98	98	100	0.45	0.1
Canada	90	96	99	100	0.18	0.0
Singapore	94	98	95	99	0.13	0.0
Shanghai–China	96	95	99	95	–0.01	0.1
OECD average	**91**	**94**	**95**	**97**	**0.00**	**0.0**

Results for Australia by jurisdiction are presented in Table 8.24 and demonstrate that while teacher morale is perceived to be high in Australian Capital Territory schools, it is low (below the OECD average) in Northern Territory schools.

Table 8.24 Teacher morale by jurisdiction

	Percentage of students in schools whose principals reported to 'agree' or 'strongly agree' with the following statements				Index of teacher morale	
Jurisdiction	The morale of teachers in this school is high	Teachers work with enthusiasm	Teachers take pride in this school	Teachers value academic achievement	Mean index	SE
ACT	95	100	100	100	0.36	0.0
NSW	92	96	98	99	0.12	0.1
VIC	95	98	97	99	0.15	0.1
QLD	93	99	98	99	0.16	0.1
SA	96	98	98	100	0.23	0.1
WA	95	97	99	99	0.16	0.1
TAS	95	100	99	99	0.07	0.0
NT	70	82	87	100	–0.46	0.2
Australia	**93**	**98**	**98**	**99**	**0.14**	**0.0**
OECD average	**91**	**94**	**95**	**97**	**0.00**	**0.0**

CHAPTER 9

Equity in learning opportunities and outcomes

Key findings

- The socioeconomic gradient for Australia follows that of all other countries: each increment of the PISA scale of economic, social and cultural status is associated with a roughly consistent increase in performance in mathematical literacy.
- The key proxy for equity in PISA is the *strength* of the relationship between socioeconomic background and performance, i.e., the amount to which variance in mathematical literacy scores is explained by students' socioeconomic background. On this measure, the strength of the relationship is weaker for Australia than on average for the OECD, such that we are classified for mathematical literacy as a high-equity country.
- The slope of the socioeconomic gradient is steeper than on average across the OECD; in Australia, the effect of socioeconomic background on performance in mathematical literacy is greater than on average across the OECD.
- The amount of variance in performance between schools is lower than the OECD average; the amount of variance within schools is greater (79%). With 31% of the variance between schools though, it still matters which school a child attends.
- A large proportion of the between-schools variance is due to socioeconomic background.
- The highest and the narrowest range of socioeconomic levels was found in the Australian Capital Territory. The average socioeconomic background of students in Tasmania was the lowest of all Australian jurisdictions and the largest range was found in Tasmania and the Northern Territory.
- Socioeconomic levels of students and schools in the independent and Catholic school sectors were much higher than those of students and schools in the government sector.
- Regardless of their own socioeconomic background, students who are enrolled in a school with a high average socioeconomic background tend to perform better than when they are enrolled in a school with a low average socioeconomic background.
- Students in socioeconomically disadvantaged schools in Western Australia performed better than students in similar schools elsewhere in Australia. The gap between socioeconomically advantaged and disadvantaged schools was highest in New South Wales and was the equivalent of more than 3 years of schooling.

- Socioeconomically average schools in the Australian Capital Territory performed at about the same level as similar schools in Victoria, South Australia and Tasmania; while students in socioeconomically average and advantaged schools in the Australian Capital Territory performed at a lower level than students in similar schools in New South Wales, Queensland and Western Australia.

This chapter examines the extent to which socioeconomic background is related to performance in Australia and the Australian jurisdictions. This relationship has been touched upon in each of the chapters of this report examining performance. In each of the assessment areas of mathematical literacy, reading literacy and scientific 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 these chapters and these analyses showed that the average performance differences between sectors disappear once student and average school-level socioeconomic background were accounted for. In other words, the differences in student performance that could be attributed to differences in the environments of independent, Catholic and government 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, 39 score points separate the mathematical literacy performance of students from advantaged backgrounds (those in the highest quartile of socioeconomic background) and the average student. In Australia, this difference is slightly higher—46 score points, which represents more than a full year of schooling. Not surprisingly, the difference between advantaged students and disadvantaged students (those in the lowest quartile of socioeconomic background) is even larger: 90 score points on average across the OECD and 87 score points in Australia. This is the equivalent of more than two years of schooling and one full proficiency level.

Socioeconomic status or background is a broad concept that summarises many different aspects of a student, school or system. In PISA, a student's 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 student's parents or guardians, the highest level of education of the student's parents, and an index of home possessions (including educational resources, cultural possessions and other items in the home). The index is built to be internationally comparable and reflects many important differences related across students and schools.

Students are considered to be socioeconomically advantaged if they are in the 25% of students with the highest ESCS in their country and are considered to be socioeconomically disadvantaged if they are 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. To some extent, these patterns reflect the inherent advantages in resources that a relatively high socioeconomic background can provide. The patterns may also reflect other characteristics that are associated with high socioeconomic background that are not measured by the PISA ESCS index. E.g., a high average socioeconomic background could be related to: higher spending on education at the system level; a safe environment and, possibly, a higher level and quality of educational resources at the school level; and parental attitudes and understanding of education, aspirations and provision of further resources at the student level.

In Australia, students from socioeconomically advantaged backgrounds were much more likely to have parents with at least a tertiary degree; 87% of advantaged students reported that at least one parent had this level of education compared to just 6% of disadvantaged students. Similarly, 67% of students from advantaged backgrounds reported that their parents were employed in skilled occupations compared to just 4% of students from disadvantaged backgrounds, whose parents were most likely to be employed in semi-skilled blue-collar (55%) or semi-skilled white-collar (15%) jobs. In terms of home resources, 50% of students from advantaged backgrounds reported more than 200 books in the home compared to 10% of students from disadvantaged backgrounds; and 86% of students from advantaged backgrounds had three or more computers at home compared to 45% of students from disadvantaged backgrounds.

The relationship between socioeconomic background and performance—socioeconomic gradients

The terms socioeconomic gradient or social gradient refer to the relationship between an outcome and socioeconomic background. In the case of PISA, the outcome is students' performance and the measure of socioeconomic background is the ESCS index. PISA data show that there is a significant relationship between students' performance and their socioeconomic background as measured by ESCS. This relationship is evident in Australia and all 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 students' 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 9.1 shows the socioeconomic gradient for Australia plotted with the average gradient of the OECD countries that took part in the PISA 2012 mathematical literacy assessment. It can be seen that 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 is associated with a roughly consistent increase in performance on the mathematical 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 9.1. 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 mathematical achievement could be predicted accurately simply by knowing a student's socioeconomic background. This is not the case, as there is a diverse range of scores that students achieve that do not fall on the line. To illustrate the range of results that was obtained, 2,000 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 is a wide range of results, with a number of students with a low-socioeconomic background achieving high scores and, conversely, a number of students with a high-socioeconomic background achieving low scores.

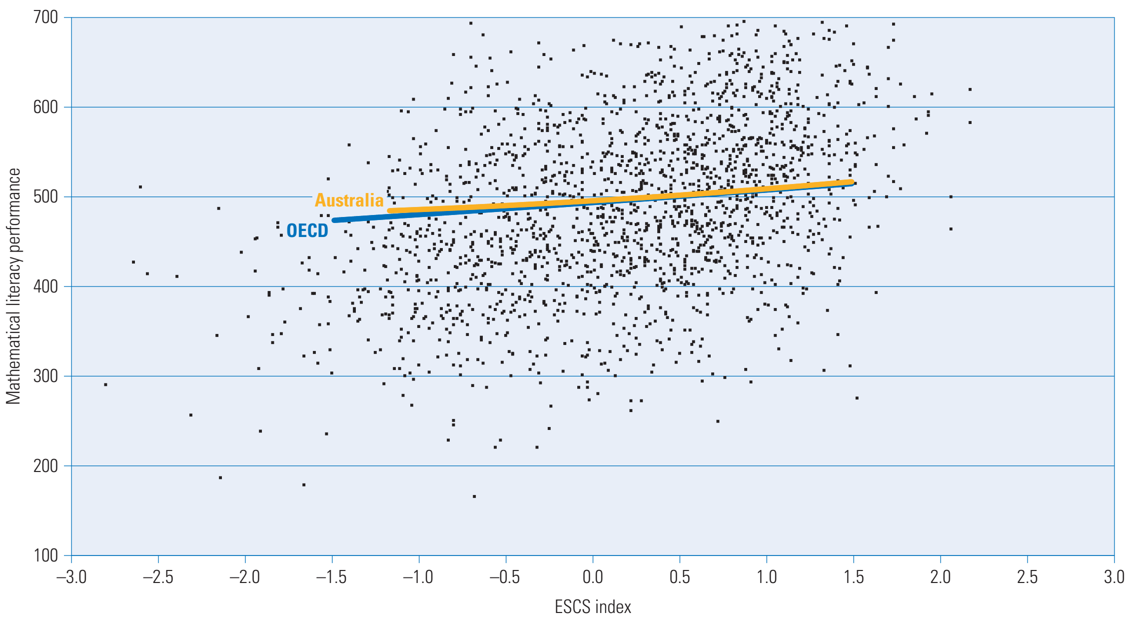


Figure 9.1 Socioeconomic gradients for Australia and the OECD

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.

Five types of information are relevant to a consideration of social gradients:

- The *strength* of the relationship between achievement and socioeconomic background refers to how well socioeconomic background predicts performance. It is important to consider how closely individual results fit 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 the individual students 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 the percentage is small, it indicates that performance is not highly determined by ESCS. For OECD countries as a whole, the strength of the relationship between mathematical achievement and socioeconomic background is about 15, meaning that 15% of the variation in student performance is accounted for by socioeconomic background. In Australia, for mathematical literacy, the strength of the relationship was just over 12, meaning that about 12% of the variation in achievement was explained by socioeconomic background.
- The *slope* of the gradient line 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 be indicated by a flatter gradient. Australia is the only country where performance differences related to socioeconomic background are relatively large (i.e., the *strength* of the relationship is weak).
- The average *level* of the line in the graph gives an indication of how well the overall population has achieved on the given assessment. Lines at higher levels indicate higher mean performance by the students.
- The *length* of the line indicates the *range* of ESCS. The figures in this chapter are plotted between the 5th and the 95th percentiles of ESCS (i.e., a figure spans 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 in the country. The range can be measured by projecting the starting point and the finishing point of the gradient onto the horizontal axis.
- The *linearity* of the gradient 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—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.

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 is not the case—that while it does happen to some extent, there are many exceptions.

Figure 9.2 shows the socioeconomic gradients for a number of comparative countries (the high performers plus countries with which we usually make comparisons) and Table 9.1 provides the data underlying the graph. Shanghai–China's socioeconomic gradient is at the top of the graph, showing high levels of achievement right along the socioeconomic spectrum. The length of the socioeconomic gradient line shows that the education system in Shanghai–China has to manage a very wide range of socioeconomic backgrounds among students in the system, while the slight negative curve of the line indicates that the effect of socioeconomic background declines more than on average across the OECD as socioeconomic background increases.

The socioeconomic gradient for Hong Kong–China shows that this education system also caters for a very wide range of socioeconomic backgrounds. Achievement at the lower levels of socioeconomic background is very high, almost the same as that of Shanghai–China and some 62 score points higher than the OECD average. The socioeconomic gradient is not significantly different to the average across the OECD and the difference in scores between Hong Kong–China and the OECD average at the highest level of ESCS is 57 score points.

Australian students performed higher than the OECD average at all points along the gradient, with students at the lowest level of socioeconomic background scoring around 8 points higher and those at the highest level scoring 17 points higher than the OECD average. In comparison, the socioeconomic gradient for Canada is flatter than that of Australia. At the lower levels of socioeconomic background, Canadian students outperformed Australian students by around 25 score points and the OECD average by 33 score points. At the highest levels of socioeconomic background, the average scores were more or less the same for Canada and Australia, and about 15 score points higher than the OECD average.

New Zealand's socioeconomic gradient is the steepest in this group and, unfortunately, the association is also strong. On average, students at the lowest socioeconomic background level scored 13 points lower than the OECD average, while those at the highest level of socioeconomic background scored 20 score points higher than the OECD average.

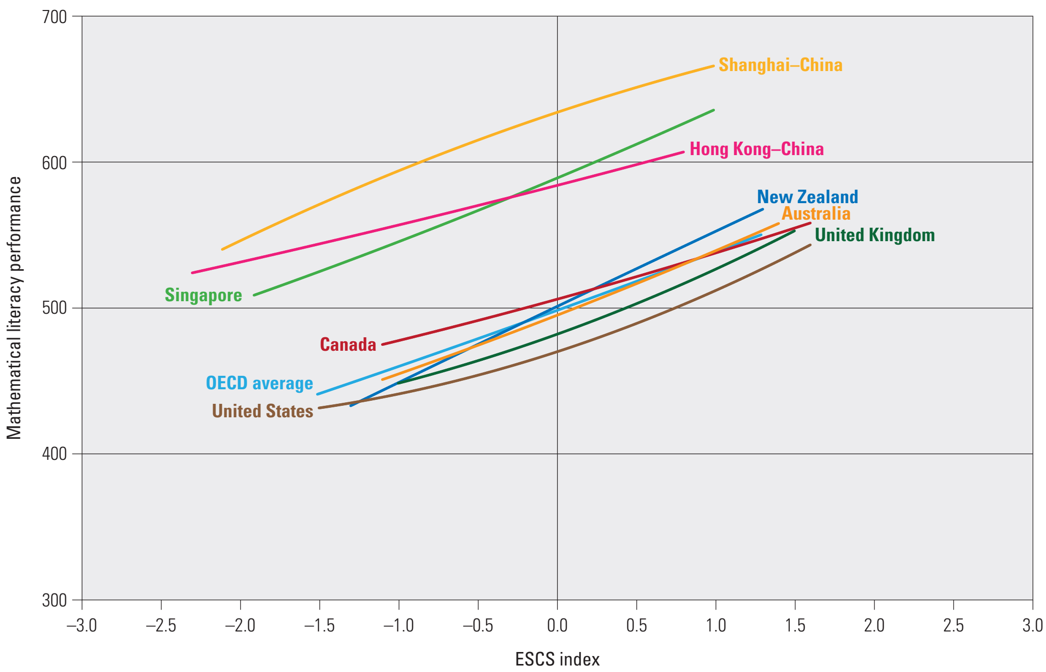


Figure 9.2 Socioeconomic gradients for Australia and comparison countries

The association between socioeconomic background and performance for Australian students is lower than that found on average over OECD countries. Around 12% of the explained variance in student performance in Australia was found to be attributable to students' socioeconomic background, compared to around 18% in New Zealand and as little as 8% in Hong Kong–China. It is this measure—the measure of the strength of the relationship between socioeconomic background and performance—that is used as the proxy for equity in PISA. Australia is considered above-average in terms of equity in mathematical literacy.

The slope of the gradient for Australia is higher than that of the OECD average, indicating that the effect of socioeconomic advantage on performance is stronger than the average across OECD countries. Australian students' scores on the mathematical literacy scale are 42 score points higher for each extra unit on the PISA index of ESCS, while the average for the OECD is 39 points. Furthermore, Table 9.1 shows that the Australian school system is slightly more homogenous than many of the other countries in Figure 9.2, with a relatively narrow range of ESCS scores between the 5th and 95th percentiles.

Table 9.1 Socioeconomic relationships for Australia and selected countries

Country	Strength of the relationship between student performance and the ESCS index[1]		Slope of the socioeconomic gradient[1]		Index of curvilinearity[1]			
	Percentage of explained variance in student performance	SE	Score point difference associated with one unit increase in the ESCS	SE	Score point difference associated with one unit increase in the ESCS squared	SE	Difference between 5th and 95th percentiles of the ESCS	SE
Australia	**12**	0.8	**42**	1.3	2.0	1.1	2.5	0.0
Canada	**9**	0.7	**31**	1.2	1.7	1.0	2.7	0.0
United Kingdom	**12**	1.2	41	2.4	**5.5**	1.5	2.5	0.0
United States	15	1.3	**35**	1.7	**6.5**	1.2	3.1	0.1
Hong Kong–China	**8**	1.5	**27**	2.6	0.9	1.4	3.1	0.0
New Zealand	**18**	1.3	**52**	1.9	–0.3	2.0	2.6	0.0
Singapore	14	0.9	**44**	1.4	1.7	1.4	3.0	0.0
Shanghai–China	**15**	1.9	41	2.7	**–3.9**	1.8	3.0	0.1
OECD average	15	0.2	39	0.4	**0.8**	0.3	2.8	0.0

[1] In these columns, values that are significantly different from the OECD average are indicated in bold.

Figure 9.3 displays the socioeconomic gradients for the Australian jurisdictions. It is informative to examine the average achievement of students of the same socioeconomic background in different jurisdictions. At the lowest levels of socioeconomic background, students in the Australian Capital Territory, Western Australia, New South Wales, Victoria, South Australia and Queensland clearly scored substantially higher than students in the Northern Territory and higher than students in Tasmania. The relationship between performance and socioeconomic background is stronger than the Australian average in Tasmania and the Northern Territory, and lower than the Australian average in Victoria.

Figure 9.4 shows the socioeconomic gradients just for Victoria and the Northern Territory, as they are quite different. The steepness of the slope for the Northern Territory shows that there are substantial

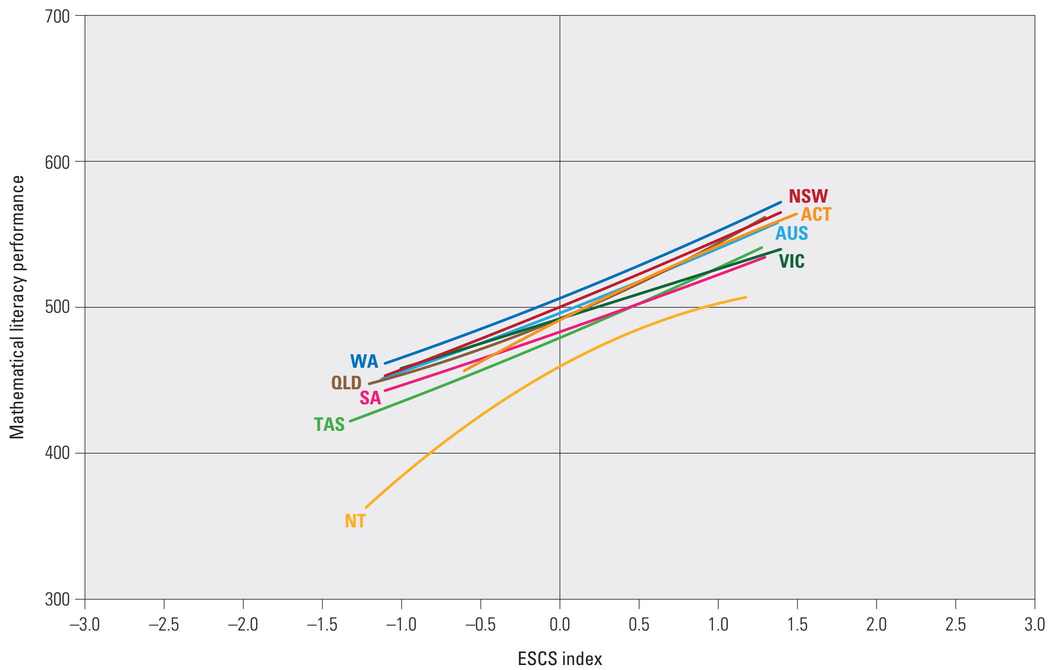


Figure 9.3 Socioeconomic gradients for Australia and the jurisdictions

increments in mathematical literacy achievement with increments in privilege. In contrast, Victoria has the flattest slope of all Australian jurisdictions, indicating that in this jurisdiction there is much less of a gain in educational achievement associated with higher levels of socioeconomic background.

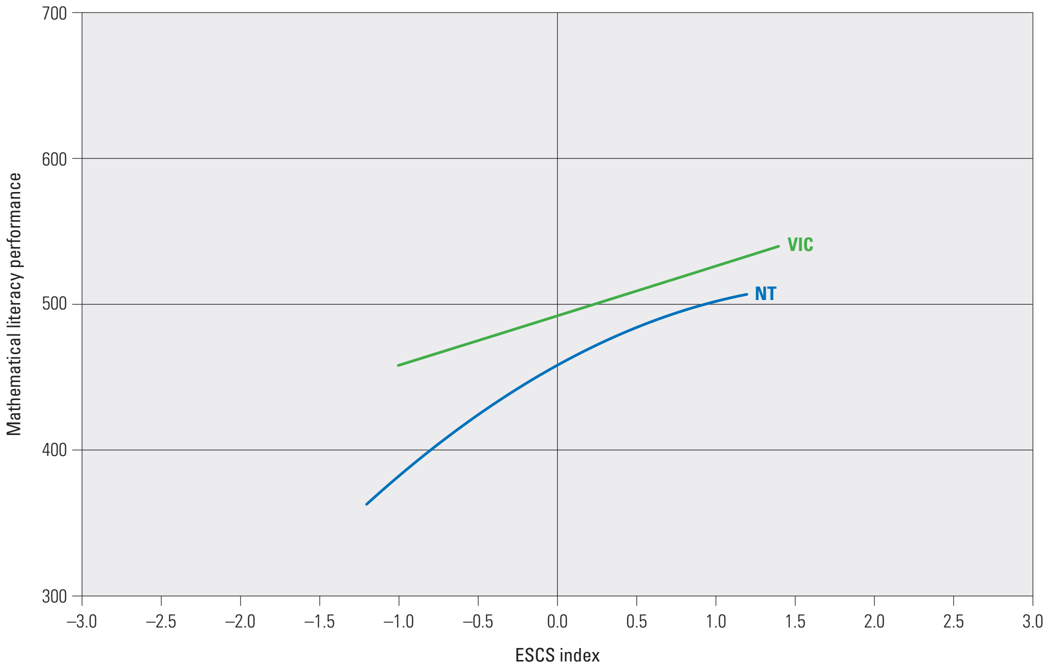


Figure 9.4 Socioeconomic gradients for Victoria and the Northern Territory

There are many differences in the extent to which countries are able to moderate the association between socioeconomic background and performance. The relationship between equity and mean mathematical literacy for a selection of the countries that participated in PISA 2012 is shown in Figure 9.5. 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 in which the strength of the relationship between socioeconomic background and performance is significantly lower than the OECD average (like Hong Kong–China, Canada, Estonia and Australia) are plotted to the right of the line which delineates the average strength of the relationship across the OECD. Mean performance in mathematical literacy is plotted on the vertical axis, with the line at 494 representing the OECD average.

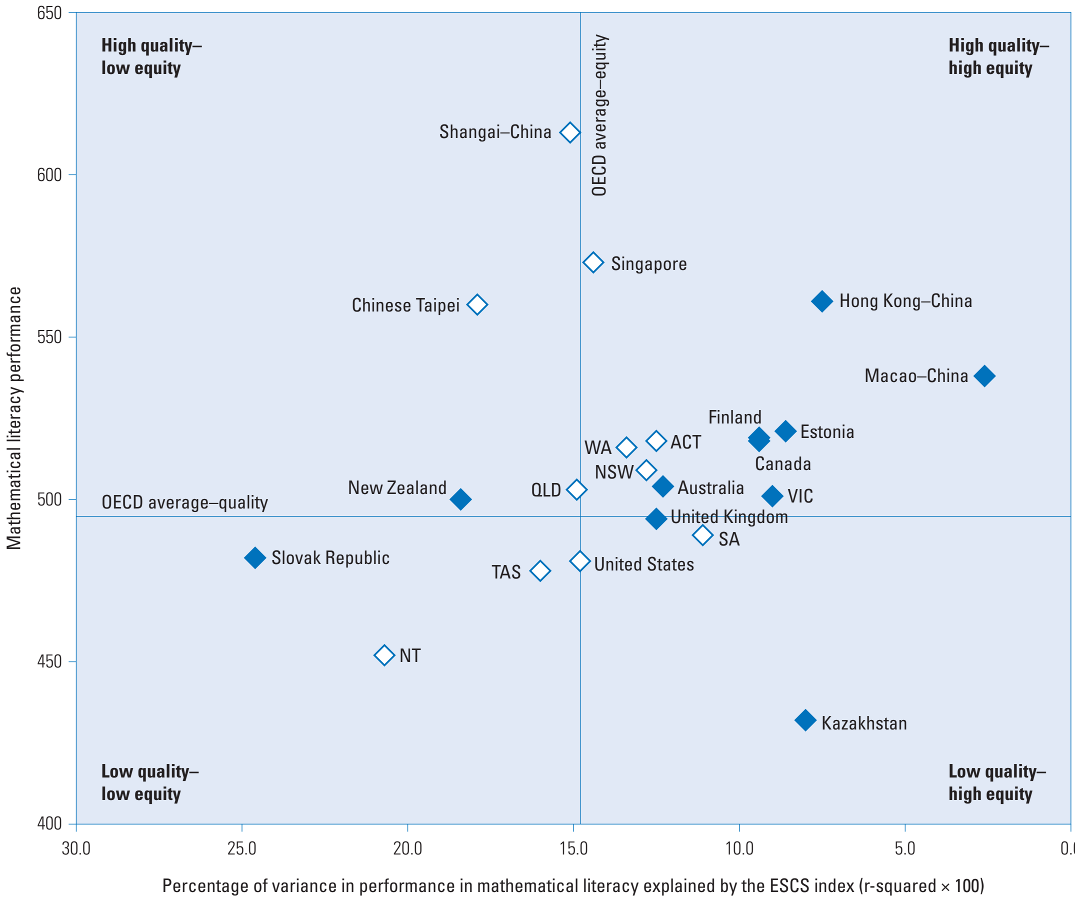
Countries to the right of the OECD average slope line have a *lower* impact of socioeconomic background than the OECD average and are classified as high equity. Countries to the left of the OECD average slope line have a *higher* impact of socioeconomic background than the OECD average and are classified as low equity. Countries achieving higher scores than the OECD average are classed as high quality and with lower scores are classed as low quality.

As with all data there are confidence intervals. The shading on the markers on Figure 9.5 indicates whether the difference between the score for the country and the OECD average for equity is significant or not.

In PISA 2003, Australia's overall performance in mathematical literacy was described as high quality–high equity, as the overall scores in mathematical literacy were higher than the OECD average and the impact of socioeconomic background was lower than the OECD average.

In PISA 2012, Australia was also categorised as high quality–high equity in mathematical literacy, along with the high-scoring countries of Macao–China, Hong Kong–China, Estonia, Finland and Canada. Shanghai-China, Chinese Taipei and Singapore scored well above the OECD average, putting them in the high-quality half, but their equity scores were not significantly different to the OECD average. The scores for the Slovak Republic placed it in the low quality–low equity quarter, with scores significantly lower than the OECD average for achievement but a significantly higher proportion of the score explained by the ESCS index.

The figure 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.



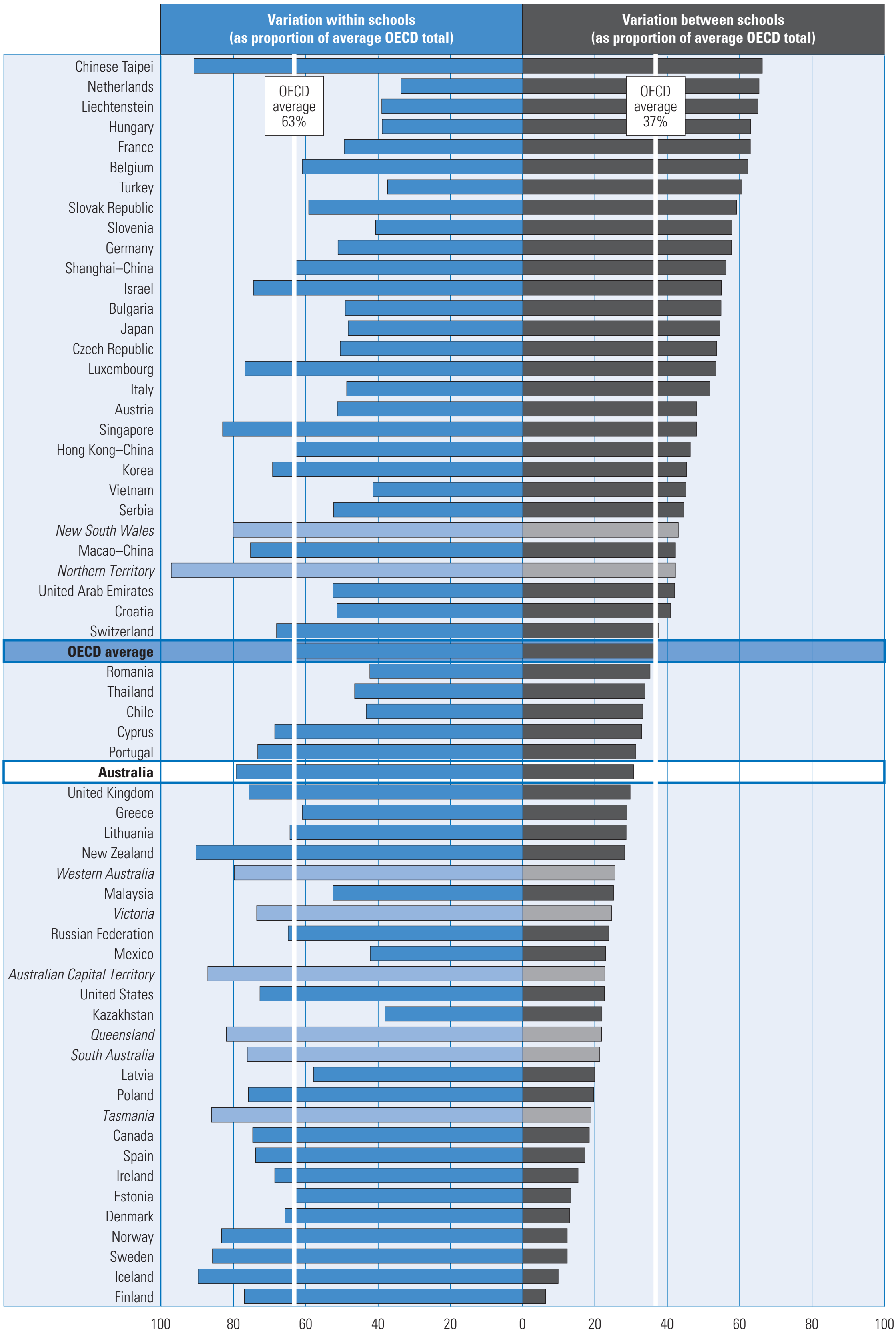
Note: Shaded diamonds represent countries in which the strength of the relationship is significantly different to the OECD average.

Figure 9.5 Quality and equity of performance in mathematical literacy internationally

It is also of interest to examine results at the school level. Figure 9.6 shows the proportion of variance in achievement for each country and for the Australian jurisdictions, divided into the amount of variation that occurs between schools (i.e., the performance variation attributable to differences in student results in different schools) and the amount of variation that occurs within schools (the performance variation attributable to the range of student results that cannot be attributed to differences between schools).

In Finland and Estonia, there is little variation between schools and average performance is high, meaning that parents and students can expect that students can achieve at high levels no matter which school they attend. In countries such as Chinese Taipei and the Netherlands, there is a large amount of variation between schools, making it important to attend the 'right' school. In Australia overall, the amount of variation between schools is lower than the OECD average, while the amount of variation within schools is higher than the OECD average. This pattern is similar to that seen in the United Kingdom, New Zealand, the United States and Canada. There are two Australian jurisdictions that are an exception to this: New South Wales and the Northern Territory. In these two jurisdictions, the variation between schools is larger than on average across the OECD, while the amount of variation within schools is still higher than the OECD average. Within both, it is more important than in other jurisdictions to attend the 'right' school.

While the Australian school system is not streamed as in some countries, there are differences between schools that could have important implications for parents when considering which school to send their child to.

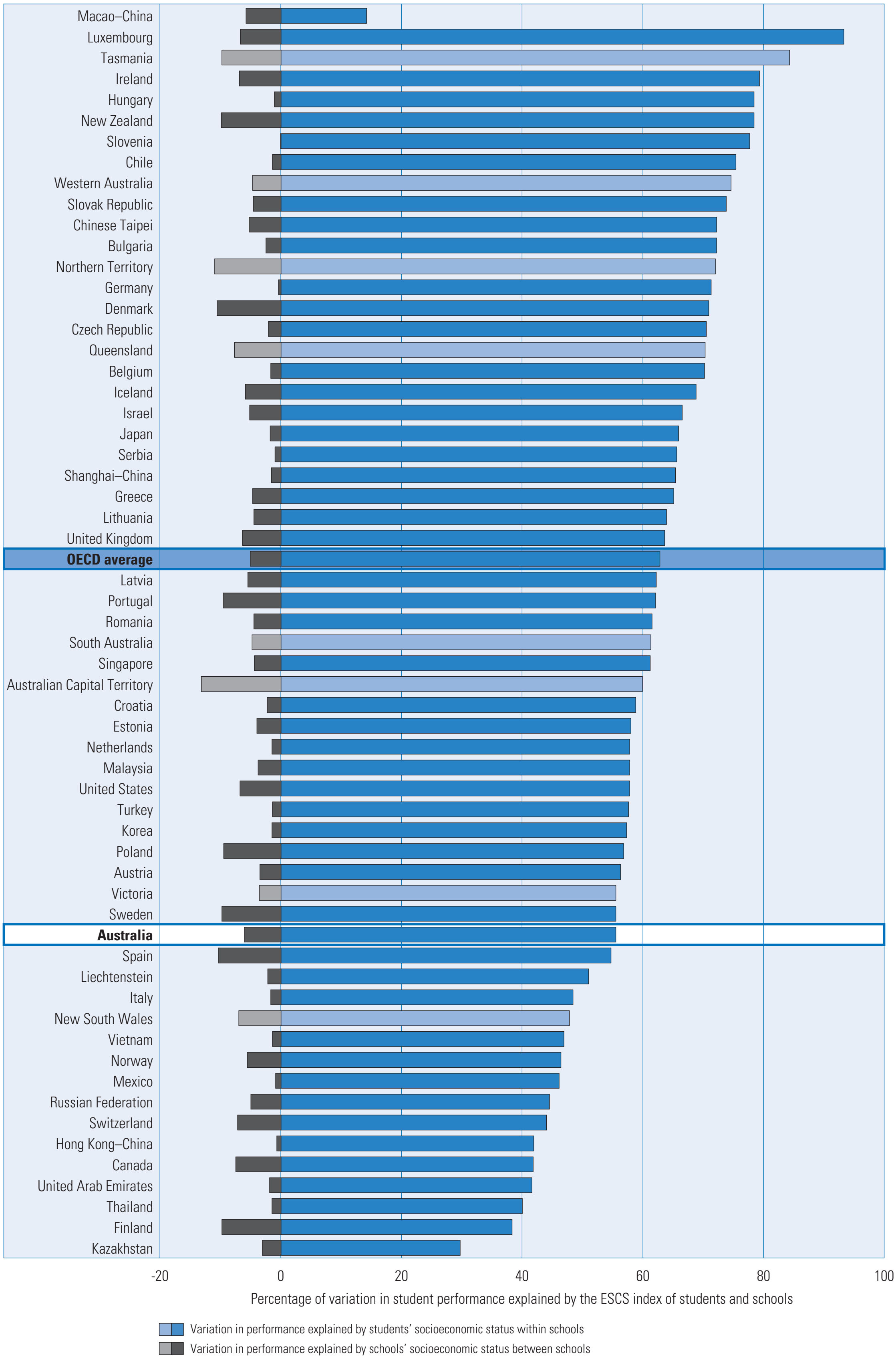


Source: OECD (forthcoming), Vol. II

Figure 9.6 Variation in mathematical literacy performance between and within schools by country and jurisdiction

Figure 9.7 shows the proportion of between – and within – school variation in mathematical literacy performance that can be attributed to the socioeconomic differences of students and schools. The dark part of the bar represents the between-school variance and the light part of the bar represents the within-school variance that is explained by student and school socioeconomic background.

More than half of the performance differences observed across students in different schools can be accounted for by socioeconomic differences across students and schools, on average across the OECD, for Australia and for the individual states. This varies widely. Socioeconomic disparities between-schools are closely associated with performance in Tasmania, the Northern Territory and Western Australia, where more than 75 per cent of the between-school variation in performance is accounted for by the socioeconomic background of students and schools.



Source: OECD (forthcoming), Vol. II

Figure 9.7 Performance differences between and within schools explained by students' and schools' socioeconomic background

Differences in the socioeconomic background of students and schools

Given these findings—and the findings from earlier chapters that showed achievement levels were higher in some jurisdictions, in Catholic and independent schools, and in metropolitan schools—further investigation was carried out examining socioeconomic backgrounds in these systems and schools. Figure 9.8 shows the interquartile[1] range for student-level ESCS by jurisdiction, Australia and the OECD average, by school sector and by geographic location, while Figure 9.9 shows the interquartile range for schools' socioeconomic background. The longer the bars, the more diverse the background of students and schools is. Together these figures show that the range between these two percentiles (both between schools and individuals) varies substantially within a country and between jurisdictions, geographic locations and school systems.

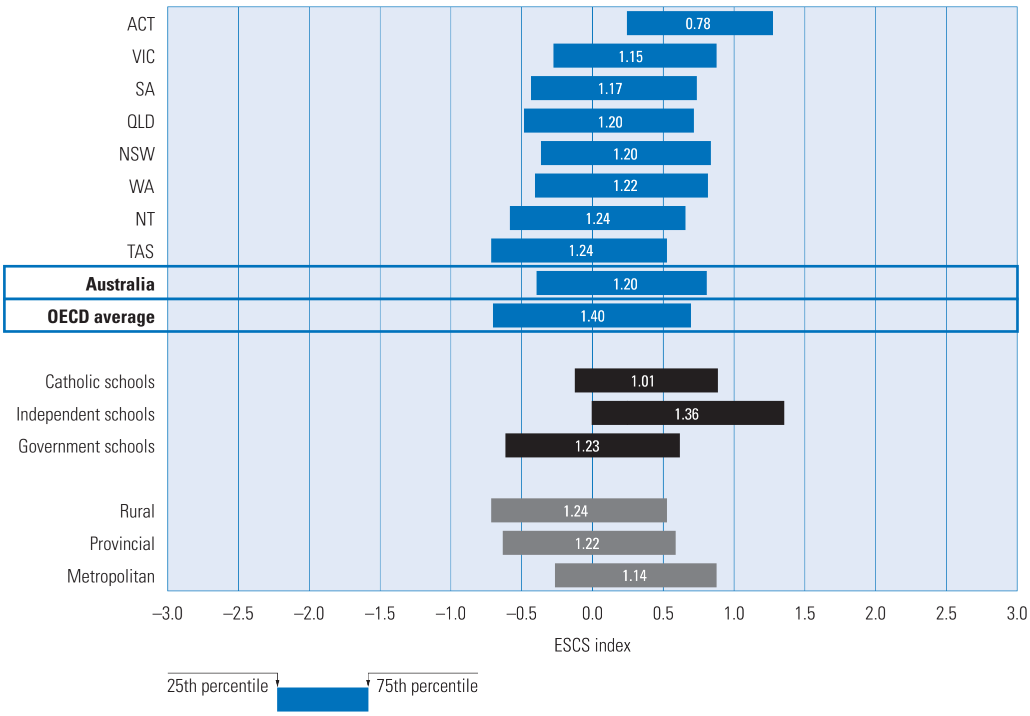


Figure 9.8 Range of students' socioeconomic backgrounds

On average across OECD countries, the interquartile range on the ESCS index for students is 1.40 units. The interquartile range for the jurisdictions varies between 0.78 for the Australian Capital Territory to 1.24 in Tasmania and the Northern Territory, but clearly the 25th and 75th percentiles for the Australian Capital Territory are much higher than any other jurisdiction, while those for Tasmania and the Northern Territory are lower than any other jurisdiction.

The range of schools' socioeconomic background is similar across Australia (Figure 9.9), with the lowest range in the Australian Capital Territory (0.4) and the highest in Western Australia (0.7).

1 The interquartile range, or the range between the 25th and 75th percentiles, is used by the OECD as the benchmark for measuring performance gaps because this value describes realistic differences between schools in terms of their socioeconomic composition.

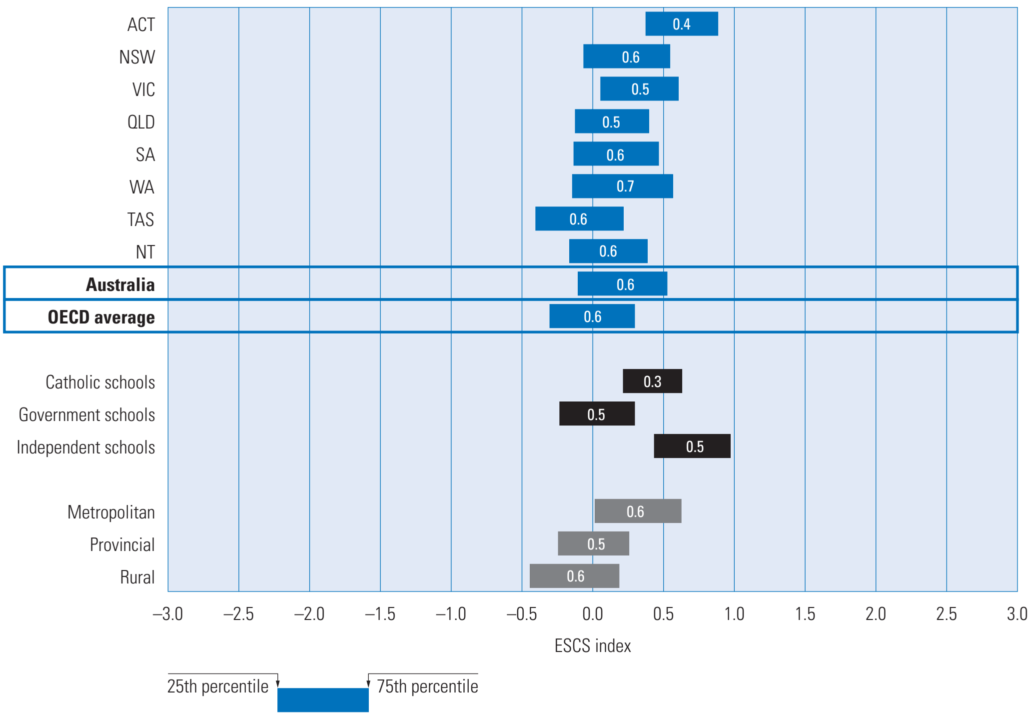


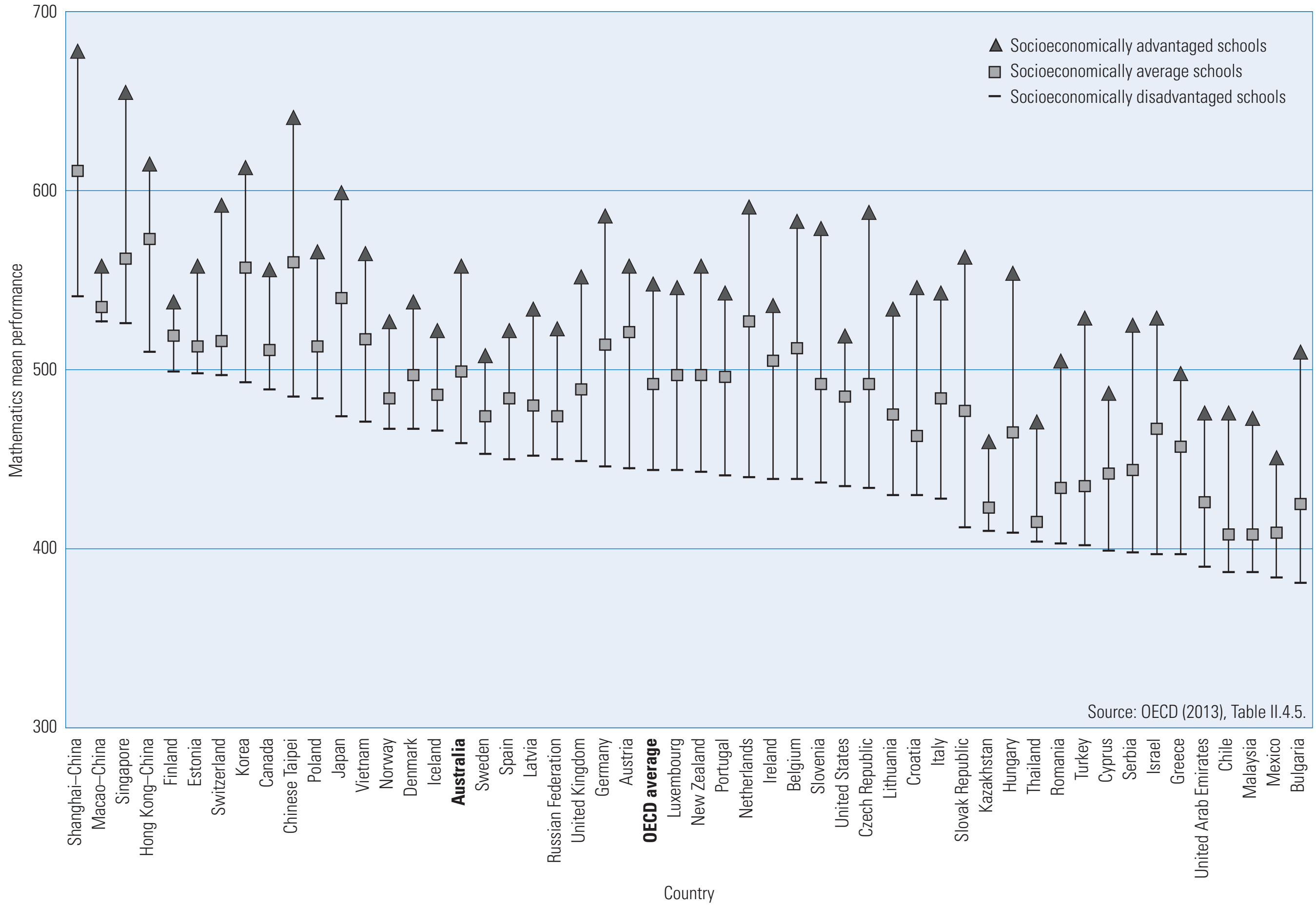
Figure 9.9 Range of schools' socioeconomic backgrounds

Figure 9.8 and Figure 9.9 help to explain some of the differences in performance across different groups of students by providing an understanding of the underlying socioeconomic background of students in each of the groups. The relationship between socioeconomic background at student and at school level is—as has been shown in this and previous chapters—very important.

Tasmania and the Northern Territory have the largest proportion of low-socioeconomic students enrolled in their schools, while the Australian Capital Territory has more students from high-socioeconomic backgrounds. Similarly, the range of socioeconomic backgrounds is much greater in government schools than in either Catholic or independent schools and the number of students from low-socioeconomic backgrounds is much greater in government schools than in either Catholic or independent schools. The range of students' socioeconomic background is higher in metropolitan schools, as expected given that they form the largest part of the sample; however, Figure 9.8 and Figure 9.9 show that provincial and rural schools have more students from lower socioeconomic backgrounds, and that these schools' socioeconomic background is also generally lower.

In general, students in advantaged schools perform better than those in disadvantaged schools, but they may not perform particularly well when compared against an international standard. Figure 9.10 shows the performance of students in advantaged and disadvantaged schools across countries. On average, a little more than 100 score points separates students in advantaged and disadvantaged schools. In some countries this difference is small—e.g., in Macao–China and Finland the difference is less than 40 score points. While this is relatively small it should be remembered that this still represents more than one full school year. In other countries, the score is somewhat larger: in the Slovak Republic, the Czech Republic, Chinese Taipei and the Netherlands, it is more than 150 score points; and in Australia, the difference is 100 score points.

Figure 9.10 also shows the average performance of students attending disadvantaged, average and advantaged schools. In some countries, students attending schools with a relatively disadvantaged student population still manage to achieve high levels of performance. In Macao–China, Hong Kong–China, Singapore and Shanghai–China, students attending disadvantaged schools still scored higher than 500 score points in mathematics.



Notes:

A socioeconomically disadvantaged school is one whose students' mean socioeconomic status is statistically significantly below the mean socioeconomic status of the country; an average school is one where there is no difference between the students' and the country's mean socioeconomic status; and an advantaged school is one whose students' mean socioeconomic status is statistically significantly above the country mean.

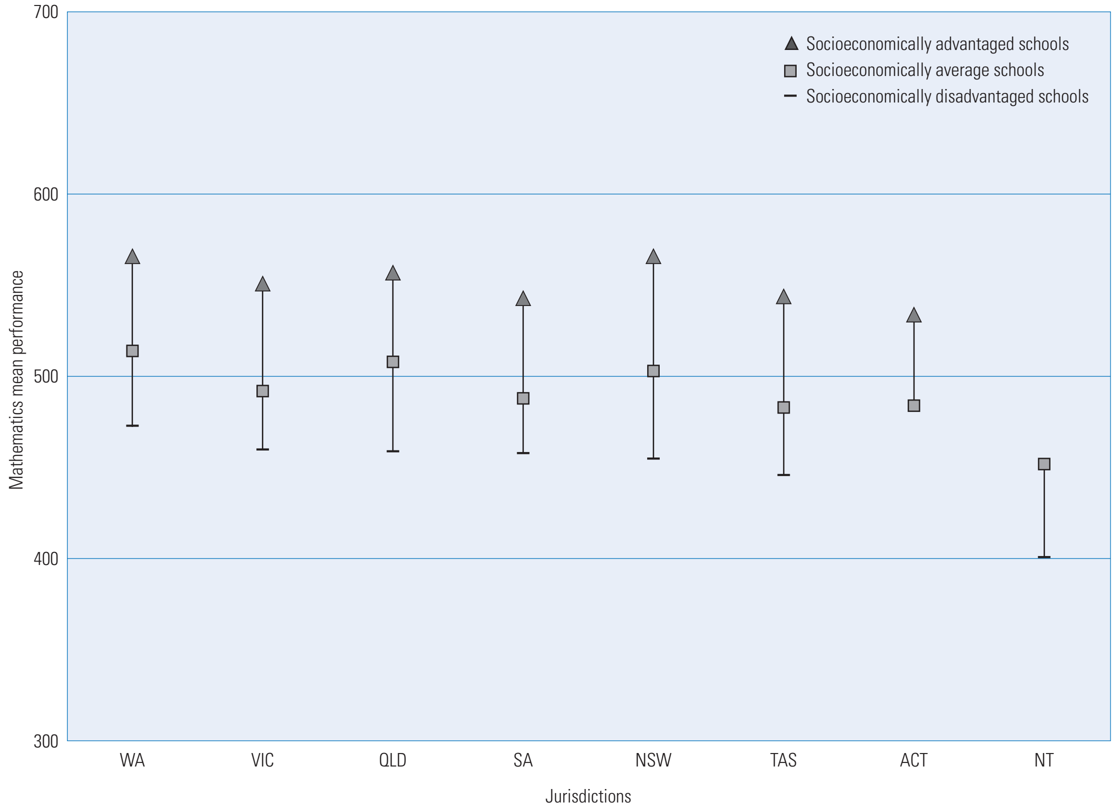
Countries are ranked in descending order of the mean performance of students in disadvantaged schools.

Data for France and Liechtenstein are not available and these countries have been omitted from the figure.

Figure 9.10 Performance of students in socioeconomically disadvantaged, average and advantaged schools internationally

Figure 9.11 provides the same analysis for the Australian jurisdictions. In the Australian Capital Territory, there were too few low socioeconomic schools sampled to obtain reliable statistics and in the Northern Territory there were too few high socioeconomic schools sampled to obtain reliable statistics.

Students in socioeconomically disadvantaged schools in Western Australia performed better than students in similar schools elsewhere in Australia; while Western Australian students in socioeconomically advantaged schools performed at the same level as students in similar schools in New South Wales. The gap between socioeconomically advantaged and disadvantaged schools was highest in New South Wales: 111 score points, or more than 3 years of schooling. Somewhat surprisingly (given the Australian Capital Territory's overall socioeconomic background), socioeconomically average schools in the Australian Capital Territory performed at about the same level as similar schools in Victoria, South Australia and Tasmania; while students in socioeconomically average and advantaged schools in the Australian Capital Territory performed at a lower level than students in similar schools in New South Wales, Queensland and Western Australia.



Notes:

A socioeconomically disadvantaged school is one whose students' mean socioeconomic status is statistically significantly below the mean socioeconomic status of the country; an average school is one where there is no difference between the students' and the country's mean socioeconomic status; and an advantaged school is one whose students' mean socioeconomic status is statistically significantly above the country mean.

Countries are ranked in descending order of the mean performance of students in disadvantaged schools.

Figure 9.11 Performance of Australian students in socioeconomically disadvantaged, average and advantaged schools

References

Australian Curriculum, Assessment and Reporting Authority (ACARA). (2012). *Measurement framework for schooling in Australia*. Sydney: Author.

Bong, M. (2004). Academic motivation in self-efficacy, task value, achievement goal orientations, and attributional beliefs. *Journal of Educational Research, 97*, 287–297.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology, 53*, 109–132.

Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA). (2008). *Melbourne declaration on educational goals for young Australians*. Carlton: Curriculum Corporation. Retrieved from http://www.mceecdya.edu.au/verve/_resources/National_Declaration_on_the_Educational_Goals_for_Young_Australians.pdf/

Organisation for Economic Co-operation and Development (OECD). (2007). *PISA 2006: Science competencies for tomorrow's world* (Vol. 1). Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (2013). *PISA 2012 assessment and analytical framework: Mathematics, reading, science, problem solving and financial literacy*. Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (forthcoming). *PISA 2012 results: Excellence through equity: Giving every student the chance to succeed* (Vol. II). Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (forthcoming). *PISA 2012 results: What students know and can do: Student performance in reading, mathematics and science* (Vol. I). Paris: Author.

Organisation for Economic Co-operation and Development (OECD). (forthcoming). *PISA 2012 technical report*. Paris: Author.

Thomson, S. & De Bortoli, L. (2007). *Exploring scientific literacy: How Australia measures up*. Camberwell, VIC: ACER.

Thomson, S., De Bortoli, L., Nicholas, M., Hillman, K., & Buckley, S. (2010). *Challenges for Australian education: Results from PISA 2009.* Camberwell, VIC: ACER.

Zullig, K.J., Koopman, T.M., Patton, J.M. & Ubbes, V.A. (2010). School climate: Historical review, instrument development, and school assessment. *Journal of Psychoeducational Assessment, 28*(2) 139–152.

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 *Technical Report* for PISA 2012, which is published by the OECD. Most of the operational procedures have both international and national components.

Information on how PISA operated internationally and its implementation in 2012 is given first, followed by details of its implementation in Australia.

PISA internationally

International consortium

PISA 2012 was implemented through an international consortium managed by the Australian Council for Educational Research (ACER). Other members are the Analyse des systèmes et des pratiques d'enseignement (aSPe) and cApStAn Linguistic Quality Control in Belgium, the Deutches Institut fur Internationale Padagogische Forschung (DIPF) and the Leibniz-Institute for Science and Mathematics Education (IPN) in Germany, Westat and the Educational Testing Service (ETS) in the United States, the Institutt for Laererutdanning of Skoleforskning (ILS) in Norway and CRP Henri Tudor and Universite de Luxembourg (EMACS) in Luxembourg.

Collaborative development

PISA is an international assessment that has been jointly developed by the OECD's participating countries. Through their national project managers and national committees, countries have been able to contribute to the assessment by providing sample assessment material to the consortium and offering comment on many aspects of the project to the international bodies described below—Network A, the PISA Governing Board and subject matter expert groups.

The OECD set up several networks to undertake specific tasks relating to PISA. Network A focuses on educational outcomes and is responsible for the Education at a Glance project. Network A's work during the mid-1990s led to the development of the initial specifications for PISA.

Each OECD country taking part in PISA has one member (usually from an education ministry) as a representative on the PISA Governing Board (PGB). This group sets the policy objectives of the assessment and the policy priorities for the implementation of the survey. 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 from the PISA Technical Advisory Group on technical aspects of design; e.g., concerning the balance of multiple choice and open-ended items, the number of assessment booklets and the design for rotation.

The five subject matter expert groups for PISA 2012 consisted of subject matter and technical experts from participating countries. Each assessment domain (mathematical, scientific and reading literacy and problem solving), as well as the questionnaire, had its own subject matter expert group. Together with the PISA Technical Advisory Group, these groups linked the policy objectives specified by the PGB with expertise in the field of international comparative assessments to provide input into the frameworks for the assessment and to monitor the quality of assessment items prepared. The expert groups typically contain between eight and ten members each. The members are not intended to represent countries as such, but rather to provide a cross-section of the world's most renowned experts in each area. All of these groups provide advice and recommendations to the consortium, and (through the 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 outlined here. More detail is provided later on how the various procedures worked in Australia.

Framework and item review

The development of the assessment frameworks has been a continuous effort since the inception of PISA. In PISA 2012, an expanded framework for the assessment of mathematical 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 scientific literacy frameworks remained essentially the same for PISA 2012.

Field trial

The field trial was an instrumental part of the study, not only to refine the assessment materials but also to try out the operational procedures. Internationally, many thousands of students took part, including approximately 2,000 from Australia. Ten assessment booklets and 18 computer forms were used as practice for the main study and there were four questionnaire forms in order to achieve a greater coverage of material than would be possible with one form. The field trial took place from March to June 2011.

Main study

For most countries, the PISA main study was administered between March and August 2012. For many northern hemisphere countries, where the academic year begins in September and ends in June, the assessment was conducted between March and the end of the academic year. For countries in the southern hemisphere, where the academic year extends from early February until December, the assessment was conducted between mid-May and the end of August.

Within the majority of countries, between 4,000 and 9,000 students were tested. In a few small countries (such as Iceland, Liechtenstein and Luxembourg), the whole cohort of age-eligible schools and students was assessed. In some countries, the sample size was increased so that regions could be adequately represented (e.g., Belgium, Canada, Italy, Mexico and Spain). Details of the field trial and main study in Australia 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

Assessment booklets and computer forms

In PISA 2012, a paper-based assessment was prepared in booklet style and 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 takes the form of some stimulus material followed by a series of items relating to the material. The stimulus material and its associated items are called a unit. For both the field trial and the main study, each unit in the pool is allocated to a test cluster.

The clusters typically contain about four units and are designed to take 30 minutes to complete. For the PISA 2012 paper-based assessment, there were seven mathematical literacy clusters, three scientific literacy clusters and three reading literacy clusters; while for the computer-based assessment, there were four mathematical literacy clusters, two reading literacy clusters and two problem-solving clusters. Use of such a design allows a large amount of material to be covered, with different students completing different combinations of the items. The booklets and computer forms were allocated to students from a random starting point in each school.

Questionnaires

As well as the assessment booklets, there were two context questionnaires. Each principal completed a school questionnaire and each student completed a student questionnaire. Students were allocated one of the four questionnaire forms. These were designed to enable analysis of achievement data in relation to different backgrounds, living conditions, educational programs and other factors that might have an impact on performance. As well as gathering information about students and their family background, academic environments and their attitudes and motivations for learning, the student questionnaire also included optional sections to assess 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.

Ensuring a high-quality assessment

Quality monitoring is an integral part of PISA, and the implementation of checking procedures within all components and stages of the assessment have 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 Project Centre (IPC), set up by the lead member of the consortium, ACER, was designed to manage the implementation of PISA internationally. IPC staff were always available to give advice to countries as requested. They continuously monitored countries' progress and were proactive in offering assistance with procedures if this seemed to be warranted.

Translation procedures

Experts in translation procedures ensured that translated materials were as equivalent in meaning and level of complexity as possible. Translation of the assessment booklets, questionnaires and manuals involved extensive and thorough processes. Materials from the IPC 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 trilingual verifiers working for the IPC.

Sampling procedures

Ensuring the quality of sampling in PISA was the responsibility of Westat. A senior staff member was appointed to be the international sampling referee for the project. A team of sampling experts at Westat and ACER 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, including the school sampling frame (i.e., the list of all schools containing students in the PISA target population). Countries were required to use the KeyQuest software developed by the 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, so that valid comparisons of results between countries could be made.

Test administration procedures

Criteria for test administrators were set internationally. It was required that the test administrator not be the mathematics, science or language-of-instruction teacher of any students in the sessions they would be administering. It was further recommended that the test administrator be independent of participating schools and not be a member of the staff of any school where they would be administering PISA nor of any school in 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 were brought together 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 national project managers or their designated staff, who were then responsible for training the test administrators in their country. In that way, it was hoped that standardised administration of the PISA tests could be achieved.

Monitoring of procedures

The IPC set up a two-stage process of monitoring the implementation of PISA in each country. Prior to the main study, a number of participating national centres were visited by national centre quality monitors. The national centre quality monitors were drawn from staff of the various consortium members to ensure that procedures were being followed correctly in national centres and to offer assistance if this seemed needed. This process was also carried out during the main study.

A second kind of monitor was used during the main study. These monitors, known as PISA quality monitors (PQMs), were nominated by national project teams, but were employed by and worked on behalf of the consortium. They were not allowed to be connected in any way to a national centre. 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 trained nationally in PISA's procedures by the visiting national centre quality monitors (see above) and then went to a subset of schools, unannounced, during the assessment sessions.

Coding of responses to open-ended items

Approximately one-third of items from each of the three domains (mathematical, scientific and reading literacy) were open-ended, necessitating coding. Standardised coding guides were developed by consortium staff and reviewed by PISA national project staff before being finalised. In countries where languages other than English or French were used, these guides had to be translated and the translations verified by the consortium (double translations were not required). The same approach to training coders was used as for test administrators, in that national project managers or their designated staff first attended international training sessions and then trained the coders in their country.

Reliability studies were carried out to ensure that coders were applying the criteria consistently and to quantify any variation between coders. Monitoring of consistency in applying the coding criteria was required to be done on a daily basis so that systematic errors could be corrected. In the main study, four coders in each country were required to code all of the items in their subject area from 100 of each of four assessment booklets. A cross-national study of coder reliability was also undertaken. These data were collected to ensure the reliability of coding across PISA.

Data-entry procedures

Another step in ensuring the high quality of PISA data was the provision to countries of specially developed software for entering and validating data. It was important that data were submitted to the IPC in a standard format so that they could readily be combined into a single international data set. Many data-cleaning procedures were carried out before data were considered to be ready for analysis.

PISA nationally

Project management

A national project manager is appointed by each participating country to ensure that the assessment is implemented according to the international timeline and that all duties are carried out according to the specified procedures and standards. National project managers play a role in evaluating 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, to assist with reviewing materials and to provide a forum for discussion of implementation issues at the national level. In Australia, the International Assessments Joint National Advisory Committee (IAJNAC) guides all aspects of the project. The committee's members are from many areas of Australian education and include subject matter experts to advise the national project manager and the national PGB representative on the content and methods of the assessment. Each of the jurisdiction's education departments has a representative on the IAJNAC.

The committee's involvement in policy decisions relating 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 during early-May to mid-June 2011. A summary of its scope is presented here. In addition to PISA, Australia also participated in the assessment of financial literacy, which was offered as an international option.

Schools

The selection of schools for the field trial was much less rigorous than school sampling for the main study. Schools were chosen by convenience and were representative of schools from a range of communities and socioeconomic areas. In all, 65 Australian schools from three jurisdictions—New South Wales, Victoria and South Australia—took part in the field trial.

Students

The target population for the field trial was students born between 1 February 1995 and 31 January 1996. The school coordinator was asked to provide a list of all age-eligible students, regardless of a student's year level. In accordance with the international sampling manual, ACER staff randomly selected up to 50 students from each school. Of the approximately 2,000 age-eligible students selected, around 1,000 participated in the paper-based assessment and around 1,600 participated in the computer-based assessment in the PISA field trial.

Adaptations to manuals, assessment booklets and questionnaires

Minimal adaptations for Australia were required to the administrative manuals, coding guides, assessment booklets and questionnaires. Amendments to the assessment booklets, such as vocabulary, were submitted to and approved for use by the IPC.

Test administration

Each student was asked to complete an assessment booklet (consisting of multiple-choice and open-ended items) and a questionnaire. Two hours plus administration time were required for the assessment booklet and about 40 minutes were required for the questionnaire. There was provision for a short break to be taken after students had worked on their assessment booklet for an hour and a break of 5 to 10 minutes to be taken before starting the questionnaire. For those students who completed the computer-based assessment, this was undertaken after a break, once the questionnaire was completed. The computer-based assessment consisted of a 20-minute tutorial, to allow students to become familiar with the testing environment, and a 40-minute assessment.

A total of 10 experienced teachers were employed by ACER to conduct the field trial sessions. Training of test administrators took place at the ACER offices in Melbourne in mid-April 2011.

Coding

Almost half of the field trial items were open-ended and required coders to code the students' responses to the mathematical literacy items. Training of the coding procedures using internationally prepared coding guides was conducted during mid-June 2011 and involved eight experienced coders. The coding process also included multiple coding from three assessment booklets, as specified internationally.

Data entry

All data were entered using KeyQuest, the specially developed software provided to national centres by the IPC.

Main study

Assessment dates in Australia

In Australia, the main study assessment took place from late July to early September 2012.

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 97.9% of the selected schools and 86.8% of the selected students taking part.

Obtaining the school sample

PISA is one of a suite of assessments of the National Assessment Program. Liaison officers were appointed from jurisdiction education departments, Catholic Education Offices and Associations of Independent Schools to inform schools that they had been randomly selected to participate in PISA. A number of schools were approached in late November 2011, while other schools were approached at the start of the school year in 2012. All schools 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. The school coordinator was the main liaison contact between their respective school and the national centre. School coordinators assisted by making administrative arrangements for the assessment session in their school—e.g., 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. Schools were also asked to nominate an IT coordinator to assist in providing the national centre with details about the school's IT infrastructure.

National options

Countries were permitted to introduce additional aspects of national relevance subject to approval from the IPC.

Additional questionnaire items

Information was sought on Indigenous background and the selection and study of mathematics subjects. The items on language spoken at home and on parents' and respondent's countries of birth were adapted in the Australian questionnaire. E.g., it was felt that responses to the international format question of 'Were you born in Australia?' (Yes/No) would not be accurate as an indication of ethnic background.

Test administrators

Around 100 test administrators external to the school administered the assessment sessions.[1] All were employed by ACER on a casual basis and a number had also been involved in previous PISA cycles. All were highly experienced, trained teachers, many of whom were also experienced in conducting test sessions according to standardised procedures.

All test administrators attended full-day training sessions, which were held in all capital cities of Australia, except Canberra, during June 2012. The sessions were highly useful: to establish a sense of common purpose among the diverse group of test administrators, especially for those who had not met each other before; to ensure that they were appropriately briefed for conducting the sessions; and to apportion the test sessions and establish travelling schedules in what was a complex logistical operation.

Scheduling of sessions: logistics

The assessment booklets and questionnaires were mostly administered in a single morning session, except in a handful of schools where the test took place in the morning and the questionnaire session took place in the afternoon. The amount of time required was about three-and-a-half hours, arranged the same way as in the field trial. The computer-based assessment was held in the afternoon, taking one hour to

1 However, in a small number of remote schools, a staff member was nominated as test administrator and administered the assessment.

complete. Breaks were arranged after the first hour of the paper-based assessment between the paper-based assessment and questionnaire, and between the questionnaire and the computer-based assessment.

Students were allowed to talk to each other during the breaks, though they were asked not to talk about the assessments.

More than 1,000 assessment sessions (including follow-up sessions) took place. The paper-based assessment sessions were mostly carried out in classrooms, although school libraries, school halls, areas such as common rooms, meeting rooms or computer rooms were also used as assessment venues. The computer-based assessment sessions were held in computer laboratories or in classrooms, if students were undertaking the assessment on their own laptops.

Coding processes

Eleven mathematical literacy, seven scientific literacy and seven reading literacy coders were used for the whole duration of the coding. All coders were experienced secondary teachers, not currently teaching. The coders were trained in the use of the coding guide, with the initial training session beginning in late August, two weeks before the end of the testing. The coding rotation developed by the IPC enabled all three literacy domains to be coded simultaneously using different assessment booklets.

Following the procedures specified by the IPC, coding was done by cluster rather than by booklet. Before a new cluster was started, further training and practice on the new cluster was carried out. Within clusters, coding was done by item. The specified procedures for randomly allocating booklets to coders were followed.

Three table leaders[2] (one for each literacy assessment domain) were used to field queries from individual coders, to review with individual coders any issues that needed to be drawn to their attention, to document difficulties that needed resolution from the national project manager or the IPC and to monitor the coding process generally.

The coding across all domains was completed in approximately four weeks. In addition to improved coding guides, revised after the field trial, the expertise and experience of the table leaders ensured that the work progressed well.

Data entry

All assessment booklets and student questionnaires were scanned. The data from the multiple-choice items in the assessment booklets and responses from the student questionnaires were captured and imported into KeyQuest. The school questionnaire was administered as a web-based questionnaire, with data later being imported into KeyQuest. Checking and cleaning steps, which took approximately two to three weeks, were then undertaken prior to the Australian data being submitted to the IPC.

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 sample, initiating and maintaining contact with schools, through to the preparation of materials, printing, packing, mailing, receiving and tallying returns. Other aspects of quality assurance included the detailed training of test administrators adhering to the internationally laid-down procedures, and the training and monitoring of coders and the entry of data.

PISA quality monitors, on behalf of the IPC, visited approximately 15 of the participating Australian schools when the assessment was taking place to ensure that procedures were followed accurately and instructions were adhered to.

2 Very experienced coders

Appendix B
Sampling

Australian sampling results

Sampling in PISA was carried out in two stages in most countries, including Australia. Schools were selected with a probability proportional to enrolment size of 15-year-olds. Thus, large schools had a greater chance than small schools of being selected.

Internationally, the minimum required sample for each country was 150 schools and 4,500 students. In Australia, a larger sample was drawn to enable results to be reported by jurisdiction and for Indigenous students. Table B.1 gives the details of the Australian sample design.

Table B.1 Designed PISA school sample by jurisdiction and sector

	Sector			
Jurisdiction	**Catholic**	**Government**	**Independent**	**Total**
ACT	8	27	11	46
NSW	43	115	28	186
VIC	31	79	27	137
QLD	25	85	25	135
SA	18	58	19	95
WA	18	54	21	93
TAS	14	49	12	75
NT	6	47	8	61
Australia	163	514	151	828

Stratification variables used in Australia when selecting the sample were jurisdiction, sector (government, Catholic and independent), as well as geographic location of the school (based on the MCEECDYA *Schools Geographic Location Classification*), sex of students at the school, a socioeconomic background variable (based on SEIFA) and an achievement variable (based on a NAPLAN numeracy school-level score).

Following PISA procedures, schools were randomly selected with probability proportional to estimated enrolment size of PISA age-related students within strata, using the latest available data in ACER's sampling frame. To define the PISA population, estimates of the numbers of 15-year-olds were made by sector within each jurisdiction, from information obtained from each jurisdiction Education Department and previous PISA data on the proportion of 15-year-old students.

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, distance education 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 828 schools sampled for PISA 2012 main study, 38 schools were not eligible and, therefore, were not included in the school sample (on the basis that there were two or fewer age-eligible students[1] or the school had closed). Fifteen of the participating schools achieved a student response rate that was lower than 25%. Subsequently, these schools were identified as non-participating schools.

In all, 775 schools participated in the main study. The achieved Australian PISA school sample is included as Table 1.1 in Chapter 1. The 775 schools represented a weighted response rate of 97.9%, meeting the international standards on response rates as specified by the PISA Technical Advisory Group.

In each school, 20 students and all age-eligible Indigenous students were sampled to participate in PISA. This was a deviation from the student sample design used in PISA 2009 (where 48 students and all age-eligible Indigenous students were sampled). It was undertaken so that there was less disruption to schools (e.g., it was easier to accommodate 20 students in a classroom rather than having to organise a larger space for around 50 students) and also to obtain more precise results. Australia achieved a weighted student response rate of 86.8%, which was higher than the minimum required student response rate.

Population coverage

All countries attempt to maximise the coverage of eligible 15-year-old students in their national sample. According to the PISA sampling standards, countries are permitted to exclude a total of 5% of the total relevant population either by excluding schools or by excluding students within schools.

Table B.2 describes the target population of the countries participating in PISA 2012. Further information on the target population and the implementation of PISA sampling standards can be found in the *PISA 2012 Technical Report* (OECD, forthcoming).

1 Schools with two or fewer students are considered ineligible and do not participate in PISA.

Table B.2 PISA target populations and samples[2]

	Population and sample information												Coverage indices		
	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	Number of excluded students	Weighted number of excluded students	Within-school exclusion rate (%)	Overall exclusion rate (%)	Coverage index 1: Coverage of national desired population	Coverage index 2: Coverage of national enrolled population	Coverage index 3: Coverage of 15-year-old population
Albania	76 910	50 157	50 157	56	50 101	0.11	4 743	42 466	1	10	0.02	0.14	0.999	0.999	0.552
Argentina	684 879	637 603	637 603	3 995	633 608	0.63	5 908	545 942	12	641	0.12	0.74	0.993	0.993	0.797
Australia	291 967	288 159	288 159	5 702	282 457	1.98	17 774	250 779	505	5 282	2.06	4.00	0.960	0.960	0.859
Austria	93 537	89 073	89 073	106	88 967	0.12	4 756	82 242	46	1 011	1.21	1.33	0.987	0.987	0.879
Belgium	123 469	121 493	121 209	1 324	119 885	1.09	9 690	117 912	39	367	0.31	1.40	0.986	0.984	0.955
Brazil	3 574 928	2 786 064	2 786 064	34 932	2 751 132	1.25	20 091	2 470 804	44	4 900	0.20	1.45	0.986	0.986	0.691
Bulgaria	70 188	59 684	59 684	1 437	58 247	2.41	5 282	54 255	6	80	0.15	2.55	0.974	0.974	0.773
Canada	417 873	409 453	404 767	2 936	401 831	0.73	21 548	348 070	1,796	21 013	5.69	6.38	0.936	0.926	0.833
Chile	274 803	252 733	252 625	2 687	249 938	1.06	6 857	229 199	18	548	0.24	1.30	0.987	0.987	0.834
Chinese Taipei	328 356	328 336	328 336	1 747	326 589	0.53	6 046	292 542	44	2 029	0.69	1.22	0.988	0.988	0.891
Colombia	889 729	620 422	620 422	4	620 418	0.00	11 173	560 805	23	789	0.14	0.14	0.999	0.999	0.630
Costa Rica	81 489	64 326	64 326	0	64 326	0.00	4 602	40 384	2	12	0.03	0.03	1.000	1.000	0.496
Croatia	48 155	46 550	46 550	417	46 133	0.90	6 153	45 502	91	627	1.36	2.24	0.978	0.978	0.945
Cyprus	9 956	9 956	9 955	128	9 827	1.29	5 078	9 650	157	200	2.03	3.29	0.967	0.967	0.969
Czech Republic	96 946	93 214	93 214	1 577	91 637	1.69	6 535	82 101	15	118	0.14	1.83	0.982	0.982	0.847
Denmark	72 310	70 854	70 854	1 965	68 889	2.77	7 481	65 642	368	2 381	3.50	6.18	0.938	0.938	0.908
Estonia	12 649	12 438	12 438	442	11 996	3.55	5 867	11 634	143	277	2.33	5.80	0.942	0.942	0.920
Finland	62 523	62 195	62 195	523	61 672	0.84	8 829	60 047	225	653	1.08	1.91	0.981	0.981	0.960
France	792 983	755 447	755 447	27 403	728 044	3.63	5 682	701 399	52	5 828	0.82	4.42	0.956	0.956	0.885
Germany	798 136	798 136	798 136	10 914	787 222	1.37	5 001	756 907	8	1 302	0.17	1.54	0.985	0.985	0.948
Greece	110 521	105 096	105 096	1 364	103 732	1.30	5 125	96 640	136	2 304	2.33	3.60	0.964	0.964	0.874
Hong Kong–China	84 200	77 864	77 864	813	77 051	1.04	4 670	70 636	38	518	0.73	1.76	0.982	0.982	0.839
Hungary	111 761	108 816	108 816	1 725	107 091	1.59	4 810	91 179	27	928	1.01	2.58	0.974	0.974	0.816
Iceland	4 505	4 491	4 491	10	4 481	0.22	3 508	4 169	155	156	3.60	3.81	0.962	0.962	0.925
Indonesia	4 174 217	3 599 844	3 544 028	8 039	3 535 989	0.23	5 622	2 645 155	2	860	0.03	0.26	0.997	0.982	0.634
Ireland	59 296	57 979	57 952	0	57 952	0.00	5 016	54 010	271	2 524	4.47	4.47	0.955	0.955	0.911

2 OECD (forthcoming), Table A2.1

Israel	118 953	113 278	113 278	2 784	110 494	2.46	6 061	107 745	114	1 884	1.72	4.13	0.959	0.959	0.906
Italy	605 490	566 973	566 973	8 498	558 475	1.50	38 142	521 288	741	9 855	1.86	3.33	0.967	0.967	0.861
Japan	1 241 786	1 214 756	1 214 756	26 099	1 188 657	2.15	6 351	1 128 179	0	0	0.00	2.15	0.979	0.979	0.909
Jordan	129 492	125 333	125 333	141	125 192	0.11	7 038	111 098	19	304	0.27	0.39	0.996	0.996	0.858
Kazakhstan	258 716	247 048	247 048	7 374	239 674	2.98	5 808	208 411	25	951	0.45	3.43	0.966	0.966	0.806
Korea	687 104	672 101	672 101	3 053	669 048	0.45	5 033	603 632	17	2 238	0.37	0.82	0.992	0.992	0.879
Latvia	18 789	18 389	18 375	655	17 720	3.56	5 276	16 054	14	76	0.47	4.02	0.960	0.959	0.854
Liechtenstein	417	383	383	1	382	0.26	293	314	13	13	3.97	4.22	0.958	0.958	0.753
Lithuania	38 524	35 567	35 567	526	35 041	1.48	4 618	33 042	130	867	2.56	4.00	0.960	0.960	0.858
Luxembourg	6 187	6 082	6 082	151	5 931	2.48	5 260	5 523	357	357	6.07	8.40	0.872	0.872	0.850
Macao–China	6 600	5 416	5 416	6	5 410	0.11	5 335	5 366	3	3	0.06	0.17	0.998	0.998	0.813
Malaysia	544 302	457 999	457 999	225	457 774	0.05	5 197	432 080	7	554	0.13	0.18	0.998	0.998	0.794
Mexico	2 114 745	1 472 875	1 472 875	7 307	1 465 568	0.50	33 806	1 326 025	58	3 247	0.24	0.74	0.993	0.993	0.627
Montenegro	8 600	8 600	8 600	18	8 582	0.21	4 744	7 714	4	8	0.10	0.31	0.997	0.997	0.897
Netherlands	194 000	193 190	193 190	7 546	185 644	3.91	4 460	196 262	27	1 056	0.54	4.42	0.956	0.956	1.012
New Zealand	60 940	59 118	59 118	579	58 539	0.98	5 248	53 414	255	2 030	3.66	4.61	0.954	0.954	0.876
Norway	64 917	64 777	64 777	750	64 027	1.16	4 686	59 432	278	3 133	5.01	6.11	0.939	0.939	0.916
Peru	584 294	508 969	508 969	263	508 706	0.05	6 035	419 945	8	549	0.13	0.18	0.998	0.998	0.719
Poland	425 597	410 700	410 700	6 900	403 800	1.68	5 662	379 275	212	11 566	2.96	4.59	0.954	0.954	0.891
Portugal	108 728	127 537	127 537	0	127 537	0.00	5 722	96 034	124	1 560	1.60	1.60	0.984	0.984	0.883
Qatar	11 667	11 532	11 532	202	11 330	1.75	10 966	11 003	85	85	0.77	2.51	0.975	0.975	0.943
Romania	146 243	146 243	146 243	5 091	141 152	3.48	5 074	140 915	0	0	0.00	3.48	0.965	0.965	0.964
Russian Federation	1 272 632	1 268 814	1 268 814	17 800	1 251 014	1.40	6 418	1 172 539	69	11 940	1.01	2.40	0.976	0.976	0.921
Serbia	80 089	75 870	74 272	1 987	72 285	2.67	4 684	67 934	10	136	0.20	2.87	0.971	0.951	0.848
Shanghai–China	122 402	90 796	90 796	1 252	89 544	1.38	6 374	85 127	8	107	0.13	1.50	0.985	0.985	0.695
Singapore	53 637	52 163	52 163	293	51 870	0.56	5 546	51 088	33	315	0.61	1.17	0.988	0.988	0.952
Slovak Republic	59 723	59 367	59 367	1 480	57 887	2.49	5 737	54 486	29	246	0.45	2.93	0.971	0.971	0.912
Slovenia	19 471	18 935	18 935	115	18 820	0.61	7 229	18 303	84	181	0.98	1.58	0.984	0.984	0.940
Spain	423 444	404 374	404 374	2 031	402 343	0.50	25 335	374 266	959	14 931	3.84	4.32	0.957	0.957	0.884
Sweden	102 087	102 027	102 027	1 705	100 322	1.67	4 739	94 988	201	3 789	3.84	5.44	0.946	0.946	0.930
Switzerland	87 200	85 239	85 239	2 479	82 760	2.91	11 234	79 679	256	1 093	1.35	4.22	0.958	0.958	0.914
Thailand	982 080	784 897	784 897	9 123	775 774	1.16	6 606	703 012	12	1 144	0.16	1.32	0.987	0.987	0.716
Tunisia	132 313	132 313	132 313	169	132 144	0.13	4 407	120 784	5	130	0.11	0.24	0.998	0.998	0.913
Turkey	1 266 638	965 736	965 736	10 387	955 349	1.08	4 848	866 681	21	3 684	0.42	1.49	0.985	0.985	0.684
United Arab Emirates	48 824	48 446	48 446	971	47 475	2.00	11 500	40 612	11	37	0.09	2.09	0.979	0.979	0.832
United Kingdom	738 066	745 581	745 581	19 820	725 761	2.66	12 659	688 236	486	20 173	2.85	5.43	0.946	0.946	0.932
United States	3 985 714	4 074 457	4 074 457	41 142	4 033 315	1.01	6 111	3 536 153	319	162 194	4.39	5.35	0.946	0.946	0.887
Uruguay	54 638	46 442	46 442	14	46 428	0.03	5 315	39 771	15	99	0.25	0.28	0.997	0.997	0.728
Vietnam	1 717 996	1 091 462	1 091 462	7 729	1 083 733	0.71	4 959	956 517	1	198	0.02	0.73	0.993	0.993	0.557

Note: The figure for total national population of 15-year-olds enrolled in Column 1 may occasionally be larger than the total number of 15-year-olds in Column 2 due to differing data sources.

Column 1 shows the **total number of 15-year-olds** according to the most recent available information, which in most countries was the year 2011 as the year before the assessment.

Column 2 shows the number of 15-year-olds enrolled in schools in Grades 7 or above, that is referred to as the **eligible population**.

Column 3 shows the **national desired target population**. As part of the school-level exclusions, countries were allowed to exclude up to 0.5% of students a priori from the eligible population, essentially for practical reasons.

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 2012**. Note that 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**, i.e., the number of students in the nationally defined target population that the PISA sample represents.

Column 9 indicates the total number of **excluded students**. Each country 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.

Column 10 indicates the **weighted number of excluded students**, i.e., 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 the within-school exclusion rate (Column 11 divided by 100) multiplied by 1 minus the school-level exclusion rate (Column 6 divided by 100).

Column 13 presents an index of the extent to which the national desired target population is covered by the PISA sample.

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 2000. 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), multiplied by 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).

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 were developed for PISA that ensured that national samples provided comparable data and that the results could be compared with confidence. However, statistics in this report are 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 PISA International Consortium 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, i.e., typically smaller than the sampling error.

A minimum response rate of 85% was required for the schools initially selected. However, where 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. Therefore, participating countries were 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 of less than 25% were excluded from the database.

PISA 2012 also required a minimum participation rate of 80% of students within participating schools (original and replacement 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 using all original schools, and using all schools whether original sample or replacement schools, and from the participation of students in both the original assessment and any follow-up sessions.

Appendix C
Sample mathematical literacy items and responses[3]

A selection of example items and responses have been provided to show the types of assessment items included in PISA and to illustrate the ways in which performance in mathematical literacy was measured. The mathematical literacy assessment items provided here have been drawn from items released after the 2012 administration of PISA.

The six units in the table following—Which car?, Charts, Garage, Helen the cyclist, Climbing Mount Fuji and Revolving door—were all included in the main survey assessment instrument for PISA 2012 and provide examples of the six proficiency levels, and the mathematical skills and knowledge required at each level.

The first item in the units Which car? and Charts are examples of items located below Level 1 on the proficiency scale. The first items in the units Garage, Helen the cyclist and Climbing Mount Fuji, and the second and fifth items in the unit Charts are examples of items located towards the lower end of the proficiency scale—Levels 1 and 2. Items located at these levels are typically set in familiar contexts where all relevant information is present, and students can interpret and recognise situations in contexts that require no more than direct inference.

The first item in the unit Revolving door, and the second items in the units Helen the cyclist and Which car? are all examples of items placed at proficiency Level 3. At Level 3 students can typically interpret and use representations based on different information sources and reason directly from them.

Item 3 in the units Which car?, Revolving door and Climbing Mount Fuji (partial credit) are examples of items placed at proficiency Level 4. At Level 4 students can typically work effectively with explicit models for complex concrete situations. Students can also select and integrate different representations, linking them directly to aspects of real-world situations.

Item 2 (full credit) and item 3 in the unit Climbing Mount Fuji, and item 2 in the unit Garage (partial credit) are examples of items placed at proficiency Level 5. At Level 5 students can typically develop and work with models for complex situations, identifying constraints and specifying assumptions using well-developed thinking and reasoning skills and insights pertaining to these situations.

Item 2 in the unit Garage (full credit), Item 3 in the unit Helen the cyclist and Item 2 in the unit Revolving door are all located at proficiency Level 6. At Level 6 students are able to successfully complete the most difficult PISA items. Students have the skills to conceptualise, generalise and use information based on their investigations and modelling of complex problem situations. Students are typically capable of advanced mathematical thinking and reasoning at this level.

For each of the items in this Appendix, details about the item characteristics, including the item format, the classification and difficulty of the item have been presented.

Table C.1 presents a map of the sample mathematical literacy items presented in this Appendix.

3 The commentary in this Appendix has been taken from the *PISA International Report Volume 1* (OECD, forthcoming). The sample mathematical items and responses have been taken from completed assessment booklets.

Table C.1 Sample items and cut-off score points on the mathematical literacy proficiency scale

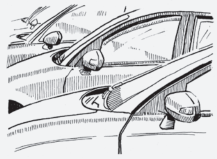
Proficiency level	Interpret				Employ				Formulate			
	Uncertainty and data	Quantity	Space and shape	Change and relationships	Uncertainty and data	Quantity	Space and shape	Change and relationships	Uncertainty and data	Quantity	Space and shape	Change and relationships
6			Garage Item 02 (687) (full credit)					Helen the cyclist Item 03 (697)			Revolving door Item 02 (840)	
669.3 score points												
5			Garage Item 02 (663) (partial credit)			Climbing Mount Fuji Item 03 (610) (full credit)						Climbing Mount Fuji Item 02 (642)
607.0 score points												
4						Climbing Mount Fuji Item 03 (591) (partial credit) Which car? Item 03 (553)				Revolving door Item 03 (561)		
544.7 score points												
3						Which car? Item 02 (491)	Revolving door Item 01 (512)	Helen the cyclist Item 02 (511)				
482.4 score points												
2	Charts Item 05 (428)							Helen the cyclist Item 01 (441)		Climbing Mount Fuji Item 01 (464)		
420.1 score points												
1	Charts Item 02 (415)		Garage Item 01 (420)									
357.8 score points												
Below 1	Which car? Item 03 (328) Charts Item 01 (348)											

Which car?

Which car?

Chris has just received her car driving licence and wants to buy her first car.

This table below shows the details of four cars she finds at a local car dealer.



Model:	Alpha	Bolte	Castel	Dezal
Year	2003	2000	2001	1999
Advertised price (zeds)	4800	4450	4250	3990
Distance travelled (kilometres)	105 000	115 000	128 000	109 000
Engine capacity (litres)	1.79	1.796	1.82	1.783

Which car? Item 1

Item type: Simple multiple-choice
Content: Uncertainty and data
Process: Interpret
Context: Personal
Difficulty: 328 score points (Below Level 1)

The first item requires students to understand the basic row–column conventions of a table in order to identify one value where three numerical conditions are simultaneously satisfied.

Chris wants a car that meets all of these conditions:

- The distance travelled is **not** higher than 120 000 kilometres.
- It was made in the year 2000 or a later year.
- The advertised price is **not** higher than 4500 zeds.

Which car meets Chris's conditions?

A Alpha

B Bolte

C Castel

D Dezal

Which car? Item 2

Item type: Simple multiple-choice	
Content: Quantity	
Process: Employ	
Context: Personal	
Difficulty: 491 score points (Level 3)	

Based on information provided in the table, the second item in the Which car? unit requires students to choose which car's engine capacity is the smallest. Students need to identify the smallest decimal number in a set of four.

Which car's engine capacity is the smallest?

A Alpha

B Bolte

C Castel

D Dezal

Which car? Item 3

Item type: Open-constructed response	
Content: Quantity	
Process: Employ	
Context: Personal	
Difficulty: 553 score points (Level 4)	

Item 3 is the most difficult of the three items comprising the Which car? unit. The item requires students to calculate 2.5% of a value in the thousands within a financial context. The item requires students to deal with both decimal numbers and percentages.

Chris will have to pay an extra 2.5% of the advertised cost of the car as taxes.

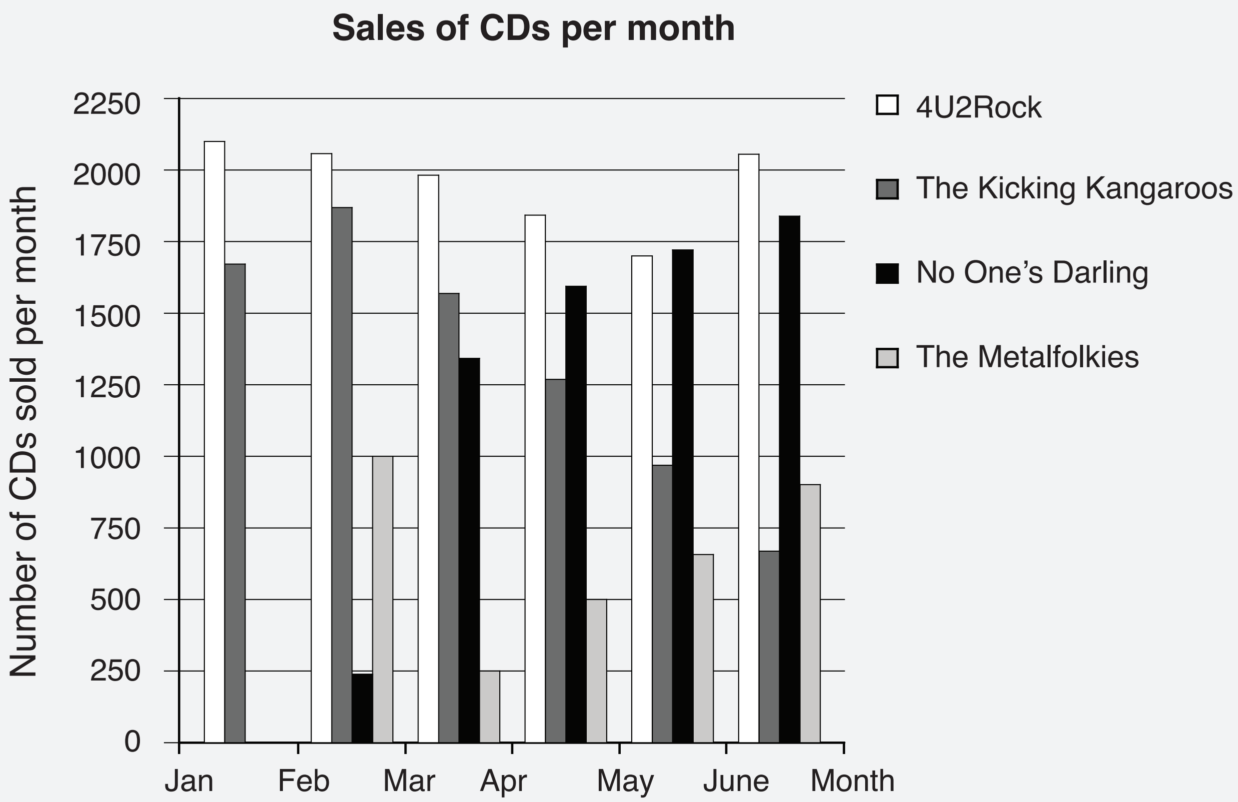
How much are the extra taxes for the Alpha?

Extra taxes in zeds: 120

Charts

Charts

In January, the new CDs of the bands *4U2Rock* and *The Kicking Kangaroos* were released. In February, the CDs of the bands *No One's Darling* and *The Metalfolkies* followed. The following graph shows the sales of the bands' CDs from January to June.



Charts Item 1

Item type: Simple multiple-choice
Content: Uncertainty and data
Process: Interpret
Context: Societal
Difficulty: 348 score points (Below Level 1)

The first item requires students to read a bar chart that displays four separate data series (four different music bands). From the graphical representation students have to find how many CDs the band *The Metalfolkies* sold in April.

How many CDs did the band *The Metalfolkies* sell in April?

A 250

B 500

C 1000

D 1270

Charts Item 2

Item type: Simple multiple-choice
Content: Uncertainty and data
Process: Interpret
Context: Societal
Difficulty: 415 score points (Level 1)

The second item in the Charts unit requires students to identify the bars representing two bands in order to compare the height so as to determine in which month did the band *No One's Darling* sell more CDs than the band *The Kicking Kangaroos* for the first time.

In which month did the band *No One's Darling* sell more CDs than the band *The Kicking Kangaroos* for the first time?

A No month

B March

C April

D May

Charts Item 5

Item type: Simple multiple-choice
Content: Uncertainty and data
Process: Interpret
Context: Societal
Difficulty: 428 score points (Level 2)

Item 5 in the Charts unit requires students to interpret a bar chart in order to identify the data series for *The Kicking Kangaroos* band and estimate the number of CDs the band will sell in the future assuming that the linear trend continues.

The manager of *The Kicking Kangaroos* is worried because the number of their CDs that sold decreased from February to June.

What is the estimate of their sales volume for July if the same negative trend continues?

A 70 CDs

B 370 CDs

C 670 CDs

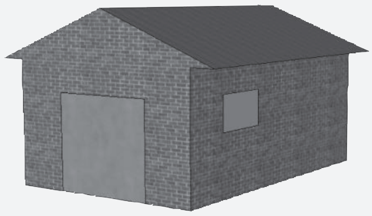
D 1340 CDs

Garage

Garage

A garage manufacturer's "basic" range includes models with just one window and one door.

George chooses the following model from the "basic" range. The position of the window and the door are shown here.



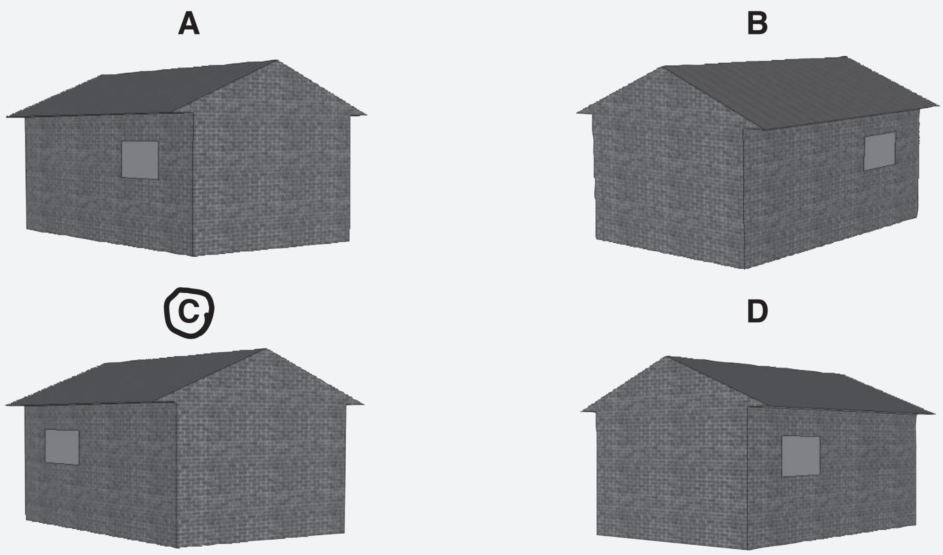
Garage Item 1

Item type: Simple multiple-choice	
Content: Space and shape	
Process: Interpret	
Context: Occupational	
Difficulty: 420 score points (Level 1)	

The first item in the Garage unit requires students to use space ability to identify a 3D picture of a building from the back that corresponds to another 3D building from the front.

The illustrations below show different "basic" models as viewed from the back. Only one of these illustrations matches the model above chosen by George.

Which model did George choose? Circle A, B, C or D.

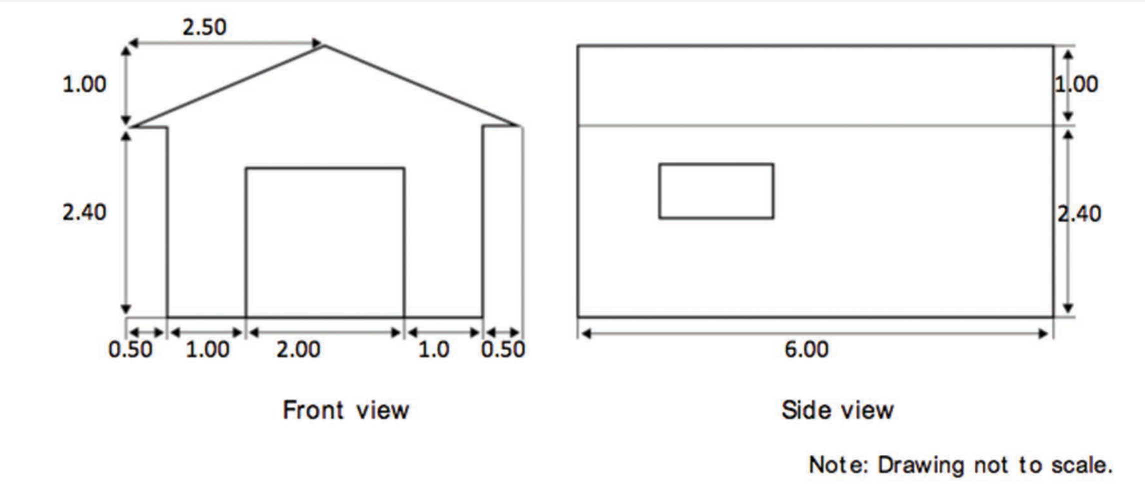


Garage Item 2

Item type: Open-constructed response
Content: Space and shape
Process: Interpret
Context: Occupational
Difficulty: Full credit: 687 score points (Level 6) Partial credit: 663 score points (Level 5)

The second item in the Garage unit requires students to know how to use Pythagoras' theorem to calculate the total area of the roof. Students are required to show their working. A student is awarded full credit if they calculate the correct response, while partial credit is attained based on the explanation of reasoning for incorrect responses.

The two plans below show the dimensions, in metres, of the garage George chose.



The roof is made up of two identical rectangular sections.

Calculate the **total** area of the roof. Show your work.

12 x 2.69 = 32.28 m²

Helen the cyclist

Helen the cyclist

Helen has just got a new bike. It has a speedometer which sits on the handlebar.

The speedometer can tell Helen the distance she travels and her average speed for a trip.

Helen the cyclist Item 1

Item type: Simple multiple-choice
Content: Change and relationships
Process: Employ
Context: Personal
Difficulty: 441 score points (Level 2)

The first item in the Helen the cyclist unit requires students to compare speed when travelling 4 km in 10 minutes versus travelling 2 km in 5 minutes.

On one trip, Helen rode 4 km in the first 10 minutes and then 2 km in the next 5 minutes.

Which one of the following statements is correct?

A Helen's average speed was greater in the first 10 minutes than in the next 5 minutes.

B Helen's average speed was the same in the first 10 minutes and in the next 5 minutes.

C Helen's average speed was less in the first 10 minutes than in the next 5 minutes.

D It is not possible to tell anything about Helen's average speed from the information given.

Helen the cyclist Item 2

Item type: Simple multiple-choice
Content: Change and relationships
Process: Employ
Context: Personal
Difficulty: 511 score points (Level 3)

The second item in the unit requires students to employ simple proportional reasoning in order to calculate the time Helen travelled when provided with the average speed and distance travelled.

Helen rode 6 km to her aunt's house. Her speedometer showed that she had averaged 18 km/h for the whole trip.

Which one of the following statements is correct?

A It took Helen 20 minutes to get to her aunt's house.

B It took Helen 30 minutes to get to her aunt's house.

C It took Helen 3 hours to get to her aunt's house.

D It is not possible to tell how long it took Helen to get to her aunt's house.

Helen the cyclist Item 3

Item type: Open-constructed response
Content: Change and relationships
Process: Employ
Context: Societal
Difficulty: 697 score points (Level 6)

For the final item in the Helen the cyclist unit students are required to demonstrate a greater understanding of the meaning of average speed, while appreciating the importance of linking total time with distance. Students are required to calculate the average speed Helen travelled over two trips when the two given distances travelled and the two times taken are provided.

Helen rode her bike from home to the river, which is 4 km away. It took her 9 minutes. She rode home using a shorter route of 3 km. This only took her 6 minutes.

What was Helen's average speed, in km/h, for the trip to the river and back?

Average speed for the trip: 28 km/h

Climbing Mount Fuji

Climbing Mount Fuji

Mount Fuji is a famous dormant volcano in Japan.

Climbing Mount Fuji Item 1

Item type: Simple multiple-choice
Content: Quantity
Process: Formulate
Context: Societal
Difficulty: 464 score points (Level 2)

The first item in this unit requires students to calculate the number of days the trail is open based on the given dates and then calculate the average.

Mount Fuji is only open to the public for climbing from 1 July to 27 August each year.
About 200 000 people climb Mount Fuji during this time.

On average, about how many people climb Mount Fuji each day?

A 340

B 710

C 3400

D 7100

E 7400

Climbing Mount Fuji Item 2

Item type: Open-constructed response
Content: Change and relationships
Process: Formulate
Context: Societal
Difficulty: 642 score points (Level 5)

The second item in the Climbing Mount Fuji unit requires students to calculate the starting time for a trip having been provided with given two different speeds, a total distance to be travelled and a given finish time.

The Gotemba walking trail up Mount Fuji is about 9 kilometres (km) long.

Walkers need to return from the 18 km walk by 8 pm.

Toshi estimates that he can walk up the mountain at 1.5 kilometres per hour on average, and down at twice that speed. These speeds take into account meal breaks and rest times.

Using Toshi's estimated speeds, what is the latest time he can begin his walk so that he can return by 8 pm?

11 am 9/1.5 = 6hrs, 9/3 = 3 hrs total time needed = 6 + 3 = 9 hrs

Climbing Mount Fuji Item 3

Item type: Open-constructed response
Content: Quantity
Process: Employ
Context: Societal
Difficulty: Full credit: 610 score points (Level 5) Partial credit: 591 score points (Level 4)

The final item in this unit requires students to calculate the average step length for Toshi's walk based on the distance he travelled and the number of steps he took, and then making the appropriate unit conversions so the quotient is expressed in centimetres.

Students received full credit for this item if they calculated the correct answer, while students received partial credit if they calculated the correct digit but it was based on an incorrect conversion to centimetres.

Toshi wore a pedometer to count his steps on his walk along the Gotemba trail.

His pedometer showed that he walked 22 500 steps on the way up.

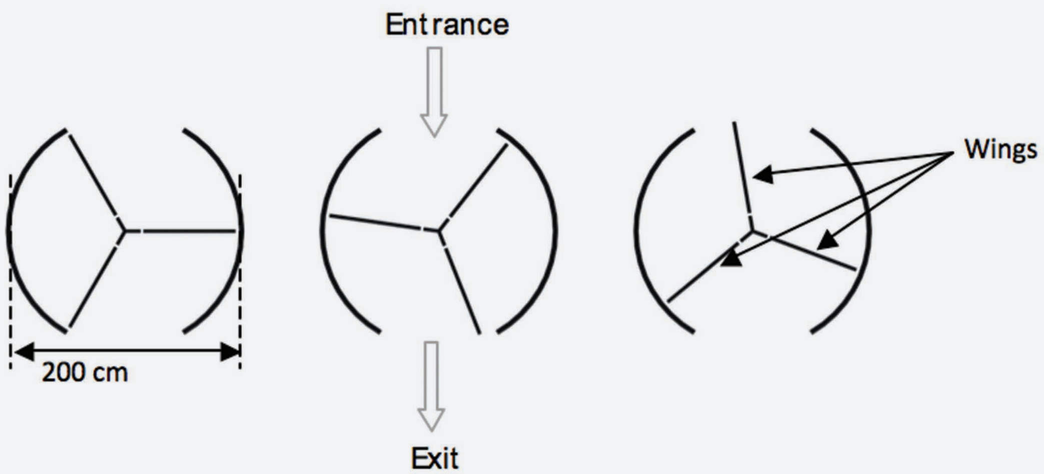
Estimate Toshi's average step length for his walk up the 9 km Gotemba trail. Give your answer in centimetres (cm).

Answer: 900000 / 22500 = 40 cm cm

Revolving door

Revolving door

A revolving door includes three wings which rotate within a circular-shaped space. The inside diameter of this space is 2 metres (200 centimetres). The three door wings divide the space into three equal sectors. The plan below shows the door wings in three different positions viewed from the top.



Revolving door Item 1

Item type: Open-constructed response
Content: Space and shape
Process: Employ
Context: Scientific
Difficulty: 512 score points (Level 3)

This item requires students to find the angle of 120 degrees between the two door wings. To successfully answer this item a student needs to have a specific knowledge of circle geometry.

What is the size in degrees of the angle formed by two door wings?

Size of the angle: 120 °

Revolving door Item 3

Item type: Simple multiple-choice
Content: Quantity
Process: Formulate
Context: Scientific
Difficulty: 561 score points (Level 4)

Item 3 of the Revolving door unit requires students to identify information and construct an (implicit) quantitative model to solve a problem involving rates and proportional reasoning.

The door makes 4 complete rotations in a minute. There is room for a maximum of two people in each of the three door sectors.

What is the maximum number of people that can enter the building through the door in 30 minutes?

A 60

B 180

C 240

D 720

Revolving door Item 2

Item type: Open constructed response
Content: Space and shape
Process: Formulate
Context: Scientific
Difficulty: 840 score points (Level 6)

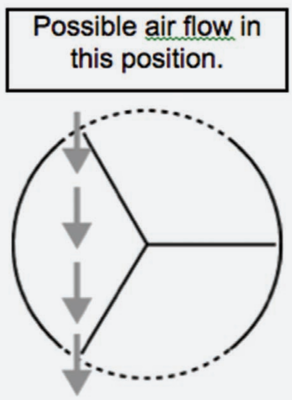
The second item in the Revolving door unit is one of the most challenging items in the PISA assessment and requires students to perform complex geometrical reasoning to calculate the length of an arc that each door opening can have. Students needed to accurately complete this calculation in centimetres.

The two door **openings** (the dotted arcs in the diagram) are the same size. If these openings are too wide the revolving wings cannot provide a sealed space and air could then flow freely between the entrance and the exit, causing unwanted heat loss or gain. This is shown in the diagram opposite.

What is the maximum arc length in centimetres (cm) that each door opening can have, so that air never flows freely between the entrance and the exit?

100 π/3

Maximum arc length: 105 cm



Appendix D
Mathematical literacy multiple comparison table for the jurisdictions and PISA 2012 countries

Jurisdiction	Mean score	SE	Shanghai–China	Singapore	Hong Kong–China	Chinese Taipei	Korea	Macao–China	Japan	Liechtenstein	Switzerland	Netherlands	Estonia	Finland	Canada	Poland	Belgium	Germany	Vietnam	Austria	Ireland	Slovenia	Denmark	New Zealand	Czech Republic	France	OECD average
	Country Mean score		613	573	561	560	554	538	536	535	531	523	521	519	518	518	515	514	511	506	501	501	500	500	499	495	494
	SE		3.3	1.3	3.2	3.3	4.6	1.0	3.6	4.0	3.0	3.5	2.0	1.9	1.8	3.6	2.1	2.9	4.8	2.7	2.2	1.2	2.3	2.2	2.9	2.5	0.5
ACT	518	3.6	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
WA	516	3.4	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
VIC	509	3.6	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲
NSW	503	2.9	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	▲	▲
QLD	501	3.7	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●
SA	489	3.3	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●
TAS	478	3.4	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
NT	452	10.4	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼

Notes: Read across the row to compare a juridiction's performance with the performance of each country listed in the column heading.

Australia has not been included in the multiple comparison table. To make this comparison, the jurisdiction would need to be compared with Australia's mean score, calculated without the data for the jurisdiction that is being compared.

▲ Average performance statistically significantly higher than in comparison country

● No statistically significant difference from comparison country

▼ Average performance statistically significantly lower than in comparison country

United Kingdom	Iceland	Latvia	Luxembourg	Norway	Portugal	Italy	Spain	Russian Federation	Slovak Republic	United States	Lithuania	Sweden	Hungary	Croatia	Israel	Greece	Serbia	Turkey	Romania	Cyprus	Bulgaria	United Arab Emirates	Kazakhstan	Thailand	Chile	Malaysia	Mexico
494	493	491	490	489	487	485	484	482	482	481	479	478	477	471	466	453	449	448	445	440	439	434	432	427	423	421	413
3.3	1.7	2.8	1.1	2.7	3.8	2.0	1.9	3.0	3.4	3.6	2.6	2.3	3.2	3.5	4.7	2.5	3.4	4.8	3.8	1.1	4.0	2.4	3.0	3.4	3.1	3.2	1.4
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲

Appendix E
Sample scientific literacy items and responses[1]

A number of example items and responses are included to show the types of assessment items included in PISA and to illustrate the ways in which performance was measured. No scientific literacy assessment items have been released in this current PISA cycle. The remaining scientific literacy assessment items are secure, so that they can be used as linking items for future PISA cycles.

Table E.1 provides a visual representation of the location of the sample items on the scientific literacy scale, the scientific competencies that each assessment item assessed and the difficulty of each item (the number in the brackets).

Item 2 in the unit Clothes, and Item 3 in the units Genetically modified crops and Acid rain are examples of items at the lower end of the proficiency scale—Levels 1 and 2. Item 3 and a partial credit for Item 4 in Greenhouse, Item 2 in Genetically modified crop*s*, Item 2 and a partial credit for Item 5 in Acid rain, and Item 1 in Clothes are illustrative of items placed around the middle of the proficiency scale—Levels 3 and 4. Finally, a full credit for Item 4 as well as Item 5 in the Greenhouse unit and a full credit for Item 5 in Acid rain are examples of items at the upper end of the scientific literacy scale—Levels 5 and 6.

Assessment items are set in simple and relatively familiar contexts and require only the most limited interpretation of a situation. Acid rain, Greenhouse and Clothes are illustrative of items that assess more than one scientific competency across a unit.

Item 5 in Acid rain is an example of a partial credit item. Students who provided all the required detail to this item were given full credit and placed at proficiency Level 6; while students who only provided part of the complete answer to this item were awarded a partial credit and placed at Level 3.

For each of the items in this Appendix, details about the item characteristics, including the item format, the classification and difficulty of the item have been presented.

1 No further release of scientific literacy items has occurred since the PISA 2006 assessment. The commentary and sample scientific literacy items in this Appendix have been taken from the Australian national report on PISA 2006 (Thomson & De Bortoli, 2007).

Table E.1 Sample items and cut-off score points on the scientific literacy proficiency scale

Proficiency level	Competencies: Identifying scientific issues	Competencies: Explaining phenomena scientifically	Competencies: Using scientific evidence
6	Acid rain Item 05 (717) (full credit)	Greenhouse Item 05 (709)	
707.9 score points			
5			Greenhouse Item 04 (659) (full credit)
633.3 score points			
4	Clothes Item 01 (567)		Greenhouse Item 04 (568) (partial credit)
558.7 score points			
3	Acid rain Item 05 (513) (partial credit) Genetically modified crops Item 02 (488)	Acid rain Item 02 (506)	Greenhouse Item 03 (529)
484.1 score points			
2	Genetically modified crops Item 03 (421)		Acid rain Item 03 (460)
409.5 score points			
1		Clothes Item 02 (399)	
334.9 score points			

Clothes

CLOTHES

Read the text and answer the questions that follow.

A team of British scientists is developing "intelligent" clothes that will give disabled children the power of "speech". Children wearing waistcoats made of a unique electrotextile, linked to a speech synthesiser, will be able to make themselves understood simply by tapping on the touch-sensitive material.

The material is made up of normal cloth and an ingenious mesh of carbon-impregnated fibres that can conduct electricity. When pressure is applied to the fabric, the pattern of signals that passes through the conducting fibres is altered and a computer chip can work out where the cloth has been touched. It then can trigger whatever electronic device is attached to it, which could be no bigger than two boxes of matches.

"The smart bit is in how we weave the fabric and how we send signals through it – and we can weave it into existing fabric designs so you cannot see it's in there," says one of the scientists.

Without being damaged, the material can be washed, wrapped around objects or scrunched up. The scientist also claims it can be mass-produced cheaply.

Source: Steve Farrer, `Interactive fabric promises a material gift of the garb', *The Australian*, 10 August 1998.

Clothes Item 1

Item type: Complex multiple-choice
Competency: Identifying scientific issues
Knowledge category: Knowledge about science – Scientific enquiry
Application area: Frontiers of science and technology
Setting: Social
Difficulty: 567 score points (Level 4)

The first item requires students to rely on their knowledge about science, specifically scientific enquiry, to complete the item. Students are asked whether claims made in the article can be tested through scientific investigation in a laboratory.

Can these claims made in the article be tested through scientific investigation in the laboratory?

Circle either "Yes" or "No" for each.

The material can be	Can the claim be tested through scientific investigation in the laboratory?
washed without being damaged.	Yes / No
wrapped around objects without being damaged.	Yes / No
scrunched up without being damaged.	Yes / No
mass-produced cheaply.	Yes / No

Clothes Item 2

Item type: Multiple-choice
Competency: Explaining phenomena scientifically
Knowledge category: Knowledge of science – Technical systems
Application area: Frontiers of science and technology
Setting: Personal
Difficulty: 399 score points (Level 1)

The second item requires students to simply recall which piece of laboratory equipment would be used to check a fabric's conductivity.

Which piece of laboratory equipment would be among the equipment you would need to check that the fabric is conducting electricity?

A Voltmeter
B Light box
C Micrometer
D Sound meter

Genetically modified crops

GENETICALLY MODIFIED CROPS

GM CORN SHOULD BE BANNED

Wildlife conservation groups are demanding that a new genetically modified (GM) corn be banned.

This GM corn is designed to be unaffected by a powerful new herbicide that kills conventional corn plants. This new herbicide will kill most of the weeds that grow in cornfields.

The conservationists say that because these weeds are feed for small animals, especially insects, the use of the new herbicide with the GM corn will be bad for the environment. Supporters of the use of the GM corn say that a scientific study has shown that this will not happen.

Here are details of the scientific study mentioned in the above article:

- Corn was planted in 200 fields across the country.
- Each field was divided into two. The genetically modified (GM) corn treated with the powerful new herbicide was grown in one half, and the conventional corn treated with a conventional herbicide was grown in the other half.
- The number of insects found in the GM corn, treated with the new herbicide, was about the same as the number of insects in the conventional corn, treated with the conventional herbicide.

Genetically modified crops Item 2

Item type: Complex multiple-choice
Competency: Identifying scientific issues
Knowledge category: Knowledge about science – Scientific enquiry
Application area: Frontiers of science and technology
Setting: Social
Difficulty: 488 score points (Level 3)

Item 2 asks students to identify the factors that were varied in the scientific investigation.

What factors were deliberately varied in the scientific study mentioned in the article? Circle "Yes" or "No" for each of the following factors.

Was this factor deliberately varied in the study?	Yes or No?
The number of insects in the environment	Yes / No
The types of herbicide used	Yes / No

Genetically modified crops Item 3

Item type: Simple multiple-choice
Competency: Identifying scientific issues
Knowledge category: Knowledge about science – Scientific enquiry
Application area: Frontiers of science and technology
Setting: Social
Difficulty: 421 score points (Level 2)

Item 3 asks about varying conditions in a scientific investigation and students are required to demonstrate knowledge about the design of science experiments.

Corn was planted in 200 fields across the country. Why did the scientists use more than one site?

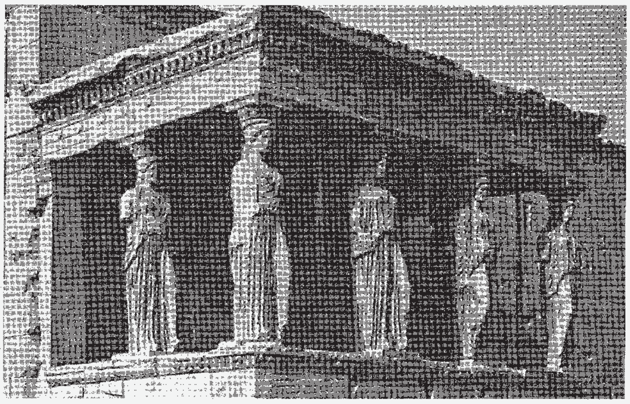
A So that many farmers could try the new GM corn.
B To see how much GM corn they could grow.
C To cover as much land as possible with the GM crop.
D To include various growth conditions for corn.

Acid rain

ACID RAIN

Below is a photo of statues called Caryatids that were built on the Acropolis in Athens more than 2500 years ago. The statues are made of a type of rock called marble. Marble is composed of calcium carbonate.

In 1980, the original statues were transferred inside the museum of the Acropolis and were replaced by replicas. The original statues were being eaten away by acid rain.



Acid rain Item 2

Item type: Open-constructed response
Competency: Explaining phenomena scientifically
Knowledge category: Knowledge of science – Physical systems
Application area: Hazards
Setting: Social
Difficulty: 506 score points (Level 3)

In Item 2 students need to demonstrate an understanding of the chemicals as originating as car exhaust, factory emission and burning fossil fuels.

Students gaining full credit display a capacity to recall relevant facts so they can explain that the source of the gases contributing to acid rain was atmospheric pollutants.

Normal rain is slightly acidic because it has absorbed some carbon dioxide from the air. Acid rain is more acidic than normal rain because it has absorbed gases like sulphur oxides and nitrogen oxides as well.

Where do these sulphur oxides and nitrogen oxides in the air come from?

They come from pollutants in the air such as ~~[illegible]~~ ~~[illegible]~~ car/truck exaust and power plants.

volcanic eruptions, the gases and oxides have been absorbed into the air and next time it rains, or near to, its acidic.

Acid rain Item 3

Item type: Multiple-choice	
Competency: Using scientific evidence	
Knowledge category: Knowledge of science – Physical systems	
Application area: Hazards	
Setting: Personal	
Difficulty: 460 score points (Level 2)	

To answer Item 3 students are required to use information provided to draw a conclusion about the effects of vinegar on marble—a simple model for the influence of acid rain on marble. Students need to be able to recognise relevant and obvious cues that outline the logical path to a simple conclusion.

A marble chip has a mass of 2.0 grams before being immersed in vinegar overnight. The chip is removed and dried the next day. What will the mass of the dried marble chip be?

A Less than 2.0 grams
B Exactly 2.0 grams
C Between 2.0 and 2.4 grams
D More than 2.4 grams

Acid rain Item 5

Item type: Open-constructed response	
Competency: Identifying scientific issues	
Knowledge category: Knowledge about science – Scientific enquiry	
Application area: Hazards	
Setting: Personal	
Difficulty: Full credit: 717 score points (Level 6) Partial credit : 513 score points (Level 3)	

In Item 5 students have to demonstrate an ability to understand scientific investigation and the purpose of using a control variable.

To gain full credit for this item, students had to explain that the marble chips placed in distilled water were to be compared with the test of vinegar and marble, to show that the acid (vinegar) was necessary for the reaction to occur. Below is an example of a response that achieved full credit.

Students who did this experiment also placed marble chips in pure (distilled) water overnight.

Explain why the students include this step in their experiment.

to see the effect on the marble with a non-acidic substance and prove it was indeed the acid affecting it.

To achieve a partial credit for this item, students provided a response that included a comparison with the test of vinegar and marble, but did not make it clear that this was being done to show that the acid (vinegar) is necessary for the reaction. A partial credit response is shown below.

By placing marble chips in water, they have created a "control-experiment" to compare the results later on with the ~~ac~~ vinegar.

Greenhouse

GREENHOUSE

Read the texts and answer the questions that follow.

THE GREENHOUSE EFFECT: FACT OR FICTION?

Living things need energy to survive. The energy that sustains life on the Earth comes from the Sun, which radiates energy into space because it is so hot. A tiny proportion of this energy reaches the Earth.

The Earth's atmosphere acts like a protective blanket over the surface of our planet, preventing the variations in temperature that would exist in an airless world.

Most of the radiated energy coming from the Sun passes through the Earth's atmosphere. The Earth absorbs some of this energy, and some is reflected back from the Earth's surface. Part of this reflected energy is absorbed by the atmosphere.

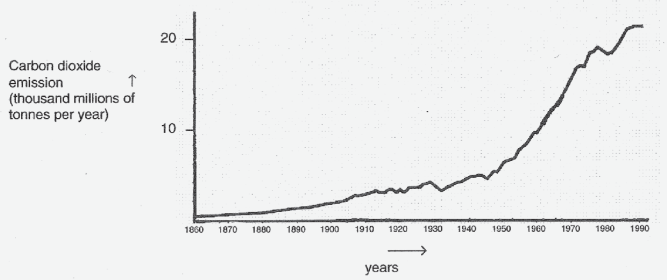
As a result of this the average temperature above the Earth's surface is higher than it would be if there were no atmosphere. The Earth's atmosphere has the same effect as a greenhouse, hence the term *greenhouse effect.*

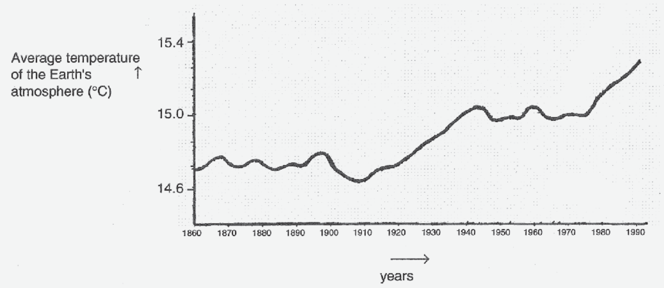
The greenhouse effect is said to have become more pronounced during the twentieth century.

It is a fact that the average temperature of the Earth's atmosphere has increased. In newspapers and periodicals the increased carbon dioxide emission is often stated as the main source of the temperature rise in the twentieth century.

A student named André becomes interested in the possible relationship between the average temperature of the Earth's atmosphere and the carbon dioxide emission on the Earth.

In a library he comes across the following two graphs.





André concludes from these two graphs that it is certain that the increase in the average temperature of the Earth's atmosphere is due to the increase in the carbon dioxide emission.

Greenhouse Item 3

Item type: Open-constructed response
Competency: Using scientific evidence
Knowledge category: Knowledge about scientific explanation
Application area: Environment
Setting: Global
Difficulty: 529 score points (Level 3)

For Item 3 students are asked to identify information in two graphs that support a conclusion. To achieve full credit, students must interpret the graphs to conclude there is an increase in both (average) temperature and carbon dioxide emissions.

What is it about the graphs that supports André's conclusion?

They both follow the same pattern when there is a decrease in the emissions there is a decrease in the temperature.

Greenhouse Item 4

Item type: Open-constructed response
Competency: Using scientific evidence
Knowledge category: Knowledge about science – Scientific enquiry
Application area: Environment
Setting: Global
Difficulty: Full credit: 659 score points (Level 5) Partial credit: 568 score points (Level 4)

Item 4 requires students to provide an example of the two graphs that do not support André´s conclusion. To achieve full credit, students must identify a segment on both graphs in which the curves are not both descending or both climbing and give a corresponding explanation. The following example shows a response that achieved full credit.

Another student, Jeanne, disagrees with André's conclusion. She compares the two graphs and says that some parts of the graphs do not support his conclusion.

Give an example of a part of the graphs that does not support André's conclusion. Explain your answer.

In the years 1940 – 1980 the top graph takes a pretty steep rise, where as the bottom one goes pretty flat with a few rises and falls then becomes steep in 1980 - 1990

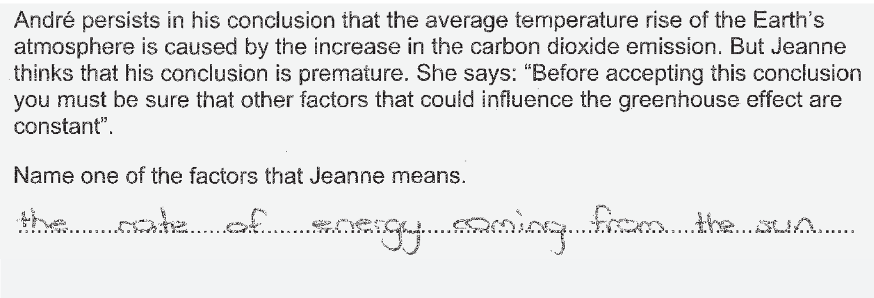
Students were awarded a partial credit result if they: mentioned the correct period but without any explanation; mentioned only one particular year (not a period of time) with an acceptable explanation; or referred to differences between the two curves without mentioning a specific period.

Greenhouse Item 5

Item type: Open-constructed response
Competency: Explaining phenomena scientifically
Knowledge category: Knowledge of science (Earth and space systems)
Application area: Environment
Setting: Global
Difficulty: 709 score points (Level 6)

Item 5 is one of the more difficult scientific literacy items requiring students to provide a factor that could influence the greenhouse effect.

Students need to understand the necessity of controlling factors outside the change and measured variables, and to recognise those variables. Students must also possess sufficient knowledge of earth systems to be able to identify at least one of the factors that could be controlled. The following example shows a correct response.


André persists in his conclusion that the average temperature rise of the Earth's atmosphere is caused by the increase in the carbon dioxide emission. But Jeanne thinks that his conclusion is premature. She says: "Before accepting this conclusion you must be sure that other factors that could influence the greenhouse effect are constant".

Name one of the factors that Jeanne means.

the rate of energy coming from the sun

Students received a full credit result if they provided a factor referring to the energy/radiation coming from the sun. E.g., the sun heating and maybe the earth changing position, or the energy reflected back from earth (where earth refers to the ground).

Appendix F
Scientific literacy multiple comparison table for the jurisdictions and PISA 2012 countries

Jurisdiction		Country	Shanghai–China	Hong Kong–China	Singapore	Japan	Finland	Estonia	Korea	Vietnam	Poland	Canada	Liechtenstein	Germany	Chinese Taipei	Netherlands	Ireland	Macao–China	New Zealand	Switzerland	Slovenia	United Kingdom	Czech Republic	Austria	Belgium	Latvia	OECD average
	Mean score		580	555	551	547	545	541	538	528	526	525	525	524	523	522	522	521	516	515	514	514	508	506	505	502	501
	SE		3.0	2.6	1.5	3.6	2.2	1.9	3.7	4.3	3.1	3.5	1.9	3.0	2.3	3.5	2.5	0.8	2.1	2.7	1.3	3.4	3.0	2.7	2.1	2.8	0.5
ACT	535	3.7	▼	▼	▼	▼	▼	▼	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
WA	534	3.9	▼	▼	▼	▼	▼	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
VIC	526	3.6	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
NSW	519	3.1	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲
QLD	518	3.8	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲
SA	513	3.7	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	▲	▲
TAS	500	3.8	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●
NT	483	10.2	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●

Notes: Read across the row to compare a juridiction's performance with the performance of each country listed in the column heading.

Australia has not been included in the multiple comparison table. To make this comparison, the jurisdiction would need to be compared with Australia's mean score, calculated without the data for the jurisdiction that is being compared.

▲ Average performance statistically significantly higher than in comparison country

● No statistically significant difference from comparison country

▼ Average performance statistically significantly lower than in comparison country

France	Denmark	United States	Spain	Lithuania	Norway	Hungary	Italy	Croatia	Luxembourg	Portugal	Russian Federation	Sweden	Iceland	Slovak Republic	Israel	Greece	Turkey	United Arab Emirates	Bulgaria	Chile	Serbia	Thailand	Romania	Cyprus	Costa Rica	Kazakhstan	Malaysia	Uruguay	Mexico
499	498	497	496	496	495	494	494	491	491	489	486	485	478	471	470	467	463	448	446	445	445	444	439	438	429	425	420	416	415
2.6	2.7	3.8	1.8	2.6	3.1	2.9	1.9	3.1	1.3	3.7	2.9	3.0	2.1	3.6	5.0	3.1	3.9	2.8	4.8	2.9	3.4	2.9	3.3	1.2	2.9	3.0	3.0	2.8	1.3
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Appendix G
Sample reading literacy items and responses[1]

A small number of reading literacy items have been publicly released to help illustrate the dimensions outlined in the framework (aspect, situation and text format), the range of tasks included in the assessments and the scope of PISA's reading literacy domain. The majority of reading literacy items has been retained for future PISA assessments to allow monitoring of performance over time (across cycles).

Students are asked to respond to a variety of tasks at different levels. About one-quarter of the items in the pool of PISA reading literacy tasks were assigned the access and retrieve classification, around half of the items were organised in the aspect of integrate and interpret, and one-quarter of the items were classified as reflect and evaluate by aspect. Proficiency level descriptions have also been developed for each of the three aspect subscales and the two text format subscales.

Table G.1 presents a map of the sample reading literacy items included. The most difficult items are located at the top of the table at the higher proficiency levels and the least difficult items are located at the bottom of the table at the lower levels. Each of the items is placed in the relevant proficiency level according to the difficulty of the item (the number in brackets), and in the aspect (access and retrieve, integrate and interpret, and reflect and evaluate) and text format (continuous and non-continuous) subscales they are assessing.

The units Brushing your teeth and Blood donation notice include examples of particularly easy reading literacy items. Most of the items from The play's the thing are more difficult items, with two of three of the items in the table placed at Level 4 or higher. None of the released items are located at Level 5.

One of the items in the unit Balloon illustrates a partial credit response placed at Level 2 and a full credit response located at Level 4. The coding instructions have also been included for this item to illustrate how this open constructed-response item is coded.

For each of the items in this Appendix, details about the item characteristics, including the item format, the classification and difficulty of the item have been presented.

1 No further release of reading literacy items has occurred since the PISA 2009 assessment. The commentary and sample reading literacy items in this Appendix have been taken from the Australian national report on PISA 2009 (Thomson, De Bortoli, Nicholas, Hillman & Buckley, 2010).

Table G.1 Sample items and cut-off score points on the reading literacy proficiency scale

Proficiency level	Access and retrieve		Integrate and interpret		Reflect and evaluate	
	Continuous	Non-continuous	Continuous	Non-continuous	Continuous	Non-continuous
6			The play's the thing Item 03 (730)			
698.3 score points						
5						
625.6 score points						
4		Balloon Item 03 (595) (full credit)	The play's the thing Item 07 (556)	Mobile phone safety Item 02 (561)		Mobile phone safety Item 11 (604)
552.9 score points						
3			Miser Item 05 (548) Telecommuting Item 01 (537)	Mobile phone safety Item 09 (488)	Telecommuting Item 07 (514)	Mobile phone safety Item 06 (526) Balloon Item 04 (510)
480.2 score points						
2		Balloon Item 03 (449) (partial credit)	The play's the thing Item 04 (474) Blood donation notice Item 08 (438)			Balloon Item 06 (411)
407.5 score points						
1a	Brushing your teeth Item 02 (358)		Miser Item 01 (373) Brushing your teeth Item 01 (353)	Balloon Item 08 (370)	Brushing your teeth Item 04 (399) Blood donation notice Item 09 (368)	
334.6 score points						
1b	Miser Item 07 (310) Brushing your teeth Item 03 (285)					
262.0 score points						

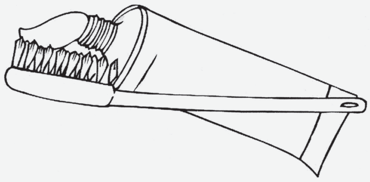
Brushing your teeth

BRUSHING YOUR TEETH

Do our teeth become cleaner and cleaner the longer and harder we brush them?

British researchers say no. They have actually tried out many different alternatives, and ended up with the perfect way to brush your teeth. A two minute brush, without brushing too hard, gives the best result. If you brush hard, you harm your tooth enamel and your gums without loosening food remnants or plaque.

Bente Hansen, an expert on tooth brushing, says that it is a good idea to hold the toothbrush the way you hold a pen. "Start in one corner and brush your way along the whole row," she says. "Don't forget your tongue either! It can actually contain loads of bacteria that may cause bad breath."



"Brushing your Teeth" is an article from a Norwegian magazine.

Use "Brushing Your Teeth" above to answer the questions that follow.

All of the items relating to Brushing your teeth are among the easiest PISA reading literacy items, located at the lower end of the reading literacy proficiency scale. This unit assesses all three reading aspects.

Brushing your teeth Item 1

Situation: Educational
Text format: Continuous
Text type: Exposition
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 353 score points (Level 1a)

Item 1 requires students to recognise a broad generalisation about what the article describes. The required information in the text is prominent, making it an easy reading task.

What is this article about?

A The best way to brush your teeth.
B The best kind of toothbrush to use.
C The importance of good teeth.
D The way different people brush their teeth.

Brushing your teeth Item 2

Situation: Educational
Text format: Continuous
Text type: Exposition
Aspect: Access and retrieve – Retrieve information
Item type: Multiple-choice
Difficulty: 358 score points (Level 1a)

Item 2 has a similar item difficulty to the previous item and requires students to retrieve a synonymous piece of information from the text.

What do the British researchers recommend?

A That you brush your teeth as often as possible.
B That you do not try to brush your tongue.
C That you do not brush your teeth too hard.
D That you brush your tongue more often than your teeth.

Brushing your teeth Item 3

Situation: Educational
Text format: Continuous
Text type: Exposition
Aspect: Access and retrieve – Retrieve information
Item type: Short response
Difficulty: 285 score points (Level 1b)

Item 3 is one of the easiest items in the PISA reading assessment. The item requires students to locate a single piece of information directly stated in the text and to write it out.

Why should you brush your tongue, according to Bente Hansen?

You should brush your tongue because it contains loads of bacteria that may cause bad breath.

Brushing your teeth Item 4

Situation: Educational
Text format: Continuous
Text type: Exposition
Aspect: Reflect and evaluate – Reflect on and evaluate the form of a text
Item type: Multiple-choice
Difficulty: 399 score points (Level 1a)

This item requires students to recognise the purpose of an analogy, in this instance referring to a pen in helping to understand how to hold a toothbrush. Students need to reflect on and evaluate why the pen was mentioned in the text.

Why is a pen mentioned in the text?

A To help you understand how to hold a toothbrush.
B Because you start in one corner with both a pen and a toothbrush.
C To show that you can brush your teeth in many different ways.
D Because you should take tooth brushing as seriously as writing.

Miser

The fable by Aesop is a well-known story and a favourite text type in reading assessments because it is short, self-contained and has an identifiable moral.

THE MISER AND HIS GOLD

A fable by Aesop

A miser sold all that he had and bought a lump of gold, which he buried in a hole in the ground by the side of an old wall. He went to look at it daily. One of his workmen observed the miser's frequent visits to the spot and decided to watch his movements. The workman soon discovered the secret of the hidden treasure, and digging down, came to the lump of gold, and stole it. The miser, on his next visit, found the hole empty and began to tear his hair and to make loud lamentations. A neighbour, seeing him overcome with grief and learning the cause, said, "Pray do not grieve so; but go and take a stone, and place it in the hole, and fancy that the gold is still lying there. It will do you quite the same service; for when the gold was there, you had it not, as you did not make the slightest use of it."

Miser Item 1

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Integrate and interpret – Develop an interpretation
Item type: Closed constructed-response
Difficulty: 373 score points (Level 1a)

Item 1 requires students to integrate and interpret the text in order to put a series of statements about the story into the correct order.

Read the sentences below and number them according to the sequence of events in the text.

The miser decided to turn all his money into a lump of gold.	1
A man stole the miser's gold.	3
The miser dug a hole and hid his treasure in it.	2
The miser's neighbour told him to replace the gold with a stone.	4

Miser Item 7

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Access and retrieve – Retrieve information
Item type: Short response
Difficulty: 310 score points (Level 1b)

In Item 7 students are asked to locate information that is explicitly stated at the beginning of the short piece of text and make connections between the miser selling all that he had and buying gold, as shown in the following response.

How did the miser get a lump of gold?

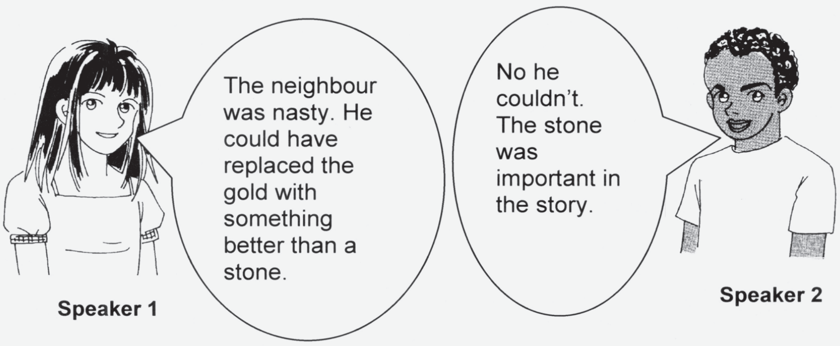
He sold all that he had and bought a lump of gold.

Miser Item 5

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Integrate and interpret – Develop and interpretation
Item type: Open constructed-response
Difficulty: 548 score points (Level 3)

Item 5 is the most difficult of all the Miser items. Students are presented with a part of a conversation between two people who have conflicting interpretations of the story and they are required to relate a detail of the fable to the main idea. This item assesses students' skills in integrating and interpreting text.

Here is part of a conversation between two people who read "The miser and his gold".



What could Speaker 2 say to support his point of view?

To achieve a full credit for this item, students are required to make sense of the neighbour's speech in the story and then express the idea that wealth has no value unless it is used. The following example shows a response that received full credit.

That the gold was only worth as much as the stone because he made no use of it.

Responses that are insufficient or vague, such as the response below, are given no credit.

The stone is like a shape of gold and it is heavy like gold too.

Blood donation notice

The Blood donation notice unit features a persuasive piece of writing about blood donation, set in a context that students are familiar with and come into contact with regularly. Students are asked three items from to this unit. The first item, a multiple-choice item (not shown here), asked students to recognise the main purpose of an advertisement.

BLOOD DONATION NOTICE

Blood donation is essential.

There is no product that can fully substitute for human blood. Blood donation is thus irreplaceable and essential to save lives.

In France, each year, 500,000 patients benefit from a blood transfusion.

The instruments for taking the blood are sterile and single-use (syringe, tubes, bags).

There is no risk in giving your blood.

Blood donation:

It is the best-known kind of donation, and takes from 45 minutes to 1 hour.

A 450-ml bag is taken as well as some small samples on which tests and checks will be done.

- A man can give his blood five times a year, a woman three times.
- Donors can be from 18 to 65 years old.

An 8-week interval is compulsory between each donation.

Blood donation notice Item 8

Situation: Public
Text format: Continuous
Text type: Argumentation
Aspect: Integrate and interpret – Develop an interpretation
Item type: Open constructed-response
Difficulty: 438 score points (Level 2)

Item 8 assesses student's ability to integrate and interpret. Students are required to make links across the text to reach a conclusion. Students need to carefully match the case described in the item stem with four pieces of information in the second half of the text.

Students receive full credit for this item if they can identify that enough time has elapsed since her last donation. This is demonstrated in the example response below.

An eighteen-year-old woman who has given her blood twice in the last twelve months wants to give blood again. According to "Blood Donation Notice", on what condition will she be allowed to give blood again?

A woman can only give her blood 3 times a year and an 8-week interval is compulsory between each donation.

Blood donation notice Item 9

Situation: Public	
Text format: Continuous	
Text type: Argumentation	
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text	
Item type: Multiple-choice	
Difficulty: 368 score points (Level 1a)	

Item 9 is a multiple-choice item that requires students to reflect and evaluate. Students need to: recognise the persuasive purpose of a phrase in the advertisement; consider the wider context of what is meant by a statement in the stimulus; and recognise the author's motive for including it.

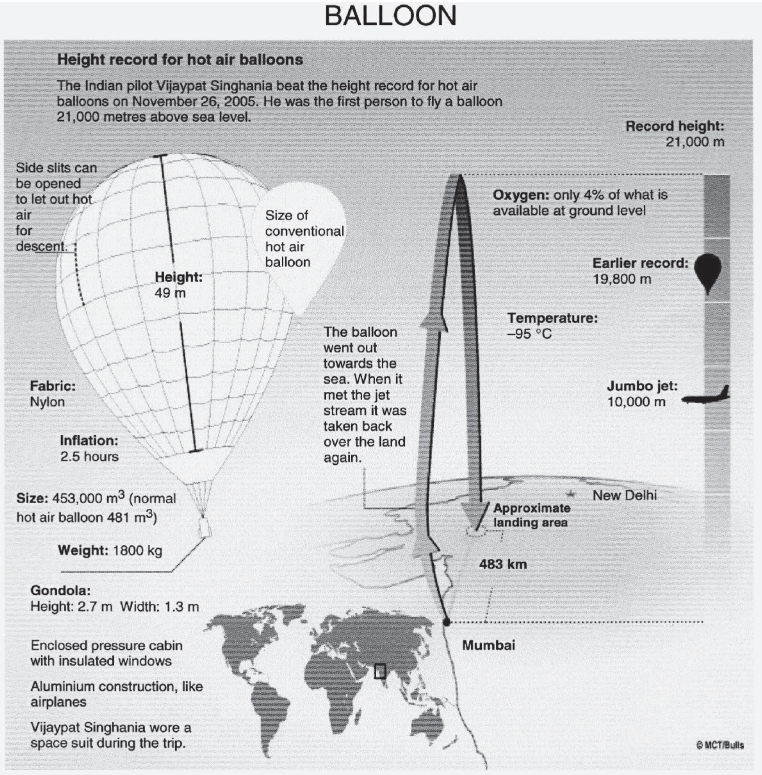
The text says: "The instruments for taking the blood are sterile and single-use … "

Why does the text include this information?

A To reassure you that blood donation is safe.
B To emphasise that blood donation is essential.
C To explain the uses of your blood.
D To give details of the tests and checks.

Balloon

The stimulus for the Balloon unit is an example of a non-continuous text, presented with different kinds of graphs and captions with a minimum of text. Items in this unit ranged from Levels 1a to 4, are set in an educational context and involve all reading aspects.



Balloon Item 8

Situation: Educational
Text format: Non-continuous
Text type: Description
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 370 score points (Level 1a)

Item 8 requires students to recognise the main idea expressed in a piece of diagrammatic descriptive text, which is predominantly displayed and repeated throughout the text, including the title.

What is the main idea of this text?

A Singhania was in danger during his balloon trip.
B Singhania set a new world record.
C Singhania travelled over both sea and land.
D Singhania's balloon was enormous.

Balloon Item 3

Situation: Educational	
Text format: Non-continuous	
Text type: Description	
Aspect: Access and retrieve – Retrieve information	
Item type: Open constructed-response	
Difficulty: Full credit: 595 (level 4) Partial credit: 449 (Level 2)	

Item 3 is a short-response item in which students can receive full or partial credit for their response. Students are required to locate two pieces of information that are explicitly stated in the stimulus. The example shown below is an example of a response that received full credit.

Vijaypat Singhania used technologies found in two other types of transport. Which types of transport?

1. Airplanes
2. Spaceships

This is the only item from the released set of PISA items that shows an example of a partial credit item. The coding rules for this item are shown below to illustrate how an open response is coded, including examples of acceptable responses.

Balloon scoring Item 3

Full Credit Refers to *BOTH aeroplanes AND spacecraft* (in either order). *[may include both answers on one line]*	
◗ 1. Aircraft 2. Spacecraft	
◗ 1. Aeroplanes 2. space ships	
◗ 1. Air travel 2. space travel	
◗ 1. Planes 2. space rockets	
◗ 1. jets 2. rockets	
Partial Credit Refers to EITHER *airplanes OR spacecraft*.	
◗ spacecraft	
◗ space travel	
◗ space rockets	
◗ rockets	
◗ Aircraft	
◗ Aeroplanes	
◗ Air travel	
◗ jets	
No Credit	
Code 0:	Gives an *insufficient or vague* response.
	◗ Things that fly.
	Shows *inaccurate comprehension* of the material or gives an *implausible or irrelevant* response.
	◗ Space suits. *[not a type of transport]*
	◗ Jumbos. *[The specificity is not justified by the text – the reference to jumbo jets is not relevant to this question.]*
	◗ Airships.
Code 9:	Missing.

Balloon Item 4

Situation: Educational
Text format: Non-continuous
Text type: Description
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text
Item type: Open constructed-response
Difficulty: 510 score points (Level 3)

Item 4 in the Balloon unit is a further example of an open constructed-response item. The item requires students to reflect and evaluate the content of a text.

What is the purpose of including a drawing of a jumbo jet in this text?

The following two responses provide examples where a student received a full credit. These examples show how the student has referred either explicitly or implicitly to the height of the balloon or the record.

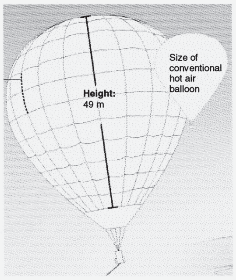
To show the level at which a large plane can fly at and how much higher the hot air balloon reached.

this was ~~b~~ to put this record in proportion of how ~~big~~ high it was

Balloon Item 6

Situation: Educational
Text format: Non-continuous
Text type: Description
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text
Item type: Multiple-choice
Difficulty: 411 score points (Level 2)

Item 6 is a multiple-choice item requiring students to recognise and use linked illustrations in a diagrammatic descriptive text.



Why does the drawing show two balloons?

A To compare the size of Singhania's balloon before and after it was inflated.
B To compare the size of Singhania's balloon with that of other hot air balloons.
C To show that Singhania's balloon looks small from the ground.
D To show that Singhania's balloon almost collided with another balloon.

Telecommuting

The stimulus for Telecommuting consists of two short pieces of text that offer contrasting opinions on telecommuting. A footnote provided the definition of telecommuting for those 15-year-old students who may have been unfamiliar with this term. The topic is set in an occupational context and the purpose of the stimulus is to persuade readers to their point of view.

TELECOMMUTING

The way of the future

Just imagine how wonderful it would be to "telecommute"[1] to work on the electronic highway, with all your work done on a computer or by phone! No longer would you have to jam your body into crowded buses or trains or waste hours and hours travelling to and from work. You could work wherever you want to – just think of all the job opportunities this would open up!

Molly

Disaster in the making

Cutting down on commuting hours and reducing the energy consumption involved is obviously a good idea. But such a goal should be accomplished by improving public transportation or by ensuring that workplaces are located near where people live. The ambitious idea that telecommuting should be part of everyone's way of life will only lead people to become more and more self-absorbed. Do we really want our sense of being part of a community to deteriorate even further?

Richard

[1] "Telecommuting" is a term coined by Jack Nilles in the early 1970s to describe a situation in which workers work on a computer away from a central office (for example, at home) and transmit data and documents to the central office via telephone lines.

Telecommuting Item 1

Situation: Occupational
Text format: Continuous
Text type: Argumentation
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 537 score points (Level 3)

The first item requires students to recognise the relationship between two short argumentative texts. To respond correctly to the item, students have to form a global understanding of each of the short texts and then identify the relationship between them.

What is the relationship between "The way of the future" and "Disaster in the making"?

A They use different arguments to reach the same general conclusion.
B They are written in the same style but they are about completely different topics.
C They express the same general point of view, but arrive at different conclusions.
D They express opposing points of view on the same topic.

Telecommuting Item 7

Situation: Occupational
Text format: Continuous
Text type: Argumentation
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text
Item type: Open constructed-response
Difficulty: 514 score points (Level 3)

This item relies on students using their prior knowledge to provide an example that fits a category described in a text; in this case, a profession in which it would be difficult to telecommute. Students are required to link their comprehension of the text with outside knowledge, as no specific profession is mentioned in the text.

What is one kind of work for which it would be difficult to telecommute? Give a reason for your answer.

The coding rules for this item are shown below to illustrate how an open constructed-response item is scored.

Telecommuting scoring Item 7

Full Credit Identifies a kind of work and gives a plausible explanation as to why a person who does that kind of work could not telecommute. Responses MUST indicate (explicitly or implicitly) that it is necessary to be physically present for the specific work.
◗ Building: It's hard to work with the wood and bricks from just anywhere
◗ Sportsperson: You need to really be there to play the sport.
◗ Plumber: You can't fix someone else's sink from your home!
◗ Digging ditches because you need to be there.
◗ Nursing: it's hard to check if patients are ok over the Internet.
No Credit Identifies a kind of work but includes no explanation OR provides an explanation that does not relate to telecommuting.
◗ Digging ditches
◗ Fire fighter
◗ Student
◗ Digging ditches because it would be hard work. [*Explanation does not show why this would make it difficult to telecommute.*]
OR Gives an insufficient or vague response
◗ You need to be there.
OR Shows inaccurate comprehension of the material or gives an implausible or irrelevant response.
◗ Manager. No-one takes any notice of you anyway. [*irrelevant explanation*]

To achieve full credit, as shown in the following two examples, students had to identify a profession and provide a plausible explanation as to why a person who does that kind of work could not telecommute.

A doctor because they need to examine their patients physically.

Farming, as the job requires hands-on and physical work, rather than transmitting data.

Students did not receive credit for a response that identified an occupation but did not provide an explanation why this would make it difficult to telecommute.

Mobile phone safety

The Mobile phone safety unit assesses two aspects of the PISA reading literacy assessment — integrate and interpret and reflect and evaluate. The stimulus (set in a public context/situation and sourced from a website) uses non-continuous texts in the form of two tables and key points, as shown below.

MOBILE PHONE SAFETY

Are mobile phones dangerous?

	Yes	No
1.	Radio waves given off by mobile phones can heat up body tissue, having damaging effects.	Radio waves are not powerful enough to cause heat damage to the body.
2.	Magnetic fields created by mobile phones can affect the way that your body cells work.	The magnetic fields are incredibly weak, and so unlikely to affect cells in our body.
3.	People who make long mobile phone calls sometimes complain of fatigue, headaches, and loss of concentration.	These effects have never been observed under laboratory conditions and may be due to other factors in modern lifestyles.
4.	Mobile phone users are 2.5 times more likely to develop cancer in areas of the brain adjacent to their phone ears.	Researchers admit it's unclear this increase is linked to using mobile phones.
5.	The International Agency for Research on Cancer found a link between childhood cancer and power lines. Like mobile phones, power lines also emit radiation.	The radiation produced by power lines is a different kind of radiation, with much more energy than that coming from mobile phones.
6.	Radio frequency waves similar to those in mobile phones altered the gene expression in nematode worms.	Worms are not humans, so there is no guarantee that our brain cells will react in the same way.

Key Point

Conflicting reports about the health risks of mobile phones appeared in the late 1990s.

Key Point

Millions of dollars have now been invested in scientific research to investigate the effects of mobile phones.

Mobile phone safety Item 2

Situation: Public	
Text format: Non-continuous	
Text type: Exposition	
Aspect: Integrate and interpret – Form a broad understanding	
Item type: Multiple-choice	
Difficulty: 561 score points (Level 4)	

Item 2 asks students to recognise the purpose of a section (a table) in an expository text. The 'key points' in the text are related to (but do not summarise) the information in the body of the two main tables, so students need to focus on what appears as a peripheral part of the text structure.

To achieve a full credit, students need to establish a hierarchy among the ideas presented and choose the one that is most general and overarching.

What is the purpose of the **Key points**?

A To describe the dangers of using mobile phones.
B To suggest that debate about mobile phone safety is ongoing.
C To describe the precautions that people who use mobile phones should take.
D To suggest that there are no known health problems caused by mobile phones.

Mobile phone safety Item 6

Situation: Public
Text format: Non-continuous
Text type: Exposition
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text
Item type: Open constructed-response
Difficulty: 526 score points (Level 3)

This is another item that requires students to reflect on and evaluate the content of a text. Students are required to use their prior knowledge to reflect on information presented in a text. To obtain full credit, students need to provide a factor in modern lifestyles that could be related to fatigue, headaches or loss of concentration.

Look at Point 3 in the **No** column of the table. In this context, what might one of these "other factors" be? Give a reason for your answer.

The following three examples received full credit.

School, too much homework, watching too much TV, spending too much time on the computer – all these things make people tired and increase the possibility of headache.

another factor could be stress, as many people experience stress today.

Lack of sleep meaning people become fatigued and lose concentration.

No credit is given to answers that provided vague, insufficient or irrelevant responses. The following example received no credit.

Could be how much the phone gets used.

Mobile phone safety Item 9

Situation: Public
Text format: Non-continuous
Text type: Exposition
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 488 score points (Level 3)

Item 9 directs students to look at the second table and asks them to recognise its underlying assumptions (which are located in the last boxed key point).

Look at the table with the heading **If you use a mobile phone …**

Which of these ideas is the table based on?

A There is no danger involved in using mobile phones.
B There is a proven risk involved in using mobile phones.
C There may or may not be danger involved in using mobile phones, but it is worth taking precautions.
D There may or may not be danger involved in using mobile phones, but they should not be used until we know for sure.
E The **Do** instructions are for those who take the threat seriously, and the **Don't** instructions are for everyone else.

Mobile phone safety Item 11

Situation: Public
Text format: Non-continuous
Text type: Exposition
Aspect: Reflect and evaluate – Reflect on and evaluate the content of a text
Item type: Multiple-choice
Difficulty: 604 score points (Level 4)

Item 11 assesses students' skills in reflecting and evaluating the content of a text. Students are required to recognise the relationship between a generalised statement external to the text and a pair of statements in a table.

"It is difficult to prove that one thing has definitely caused another."

What is the relationship of this piece of information to the Point 4 **Yes** and **No** statements in the table **Are mobile phones dangerous?**

A It supports the Yes argument but does not prove it.
B It proves the Yes argument.
C It supports the No argument but does not prove it.
D It shows that the No argument is wrong.

The play's the thing

The stimulus for the unit The play's the thing is the beginning of a play by the Hungarian dramatist Ferenc Molnár and involves a conversation between three characters about the relationship between life and art and the challenges of writing for the theatre. This text is quite long in comparison to other stimuli in PISA 2009. It is set in a personal context and all of the tasks require students to integrate and interpret the text, assessing their skills across three different proficiency levels.

THE PLAY'S THE THING

Takes place in a castle by the beach in Italy.

FIRST ACT

Ornate guest room in a very nice beachside castle. Doors on the right and left. Sitting room set in the middle of the stage: couch, table, and two armchairs. Large windows at the back. Starry night. It is dark on the stage. When the curtain goes up we hear men conversing loudly behind the door on the left. The door opens and three tuxedoed gentlemen enter. One turns the light on immediately. They walk to the centre in silence and stand around the table. They sit down together, Gál in the armchair to the left, Turai in the one on the right, Ádám on the couch in the middle. Very long, almost awkward silence. Comfortable stretches. Silence. Then:

GÁL

Why are you so deep in thought?

TURAI

I'm thinking about how difficult it is to begin a play. To introduce all the principal characters in the beginning, when it all starts.

ÁDÁM

I suppose it must be hard.

TURAI

It is – devilishly hard. The play starts. The audience goes quiet. The actors enter the stage and the torment begins. It's an eternity, sometimes as much as a quarter of an hour before the audience finds out who's who and what they are all up to.

GÁL

Quite a peculiar brain you've got. Can't you forget your profession for a single minute?

TURAI

That cannot be done.

GÁL

Not half an hour passes without you discussing theatre, actors, plays. There are other things in this world.

TURAI

There aren't. I am a dramatist. That is my curse.

GÁL

You shouldn't become such a slave to your profession.

TURAI

If you do not master it, you are its slave. There is no middle ground. Trust me, it's no joke starting a play well. It is one of the toughest problems of stage mechanics. Introducing your characters promptly. Let's look at this scene here, the three of us. Three gentlemen in tuxedoes. Say they enter not this room in this lordly castle, but rather a stage, just when a play begins. They would have to chat about a whole lot of uninteresting topics until it came out who we are. Wouldn't it be much easier to start all this by standing up and introducing ourselves? *Stands up.* Good evening. The three of us are guests in this castle. We have just arrived from the dining room where we had an excellent dinner and drank two bottles of champagne. My name is Sándor Turai, I'm a playwright, I've been writing plays for thirty years, that's my profession. Full stop. Your turn.

GÁL

Stands up. My name is Gál, I'm also a playwright. I write plays as well, all of them in the company of this gentleman here. We are a famous playwright duo. All playbills of good comedies and operettas read: written by Gál and Turai. Naturally, this is my profession as well.

GÁL and TURAI

Together. And this young man …

ÁDÁM

Stands up. This young man is, if you allow me, Albert Ádám, twenty-five years old, composer. I wrote the music for these kind gentlemen for their latest operetta. This is my first work for the stage. These two elderly angels have discovered me and now, with their help, I'd like to become famous. They got me invited to this castle. They got my dress-coat and tuxedo made. In other words, I am poor and unknown, for now. Other than that I'm an orphan and my grandmother raised me. My grandmother has passed away. I am all alone in this world. I have no name, I have no money.

TURAI

But you are young.

GÁL

And gifted.

ÁDÁM

And I am in love with the soloist.

TURAI

You shouldn't have added that. Everyone in the audience would figure that out anyway.

They all sit down.

TURAI

Now wouldn't this be the easiest way to start a play?

GÁL

If we were allowed to do this, it would be easy to write plays.

TURAI

Trust me, it's not that hard. Just think of this whole thing as …

GÁL

All right, all right, all right, just don't start talking about the theatre again. I'm fed up with it. We'll talk tomorrow, if you wish.

The play's the thing Item 3

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Integrate and interpret – Form a broad understanding
Item type: Short response
Difficulty: 730 score points (Level 6)

Item 3 requires a high level of interpretation to define the meaning of the item's terms in relation to the text. The item asks what the characters were doing just before the curtain went up, and so students need to distinguish between the characters and the actors. The following example achieved a full credit. Responses referring to the actors, such as 'off the stage', 'talking loudly behind a door' or 'thinking about how to begin the play' are scored as incorrect.

What were the characters in the play doing **just before** the curtain went up?

They were having dinner and drinking champagne.

The play's the thing Item 4

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 474 score points (Level 2)

Item 4 includes lines quoted directly from the text so students can refer to the relevant section in the play. Students then need to understand the context in which the line is spoken in order to respond correctly to the item.

"It's an eternity, sometimes as much as a quarter of an hour … " (lines 29-30)

According to Turai, why is a quarter of an hour "an eternity"?

A It is a long time to expect an audience to sit still in a crowded theatre.
B It seems to take forever for the situation to be clarified at the beginning of a play.
C It always seems to take a long time for a dramatist to write the beginning of a play.
D It seems that time moves slowly when a significant event is happening in a play.

The play's the thing Item 7

Situation: Personal
Text format: Continuous
Text type: Narration
Aspect: Integrate and interpret – Form a broad understanding
Item type: Multiple-choice
Difficulty: 556 score points (Level 4)

The final item in this unit is a multiple-choice item that requires students to recognise the conceptual theme of a play, where the theme is literary and abstract.

Overall, what is the dramatist Molnár doing in this extract?

A He is showing the way that each character will solve his own problems.
B He is making his characters demonstrate what an eternity in a play is like.
C He is giving an example of a typical and traditional opening scene for a play.
D He is using the characters to act out one of his own creative problems.

Appendix H
Reading literacy multiple comparison table for the jurisdictions and PISA 2012 countries

Jurisdiction		Country	Shanghai–China	Hong Kong–China	Singapore	Japan	Korea	Finland	Ireland	Chinese Taipei	Canada	Poland	Estonia	Liechtenstein	New Zealand	Netherlands	Belgium	Switzerland	Macao–China	Vietnam	Germany	France	Norway	United Kingdom	United States	OECD average	Denmark
	Mean score		570	545	542	538	536	524	523	523	523	518	516	516	512	511	509	509	509	508	508	505	504	499	498	496	496
	SE		2.9	2.8	1.4	3.7	3.9	2.4	2.6	3.0	1.9	3.1	2.0	4.1	2.4	3.5	2.2	2.6	0.9	4.4	2.8	2.8	3.2	3.5	3.7	0.5	2.6
ACT	525	3.6	▼	▼	▼	▼	▼	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
WA	519	3.1	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
VIC	517	3.5	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
NSW	513	3.3	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲
QLD	508	3.4	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲
SA	500	4.0	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●
TAS	485	3.6	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
NT	466	8.3	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼

Notes: Read across the row to compare a juridiction's performance with the performance of each country listed in the column heading.

Australia has not been included in the multiple comparison table. To make this comparison, the jurisdiction would need to be compared with Australia's mean score, calculated without the data for the jurisdiction that is being compared.

▲ Average performance statistically significantly higher than in comparison country

● No statistically significant difference from comparison country

▼ Average performance statistically significantly lower than in comparison country

Czech Republic	Italy	Austria	Latvia	Hungary	Spain	Luxembourg	Portugal	Israel	Croatia	Sweden	Iceland	Slovenia	Lithuania	Greece	Turkey	Russian Federation	Slovak Republic	Cyprus	Serbia	United Arab Emirates	Chile	Thailand	Costa Rica	Romania	Bulgaria	Mexico
493	490	490	489	488	488	488	488	486	485	483	483	481	477	477	475	475	463	449	446	442	441	441	441	438	436	424
2.9	2.0	2.8	2.4	3.2	1.9	1.5	3.8	5.0	3.3	3.0	1.8	1.2	2.5	3.3	4.2	3.0	4.2	1.2	3.4	2.5	2.9	3.1	3.5	4.0	6.0	1.5
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲

Appendix I
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.edu.au/ozpisa/reports/.

www.oecd.org
www.ozpisa.acer.edu.au

ISBN 978-1-74286-233-0
9 781742 862330

ACER

Australian Council *for* Educational Research