



## Release of the 2015 trends in International Mathematics and Science Study (TIMSS)

### Background

The Trends in International Mathematics and Science Study (TIMSS) collects educational achievement data at Year 4 and Year 8 to provide information about trends in performance over time. The goal of TIMSS is to provide comparative information about educational achievement across countries to assist in improving teaching and learning.

TIMSS has a curriculum focus, attempting to assess *'what students know'*, whereas PISA, the other major international testing program, seeks to assess *'what students can do with their knowledge'*. TIMSS endeavours to relate the intended curriculum of nations (the curriculum specified by the system or other body) to the implemented curriculum (the curriculum as taught by teachers) and the attained curriculum (what students have learned).

Data was gathered on student achievement in mathematics and science as well as issues relating to the quantity, quality and content of instruction through student, 'home', teacher and school questionnaires.

TIMSS has measured trends in mathematics and science achievement every four years since 1995. 2015 marked Australia's sixth cycle in TIMSS, following participation in 1995, 1999, 2003, 2007 and 2011.

Internationally, there were 49 countries and seven benchmarking participants (a province or region rather than a country) in Year 4 TIMSS and 39 countries and seven benchmarking participants in Year 8 TIMSS. In Australia 287 primary schools (Western Australia – 40) and 285 secondary schools (Western Australia – 38) participated, providing a nationally representative sample of around 13 700 students (Western Australia – around 1740).

At each school at least one intact class from the relevant year level along with all Indigenous students in that year level – were selected to participate.

Results are reported as average scores, with the standard error, as distributions of scores, and as percentages of students who attain the international benchmarks (Advanced, High, Intermediate, Low, Below Low) for countries and specific groups of students within Australia. The Intermediate international benchmark is considered to be the minimum proficient standard.

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### Australia's Performance

- Australia was outperformed by 21 countries in Year 4 mathematics and 17 countries in Year 4 science, and by 12 countries in Year 8 mathematics and 14 countries in Year 8 science.
- Australian performances in mathematics and science have largely stagnated over the past 20 years.
- During this same period, high-performing countries Singapore, Korea, Hong Kong, Chinese Taipei and Japan made steady improvements, while countries including Canada, England, Ireland, Northern Ireland and the United States have improved and now outperform Australia.
- Many more countries outperformed Australia in mathematics and science in TIMSS 2015 than did in TIMSS 1995, while a number of countries whose performance was lower than Australia's are now achieving a similar or higher level.
- In all four assessments Australia has a substantial 'tail' of low performance. In comparison to higher achieving countries, the proportion of Australian students at the High and Advanced benchmarks is modest.
- A substantial proportion of our students are below the Australian proficient standard, with roughly half of students in remote areas at or below that level.
- In Year 4 Australia's average mathematics score in TIMSS 2015 (517) was one point higher than in 2011 but it was a significant 22 points higher than in TIMSS 1995. Australia's average Year 4 science score in TIMSS 2015 (524) was significantly higher than in 2011 (516) but was not statistically different to 1995 (521).
- In Year 8 Australia's average mathematics and science scores have not changed significantly from the results in 2011 or 1995.
- Thirty percent of Year 4 and Year 8 students in Australia performed below the Intermediate benchmark in mathematics and 24–31% in science.
- Males outperformed females in Year 8 Science. There was no statistical difference in mean scores relating to gender in Year 4 and Year 8 mathematics and Year 4 science.
- Students who identified themselves as Indigenous performed at a significantly lower level than non-Indigenous students in all tests in both Years 4 and 8. The difference between the two groups is significant, as it has been in each cycle of testing. The gap in average mathematics and science performance has changed little over the six cycles of TIMSS testing.

### Western Australia's performance

- WA was ranked fifth in Year 4 mathematics tests and seventh in Year 4 science (sixth in both in 2011), but was significantly outperformed only by the ACT.
- In Year 8 WA was ranked third in both mathematics (fifth in 2011) and science (fourth in 2011).
- In all four assessments WA had less than 10% of students achieve the Advanced International benchmark.
- Though improvements were made in all mean scores when compared to 2011, none were statistically significant.
- The high percentage of students failing to reach the TIMSS intermediate benchmark (the proficient standard for Australia) between both mathematics (Year 4 – 33%; Year 8 – 36%) and science (Year 4 – 30%; Year 8 – 30%) is cause for concern.
- The differences in percentages of students achieving the proficient standard between 2015 and 2011 for WA and Australia were not significant for Australia or WA for any test or year group.
- The geographic location of schools has a significant impact on performance in all tests, such that metropolitan students performed better than provincial students, who similarly performed better than students in remote schools.

## Attachment 1: TIMSS 2015 – Summary

### Mathematics

#### Year 4 Mathematics

Singapore and Hong Kong were the top-performing countries of TIMSS 2015, scoring well in excess of the High international benchmark of 550. The scores for these countries were not significantly different from each other but were significantly higher than all other countries.

Australia's mean score of 517 was significantly higher than that of 20 countries, such as Italy, Spain and New Zealand but significantly below that of 21 countries including Northern Ireland, Ireland, England and the United States, as well as the participating East Asian countries, Singapore, Hong Kong, Korea, Chinese Taipei and Japan.

In the top performing countries, more than one third of the students assessed (32–50%) reached the Advanced benchmark (Australia – 9%; WA – 10%), and between 3 and 14% failed to reach the Intermediate benchmark, the proficient standard for Australia (Australia – 30%, WA – 33%).

Australia's average Year 4 mathematics score in TIMSS 2015 was a significant 22 points higher than in TIMSS 1995, but has remained the same for the last three rounds. By comparison, scores for the United States significantly increased over the period 2003 to 2011, but did not change over the last cycle. Similarly, England and New Zealand showed significant growth in early cycles but this has slowed over recent years. Singapore's score has increased steadily since TIMSS 1995, such that the mean score for 2015 is significantly higher than for all other cycles. The score for the Czech Republic has rebounded over the past two cycles after a sharp decline in TIMSS 2007.

Students in the ACT performed significantly higher than students all other states and territories, except Victoria, while all states and territories performed significantly higher than the Northern Territory. WA was ranked fifth with the average score 13 points higher than in 2011, but only significantly higher than in 2003 and 1995. While 10% of WA's students achieved the Advanced benchmark, 33% of WA's Year 4 students did not reach the Intermediate benchmark (ACT – 18%).

#### Year 8 Mathematics

Singapore, Korea, Chinese Taipei, Hong Kong and Japan were the top-performing countries of TIMSS 2015, with an average score higher than the High international benchmark of 550. Singapore's score of 621 was significantly higher than the scores of all other countries. The scores of the next 11 countries were significantly higher than all other countries.

In the top five countries, over one third of the students assessed (34–54%) reached the Advanced benchmark (Australia – 7%; WA – 8%). They had between 5 and 12% failing to reach the Intermediate benchmark (Australia – 36%, WA – 36%).

Australia's achievement score of 505 was significantly higher than that of 21 countries, such as Italy, New Zealand and Malaysia and below that of 12 countries, including Canada, Ireland, England and the United States, as well as the top five countries from Asia – Singapore, Korea, Chinese Taipei, Hong Kong and Japan.

Australia's average Year 8 mathematics score in TIMSS 2015 was exactly the same as the achieved score in TIMSS 1995, although there have been some small fluctuations over the 20 years. Sixty-four per cent of Australian Year 8 students achieved the Intermediate international benchmark – the proficient standard for Australia.

The United States and England have improved over recent cycles so that their average performance is now significantly higher than that of Australia.

Australia was one of the countries in which there was no change in the percentages of students falling below the Low benchmark or achieving the advanced benchmark over the past 20 years.

WA was ranked third (fifth in 2011), below the ACT and Victoria, but their scores were not significantly different. After Victoria, WA had the second highest percentage of students achieving the Advanced benchmark (8%). Thirty six percent of WA's students did not reach the proficient standard for Australia. Over the 20 year period WA's 2015 average score, as has been the case in all other cycles, is significantly below that of 1995. However it is significantly higher than in 2003 and 2007.

## **Science**

### **Year 4 Science**

Singapore and Korea were the top-performing countries of TIMSS 2015, scoring well in excess of the High international benchmark of 550. The scores for these countries were not significantly different to each other but were significantly higher than all other countries.

Australia's average score of 524 was significantly higher than that of 17 countries, including Portugal, New Zealand and France, but below that of 17 countries, including most of the Asian countries, England and the United States.

Australia's average Year 4 science score in TIMSS 2015, though higher than that achieved in TIMSS 2011, was not significantly different to the scores in TIMSS 1995 or 2011. While 8% of Australia's students achieved the Advanced benchmark, 25% failed to reach the Intermediate benchmark.

Australia's average Year 4 science score in TIMSS 2015 (524) was significantly higher than in 2011 (516) but was not statistically different to 1995 (521).

Western Australia's mean score of 516 was ranked seventh, above the Northern Territory, though statistically only lower than the ACT. Though WA had the second highest percentage of students (9%) achieving the Advanced benchmark, it also had the second highest percentage of students failing to reach the Intermediate benchmark (30%).

### **Year 8 Science**

Singapore, Japan and Chinese Taipei had the highest average achievement in science at Year 8. Australia's average score of 512 was similar to the scores of six other countries, including the United States and New Zealand. Australia's score was significantly higher than 20 countries, but significantly lower than 14 countries, including Canada, the United States, England, Ireland, Singapore, Japan, Chinese Taipei, Korea and Hong Kong.

Australia's average Year 8 science score in TIMSS 2015 was not significantly different to the achieved score in TIMSS 1995, although there have been some fluctuations over the 20 years. While Western Australia's mean score of 518 ranks them equal second (up from fourth in 2011), the score was not significantly different to that of the ACT.

In Singapore, 42% of students reached the Advanced Benchmark, with more than 25% in Japan and Chinese Taipei (Australia – 7%; WA – 10%). The top countries had 10–14% failing to reach the Intermediate benchmark (Australia – 31%, WA – 30%).

## **Gender**

Internationally, gender differences are small in Year 4 mathematics but vary considerably from country to country. In Australia there were no significant gender differences in Year 4 mathematics or in Year 8 science and mathematics.

For the first time since 1995 a statistically significant gender gap in favour of males has been found in Year 4 mathematics in Australia. This difference is not significant in Western Australia.

**Indigenous students**

Indigenous students at the Year 4 and Year 8 level did not perform as well as their non-Indigenous counterparts. Across the four tests between 53% (Year 4 science) and 68% (Year 8 mathematics) of Indigenous students did not meet the Intermediate benchmark. This compares with a range of 28% (Year 4 science) to 34% (Year 8 mathematics) of non-Indigenous students failing to meet the Intermediate benchmark.

The difference between the two groups is significant, as it has been in each cycle of testing. The gap in average mathematics and science performance has changed little over the six cycles of TIMSS testing.

Of concern is that 61 per cent of Indigenous students compared to 28 per cent of non-Indigenous students did not achieve the Intermediate international benchmark in Year 4 mathematics, with 30 per cent of Indigenous students not reaching the Low benchmark.

**Geolocation**

The geographic location of schools has a significant impact on performance in all tests, such that metropolitan students performed better than provincial students, who similarly performed better than students in remote schools.