



Release of the 2011 trends in International Mathematics and Science Study (TIMSS) and Progress in Reading Literacy Study (PIRLS) Reports

Background

The Trends in International Mathematics and Science Study (TIMSS) is designed to help countries all over the world improve student learning. It collects educational achievement data at Year 4 and Year 8 to provide information about trends in performance over time. The Progress in International Reading Literacy Study assesses Year 4 students in Reading for the same purpose.

TIMSS and PIRLS have 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, science and reading as well as issues relating to the quantity, quality and content of instruction through student, 'home', teacher and school questionnaires.

TIMSS is conducted on a four-year cycle (1994/95, 1998/99, 2002/03, 2006/07 and 2010/11). PIRLS is conducted every five years, with Australia participating for the first time in 2011.

Internationally, 48 countries participated in Year 4 PIRLS; 52 countries in Year 4 TIMSS and 45 countries in Year 8 TIMSS. In Australia 280 primary schools (Western Australia – 40) and 275 secondary schools (Western Australia – 38) participated, providing a nationally representative sample of around 13 700 students.

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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Key points from the report

- Australia's scores in mathematics and science, in Years 4 and 8, have largely stagnated over the past 16 years.
- Over this same time, a number of other countries have either dramatically improved their results (Chinese Taipei, for example), or slowly but surely improved (Korea, for example).
- Many more countries outperform Australia in mathematics and science in TIMSS 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. A substantial proportion of developed countries also outperform Australia in PIRLS.
- In all seven assessments Australia has a substantial 'tail' of underperformance. In comparison to higher achieving countries, the proportion of Australian students at the High and Advanced benchmarks is modest.
- The only significant changes over time in Year 8 mathematics were declines in South Australia and Western Australia from the TIMSS 1995 score to the TIMSS 2011 score. There have been no significant changes in Year 9 science scores since TIMSS 1995 in any states.

- WA was ranked sixth based on means in all Year 4 tests. Typically ACT, Victoria, NSW and Tasmania significantly outperformed other states and territories in Year 4.
- In Year 8 WA was ranked fifth in mathematics and fourth in science. The Australian Capital Territory was the highest performing state in both mathematics and science, with 14 per cent of students reaching the Advanced international benchmark in mathematics (19% in science), 43% reaching the High international benchmark (53% science) and only 18 per cent failing to reach the Intermediate benchmark. WA was one of three states in which fewer than ten per cent of students achieved at the Advanced international benchmark.
- 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.
- The movement of the Year 4 cohort in TIMSS 2007 to Year 8 in 2011 has seen a weakening of our overall mathematics score – from above the scale centre point in 2007 to equal to it in TIMSS 2011.
- Science at the primary level continues to be a concern. In comparison to the international average few primary teachers have a science background; compared to mathematics and reading there is substantially less professional development undertaken in science; and teachers' reported level of confidence in teaching science is substantially lower than their confidence in teaching reading or mathematics.
- Around one-third of Year 8 students are being taught by teachers with no content or pedagogical training in mathematics, with more than 20 per cent of students taught by teachers who were only *somewhat confident* in teaching mathematics. The situation is not quite as critical in science.
- The economic makeup of schools had an impact on the performance of students, with students in schools with more affluent than disadvantaged students scoring higher in mathematics and science than students in schools with more disadvantaged than affluent students.
- For Australian Year 4 students, engagement was highest in science, followed by mathematics and then reading. Almost one third of Australian Year 8 students reported not being engaged in their mathematics and science lessons.
- Among Australian Year 8 students, male students liked mathematics and science, valued mathematics and were confident with mathematics and science to a greater degree than their female peers.
- 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 year of testing, and has not decreased in size, except in Year 4 mathematics.
- Attending a pre-primary education program was associated with higher reading, mathematics and science achievement.

Attachment 1: TIMSS and PIRLS 2011 – a summary

Reading

Year 4 Reading

Students' reading literacy is assessed by having participating students read selected texts and respond to a variety of questions about the texts they have read.

Hong Kong, Finland, the Russian Federation and Singapore were the top performing countries. They were among 21 countries which significantly outperformed all others. Australia ranked 27 and was in the next group of countries.

Across the states WA was ranked sixth based on means and was significantly lower than ACT, Victoria, NSW and Tasmania. Eight per cent of WA's students (ACT – 17%) achieved the Advanced international benchmark while 28% were below the Intermediate benchmark (ACT – 13%)

Internationally and across Australia, Year 4 females outperform males in Reading. In WA this difference is statistically significant, with 11% of females reaching the Advanced benchmark (males – 5%) and 22% of females below the Intermediate benchmark.

Mathematics

Year 4 Mathematics

Singapore, Korea and Hong Kong were the top-performing countries of TIMSS 2011, 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 516 was significantly higher than that of 27 countries, including Sweden and New Zealand, but below that of 17 countries, including most of the Asian countries and England and the United States.

In the top performing countries, more than one third of the students assessed (37–43%) reached the Advanced benchmark (Australia – 10%; WA – 7%), and had between 3 and 15% failing to reach the Intermediate benchmark (Australia – 33%, WA – 38%)

Australia's average Year 4 mathematics score of 516 in TIMSS 2011 was not significantly different to that achieved in 2007 but was a significant 21 points higher than in TIMSS 1995.

There were some significant differences in Year 4 mathematics performance across the states. Students in New South Wales, Victoria, Australian Capital Territory and Tasmania performed significantly better than students in Western Australia, whose performance was not significantly different from students in South Australia, Queensland and the Northern Territory. WA and Victoria have improved significantly since 2003.

Year 8 Mathematics

Korea, Singapore and Chinese Taipei were the top-performing countries of TIMSS 2011, with an average score higher than 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.

In these three countries, almost half of the students assessed (47–49%) reached the Advanced benchmark. (Australia – 9%; WA – 5%), and had between 7 and 11% failing to reach the Intermediate benchmark (Australia – 37%, WA – 39%)

Australia's achievement score of 505 was significantly higher than that of 27 countries, including New Zealand and Sweden, and below that of 6 countries, including the high performing Asian countries listed above as well as the Russian Federation.

Australia's average Year 8 mathematics score in TIMSS 2011 was not significantly different to the achieved score in TIMSS 1995, although there have been some small fluctuations over the 16 years.

Students in the ACT and New South Wales significantly outperformed students in other states and territories. WA was ranked fifth, above South Australia, Tasmania and the Northern Territory.

Science

Year 4 Science

Korea and Singapore were the top-performing countries of TIMSS 2011, 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. The next highest performing country was Finland, which had higher achievement than all remaining countries.

Australia's achievement score of 516 was significantly higher than that of 23 countries, including Belgium and New Zealand, but below that of 18 countries, including most of the Asian countries, England and the United States.

Australia's average Year 4 science score in TIMSS 2011 was significantly lower than the achieved score in TIMSS 2007, but Australia's 2011 score was not significantly different to the score in TIMSS 1995.

There was a significant change in average scale scores for a number of countries from TIMSS 2003. While many countries showed improvements of up to 48 score points, Australia's increase of seven (7) score points was not significant.

Students in the ACT, Victoria, New South Wales and Tasmania outperformed students in Western Australia, who performed similarly to those in Queensland, South Australia and the Northern Territory. Western Australia's mean score of 502 ranks them sixth, above Northern Territory and Queensland and represented a significant decline in score since 1995.

Year 8 Science

Singapore and Chinese Taipei had the highest average achievement in science at Year 8. Australia's average score of 519 was similar to the scores of six other countries, including the United States and New Zealand. Australia's score was significantly higher than 26 countries, but significantly lower than 9 countries, including England and the Asian countries.

Australia's average Year 8 science score in TIMSS 2011 was not significantly different to the achieved score in TIMSS 1995, although there have been some fluctuations over the 16 years. While Western Australia's mean score of 514 ranks them fourth (up from seventh in 2007), only the ACT's mean was significantly higher.

In Singapore, 40 % of students reached the Advanced Benchmark, with 18–24% in Japan, Chinese Taipei and Korea. (Australia – 11%; WA – 7%). The top countries had 12–14% failing to reach the Intermediate benchmark (Australia – 30%, WA – 29%)

Science is the only cognitive area in which there has been a significant gender difference in Australia in each assessment since 1995, in favour of males.

Gender

Internationally and in Australia there were no significant gender differences in Year 4 mathematics and science and Year 8 mathematics.

There were significant differences internationally and in Australia in Year 4 reading where females outperformed males. Among the states this difference was most pronounced in WA (33 score points).

In Year 8 science, internationally, females achieved significantly higher scores than males. In Australia, however, males significantly outperformed females in terms of average scores and percentages achieving the advanced benchmark. In addition more females failed to achieve the Intermediate benchmark.

Indigenous students

Indigenous students at the Year 4 and Year 8 level did not perform as well as their non-Indigenous counterparts.

There was a significant improvement in mathematics achievement for Year 4 Indigenous students between 2007 and 2011, and between 1995 and 2011, however, the gap in scores between Indigenous and non-Indigenous students is around the same as that reported in TIMSS 1995.

The relative performance of Year 4 Indigenous students (to non-Indigenous students) in both mathematics and science has declined, with a gap of about 90 score points in 2007 compared to 60–70 score points in 1995 and 2003. The score difference for Year 8 has remained relatively stable, between 70 and 90 points.

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.

Student attitudes and home influences

Students who indicated that they like and felt confident in reading, mathematics or science scored higher on average in the cognitive assessments than did other students.

Among Australian students, female students were more likely to like reading and were more confident in reading than their male peers, while male students liked learning mathematics to a greater degree and expressed greater confidence with mathematics than their female peers. There was no difference between male and female students in the degree to which they liked learning science or felt confident with science.

For Year 4 students, attending a pre-primary education program was associated with higher reading, mathematics and science achievement.

Teachers and schools

The majority of Year 4 students in Australia were taught by female teachers, and teachers aged between 30 and 50, while for Year 8 science and mathematics students the distribution of male and female teachers is fairly even.

Science at the primary level continues to be a concern. In comparison to the international average few primary teachers have a science background; compared to mathematics and reading there is substantially less professional development undertaken in science; and teachers' reported level of confidence in teaching science is substantially lower than their confidence in teaching reading or mathematics.

Around one-third of Year 8 students are being taught by teachers with no content or pedagogical training in mathematics, with more than 20 per cent of students taught by teachers who were only *somewhat confident* in teaching mathematics. The situation is not quite as critical in science.

Far greater proportions of Australian Year 4 and Year 8 students had access to computers to use in their mathematics and science classes than was the case internationally, but this had no direct impact on their performance.

The school climate

Achievement in reading, mathematics and science was higher on average:

- among students who liked school and felt like they belong, were engaged during mathematics lessons, felt that they were safe and were almost never bullied, and
- in schools in which principals and teachers report a very high or high emphasis on academic success, that teachers thought were safe and orderly, and where student factors such as lack of prerequisite knowledge, nutrition and sleep deprivation and disruptive or uninterested students did not impact on student learning.

For Australian Year 4 students, engagement was highest in science, followed by mathematics and then reading. Almost one third of Australian Year 8 students reported not being engaged in their mathematics and science lessons.

The economic makeup of schools had an impact on the performance of students, with students in schools with more affluent than disadvantaged students scoring higher in mathematics and science than students in schools with more disadvantaged than affluent students.