Executive Summary

The Trends in International Mathematics and Science Study (TIMSS 2007) is the latest in a series of international studies of mathematics and science, conducted under the aegis of the International Association for the Evaluation of Educational Achievement (IEA).

The goal of TIMSS is to provide comparative information about educational achievement across countries to improve teaching and learning in mathematics and science. TIMSS measures trends in mathematics and science achievement at Year 4 and Year 8, as well as monitoring the outcomes of curricular implementation. Conducted on a regular four-year cycle, TIMSS has assessed mathematics and science in 1995, 1999, 2003, and 2007. In addition to monitoring trends in achievement at Year 4 and Year 8, TIMSS provides information about relative progress across years as the cohort of students assessed in Year 4 in one cycle moves to Year 8 four years later (e.g. the Year 4 students of 2003 became the Year 8 students of 2007). Also, to provide comparative perspectives on trends in achievement in the context of different educational systems, school organisational approaches, and instructional practices, TIMSS collects a rich array of background information.

This report analyses and interprets the Australian data collected as part of the TIMSS study. Where appropriate, this report makes comparisons with the results of other countries and the international average to better understand Australian achievement and its context.

Research Design

Building on previous IEA studies, TIMSS uses the curriculum as the major organising concept in considering how educational opportunities are provided to students and how students use these opportunities. It considers three levels of the curriculum in relation to the context in which they operate. The first level refers to what it is intended that students should learn and the educational system within which that curriculum is realised. This is referred to as the *Intended Curriculum*. The second level refers to what is taught in classrooms, who teaches it and how it is taught; the *Implemented Curriculum*. The third level refers to what students have learned and their attitudes towards what they have learned; the *Attained Curriculum*.

From this broad framework TIMSS develops tests to describe what students have learned and questionnaires to find out about what is intended to be taught and about how it is actually taught in classrooms. These instruments are based on assessment frameworks that are developed after extensive analysis of national curricula with input from an international panel of mathematics, science and assessment experts, and reviewed by the National Research Coordinators (NRCs) in each country. This ensures that goals of mathematics and science education regarded as important in a significant number of countries are included and that what is assessed links to previous studies as well as being oriented to future developments in mathematics and science education.

Who is assessed?

TIMSS 2007 focuses on two populations of students. Population 1 is students in Year 4. In most countries it is the year level that contains most nine-year-olds. Population 2 is students in Year 8. In most countries this is the year level that contains most 13-year-olds.

TIMSS 2007 took place in 59 countries around the world. Population 2 students were assessed in 49 of the participating countries, whereas Population 1 students were assessed in 36 countries.

The testing took place at the end of the school year, which was October-November 2006 in the southern hemisphere and May-June 2007 in the northern hemisphere.

TIMSS 2007 used a two-stage sampling procedure to ensure a nationally representative sample of students. In the first stage, schools were randomly selected to represent states and sectors. In the next stage, one mathematics class of Year 4 or Year 8 students was randomly selected to take part in the study.

In Australia, over 8,000 students in 457 schools participated in the main sample of TIMSS 2007. In addition, an extra sample of Indigenous students in all participating schools was also collected in order to provide a more detailed examination of the achievements of Australia's Indigenous students.

What is assessed?

Two organising dimensions, a content dimension and a cognitive dimension, framed the mathematics and science assessment for TIMSS 2007, analogous to those used in the earlier TIMSS assessments. The content dimension of the assessment specifies the domains or subject matter to be assessed within mathematics or science, while the cognitive domain specifies the domains or thinking processes to be assessed. The cognitive domains describe the sets of behaviours expected of students as they engage with the mathematics or science content. There are three content domains in mathematics and in science at Year 4 and four at Year 8. In addition there are three cognitive domains in each curriculum area: *knowing*, *applying* and *reasoning*.

In TIMSS 2007 the intended balance was as follows:

Mathematics Content Domains	Year 4	Year 8
Number	50%	30%
Geometric shapes and measures (Y4) / Geometry (Y8)	35%	20%
Algebra (Y8)	-	30%
Data display (Y4) / Data and chance (Y8)	15%	20%

Science Content Domains	Year 4	Year 8
Life science (Y4) / Biology (Y8)	45%	35%
Physical science (Y4) / Physics (Y8)	35%	20%
Chemistry (Y8)	-	25%
Earth science	20%	20%

	Mathematics		Science	
Cognitive Domain	Year 4	Year 8	Year 4	Year 8
Knowing	40%	35%	40%	30%
Applying	40%	40%	35%	35%
Reasoning	20%	25%	25%	35%

What did TIMSS 2007 participants do?

So that the full range of the assessment framework is covered, TIMSS divides the assessment material among students using a matrix sampling approach. This involves dividing the material among a set of student test booklets with each student completing just one of the booklets. For each year level, mathematics and science items were grouped into clusters, which were then rotated through 14 booklets, with each cluster found in more than one booklet.

The booklets were designed to be administered in two sessions, separated by a short break. Each session was of 45 minutes duration at Year 8 and 36 minutes at Year 4. Each booklet contained both mathematics and science items, and included both multiple choice and constructed response items. The questionnaire that students completed took 30 minutes.

How are the results reported?

Results are reported as average scores with the standard error, as distributions of scores, and as percentages of students who attain the international benchmarks, for countries and specific groups of students within Australia.

The international benchmarks were developed using scale anchoring techniques. Internationally it was decided that performance should be measured at four levels: the 'advanced international benchmark', which was set at 625; the 'high international benchmark', which was set at 550; the 'intermediate international benchmark', which was set at 475; and the 'low international benchmark', which was set at 400.

How is TIMSS managed?

TIMSS was organised by the IEA and managed by the International Study Centre, Lynch School of Education, at Boston College in the United States. In Australia, the study was funded by the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) and by State and Territory Departments of Education proportional to the size of their student population. The study was managed in Australia by the Australian Council for Educational Research (ACER), which represents Australia on the IEA.

Meetings of National Research Coordinators occur twice yearly in order to plan and report on each stage of the process, in consultation with the International Studies Centre, Statistics Canada and the IEA Data Processing Centre, Hamburg.

Australia's performance in TIMSS 2007

Some highlights from the TIMSS 2007 results are provided on the following pages. Differences are only mentioned if tests of statistical significance showed that the differences were likely to indicate real differences.

Performance internationally:

- *Year 4 mathematics* – Hong Kong and Singapore outscored all other participating countries. Australia's mean score of 516 was similar to three countries (Denmark, Hungary and Italy), significantly lower than that of 12 countries (including the Asian countries, England and the United States), and significantly higher than that of 20 countries and the TIMSS scale average.
- *Year 8 mathematics* – At Year 8, Australia's mean score in mathematics was 496, not significantly different from the TIMSS scale average of 500. Nine countries achieved scores higher than Australia, including the highest scoring countries, Chinese Taipei, Korea and Singapore. Eight countries scored similarly to Australia, while Australia scored significantly higher than 31 countries.

- *Year 4 science* – Singapore outscored all other participating countries. Australia's mean score of 527 was similar to eight countries (including Germany and the Netherlands), significantly lower than that of eight countries (including the Asian countries, England and the United States), and significantly higher than that of 19 countries and the TIMSS scale average.
- *Year 8 science* – Singapore and Chinese Taipei outscored all other participating countries. Australia's mean score of 515 was similar to three countries (including the United States), significantly lower than that of 10 countries (including five Asian countries and England) and significantly higher than that of 35 countries and the TIMSS scale average.

Performance at the international benchmarks:

- *Year 4 mathematics* – While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the nine per cent reaching the advanced benchmark was considerably less than that of the highest scoring countries. The proportion reaching the low benchmark (91%) was, however, fairly similar to the highest performing countries.
- *Year 8 mathematics* – Six per cent of Australia's Year 8 students reached the advanced benchmark, which was higher than the international median, and 11 per cent of Australian Year 8 students failed to achieve the low benchmark.
- *Year 4 science* – While the proportion of Australian Year 4 students at each of the international benchmarks was higher than the international median, the 10 per cent reaching the advanced benchmark was less than that of the highest scoring countries. The proportion reaching the low benchmark (93%) was, however, fairly similar to the highest performing countries.
- *Year 8 science* – Eight per cent of Australia's Year 8 students reaching the advanced benchmark, which was higher than the international median, but much less than that of the highest scoring countries. The proportion reaching the low benchmark (92%) was, however, similar to the proportions of students performing at this level in the highest scoring countries.

Performance in the content and cognitive domains:

- *Year 4 mathematics* – In terms of the mathematics content domains, Australian Year 4 students were strongest in *geometric shapes and measures* and *data display*, rather than in *number*. This pattern of strengths and weaknesses was apparent for all states in the content domains, and in the cognitive domains Year 4 students were strongest in *applying* and *reasoning* rather than *knowing*. The only significant gender differences were in favour of males in the *number* content domain and the *applying* cognitive domain.
- *Year 8 mathematics* – At Year 8, Australian students' performance in both *algebra* and *geometry* was significantly lower than the TIMSS scale average, while performance in *number* was equivalent, and *data and chance*, as in previous cycles, was found to be a strength. In terms of the cognitive domains, Australian Year 8 students performed at a similar level to the TIMSS scale average in *applying* and *reasoning*, and lower in *knowing*. This pattern of strengths and weaknesses was also apparent for all states. In addition, the gender bias in favour of males was found to be significant for *data and chance*, *number* and *applying*.
- *Year 4 science* – In terms of the content domains, Australian Year 4 students were stronger in *Earth science* and *life science* than in *physical science*. In the cognitive domains, performance in the areas of *reasoning* and *knowing* was relatively strong, while *applying* was the weakest area. This pattern of strengths and weaknesses was apparent for all states. There were no significant gender differences in performance in each of the three content domains.
- *Year 8 science* – In terms of the content domains, Australian Year 8 students were stronger in *Earth science* and *biology* than in *physics* and *chemistry*. In the cognitive domains, *reasoning* was a strength, while *knowing* was an area of relative weakness. This pattern of strengths and weaknesses was apparent for all of the states. The gender difference in overall science achievement in favour of males was also found to be significant in most of the content and cognitive domains, except for *biology* and *reasoning*. The gender difference was largest (around 30 score points) for *Earth science* and *physics*.

Between 1995, 2003 and 2007:

- *Year 4 mathematics* – Australia's score has increased significantly by 17 score points since 2003 and by 22 score points since 1995. In terms of relative position internationally, Australia was outperformed in 2007, as in 2003, by all of the Asian countries, as well as England and the United States. However, Australia's score in 2007 was significantly higher than the TIMSS scale average and also the scores of both Scotland and New Zealand.
- *Year 8 mathematics* – Australia's score remained unchanged from 2003 and decreased significantly from that of 1995. In 2007, as in 2003 and 1995, Australia was outperformed by all of the Asian countries other than Indonesia, but the increased scores of England, the United States and the Russian Federation, in combination with the decrease in Australia's score, resulted in those countries also significantly outperforming Australia.
- *Year 4 science* – Australia's score has remained relatively unchanged between assessments. Australia's relative position in 2007 was also much the same as in 2003. Australia was again outperformed in 2007 by all of the Asian countries, and by England and the United States. The Russian Federation's increase also resulted in a score significantly higher than Australia in 2007; on the other hand the decline in New Zealand's score has resulted in a score significantly lower than that of Australia.
- *Year 8 science* – Australia's average score has declined by 12 score points since TIMSS 2003, and is relatively unchanged since 1995. This, combined with significant improvements by the Russian Federation and Slovenia, has moved Australia a little downwards in relative terms. The same Asian countries (Singapore, Chinese Taipei, Korea, Hong Kong and Japan) outperformed Australia, as did England, Czech Republic and Hungary. In 2007 the Russian Federation and Slovenia also significantly outperformed Australia. Australia still performed on a par with the United States and outperformed Scotland.

In terms of results for the Australian states:

- *Year 4 mathematics* – Across the states there were some significant differences in Year 4 mathematics performance. Students in New South Wales performed significantly better than students in all other states. Students in Victoria performed slightly below students in New South Wales, but significantly better than the remaining states, with the exception of the Australian Capital Territory, for which there was no statistically significant difference. Students from the Australian Capital Territory and Tasmania performed significantly better than students in Western Australia, Queensland and the Northern Territory.
- *Year 8 mathematics* – There was little variation and no significant differences between the states in terms of average Year 8 scores. As for performance at each of the benchmarks, there was little variation across the states except for the substantially larger proportion of students achieving the advanced benchmark in the Australian Capital Territory and New South Wales than in the other states.
- *Year 4 science* – Across the states there were some significant differences in Year 4 performance. Students in Victoria, New South Wales, Tasmania, and the Australian Capital Territory had similar scores, with the first two of these states outperforming students in South Australia, Western Australia, Queensland and the Northern Territory.
- *Year 8 science* – Performance across the states was fairly uniform at Year 8, with no significant differences in mean scores. There was very little variation in attainment at each of the benchmarks across the states except for the substantially larger proportion of students achieving the advanced benchmark in the Australian Capital Territory and New South Wales compared to the other states.
- *Trends* – There was little movement in terms of achievement levels in the states. In Year 4 mathematics, New South Wales and Victoria had a significant increase in scores from 2003 to 2007, and New South Wales showed a sustained increase over the 12-year period from 1995. Scores in Western Australia were significantly higher in 2007 than 2003, while in Tasmania there was a slower but sustained growth over the 12-year period from 1995 resulting in a significant increase in scores from TIMSS 1995.

In Year 8 mathematics the only changes in scores were a significant decline in the scores of South Australia and Western Australia over the period since 1995, most of which seems to have occurred in the period 1995 – 2003, with less of a decline in recent years.

In science there were fewer changes – a decline of 30 score points from 1995 – 2007 in the Australian Capital Territory at Year 4 and a decline of 25 score points in Western Australia at Year 8 over the same time span.

In terms of results for males and females:

- *Year 4 mathematics* – There was no significant gender difference in the Year 4 mathematics performance of Australian students. This was similar to the results internationally, in which males and females performed equally well at this level. In Australia, a slightly higher proportion of males achieved at the advanced benchmark, while a similar proportion of males and females achieved at the low benchmark. With respect to performance within the Australian states, there were no gender differences.
- *Year 8 mathematics* – At Year 8 nationally, there was a substantial and significant gender difference in favour of males. More males than females achieved the higher benchmark levels, while similar proportions of females and males failed to achieve at the low benchmark level. The gender difference in favour of males was only significant in Queensland.
- *Year 4 science* – At Year 4, there was no significant difference between the average performance of males and females in Australia. This is different to the results internationally where females outperformed males on average. In Australia, a higher proportion of males achieved at the advanced benchmark, while a similar proportion of males and females achieved at the low benchmark. There was no difference across the states in terms of the performance of male and female students.
- *Year 8 science* – At Year 8, there was a substantial and significant gender difference in favour of males in Australia, while internationally it was female students, on average, who outperformed males. In Australia, the better performance of males is apparent mainly at the higher benchmarks – there was little difference in the proportion of females and males achieving at the low benchmark. At the state level, the only significant gender difference (in favour of males) was found in Queensland.
- *Trends* – The increased score for Australia overall for Year 4 mathematics was the result of a significant increase in the scores of both males and females.

  In contrast, the significant gender difference in favour of males found in Year 8 mathematics (not previously seen in 2003 or 1995) appears to be due to a significant decline in the average score for females over the 1995 – 2007 time span.

In terms of Indigenous students' results:

- Students who identified themselves as Indigenous performed at a significantly lower level than both non-Indigenous students and the TIMSS scale average at both Year 4 and Year 8, for mathematics and science.
- The proportion of Australian Indigenous students performing at each of the international benchmarks was also similar to or less than the international median at both year levels and in both subject areas.
- *Trends* – For Australia's Indigenous students there were no significant changes in achievement in either subject at either year level. However, significant changes in the scores of non-Indigenous students, coupled with changes in the scores for Indigenous, has resulted in a widening gap between the mathematics achievement of Indigenous and non-Indigenous students to about 90 score points at Year 4.

For other student groups:

- *Year 4 mathematics* – The geographic location of schools had a significant relationship with mathematics achievement at Year 4 such that metropolitan students performed better than provincial students, who in turn performed better than students in remote schools. A lower proportion of students from remote schools achieved at each of the higher benchmarks,

compared to metropolitan and provincial students. Students in Year 4 who spoke a language other than English at home achieved significantly lower scores on average in mathematics than students who predominantly spoke English. In addition, a smaller proportion of students who did not speak English as their main language at home reached the high benchmark and a greater proportion of these students, compared to predominantly English-speaking students, failed to reach the low benchmark.

- *Year 8 mathematics* – The geographic location of schools had a limited relationship with mathematics achievement at Year 8. There was no significant difference in the average performance of students from metropolitan, provincial or remote areas. However, a smaller proportion of remote students compared to metropolitan and provincial students achieved each of the higher benchmarks. At Year 8, there was no significant difference in mean mathematics scores according to language background. However, there was a much larger spread of scores for those that spoke a language other than English at home. The proportion of these students who were performing at the advanced benchmark or who were failing to attain the low benchmark was greater than the proportion of English-speaking students at each of these levels. Parental education was also significantly related to mathematics achievement, with mean mathematics achievement increasing as parental education increased. The proportion of students achieving the advanced and high benchmarks was considerably higher for students with at least one parent who had completed a university degree than for any other group.
- *Year 4 science* – The geographic location of schools had a significant relationship with science achievement at Year 4, such that metropolitan students performed better than provincial students, who similarly performed better than students in remote schools. Students from remote schools were much less likely to achieve at each of the higher benchmarks. Students in Year 4 who spoke a language other than English at home achieved significantly lower on average in science than students who spoke English only. This was related to a lower proportion of students who spoke a language other than English reaching the advanced benchmark, and far more students who spoke a language other than English not reaching the low benchmark.
- *Year 8 science* – The geographic location of schools had little relationship with science achievement at Year 8. Students in metropolitan and provincial schools performed at the same level, and remote students, while less likely to achieve at the higher benchmarks, were not significantly different from their metropolitan and provincial peers at other levels. Speaking a language other than English at home was related, on average, to lower achievement in science. However, the spread of scores for these students was quite large, with the proportion of students reaching the advanced benchmark similar to that of English-speaking students, but far more not reaching the low benchmark. Parental education was also significantly related to science achievement, with mean science achievement increasing as parental education increased. The proportion of students achieving the advanced benchmark was strikingly higher for students with at least one parent who had completed a university degree compared to all other parental education groups.

Students' educational resources in the home:

- Australia was amongst a small number of countries with high levels of educational resources in the home.
- At both Year 4 and Year 8, Australia had very high percentages (relative to other countries) of students who reported having over 100 books in the home.
- High percentages of Australian Year 4 and Year 8 students also had a computer and Internet connection.
- Both internationally and within Australia, a higher number of books in the home, the presence of a computer and an Internet connection were associated with higher mathematics and science achievement at Years 4 and 8.

- Students in Australia were also far more likely than students in many of the participating countries to use a computer at both home and school. At both year levels, students using a computer at home and at school had higher mathematics and science achievement than students using a computer at home but not at school or at school but not at home.
- Australian students tended to receive less mathematics and science homework at both Year 4 and Year 8 than students in other countries. On average, at both year levels, Australian students tended to receive less science homework than mathematics homework. At Year 4, Australian students who indicated they received low amounts of mathematics and science homework had higher achievement than those receiving medium or high amounts of homework, perhaps reflecting that much of the homework given at the Year 4 level had a remedial focus. However, at Year 8, students completing high amounts of mathematics and science homework had the highest average achievement. This reflects the different role of homework at Year 8, where it can provide an extension as well as remediation.

Students' attitudes and beliefs:

- Both internationally and within Australia, Year 4 students tended to have a more favourable opinion of mathematics and science than Year 8 students. However, far fewer Australian Year 8 students had high positive affect toward mathematics and science than was the case internationally. At both Year 4 and Year 8 the percentage of Australian students with high positive affect toward mathematics decreased significantly from 1995, while there was a slight increase in positive affect toward science at Year 4. At both year levels, higher positive affect toward mathematics and science was associated with higher achievement.
- Australian Year 8 students placed a relatively high value on mathematics, similar to the international average. However, the percentage placing a high value on science was considerably lower than both the international average for science and the percentage placing a high value on mathematics. Students indicating that they placed a high value on mathematics or science had higher achievement than those who did not.
- Both internationally and within Australia, Year 4 students tended to have higher self-confidence in learning mathematics and science than Year 8 students. The proportions of Australian students indicating high, medium and low self-confidence in learning mathematics and science were fairly similar to that of the international average at both year levels. Students with high self-confidence in learning mathematics and science had higher average achievement than those with medium or low self-confidence.
- More males than females had high self-confidence in learning mathematics, both within Australia and internationally, and at both year levels. For science, however, there was no gender difference in self-confidence at Year 4, contrasting with a gender difference in favour of males at Year 8. Within Australia, the gender difference in self-confidence in learning mathematics and science could help to to explain the gender difference in achievement at Year 8.
- A substantial proportion of both Year 4 and Year 8 students agree that they like school. At both year levels, those that *disagree a lot* that they like school have significantly lower achievement than those that *disagree a little* or *agree* that they like school.
- Approximately one-third of Year 8 students intended to study at least an undergraduate degree, while 13 per cent expected only to finish secondary school. A clear positive relationship was found between mathematics and science achievement and students' educational aspirations.

Australian teachers and their preparation for teaching:

- Across Australia, a majority of Year 4 teachers were female and about one half of Year 8 students were taught mathematics by female teachers. Internationally, more Year 8 students are taught by females than males. Nationally, in Year 8 science classes, there were equal proportions of male and female teachers. Internationally, however, Year 8 students were taught science more often by females than males.

- The Australian teaching workforce was well-educated in terms of completion of university and postgraduate university degrees. The majority of Year 4 and Year 8 students had teachers with a university or postgraduate university degree.
- Internationally, about one-quarter of Year 4 students were taught by teachers with a qualification in primary education and a specialisation in either mathematics or science (or both). However, in Australia, most year 4 students have teachers with a specialisation in primary education without a major or specialisation in science or mathematics. In Australia, at Year 8, about one half of students had teachers with a mathematics education qualification or mathematics qualification. Over two-thirds of students had science teachers that had studied biology, physics, chemistry or Earth science.
- At Year 4 and Year 8, across all mathematics topics, Australian students generally had teachers who reported feeling 'very well' prepared to teach all topics. Teachers of science at Year 4 were less well-prepared to teach all topics. At Year 8, more students had science teachers who reported being well prepared than was the case for Year 4 science; however, Year 8 mathematics teachers reported a higher level of preparedness to teach than Year 8 science teachers.
- For Year 4 mathematics, the percentage of students with teachers who reported feeling 'very well' prepared to teach *geometric shapes and measures* was lowest both internationally and in Australia. For Year 4 science, *physical science* was the weakest area both in Australia and internationally. For Year 8 mathematics, *data and chance* was strongest and *geometry* and *algebra* were the weakest areas in Australia. For Year 8 science, the percentage of students whose teachers reported feeling 'very well' prepared for *chemistry* was highest and *physics* and *Earth science* were the lowest areas in Australia.

Classroom activities and characteristics:

- An emphasis on problem-solving activities has been an important part of the mathematics curriculum for a number of years, and improving students' problem-solving skills continues to be a goal for educators. In Australia, being asked to explain answers was the most common of the reported problem-solving activities in mathematics classes, with over two-thirds of students saying that at least half of their lessons involved this type of activity. Forty percent of students said they spent more than half of their time in mathematics classes deciding on procedures for solving complex problems, while 42 per cent of students reported spending at least half of their time in class relating classroom mathematics to their daily lives.
- Engaging students in scientific inquiry is an important part of the science curriculum in many countries. According to students in Australia, the most common activities of scientific inquiry (i.e. those in which students reported spending at least half of their class time) were working in small groups on an experiment (68%); watching the teacher demonstrate an experiment (60%); writing explanations about what was observed and why it happened (59%); conducting an experiment (59% of students); and designing an experiment (52%). The area of least attention was being asked to relate classroom science to their daily lives, for which 39 per cent of students reported spending at least half of their time in class.
- The textbook is the foundation of mathematics and science instruction at both Year 4 and Year 8 in most countries in the TIMSS study, although less so for science at Year 4. Australia stands out amongst the countries surveyed at Year 4 as having a quarter of classes not using a textbook for mathematics. Australia and New Zealand at Year 4 reported a large proportion of classes not using a textbook for science. At Year 8, Australian mathematics teachers used a textbook in a similar manner to teachers in most other countries, but for science, Australian teachers use a science textbook as a primary basis to a lesser extent than other countries.
- At both Year 4 and Year 8, average mathematics and science achievement was related to the diversity of the students in the class and the instructional challenges involved. That is, students of teachers who reported that their classrooms were impacted only a little by these factors had higher average achievement than those whose teachers reported some limitations. This latter group had higher average achievement than those students whose teachers reported a lot of limitations. Over 40 per cent of students were in classrooms with little or no such limitations.

School contexts for learning:

- About one-third of Australian students attended schools in which there were fewer than 10 per cent of students who came from economically disadvantaged homes. This was the same as the international average for Year 4 students and substantially greater than the international average for Year 8 students. At the other end of the scale, a lower proportion of Year 4 and Year 8 students attend schools in which the principal believes that more than half of the students were from economically disadvantaged homes. At both year levels, but particularly at Year 8, this was much lower than the international averages.
- At Year 4, about one half of students in Australia attended schools rated by their principal as being at the high level of the Index of Availability of School Resources for Mathematics/ Science Instruction (i.e. resource shortages essentially were not a problem for mathematics or science classes). Very few Australian students were rated at the low level of the index. Average mathematics and science achievement was highest among students in Australia at the high level of the index. The situation was similar at Year 8.
- In Australia, a majority of students attended schools where principals reported a high positive school climate (50% at Year 4 and 33% at Year 8). Around 50–60 per cent of students attended schools in which principals rated the school climate at a medium level and very few were at the low level. Students in schools in which principals rated the school climate positively had higher achievement than students in schools in which the principal rated the school climate as medium or low.
- About one-third of Year 4 students and almost one-half of Year 8 students reported a high level of feeling safe in their school. More than one-quarter of Year 4 students in Australian schools were at the low level, implying that they encountered at least some unpleasant events in school in the past month. Average achievement was higher for those students who reported a high level of feeling safe in their school.

Policy Issues

The only area in which Australian achievement has shown improvement over the cycles of TIMSS since 1995 has been in mathematics at Year 4. However, in Year 8 mathematics and Year 4 science there has been no change to Australia's scores and in Year 8 science scores have declined significantly. This is in comparison to other countries that have improved already high scores, often associated with systemic and curricular reform.

These results suggest that greater attention be given to curriculum and teaching in junior secondary science, particularly in the areas of *physics* and *chemistry*. A failure to give sufficient attention to science in the junior secondary years is likely to have consequences for building the basis for education in the science-based occupations and for building a scientifically literate community. In addition, there are curriculum issues.

Related to this is the issue of teacher preparedness to teach. While most Year 8 teachers believed they were well-prepared to teach all of the mathematics topics covered in TIMSS, and around three-quarters of Year 8 science teachers felt they were well-prepared to teach science, this was only the case for half of the primary teachers surveyed. Further analysis needs to be conducted on this issue. There also seem to be some areas where teachers have misplaced confidence; that is, where teachers believe they are well-prepared to teach the subject matter but where the achievement of their students is not high. Professional development might well be needed to address this discrepancy.

Other important policy considerations are the gender differences in favour of males in both mathematics and science at Year 8 (particularly after a number of years in which there were no such differences); the disparity in achievement between those from a high socioeconomic background and those from a low socioeconomic background; and the education of Indigenous students. If the ideals of the National Goals for Schooling are to be realised it is imperative that action is taken that will improve these outcomes.